Review Article

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 abortificient 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 abortificient 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 (P0.01) 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)

Ethanolic 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 viscose 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 liters 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. axillareand U. lobataat* 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 Δ5-3β-hydroxy steroid dehydrogenase (Δ5-3β-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 ($p_o0.01$) 49.95% and 71.03% anti-implantation activities at 100 and 200 mg/kg doses respectively. The extract also exhibited significant ($p_o0.01$) estrogenic activity as evidenced by increase in body weight, uterine weight, increased thickness and height of endometrium, vaginal cornification and significant ($p_o0.01$) 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 ± 4.75mg), Nelumboextract treated (25 ± 3.86mg), Uterus; Control (236 ± 0.004mg), Nelumbo extract treated(214 ± 0.007mg) and Vagina; Control(221 ± 0.002mg), Nelumbo extract treated(178 ± 0.003mg) 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 ± 0.21) days, Nelumbo extract treated (3.62 ± 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 20days did not cause appreciable alterations in the histological appearance of the epididymis, while the treatment for 90days 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 orobanchioides*, 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.	*Abroma angusta Linn.*	*Sterculaceae*	Ulat kambal	RT	[22]
2.	*Abrus precatorius Linn.*	*Fabaceae*	Ghungchi	RT, SD	[22]
3.	*Acacia leucophloea (Roxb.) Willd.*	*Fabaceae*	Renjhua, Safed	BR, LF, GU	[23]
4.	*Achyranthes aspera Linn.*	*Amaranthaceae*	kikar	LF	[24]
5.	*Achyranthes bidentata Blume.*	*Amaranthaceae*	-	LF, RT	[25]
6.	*Aconitum heterophyllum Wall.*	*Ranunculaceae*	Atis	RT	[26]
7.	*Acorus calamus Linn.*	*Araceae*	Bach	RT	[27]
8.	*Adhatoda vasica Nees*	*Acanthaceae*	Adhusa	PL	[22]
9.	*Adiantum lunulatum*	*Pteridaceae*	-	AP	[5]
10.	*Aerva lantana (L.) Juss. ex. Shult*	*Amaranthaceae*	Chaya	RT	[28]
11.	*Agave americana Linn.*	*Agavaceae*	Rambans	RT Sap	[22]
12.	*Ailanthus excelsa Roxb.*	*Simaroubaceae*	Ghar Karnana	SB	[29]
13.	*Alangium salvifolium (L. f.) Wang.*	*Alangiaceae*	Aankol	RT	[30]
14.	*Allium cepa Linn.*	*Liliaceae*	Pyaj	BU	[22]
15.	*Allium sativum Linn.*	*Liliaceae*	Lahsun	SD, BU	[22]
16.	*Aloe barbadensis Mill.*	*Liliaceae*	Ghikwar	LF	[22]
17.	*Alternanthera philoxeroides Griseb.*	*Amaranthaceae*	Jaisachi-ara	PL	[28]
18.	*Alysicarpus vaginalis*	*Fabaceae*	Davai	RT	[23]
19.	*Amaranthus spinosus Linn.*	*Amaranthaceae*	Katailichaula	–	[29]

