



Role of Anti-fertility Medicinal Plants on Male & Female Reproduction

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Authors' contributions

This work was carried out in collaboration between all authors. Author AS designed the study, collected required literature, wrote the protocol and wrote the first draft of the manuscript. Author PRY helped in literature searches and designing final draft copy of manuscript and author CKB managed for the final outcome of manuscript without grammatical errors. All authors read and approved the final manuscript.

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ABSTRACT

Aim and Objective: The aim of this review was to provide a detailed concept to the researchers on antifertility activity of several plants inhibiting male and female fertility and may be developed into contraceptives. Despite of many medicinal plants have been claimed to prevent fertility, only few plants were so far been investigated for their antifertility activity.

Materials and Methods: An extensive bibliographic investigation was carried out by analyzing various classical text books, scientific journals, consulting worldwide accepted databases for

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providing suitable information on antifertility medicinal plants. Plant species traditionally used as contraceptives, abortifacients, emmenagogues, spermatogenics were considered as antifertility agents.

Results: Overall 233 plant species belonging to various families, traditionally used as antifertility agents in both males and females has been incorporated in this review. The various plant parts used in fertility regulation includes leaves, fruits, roots, bark, stem etc.

Conclusion: In conclusion, it is clear that medicinal plants play an important role as antifertility agents. Despite of various commercially available oral contraceptives in the market, herbal antifertility agents shows promising output by minimizing the number of adverse drug properties. Current research towards traditional medicine is growing rapidly because of its safety and less cost consumption.

Keywords: Antifertility; plant extracts; contraceptive; abortifacient; fertility regulation.

1. INTRODUCTION

Antifertility agents are those which are capable of preventing ovulation or fertilization and able to induce termination of pregnancy [1]. Overpopulation is becoming one of the global problems causing much influence on economic, social and natural resources [2]. The increase in population is alarming the developing world in the need for effective birth control measures [3]. One of the serious problems in the developing countries like India is over population and which would be increased about 9.2 billion by the year 2050 [4].

Although a several synthetic contraceptive agents are available today, their use is associated with severe side effects, such as hormonal imbalance, hypertension, increased risk of cancer and weight gain [5]. Hence people are looking forward to the tradition of using herbal medicines, which have minimum and less side effects [6].

Medicinal plants are been using form many centuries to treat both mental and physical illness and to improve health of individuals, and approximately 80% of medical treatments are practicing by the developing countries [7]. However in the recent past much interest has been shown to control regulation of fertility by using medicinal plants [8]. Fertility regulation comprising contraception and management of infertility forms an important component of reproductive health [9].

Several plant extracts inhibit male and female fertility and may be developed into contraceptives. Despite of many medicinal plants

have been claimed to prevent fertility, only few plants were so far been investigated for their antifertility activity. Moreover the World Health Organization (WHO) has set up a task force on plant research to find out new orally active non-steroidal contraceptive compounds [10].

1.1 Mechanism of Action of Antifertility Plants

Medicinal plants have been reported to possess antifertility effects by various mechanism of actions, one of the major action is their effect on sex hormones particularly for suppressing fertility, regularizing menstrual cycle, relieving dysmenorrhoea, treating enlarged prostate, menopausal symptoms, breast pain etc., [11].

More over plants with estrogenic property can directly influence pituitary action by peripheral modulation of luteinizing hormone (LH) and follicle stimulating hormone (FSH), decreasing their secretions and blocking ovulation [12]. The plants with anti-estrogenic activities intercept in the process of development of ovum and endometrium and on the other hand, plants have abortifacient effects [13,14].

The site of action of antifertility agents in females, comprises of the hypothalamus, the anterior pituitary, the ovary, the oviduct, the uterus and the vagina. The mammalian uterus is the main site of antifertility effects [11]. Typical estrogenic compounds possess ability to increase the uterine wet weigh and induce cornification and opening of vagina in immature rats which results anti-implantation effects [15].

Plant extracts are also shown promising antifertility effects when administered to male rats. The various effects on male reproductive system to induce antifertility action shown by plants includes antispermatogenic effect, post-testicular antifertility effect, spermicidal, sperm immobilizing effect, antiandrogenic effect etc.,.

Therefore, aim of the present study has been made to review antifertility activity of selected medicinal plants which have been used as herbal contraceptives

2. MATERIALS AND METHODS

The information provided in this review, was a result of an extensive bibliographic investigation by analyzing classical text books, scientific journals, consulting worldwide accepted databases. The peer reviewed papers were gathered from different databases like SCOPUS, PUBMED, Google Scholar, INFLIBNET etc. over all 233 plants were reviewed for their antifertility effects along with their possible mechanism of actions, part used, family and animal used.

This review was concentrated to incorporate list of various plants, that have been mentioned for their use as antifertility agents in traditional medicinal, and along with that it also contains plant extracts, those which are already proved by various scientific papers.

3. RESULTS

More than 300 scientific peer reviewed articles were investigated for searching the traditional/folk-lore use of plants possessing antifertility activity. The various plants claimed and proved as antifertility, abortifacient, contraceptive, spermicidal, emmenagogue etc were included.

Following is the list of plants reported to possess antifertility effects along with their parts used and mechanism of actions.

