

ANTIFERTILITY ACTIVITY OF PLANTS EXTRACTS ON FEMALE REPRODUCTION : A REVIEW

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ABSTRACT

Evaluation of herbs has been in progress worldwide for several decades to identify effective and safe substances for fertility regulation. This approach proved to be a good alternative to synthetic drugs as the chemicals of plant origin have limited side effects. Various medicinal plants extracts were investigated for their antifertility activity both in male and female animal models. This review presents update information gathered on scientifically screened medicinal plants used for anti-fertility activity in females. This review provides the information on botanical name along with their common name, ethnic use, parts used, solvents used and their chemical constituents present in plants and their antifertility activity on target organ like ovary, uterus and on pregnancy.

KEY WORDS

Anti-fertility, Medical plants, Anti-implantation, Abortifacient, Estrous Cycle Disruptors, Phytochemicals.

INTRODUCTION

Ever increasing world's population has severely depleted the natural resources and has forced mankind to develop new fertility regulation methods. Though considerable progress has been made in the development of effective methods of fertility control but most the methods developed include chemical formulation being non-herbal have several side effects. It has, therefore, become necessary to screened and use biologically active botanical substances as fertility-regulating agents which are safe and interfere with the natural patterns of reproduction [1].

India harbors several medicinal plants associated with traditional antifertility activity [2-5]. These plants cause antifertility in females by acting as (a) Estrous Cycle Disruptors (b) Anti-estrogenic agents (c) Anti-Implantation agents or (d) Abortifacient agents [6]. For the sake of the convenience of readers the antifertility plants is described under following headings:

Herbal Plants Acts as Estrous Cycle Disruptors

1. *Rivea hypocrateriformis* (Night Glory/Vaividang) (Convolvulaceae)

Ethanollic extract of *Rivea hypocrateriformis* was administered to adult albino rats orally at dose levels of 200 and 400 mg/kg body weight induce an irregular estrous cycle with shortened estrus and metestrus, and lengthened proestrus in a reversible manner [7]. Phytochemical analysis of extract revealed the presence of alkaloids, glycosides, saponins, tannins and phenolic compounds [8]. These phytochemicals are the principle cause contributing in oestrous cycle disruption. After administration of extract, the level of cholesterol increased possibly due to inhibition of steroidogenesis. Weight of the uterus, its myometrium and endometrium thickness and diameter also increases indicated the uterotrophic effect. The graffian follicles number decline with increase in number of atretic follicles indicating the antiovolatory effect of the extract [7]. *Rivea hypocrateriformis* extract thus has good antifertility potential and need to be analyzed for specific

phytochemical agent and for specific effect on the target tissue so as to develop a foolproof contraceptive drug from this important plant.

2. *Momordica charantia* (Bitter Melon/Karela) (Cucurbitaceae)

Methanolic extract of *Momordica charantia* seeds was administered orally at dose level of 25 mg/100g body weight resulted in irregular pattern of estrous cyclicity and significantly increased in length of the estrous cycle in rats in a reversible manner [9]. Phytochemical analysis of the extract showed the presence of steroids, triterpenoids, reducing sugars, sugars, alkaloids, phenolic compounds, flavonoids and tannins [10]. The disruption of the estrous cycle was possibly because of these phytochemicals on the ovary which controls ovarian functions and estrous cyclicity through interplay of ovarian and extra ovarian hormones [9]. It is suggested that *Momordica charantia* seeds must be tested for their impact on hormonal profile to determine whether the chemical is inhibiting the estrogen production or competing for its receptor. These findings will be of immense value in treatment of cases of estrogen deficiency in mammals.

3. *Garcinia kola* (Bitter Kola/Akuinu) (Guttiferaceae)

Garcinia kola seeds were feed to rats at dose level of 200mg/kg body weight induced alteration of oestrous cycle. [11]. Phytochemical analysis of seeds showed the presence of flavonoids, tannins, cardiac glycoside, saponins, steroids and reducing sugars [12]. The phytochemicals present in extract partially blocked the ovulation as indicated by reduced number of ova in the oviduct. There was a significant decrease in the weight of fetuses and also had malformed left upper limb [11]. Specific experiments are required to be conducted on *Garcinia kola* to determine mechanism of blocking of ovulation and teratogenesis in rats.