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

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

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

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

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

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

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

1. Zade V, Wikhe M, Dabhadkar D, et al. Antifertility efficacy of Cannabis sativa leaves on female albino rats. Int J Sci Invent Today 2013;2(2):107-117.
2. Agarwal A, Allan JJ. Antifertility effects of herbs: Need for responsible reporting. J Ayurveda Integr Med 2010;1(2):129-131.
3. Gopalkrishnan B, Shimpi SN. Antifertility effect of Madhuca latifolia (roxb.) Macbride seed extract. Int J Appl Biol Pharm Tech 2011;2(4):49-53.
4. Kulkarni TR, Kothekar MA, Mateenuddin M. Study of anti-fertility effect of lemon seeds (Citrus limonum) in female albino mice. Indian J Physiol Pharmacol 2005;49(3):305-312.
5. Bhatia DK, Sharma AK, Pathania PC, et al. Antifertility effects of crude different of Adiantum lunulatum Burm. On Reproductive Organs of male albino rats. Biological Forum — An International Journal 2010;2(2):88-93.
6. Padmashali Vaidya VP ,Vagdevi HM, Satyanarayana ND. Antifertility efficacy of the plant Balanites roxburghii in male rats. Indian J Pharm Sci.2006;68(3)
7. Sundar Rajan T, Sarathchandiran I, Kadalmani B. Evaluation of anti-fertility activity of herbal oral contraceptive suspension on male Wistar albino rats. J Pharm Res 2013;7:342- 346.
8. Sharma P, Manjusha Rani S, Malhotra H. et al. Antifertility potential of hydroalcoholic extract of Cordia dichotomaG Forst. leaves: A folklore medicine used by Meena community in Rajasthan state in India. Asian Pac J Reprod 2015;4(2):100-105.
9. Shinde N, Chauhan AS, Gupta SK, et al. Antifertility studies of curcumin and andrographolide combination in female rats. Asian Pac J Reprod 2015;4(3):188-194.
10. Naik BS, Dangi NB, Sapkota HP, et al. Phytochemical screening and evaluation of anti-fertility activity of Dactyloctenium aegyptium in male albino rats. Asian Pac J Reprod 2016;5(1):51-57.
11. Ramya R, Sivasakthi R, kumar CS, et al. Preliminary Phytochemical and Antifertility Studies on Dodonea viscosa Linn, Asian J Res Pharm Sci 2011;1(3):77-79.
12. Dhanapal R, Ratna JV, Gupta M, et al. Preliminary study on antifertility activity of Enicostemma axillareleaves and Urena lobataroot used in Indian traditional folk medicine. Asian Pac J Trop Dis 2012;616-622.
13. Ahirwar D, Ahirwar B, Kharya MD. Reversible Antifertility Activity of Hydroalcoholic Extract of Ficus Racemosa L. in Male Mice. J Reprod and Contracept 2011;22(1):37-44.
14. Jain S, Choudhary GP, Jain DK. Pharmacological evaluation of anti–fertility activity of ethanolic extract of Jatropha gossypifolia leaf in female albino mice. Asian Pac J Tropical Biomed 2012;2(3):S1671-S1674.
15. Taprial S, Kashyap D, Mehta V, et al. Antifertility effect of hydroalcoholic leaves extract of Michelia champaca L. An ethnomedicine used by Bhatra women in Chhattisgarh state of India. J. Ethnopharmacol 2013;147:671-675.