4. DISCUSSION

Medicinal plants, since ancient times have a long history of traditional use in all parts of

world. In India as well as other parts in the world there are several medicinal plants which are reported to possess antifertility properties [224]. There are several plants reported by the medical historians that can possess abortifacient, contraceptive and emmenagogue properties [154].

The objective of this review is to present a detailed and analyzed ethnopharmacological data of 233 plant species for regulating fertilization and conception which are being used by the various tribes all over the world during last few decades. The names of the plants including their family, part used, animal used and mechanism of action were included in the table. As shown in the table the plants were categorized according to their effects as antifertility agents, abortifacients, contraceptives, emmenagogues and sterilizers, and some plants which have multiple properties depending upon the dose are also included. Moreover, this review contains list of plants having their effective role in regulating fertility control in both male and females. During the literature survey it was observed that among the various parts of plants, leaves have been extensively used for controlling fertilization. The other plant parts includes fruits, stems, bark, roots, seeds, flowers, gums etc were used in small proportions.

The various medicinal plants cited such as *Abroma angusta* [16], *Acalypha indica* [23], *Allium sativum* [36], *Artemisia vulgaris* [1], *Bacopa monnieri* [43], *Butea monosperma* [52], *Calotropis procera* [53], *Daucus Carota* [84], *Embelia Ribes* [95], *Epilobium angustifolium* [96], *Ficus religiosa* [104], *Franseria artemisioides* [111], *Galium mexicanum* [112], *Gardenia jasminoides* [114], *Hamelia erecta* [121], *Hibiscus rosa-sinensis* [123], *Jasminum multiflorum* [129], *Lawsonia inermis* [136], *Lepidium sativum* [139], *Myristica fragrans* [152], *Nardostachys jatamansi* [154], *Nicotiana tabacum* [156], *Ocimum sanctum* [159], *Papaver somniferum* [33], *Piper longum* [167], *Ruta graveolens* [182], *Santalum album* [185], *Terminalia arjuna* [197], *Trigonella foenumgraecum* [200], *Urginea indica* [206], *Vernonia amygdalina* [211], *Withania somnifera* [218], *Zinziber officinale* [33], *Ziziphus nummularia* [221] confirmed potent antifertility effects.

Table 1. List of medicinal plants reported to possess antifertility effects

S. no.	Name of the plant	Family	Part used	Animal model	Mechanism of action	Reference
1.	<i>Abroma angusta</i> Linn.	Sterculiaceae	Roots	Rat	Antiimplantation & Abortifacient	[16, 17]
2.	<i>Abrus precatorius</i> Linn.	Fabaceae	Seeds	Rat	Reduced sperm motility, Post-testicular antifertility effect	[18, 19]
3.	<i>Acacia auriculaeformis</i> A. Cunn.	Fabaceae	-	-	Sperm immobilizing effect	[20]
4.	<i>Acacia caesia</i> Wight & Arn	Leguminosae	Fruit	-	Immobilization of spermatozoa	[21]
5.	<i>Acacia concinna</i> DC	Fabaceae	Stem bark	Rat	Spermicidal and semen coagulating activities	[22]
6.	<i>Acalypha indica</i> Linn.	Euphorbiaceae	Whole plant	-	Anti-estrogenic activity	[23, 24]
7.	<i>Achillea millefolium</i> Linn.	Asteraceae	Flowers	Mice	Antispermatogetic effect	[25]
8.	<i>Achyranthus aspera</i> Linn.	Amranthaceae	Root	Rat	Spermicidal action	[26]
9.	<i>Actiniopteris dichotoma</i> Kuhn	Pteridaceae	Whole plant	Rat	Antifertility effect	[27]
10.	<i>Adhatoda vasica</i> Nees Syn. <i>Justice adhatoda</i> L.	Acanthaceae	Leaves	Rat	Antiimplantation & Abortifacient	[16, 24]
11.	<i>Aegle marmelos</i> Corr. Ex Roxb.	Rutaceae	Leaf	Rat	Resist process of spermatogenesis and decrease sperm motility	[28, 29]
12.	<i>Aerva lanata</i> (L.) Juss. Ex. Shult	Amaranthaceae	Aerial parts	Rat	Antiimplantation effect	[30]
13.	<i>Afromosia laxiflora</i> (Baker) Harms	Fabaceae	Stem bark	Rat	Antigonadotropic activity and blocks oestrous cycle	[31]
14.	<i>Ailanthus excelsa</i> Roxb.	Simaroubaceae	Leaf, Stem, Bark	Rat	Antiimplantation effect and Early Abortifacient	[32]
15.	<i>Alangium Salvifolium</i> (L.f.)	Alangiaceae	Stem, Bark	Rat	Antiimplantation & Abortifacient	[33]
16.	<i>Albizia procera</i> (Roxb.) Benth.	Leguminosae	Seed and Root	Rat	Spermicidal and semen coagulating activities	[22]
17.	<i>Albizia lebbek</i> (Linn.) Benth.	Mimosaceae	Pod, Bark	Rat	Antifertility activity	[34, 35]
18.	<i>Allium cepa</i> Linn.	Liliaceae	Bulb	Rat	Antiimplantation activity	[16]
19.	<i>Allium sativum</i> Linn.	Amaryllidaceae	Pod	Rat	Antispermatogetic activity	[36]
20.	<i>Aloe barbadensis</i> Mill. Syn. <i>Acalypha indica</i> , <i>A. litoralis</i> , <i>A. vera</i>	Liliaceae	Leaves	Dog	Antiandrogenic activity	[37]
21.	<i>Alstonia scholaris</i> R.Br.	Apocynaceae	Stem bark	Rat	Antifertility activity	[38]
22.	<i>Amaranthus spinous</i> Linn.	Amaranthaceae	Root	Rat	Inhibit fusion of Sperm and Ovum	[39]
23.	<i>Amaranthus viridis</i> L.	Amaranthaceae	Root	Rat	Contraception Activity	[33]
24.	<i>Anacardium occidentale</i> Linn.	Anacardiaceae	Nut Shell	Rat	Spermicidal	[16]