4. *Aspilia africana* (Wild Sunflower) (Compositae)

Aspilia africana leaf extract was administered to female Wistar rats result in alteration of oestrous cycle indicated by the prolonged proestrous and a reduced dioestrus and estrus [13]. The phytochemical analysis revealed the presence of saponins, tannins, flavonoids and cardiac glycosides [14]. Extract reduced the ovulation marked by reduced number of

ova observed in the oviduct. Inflammation of the fallopian tube, degeneration in the ovarian cortex in the stroma cells of the ovary and disruption of the endometrium of the uterus was observed [13]. *Aspilia africana* have multiple effects on uterus, fallopian tube and ovary. Further research work is needed to be carried out on *Aspilia africana* to determine the specific phytochemical and their action on each organ of reproductive System.

5. *Anethum graveolens* (Dill/sowa) (Umbelliferae)

Ethanollic extract of *Anethum graveolens* increased duration of diestrus phases and total time of estrous cycle in female Wistar rats [15]. Phytochemically extract showed the presence of tannins, glycosides, saponins, steroids, terpenoids and reducing sugars [16]. The morphological study did not reveal any significant changes in the volumes of ovaries, primary, secondary and graffian follicles due to present phytochemicals [15]. The hormonal analysis required to be carried out to establish how actually the oestrous cycle is being disrupted by *Anethum graveolens*. It seems to have good potential in regulating estrous cyclicity.

6. *Cissampelos pareira* (Abuta/Harjeuri) (Menispermaceae)

Cissampelos pareira leaf extracts when administered orally to albino rats, altered the estrous cycle pattern and prolonged the length of estrous cycle with significant increase in the duration of diestrus stage [17]. Phytochemical analysis revealed presence of terpenoids, alkaloids, tannins, amino acid proteins, and carbohydrates [18]. The hormones profile showed that the phytochemicals present in extract altered the LH, FSH, prolactin and estradiol secretion [17]. *Cissampelos pareira* have many phytochemicals and further work is needed to determine whether a single chemical or combination of chemicals disturb the hormonal level.

7. *Citrus medica* (Lemon/Nimbu) (Rutaceae)

Petroleum ether extracts of *Citrus medica* seeds was given to albino rats caused irregular estrous cycle with prolonged proestrus and estrous, reduced metestrus and diestrus phase. [19]. Phytochemical analysis revealed presence of alkaloids, flavonoids, phenols, carbohydrates, steroids and glycosides

[20]. Histological studies indicate that the phytochemicals of extract caused increases in number of atretic follicles and decreases in number of healthy developing follicles. The total cholesterol was increased which marked the steroidogenesis inhibition [19]. Further research is required to be made on *Citrus medica* to know how it causes atresia in ovarian follicle. Its atretogenic potential need to be tapped.

8. *Azadirachta indica* (Neem) (Meliaceae)

Azadirachta indica flower alcoholic extract given to rats at dose level of 1g/kg body weight produced an irregular pattern of oestrous cycle with prolonged diestrus phase. Also subsequently lower the frequency at which the estrus phase occurs with partial block in ovulation [21]. Phytochemical analysis gave positive results for steroids, triterpenoids, reducing sugars, alkaloids, phenolic compounds, flavonoids and tannins [22]. Phytochemicals caused reduction in the number of normal follicles because of atresia which occur due to disruption of the process of follicle selection [21]. *Azadirachta indica* is suggested to be analyzed for specific phytochemicals which are disturbing the follicular selection process.

9. *Cnidioscolous aconitifolius* (Miller/Chaya) (Euphorbiaceae)

Cnidioscolous aconitifolius seed extract administered orally to female albino rats prolonged the length of estrous cycle and increased the duration of diestrus phase. The LH, FSH, estradiol and progesterone level decreased concomitant with loss of uterine weight [23]. Phytochemical screening revealed the presence of alkaloids, saponins, phenolics, tannins, flavonoids, anthraquinones, phlobatannins and triterpenes [24]. Histological observations after treatment revealed follicular atresia, degeneration of corpora lutea, degeneration of mucosal folds and epithelium cells in oviduct, and degeneration of endometrial epithelium and endometrial glands in uterus. Lamina propria and muscularis layer of vagina were found slightly disorganized [23]. As *Cnidioscolous aconitifolius* have multiple effects on reproductive system, analysis of specific phytochemical and target reproductive organ is needed to be analyzed.

10. *Plumbago zeylanica* (Laurel/Chitra) (Plumbaginaceae)

Ethanol extract of *Plumbago zeylanica* leaves given to albino rats interrupt the estrous cycle and exhibited a prolonged diestrus stage corresponding to a temporary inhibition of ovulation [25]. Phytochemical analysis indicated the presence of alkaloids, glycoside, reducing sugars, simple phenolics, tannins, Lignin, saponins and flavonoids [26]. Further work is needed to determine whether the oestrous cycle is disturbed due to hormonal changes or by other means.