16. Muterja A, Agarwal M, Kushwaha S, et al. Effect of Nelumbo nucifera seeds on the reproductive organs of female rats. Int J Reprod Biomed 2008;6(1):7-11.
17. Mishra KR, Singh SK. Antispermatogenic and antifertility effects of fruits of Piper nigrum L. in mice. Indian Journal of Experimental Biolog 2009:47:706-714.
18. Gandhi M, Lal R, Sankaranarayanan A, et al. Post-coital antifertility activity of Ruta graveolens in female rats and hamsters. J Ethnopharmacol 1991;34(1):49-59.
19. Shivayogi P, Hiremath, Badami S, et al. Antifertility and hormonal properties of Flavones of Striga orobanchioides. Eur J Pharmacol 2000;391(1-2):193-197.
20. Ghosh A, Jana K, Pakhira BP, et al. Anti-fertility effect of aqueous-ethanolic (1:1) extract of the fruit of Terminalia chebula: Rising approach towards herbal contraception, Asian Pacific Journal of Reproduction 2015;4(3):201-207.
21. Kumar SM, Reddy R, Manasa G, et al. Antifertility Effect Of Trachyspermum ammi (Linn) Sprague Fruits On Male Rats. Int j pharm biol sci arch 2011;2(2):705-709.
22. Nadkarni KM. Indian Materia Medica, 1976;Vol. I. Popular Prakashan Pvt. Ltd, Bombay, India.
23. Meena AK, Rao MM. Folk herbal medicines used by the Meena community in Rajasthan. Asian J Trad Med 2010;5:1-13.
24. Nadkarni KM. Indian Materia Medica 1982;Vol. II, 3rd ed. Popular Prakashan Pvt. Ltd, Bombay, India.
25. Paulsamy S, Vijaykumar KK, Murugesan M, et al. Ecological status of medicinal and other economically important plants in the Shola understories of Nilgiris, the Western Ghat. Natural Product Radiance 2007;6:55-61.
26. Malhi BS, Trivedi VP. Vegetable anti-fertility drugs of India. q-j-crude-drug-res 12,1922–1928.
27. Gangwar KK, Deepali, Gangwar RS. Ethnomedicinal plants diversity in Kumaun Himalya of Uttarakhand, India. Nature and Sciences 2010;8:66-78.
28. Mitra S, Mukharjee SK. Some abortifacient plants used by the tribal people of west Bengal, West Bengal. Nature Product Radiance 2009;8:167-171.
29. Tarafder CR. Ethnogynaecology in relation to plants, Part-II, plants used for abortion. J econ tax bot 1983;4:507-516.
30. Jain A, Katewa SS, Choudhary BL, Galav P. Folk herbal medicines used in birth control and sexual diseases by tribals of southern Rajasthan, India. J. Ethnopharmacol 2004;90(4):171-177.
31. Murty PP, Venkaiah M. Some abortifacient plants used by the tribal people of Andhra Pradesh, India. J phytol 2010;2:7-12.
32. De Laszlo, H, Henshaw, PS. Plant materials used by primitive people to affect fertility. Science 1954;119:626-631.
33. Kirtikar KR, Basu BD. 1946. Indian Medicinal Plants. 3rd ed.
34. Pullaiah T. Encyclopedia of World Medicinal Plants. Regency Publications. 2006.
35. Jain SK, Srivastava S. Traditional uses of some Indian plants among islanders of the Indian Ocean. Indian J Tradit Know 2005;4:345-357.
36. Sikdar M, Datta U. Traditional phytotherapy among the Nath people of Assam. J Ethnobiol Ethnomed 2008;2: 9-45.
37. Uniyal SK, Singh KN, Jamwal P, et al. Traditional use of medicinal plants among the tribal communities of Chhota Bhangal. Western Himalaya J Ethnobiol Ethnomed 2006;2:14.
38. Ghosh A. Ethanomedical plants used in West Rarrh region of West Bengal. Nat prod radiance 2008;7:461-465.