S. no.	Name of the plant	Family	Part used	Animal model	Mechanism of action	Reference
25.	<i>Anagalis arvensis</i> Linn.	Primulaceae	Whole Plant	Rat	Spermicidal and semen coagulating activities	[22]
26.	<i>Ananas comosus</i> Merr.	Bromeliaceae	Unripe fruit	Rat	Antispermato-genic activity	[40]
27.	<i>Andrographis paniculata</i> Wall. Ex Nees	Acanthaceae	Leaves	Rat	Antispermato-genic and antiandrogenic	[41]
28.	<i>Arctium lappa</i> Linn.	Asteraceae	Leaves and roots	Rat	Abortifacient	[33]
29.	<i>Ardisia solanacea</i> Roxb.	Myrsinaceae	Plants excluding roots	Rat	Spermicidal Activity	[16]
30.	<i>Aristolochia indica</i> Linn.	Aristolochiaceae	Root	Presbytes langur	Antispermato-genic and antiandrogenic	[42]
31.	<i>Artemisia afra</i> Jacq. Ex Wild.	Asteraceae	Leaf	Rats	Abortion	[33]
32.	<i>Artemisia vulgaris</i> Linn.	Asteraceae	Leaves	Rats	Antiimplantation and Estrogenic activity	[1]
33.	<i>Aspilia Africana</i> (pers.) C.D. Adams	Asteraceae	Leaves	Rats	Antio-vulatory Activity	[43]
34.	<i>Austroplenckia populnea</i> (Reiss.) Lundell.	Celastraceae	Pods	Rats	Affects the sexual behavior and epididymal sperm concentration	[44]
35.	<i>Azardirachta indica</i> A. Juss.	Maliaceae	Seed Oil	Rats	Antispermato-genic and antiandrogenic	[45]
36.	<i>Bacopa monnieri</i> (L.) Pennell	Scrophulariaceae	Whole plant	Rats	Contraception Activity	[43]
37.	<i>Balanites roxburghii</i> Linn.	Zygophyllaceae	Fruits	Dog	Antispermato-genic activity and testicular necrosis and atrophy	[46, 47]
38.	<i>Ballota undulate</i> (Sieber ex. Fresen.) Benth.	Labiatae	Leaves, Flowers	Rats	Antiimplantation activity	[43]
39.	<i>Bambusa arundinacea</i> Willd.	Graminae	Shoots, Stem	Rats	Impaired the structural and functional activity of epididymis, Reduced sperm motility	[48]
40.	<i>Barleria prionitis</i> Linn.	Acanthaceae	Roots	Rat	Antifertility effect	[49]
41.	<i>Berberis chitria</i> Buch.-Ham.ex Lindl.	Berberidaceae	Root	Dog	Antispermato-genic activity	[50]
42.	<i>Biophytum sensitivum</i> (L.) DC.	Oxalidaceae	Leaves	Rats	Antiimplantation Activity	[51]
43.	<i>Bougainvillea</i> Comm. Ex Juss.	Nyctaginaceae	Leaves	Rats	Antifertility effect	[51]
44.	<i>Butea monosperma</i> (Lam.) Kuntze	Fabaceae	Seed	Rat, Dog	Effects on testicular function	[52]
45.	<i>Calotropis procera</i> (Ait.) R. Br.	Asclepiadaceae	Roots	Rabbit, Mice	Antispermato-genic effect and leydig cell atrophy Functional alteration in the genital organs and inhibition of fertility	[53, 54]

S. no.	Name of the plant	Family	Part used	Animal model	Mechanism of action	Reference
46.	<i>Cananga odorata</i> (Lam.) Hook. F. & Thomson	Annonaceae	Root, Bark	Rat	Spermicidal Activity	[55]
47.	<i>Cannabis sativa</i> Linn.	Cannabaceae	Leaves	Presbytis Monkey	Testicular lesions and atrophy of Leydig cells	[56]
48.	<i>Cardiospermum Helicacabum</i> L.	Spindaceae	Whole plant	Rat	Antiimplantation activity	[51]
49.	<i>Carica papaya</i> Linn.	Caricaceae	Fruit	Rat	Antispermato-genic activity	[57]
50.	<i>Carum carvi</i> Linn.	Apiaceae	Rhizome	Rat	Antioestrogenic activity	[43]
51.	<i>Cassis fistula</i> Linn.	Caesalpinaceae	Pods, Seeds	Rat	Antioestrogenic activity	[58]
52.	<i>Catharanthus roseus</i> G. Don syn. Vinca rosea Linn.	Apocynaceae	Leaves	Mice	Antioestrogenic activity	[59]
53.	<i>Celastrus paniculatus</i> Willd.	Celastraceae	Seeds	Rat	Antispermato-genic action	[60]
54.	<i>Cicer arietinum</i> Linn.	Fabaceae	Seeds	Rat	Abortifacient and estrogenic activity	[61]
55.	<i>Cichorium intybus</i> Linn.	Asteraceae	Whole plant	Rat	Antispermato-genic activity	[62]
56.	<i>Cinnamomum Camphora</i> Nees & Eberm.	Lauraceae	Seed	Sparrow	Arrest and inhibition of spermatogenesis	[63]
57.	<i>Cissampelos pareira</i> Linn.	Menispermaceae	Leaves	Mice	Antioestrogenic activity	[64]
58.	<i>Citrullus colocynthis</i> Schrad.	Cucurbitaceae	Fruit, Root	Rat	Induced reversible antifertility effects and Antispermato-genic effect	[65, 66]
59.	<i>Clerodendrum serratum</i> L.	Lamiaceae/Verbenaceae	Whole plant (Excluding Roots)	Rats	Spermicidal activity	[67]
60.	<i>Cnidioscolous aconitifolius</i> (Mill.) I.M. Johnst.	Euphorbiaceae	Leaves	Rats	Contraception	[68]
61.	<i>Cola nitida</i> Schott & Endl.	Sterculiaceae	Stem Bark	Rats	Antigonadotropic activity and	[69]
62.	<i>Colebrookia oppositifolia</i> Sm.	Lamiaceae	Leaf	Rats	Antifertility Effect	[70]
63.	<i>Combretodendron macrocarpum</i> (P.Beauv.) Keay	Barringtoniaceae	Stem bark	Rats	Antigonadotropic activity and	[71]
64.	<i>Convolvulus miicrophyllus</i> Sieb. ex Spreng	Convolvulaceae	Whole Plant	Rat	Antispermato-genic effect	[72]
65.	<i>Crataeva nurvala</i> Buch.Ham.	Capparidaceae	Stem Bark	Rat	Antiimplantation and Antioestrogenic activity	[73]
66.	<i>Crotalaria juncea</i> Linn.	Papilionaceae	Seeds	Mice	Antifertility Activity, Arrest of spermatogenesis and antiandrogenic Effect	[74, 75]
67.	<i>Croton roxburghii</i> Balak.	Euphorbiaceae	Bark	Mouse	Anti-steroidogenic activity	[76]
68.	<i>Cumftiga racemosa</i> L.	Apocyanaceae	Root	Rats	Spermatogenesis	[77]
69.	<i>Cuminum cyminum</i> Linn.	Apiaceae	Seed	Rat	Antispermato-genic effect	[78]

S. no.	Name of the plant	Family	Part used	Animal model	Mechanism of action	Reference
70.	<i>Curcuma aromatica</i> Salisb.	Zingiberaceae	Rhizome	Rats	Antifertility Activity	[79]
71.	<i>Curcuma longa</i> Linn.	Zingiberaceae	Root	Rats	Interference with Spermatogenesis	[80]
72.	<i>Cyclamen persicum</i> Mill.	Primulaceae	Whole Plant	-	Spermicidal activity	[81]
73.	<i>Cyclea burmanni</i> Miers	Menispermaceae	Roots	Rat	Decrease Sperm Count	[82]
74.	<i>Cynomorum coccineum</i> Linn.	Cynomoraceae	Inner pulp of stem and root	Rats	Effect on epididymal sperm pattern	[83]
75.	<i>Daucus Carota</i> Linn.	Apiaceae	Seeds	Rat	Blastocystotoxic and Antiimplantaion effects; Postcoital contraceptive effects	[84, 85]
76.	<i>Dendrophthoe falcate</i> (Linn. f.)	Loranthaceae	Aerial parts	Rats	Antifertility effect	[86]
77.	<i>Derris brevipes</i> Baker.	Fabaceae	Root Powder	Rats	Abortifacient	[87]
78.	<i>Desmodium gangeticum</i> DC.	Fabaceae	Whole plant	Rat	Antifertility effect	[88]
79.	<i>Dioscorrea bulbifera</i> L.	Dioscoreaceae	Tuber	-	Contraceptive	[89]
80.	<i>Diploclisia echinatus</i> Linn.	Asteraceae	Stem	-	Spermicidal	[90]
81.	<i>Dipsacus mitis</i> D.Don	Spindaceae	Root	Hamster	Contraceptive	[91]
82.	<i>Ecballium elaterium</i> A. Rich.	Cucurbitaceae	-	Rabbit	Decreases sperm motility	[92]
83.	<i>Echeveria gibbiflora</i> DC	Crassulaceae	Whole plant	Guinea Pig	Decreased sperm motility	[93]
84.	<i>Echinops echinatus</i> Roxb.	Asteraceae	Root	Rat	Sperm antimotility	[94]
85.	<i>Embelia Ribes</i> Burm.f.	Myrsinaceae	Berry	Rat	Antifertility activity	[95]
86.	<i>Epilobium angustifolium</i> Linn.	Onagrariaceae	-	Rat	Reduction in weight of accessory sex organs	[96]
87.	<i>Eupatorium odoratum</i> Linn.	Asteraceae	-	-	Spermicidal activity	[97]
88.	<i>Euphorbia neriifolia</i> Linn.	Euphorbiaceae	Root	Rat	Antispermatogetic effects	[98]
89.	<i>Eugenia jambolana</i> L.	Myrtaceae	Flowers	Rat	Antifertility effect	[99]
90.	<i>Ehretia cymosa</i> Thonn.	Boraginaceae	Leaf, Bark	-	Contraceptive	[100]
91.	<i>Eleutherine bulbosa</i> Urb.	Iridaceae	Bulb	Rat	Abortifacient	[101]
92.	<i>Fevillea passiflora</i> Vell.	Cucurbitaceae	Seed	-	Abortifacient	[102]
93.	<i>Ferula assa-foetida</i> Linn.	Apiaceae	Resin	-	Emmenagogue	[103]
94.	<i>Ficus religiosa</i> Linn.	Moraceae	Fruit	Goat	Anti-implantation	[104]
95.	<i>Ficus wassa</i> Roxb.	Moraceae	Root	-	Contraceptive	[105]
96.	<i>Flagellaria indica</i> Linn.	Flagellariaceae	Leaf	-	Contraceptive	[106]
97.	<i>Flemingia strobilifera</i> (L.) J. St. Hil syn. <i>Moghania strobilifera</i> (L.) J. St.-Hill.	Fabaceae	Seed	-	Contraceptive	[107]
98.	<i>Fleura aestuans</i> Linn.	Utricaceae	Root	-	Abortifacient	[108]