39. Mali RG, Hundiwale JC, Gavit RS, et al. Herbal abor-tifacients used in North Maharashta. Nat prod radiance 2006;5:315-318.
40. Priya RS, Kumuthakalavalli R, Karuppusamy S. Some traditional folk for-mularies against fertility in Kerala. J Hum Ecol 2002;13:335-336.
41. Kumar S, Singh J, Baghotia A, et al. Antifertility potential of the ethanolic extract of Caesalpinia pulcherrima Linn. Leaves. Asian Pac J Reprod 2013;2(2):90-92.
42. Gangwar KK, Deepali Gangwar RS. Ethnomedicinal plants diversity in Kumaun Himalya of Uttarakhand, India. Nature and Sciences 2010;8:66-78.
43. Anitha P, and Indira M. Impact of feeding ethanolic extract of root bark of Cananga odorota on reproductive functions in male rats. Indian J Exp Biol 2006;44:976-980.
44. Badami S, Aneesh A, Sankar S, et al. Antifertility activity of Derris brevipes variety coriacea. J Ethnopharmacol 2003;84:99-104.
45. Emmanuel N, Claidette D. Abortifacient plants of the Buea region their participation in the sexuality of aldoscent girls, Cameroon. Indian J Tradit Know 2007;6:502-507.
46. Dash B, Basu RN. Methods for sterilization and contraception in ancient and medieval India. Indian J Hist Sci 968;3:9-24.
47. Gupta RS, Yadav RK, Dixit VP, et al. Antifertility studies of Colebrookia oppositifolia leaf extract in male rats with special references to testicular cell population dynamics. Fitoperia 2001;72(3):236-245.
48. Chauhan MG, Chavan SS. Pharmacognosy and biological activity of Cor-dia rothii Roem & Schult. bark. Indian J Tradit Know 2009;8:598-601.
49. Chaudhary MI, Khan MA. An ethnomedicinal inventory of plants used for family planning and sex diseases in Samahni valley, Pakistan. Indian J Tradit Know 2008;7:277-283.
50. Gupta M, Mazumder UK, Vamsi ML, et al. Antisteroidonegic activity of the two indian medicinal plants in mice, J Ethanopharmacol 2004;90(1):21-25.
51. Mali PY, and Bhadane VV. Ethno-medicinal wisdom tribals of Aurangabad district. Indian J Nat Prod Resour 2011;2:102-109.
52. Kamboj VP. A review of Indian medicinal plants with interceptive activity. Indian Journal of Medical Research 1988;87:336-355.
53. Satyavati GV, Gupta AK, Tondon N. Medicinal Plants of India. 1987;Vol. II. ICMR.
54. Gediya S, Ribadiya C, Soni J, et al. Herbal plants used as contraceptives. Int J Curr Pharm Res 2011;2(1):47-53.
55. Mali PC, Ansari AS, Chaturvedi M. Antifertility effect of chronically administered Martynia annua root extract on male rats J Ethnopharmacol 2002;82(2-3):61-67.
56. Jain SK. Dictionary of Indian folk Medicine and Ethnobotany. Deep Publica-tions 1991.
57. Patil MV, Patil DA. Ethnomedicinal practices of Nasik district, Maharashtra. Indian J Tradit Med 2005;4:287-290.
58. Maheshwari JK, Singh KK, Saha S. Ethanobotany of Tribals of Mirzapur District, U.P. In: Ethanobotany. National Botanical Research Institute, Lucknow, 1986;581-587.
59. Hallstrom H, Thuvander A. Toxicological evaluation of myristicin. J Nat Toxins 1997;5:186-192.
60. Gangwar KK, Deepali, Gangwar RS. Ethnomedicinal plants diversity in Kumaun Himalya of Uttarakhand, India. Nature Sci 2010;8:66-78.
61. Kong YC, Cheng KF, Cambie RC, et al. Yuehchukene: a novel indole alkaloid with anti-implantation activity. J Chem Soc Chem Commun1985;2:47-48.
62. Sharma PK, Chauhan NS, Lal B. Observations on the traditional phytotherapy among the inhabitants of Parvati valley in Western Himalaya, India. J Ethnopharmacol 2004;92:167-176.
63. Shivalingappa H, Satyanarayan ND and Purohit MG. Antiimplantation and pregnancy interruption efficacy of Rivea hypocrateriformis in the rat. J Ethanopharmacol 2001;74:245-249.
64. Rao RV, Rangaswami S. Scillarenin bis-L-rhamnoside a new cardiac glyco-side from Scilla indica roxb. J Ethnopharmacol 1967;8:4563-4565.
65. Singh SP. Fertility control of female through Sesbani sesbian seeds. J Res Educ Indian Med 1990;9(4):227-232.
66. Bullough VL, Brondegaard VJ. Contraceptive plant drugs. Planta Medica 2001;23:1671-82.
67. Katewa SS, Galav PK, Nag A, et al. Poisonous plants of southern Aravalli hills of Rajasthan. Indian J Tradit Know 2008;7:269-272.
68. Kachare SV. Ethnomedicinal use of plants as a remote control in rural areas of Mahur and Nanded. Int J Curr Res 2011;3:168-170.
69. Gupta RS, Kanwar M, Rehwani H, et al. Contraceptive efficacy of Strychnos potatorum seed extract in male Albino Rats. Asian J. Exp.Sci 2006;20(1):73-78.
70. Ayyanar M, Ignacimuthu S. Traditional knowledge of Kani tribals in Koutha-lai of Tirunelveli hills, Tamil Nadu, India. J Ethnopharmacol 2005;102:246-255.
71. Maity D, Pradhan N, Chauhan AS. Folk uses of some medicinal plants from north Sikkim. Indian J Tradit Know 2004;3:66-71.
72. Kamble SY, Patil SR, Sawant PS, et al. Studies on plants used in traditional medicine by Bhilla tribe of Maharashtra. Indian J Tradit Know 2010;9:591-598.
73. Batta SK, Santhakumari G. The antifertility effect of Ocimum sanctum and Hibiscus rosa-sinensis. Indian J Med Res 1970;59:777-781.