S. no.	Name of the plant	Family	Part used	Animal model	Mechanism of action	Reference
99.	<i>Foeniculum vulgare</i> Mill.	Apiaceae	Seed	Rat	Sperm toxic	[109]
100.	<i>Fragaria vesca</i> Linn.	Rosaceae	Leaf	-	-	[110]
101.	<i>Franseria artemisioides</i> Willd.	Asteraceae	Whole plant	-	Contraceptive	[111]
102.	<i>Galium mexicanum</i> Var.	Rubiaceae	Leaves	Cat	Abortifacient	[112]
103.	<i>Garcinia cambogia</i> Desr.	Clusiaceae	Fruit	Rat	Testicular atrophy	[113]
104.	<i>Gardenia jasminoides</i> Ellis.	Rubiaceae	Fruits	-	Abortifacient	[114]
105.	<i>Gloriosa superb</i> Linn.	Liliaceae	Roots	Rat, mice	Oxytotic activity, Abortifacient	[115]
106.	<i>Glossocardia bosvallia</i> DC.	Asteraceae	Whole plant	-	Emmenagogue	[116]
107.	<i>Glycyrrhiza glabra</i> Linn.	Fabaceae	Root	-	Emmenagogue	[117]
108.	<i>Gossypium barbadense</i> Linn.	Malvaceae	Cotton Seed	rat	Testicular	[118]
109.	<i>Grewia columnaris</i> Sm.	Triliaceae	Root	-	Sterilizer	[119]
110.	<i>Hagenia abyssinica</i> .syn. <i>Brayera anthalmintica</i>	Rosaceae	-	-	Abortifacient	[116]
111.	<i>Haematoxylon campechianum</i> L.	Fabaceae	Whole plant	-	Abortifacient	[120]
112.	<i>Hamelia erecta</i> Jacq	Rubiaceae	Leaf	-	Abortifacient	[121]
113.	<i>Hedeoma pulegoides</i> Linn.	Labiataeae	Plant without root	-	Contraceptive and Abortifacient	[122]
114.	<i>Hedera helix</i> Linn.	Araliaceae	Fruit	-	Contraceptive	[111]
115.	<i>Hibiscus rosa-sinensis</i> Linn.	Malvaceae	Root	Rats & Mice	Anti-implantation & Uterotropic activity	[123]
116.	<i>Hyptis suaveolens</i> Poit.	Labiatae	Whole plant	Mice	Antifertility	[124]
117.	<i>Hypochoeris brasiliensis</i> (Less.) Benth	Asteraceae	Leaf & Root	-	Contraceptive	[125]
118.	<i>Hypericum chinensis</i> Linn.	Clusiaceae	Leaf	-	Emmenagogue	[126]
119.	<i>Hymenaea stigonocarpa</i> Mart. Ex Hayne	Fabaceae	Bark	-	Contraceptive	[127]
120.	<i>Indigofera linnaei</i> Ali	Fabaceae	Herb	rats	Anti-fertility activity	[128]
121.	<i>Jacaranda copaia</i> (Aublet.) D. Don	Bignoniaceae	Tuber	-	Contraceptive	[127]
122.	<i>Jasminum multiflorum</i> (Burm.f.) Andrews	Oleaceae	-	-	Emmenagogue	[129]
123.	<i>Jodinia rhombifolia</i> (Hook. & Arn.) Reissek.	Santalaceae	Leaf	-	Abortifacient	[130]
124.	<i>Juglans regia</i> Linn.	Juglandaceae	Leaf	-	Contraceptive	[111]
125.	<i>Juniperus communis</i> Linn.	Cupressaceae	Stem & Fruit	-	Anti-implantation activity	[14, 131]
126.	<i>Juniperus oxycedrus</i> Linn.	Cupressaceae	Berry	-	Abortifacient	[132]

S. no.	Name of the plant	Family	Part used	Animal model	Mechanism of action	Reference
127.	<i>Justicia simplex</i> D. Don	Acanthaceae	Root	-	Contraceptive	[133]
128.	<i>Kopsia</i> SP	Apocynaceae	Leaf	-	Contraceptive	[106, 134]
129.	<i>Laurus nobilis</i> Linn.	Lauraceae	Leaf	Rats	Testicular dysfunction	[135]
130.	<i>Lawsonia inermis</i> Linn. syn. L. alba	Lythraceae	Leaves	rats	Abortifacient	[136]
131.	<i>Leonotis nepetaefolia</i> R.Br.	Labiatae	Leaf	Rats	Anti-implantation	[137]
132.	<i>Lepidium meyenii</i> Walp.	Brassicaceae	Root	Rats	invigorates spermatogenesis in male rats	[138]
133.	<i>Lepidium sativum</i> Linn.	Brassicaceae	Herb	-	Abortifacient & Anti-Ovulatory	[139]
134.	<i>Licuala</i> SP.	Arecaceae	Root bark	-	Contraceptive	[111]
135.	<i>Ligusticum porter</i> Coult. And Rose	Apiaceae	Root	-	Emmenagogue	[140]
136.	<i>Lithospermum officinale</i> Linn.	Broaginaceae	Leaves	Rat	Inhibition of hypophyseal hormone secretion	[141]
137.	<i>Lobelia nicotianifolia</i> Heyne	Campanulaceae	Whole plant	-	Contraceptive	[142]
138.	<i>Lonicera ciliosa</i>	Caprifoliaceae	Leaf	-	Contraceptive	[143]
139.	<i>Malvaviscus conzattii</i> Greenm	Malvaceae	Flower	Albino Mice	Antifertility activity	[144]
140.	<i>Martynia annua</i> Linn.	Martyniacae	Root	Rats	Antifertility Effect	[145]
141.	<i>Melodinus fusiformis</i> Champ. Ex Benth.	Apocynaceae	-	-	Spermicidal Effect	[146]
142.	<i>Mentha arvensis</i> Linn.	Labiatae	Leaves	Rabbits	Anti-Ovulatory	[147]
143.	<i>Millettia auriculata</i> Baker. ex, Brand.	Fabaceae	Leaves	Rat	Anti-Implantation effect	[148]
144.	<i>Momordica charantia</i> Linn.	Cucurbitaceae	Seeds	Rats	Antispermatogetic	[149]
145.	<i>Mondia whiteii</i> Skeels	Apocynaceae	Root bark	Rat	Antispermatogetic & Anti fertility activities	[150]
146.	<i>Mucuna urens</i> Medik.	Fabaceae	Seed	Rat	Antispermatogetic	[151]
147.	<i>Myristica fragrans</i> Houtt	Myristicaceae	Seed	-	Abortifacient	[152]
148.	<i>Mesua ferrea</i> Linn.	Clusiaceae	Flowers	Rat	Anti-implantation	[153]
149.	<i>Nardostachys jatamansi</i> DC.	Valerianaceae	Root	-	Emmenagogue	[154]
150.	<i>Nasturtium officinalis</i> R.Br.	Brassicaceae	Whole Plant	-	Abortifacient	[33]
151.	<i>Nerium indicum</i> Mill.	Aocynaceae	Whole Plant	-	Emmenagogue	[155]
152.	<i>Nicotiana tabacum</i> Linn.	Solanaceae	Leaves	Rat	Antiandrogenic effects	[156]
153.	<i>Nigella sativa</i> Linn.	Ranunculaceae	Seeds	Rat	Post-Coital Antifertility effect	[157]
154.	<i>Nothocnide repanda</i> (Bl.) Bl.	Utricaceae	Leaf	-	Abortifacient	[106]
155.	<i>Ochna jabotapita</i> Linn.	Ochnaceae	Plant (Without root)	-	Semen coagulating activity	[158]

S. no.	Name of the plant	Family	Part used	Animal model	Mechanism of action	Reference
156.	<i>Ocimum sanctum</i> Linn.	Labiatae	Leaves	Rats	Antiandrogenic Property	[159]
157.	<i>Olea europea</i> Linn.	Oleaceae	Fruit	Rats	Contraceptive	[160]
158.	<i>Ophiopogon intermedius</i> (D.Don) Maxim	Asparagaceaea	Rhizomes	-	Spermicidal	[161]
159.	<i>Opuntia dilleni</i> Haw.	Cactaceae	Phylloclade	Rats	Spermatotoxic	[162]
160.	<i>Origanum vulgare</i> Linn.	Labiatae	-	-	Abortifacient	[163]
161.	<i>Oxalis physocalyx</i> Zucc.ex Progel	Oxalidaceae	Whole Plant	-	Abortifacient	[127]
162.	<i>Oxytenanthera abyssinica</i> Munero	Poaceae	Leaf	-	Abortifacient	[108, 164]
163.	<i>Papaver somniferum</i> Linn.	Papaveraceae	Fruit	-	Induces Abortion	[33]
164.	<i>Peganum harmala</i> Linn.	Zygophyllaceae	Epigeal Plants	Rats	Abortifacient	[165]
165.	<i>Petrocarpus santalinus</i> Linn.f.	Fabaceae	Stem Bark	Rats	Anti-implantation activity	[166]
166.	<i>Piper longum</i> Linn.	Piperaceae	Fruit	Rats	Antifertility Activity	[167]
167.	<i>Pittosporum neelgherrense</i> Wight & Arn.	Pittosporaceae	Plant (Without Root)	Rats	Spermicidal and Semen Coagulation	[168]
168.	<i>Plumbago zeylanica</i> Linn.	Plumbaginaceae	Leaves & Root	Rats	oestrogenic activity	[169, 170]
169.	<i>Plumeria rubra</i> Linn.	Apocynaceae	Pod Extract	Rats	Anti-implantation activity	[171]
170.	<i>Polemonium caeruleum</i> Linn.	Polemoniaceae	-	-	Antispermatogetic effect	[172]
171.	<i>Primula vulgaris</i> Huds.	Primulaceae	-	-	Spermicidal effect	[81, 173]
172.	<i>Pueraria tuberosa</i> DC.	Fabaceae	Tubers	Rats	Antifertility activity	[14, 174]
173.	<i>Portulaca oleracea</i> Linn.	Portulacaceae	Seed	Mice	Impairment of Spermatogenesis	[175]
174.	<i>Pyrus cuspidata</i> Bertol	Rosaceae	Whole Plant	-	Spermicidal effect	[22]
175.	<i>Quassia amara</i> Linn.	Simaroubaceae	Stem wood	Rats	Antifertility activity	[16, 176]
176.	<i>Randia dumetorum</i> Lamk.	Rubiaceae	-	-	Anti-implantation effect	[131]
177.	<i>Randia spinosa</i> (Thumb.) Bl.	Rubiaceae	Fruit	-	Antifertility activity	[95, 177]
178.	<i>Ranunculus sceleratus</i> Linn.	Ranunculaceae	Whole Plant	-	Antifertility activity	[154]
179.	<i>Rauwolfia serpentina</i> Benth.	Apocynaceae	Root	-	Antifertility activity	[178]
180.	<i>Rhamnus catharticus</i> Linn.	Rhamnaceae	-	-	Emmenagogue	[179]
181.	<i>Ricinus communis</i> Linn.	Euphorbiaceae	Seed	Guinea Pigs	Anti-implantation and Abortifacient	[180]
182.	<i>Rubia cordifolia</i> Linn.	Rubiaceae	Root	-	Antifertility activity	[155]
183.	<i>Rubus ellipticus</i> Sm.	Rosaceae	Leaves	Rats	Anti-implantation Effect	[181]
184.	<i>Ruta angustifolia</i> Linn.	Rutaceae	Leaf	-	Antifertility activity	[154]
185.	<i>Ruta graveolens</i> Linn.	Rutaceae	Aerial parts and Roots	Rats and hamsters	Anticonceptive activity	[182]

S. no.	Name of the plant	Family	Part used	Animal model	Mechanism of action	Reference
186.	<i>Salvia fruticosa</i> Mill.	Labiatae	Leaves	Rats	Anti-implantation Effect	[183]
187.	<i>Samida rosea</i> Sims.	Flacourtiaceae	Leaf	Rats	Abortifacient and Emmenagogue	[101, 184]
188.	<i>Santalum album</i> Linn.	Santalaceae	Whole Plant	-	Abortifacient	[185]
189.	<i>Sapindus mukorossi</i> Gaertn	Sapindaceae	Fruit Pericarp	Rats	Alteration in Sperm membrane physiology	[186]
190.	<i>Sarcostemma acidum</i> (Roxb) Voigt	Apocynaceae	Stem	Rats	Arrests Spermatogenesis	[187]
191.	<i>Scilla indica</i> (Baker)	Liliaceae	Bulb	-	Emmenagogue	[188]
192.	<i>Semecarpus anacardium</i> Linn.	Anacardiaceae	Fruits	Rats	Spermatogenic arrest	[189]
193.	<i>Solanum surattense</i> Burm.f.	Solanaceae	Seed	Rats	Deplete the oxidative stress of cauda epididymal spermatozoa	[190]
194.	<i>Stephania hernandifolia</i> Willd.	Menispermaceae	Leaf	Rats	Inhibition of spermatogenesis	[191]
195.	<i>Stevia rebaudiana</i> Bertoni	Asteraceae	Whole plant	Rats	Decrease in Testosterone Level	[192]
196.	<i>Striga orobanchoides</i> Benth	Scrophulariaceae	Whole Plant	Rats	Antispermatogetic effect	[193]
197.	<i>Syzygium cuminii</i> Linn. Syn. <i>Eugenia jambolana</i> Lam.	Myrtaceae	Oleanolic acid isolated from the flowers of <i>Eugenia jambolana</i>	Rats	Arrest of spermatogenesis	[194]
198.	<i>Tagetes erecta</i> L.	Asteraceae	leaves	-	Emmenagogue	[195]
199.	<i>Tanacetum parthenium</i> L.Sch.	Asteraceae	Plant without Root	-	Abortifacient	[112]
201.	<i>Taxus baccata</i> Linn.	Taxaceae	Leaves	Rats	Antifertility	[196]
202.	<i>Terminalia arjuna</i> Wight & Arn.	Combretaceae	Bark	-	Antispermatogetic effect	[197]
203.	<i>Tinospora cordifolia</i> (Willd.) Miers ex Hook.f. Thoms	Menispermaceae	Stem	Rats	Reduction in testosterone levels	[198]
204.	<i>Trichosanthes cucumerina</i> Linn.	Curcubitaceae	Whole plant	Rats	Antioviulatory activity	[199]
205.	<i>Trigonella foenumgraecum</i> Linn.	Fabaceae	Seeds	Rabbits	Antifertility activity	[200]
206.	<i>Tripterygium hypoglaucum</i> (Level) Hutch	Celastraceae	Root Xylem	Humans	Reduced Sperm concentration and motility	[201]
207.	<i>Tripterygium wilfordii</i> Hook f.	Celastraceae	Root and Isolated plant fractions	Rats and Humans	Reversible infertility	[202]
208.	<i>Tylophora asthmatica</i> Wight & Arn.	Apocynaceae	Leaf and Stem	Rat	Antispermatogetic effect	[203]
209.	<i>Uria lagopodioides</i> Desv.	Fabaceae	Whole plant	-	Abortifacient effect	[204]
210.	<i>Urena lobata</i> Linn.	Malvaceae	Root	Rat	Inhibition of Spermatogenesis and	[205]

S. no.	Name of the plant	Family	Part used	Animal model	Mechanism of action	Reference
211.	<i>Urginea indica</i> Kunth.	Liliaceae	Bulb	-	Steroidogenesis	[206]
212.	<i>Urtica dioica</i> Linn.	Urticaceae	-	-	Abortifacient effect	[207]
213.	<i>Urospatha antisylleptica</i> R.E. Schult.	Araceae	-	-	Contraceptive	[208]
214.	<i>Valeriana Montana</i> Linn.	Valerianaceae	Root	-	Sterilizer	[209]
215.	<i>Ventilago neo-caledonica</i> Schlecht.	Rhamnaceae	Leaf	-	Contraceptive	[210]
216.	<i>Vernonia amygdalina</i> Delile	Asteraceae	Root	-	Antifertility effect	[211]
217.	<i>Viburnum foetidum</i> wall	Caprifoliaceae	Leaf	-	Emmenagogue	[154]
218.	<i>Vigna unguiculata</i> (Linn.)Walp (Cowpeas)	Fabaceae	-	Rat	Antifertility effect	[212]
219.	<i>Vitex negundo</i> L.	Lamiaceae	Seeds	Dog	Anti-Androgenic Effect	[213]
220.	<i>Waltheria Americana</i> Linn	Sterculaceae	-	-	Abortifacient Effect	[214]
221.	<i>Wedelia gracilis</i> Rich	Asteraceae	Whole plant	-	Abortifacient Effect	[215]
222.	<i>Wedelia trilobata</i> (L.) Hitch.	Asteraceae	-	-	Antifertility effect	[216]
223.	<i>Withania coagulans</i> (Stocks.) Dunal	Solanaceae	Fruit	-	Emmenagogue	[217]
224.	<i>Withania somnifera</i> Dunal	Solanaceae	Fruit	Rats	Decreased Sperm motility	[218]
225.	<i>Xanthium spinosum</i> Linn.	Asteraceae	Leaf	-	Contraceptive	[132]
226.	<i>Xylopia aethiopica</i> (Dunal) A.Rich	Annonaceae	Fruit	Rats	Antifertility effect	[219]
227.	<i>Zaluzania triloba</i> (Ort.) Pers.	Asteraceae	Plant without root	-	Abortifacient	[112]
228.	<i>Zingiber roseum</i> (Roxb.) Roscoe	Zinziberaceae	Stem	-	Antifertility	[220]
229.	<i>Zinziber officinale</i> Rosc.	Zinziberaceae	Rhizome	Rats	Abortifacient	[33]
230.	<i>Ziziphora tenuior</i> Linn	Labiatae	Seed	-	Emmenagogue	[86]
231.	<i>Ziziphus nummularia</i> (Burm.f.)	Rhamnaceae	Root bark	-	Abortifacient	[221]
232.	<i>Zizyphus jujuba</i> Mill.	Rhamnaceae	Bark	-	Antifertility	[222]
233.	<i>Zizyphus xylopyrus</i> (Retz.) Willd.	Rhamnaceae	Fruit	-	Induces Sterility	[223]

5. CONCLUSION

In conclusion, it is clear that medicinal plants play an important role as antifertility agents. Despite of various commercially available oral contraceptives in the market, herbal antifertility agents shows promising output by minimizing the number of adverse drug properties. Current research towards traditional medicine is growing rapidly because of its safety and less cost consumption.

Moreover the present review has provided latest information regarding new plant species which are not covered till now, and many of them still lacks suitable scientific evidence despite of their antifertility claims. This makes the researchers to carry out their research on such antifertility agents which lacks suitable evidence. As listed many of the 233 plant species appear to be an effective alternative to the commercial antifertility compounds.

6. LIMITATIONS AND FUTURE RECOMMENDATIONS

Majority of plants mentioned in this review has been used as traditional antifertility agents, have not been thoroughly and scientifically studied on animals. Present data also lacks in providing information on toxic effects of tested extracts, and also the information regarding studies carried out on human subjects. Hence, it is clear that further investigation is required to potentiate the effects of medicinal plants as antifertility agents in both animals and humans. Therefore significant research is required to be done to investigate the chemical and biological properties of such less explored plants.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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