11. *Curcuma longa* (Turmeric/Haldi) (Zingiberaceae)

Curcuma longa was given to albino rats caused suppression of the oestrous phase and suppression of ovulation [27]. Phytochemicals analysis indicated the presence of flavonoids and aminoacids and alkaloid [28]. It was presumed that antiovarian action was due to the anti-estrogenic property of phytochemicals which either block the estrogen receptors or diminished estrogen synthesis due to diminished cholesterol metabolism or both [27]. Further research is required to know the actual mechanism and specific phytochemicals causing it.

12. *Jatropha gossypifolia* (Bellyache Bush/Ratan jyoti) (Euphorbiaceae)

Ethanol extract of *Jatropha gossypifolia* leaves given to female albino mice at a dose level of 250 and 450 mg/kg body weight prolonged the estrous cycle with increase in duration of diestrus stage [29]. Phytochemicals analysis revealed the presence of saponin, tannin, flavonoid, reducing sugars, cardiac glycosides, terpenoids, triterpenoids, steroids, xanthoprotein, and starch [30]. The hormonal analysis showed that the phytochemicals present in extract altered the release of LH, FSH and prolactin, and estradiol secretion [29]. Because *Jatropha gossypifolia* is disturbing many hormones, specific phytochemical is need to be screened for specific activity.

13. *Acacia leucophloea* (Reonja) (Mimosaceae)

Alcoholic extract of *Acacia leucophloea* roots given to female Swiss albino rats at a dose level of 200 mg/kg increased the proestrus phase significantly while estrus and metaestrus phases were decreased [31]. Phytochemicals analysis revealed the presence of tannins, flavonoid, terpenes and alkaloids [32]. There

was a decrease in the weight of ovary while cholesterol content increased significantly due to above phytochemicals [31]. *Acacia leucophloea* is needed to test to find out specific phytochemical agent which is causing anti-estrogenic activity.

14. *Tabernaemontana divaricata*

(Crape jasmine/Chandni) (Apocynaceae)

Ethanol extract of *Tabernaemontana divaricata* leaves given to female albino mice at a dose level of 250 and 450 mg/kg body weight caused a prolonged estrous cycle with significant increase in the duration of diestrus phase and elongation in estrous stage [33]. Phytochemicals analysis revealed the presence of steroids, tannins, saponins, gums and reducing sugar [34]. This disruption in the estrous cycle presumably is due to simultaneously decrease in the luteinizing hormone (LH) and follicle stimulating hormone (FSH) due to plant extract [33]. Further work is suggested to be carried out to know the specific phytochemical ingredient causing the synergetic decrease in LH and FSH.

15. *Cynodon dactylon* (Bermuda Grass/Doob) (Graminae)

Aqueous extract of *Cynodon dactylon* given to female Wistar rats at a dose level of 400 mg/kg body weight caused irregular and disturbed estrous cycle [35]. Phytochemical screening shows the presence of carbohydrates, flavonoids, proteins and amino acids, tannins, organic acid and phenolic compounds [36]. These phytochemicals are suggested to be a contributing factor to cause infertility by shortening the time of transport of egg, disrupting estrous cycle, lowering the plasma progesterone and decreasing pregnanediol which finally stops development of endometrium [35]. However further research is needed to determine the specific phytochemical agents and its activity on specific target tissue.

16. *Mimosa pudica* (Shameful Plant/Chumui) (Fabaceae)

Methanolic extract of *Mimosa pudica* roots given to female albino mice at a dose level of 300 mg/kg body weight prolonged the length of the estrous cycle with significant increase in the duration of the diestrus phase [37]. Phytochemical analysis revealed the presence of alkaloids and tannins [38]. The analysis of the principal hormones (LH, FSH, prolactin, estradiol and progesterone) involved in the regulation of the

estrous cycle showed that the extract phytochemicals altered gonadotropin release and estradiol secretion [37]. *Mimosa pudica* potential herbal plant to work on for further details on reproduction.

Herbal Plants Acts as Anti-estrogenic Agents

1. *Butea monosperma* (Flame of the Forest/Dhak) (Fabaceae)

Petroleum ether and chloroform extract of *Butea monosperma* root given to albino mice at the dose level of 200 mg/kg body weight showed the estrogenic activity when given alone but exhibited slight anti-estrogenic activity when given along with ethinyl estradiol [41]. The root of *Butea monosperma* contains glucose, glycine, a glycoside (aglycon) and an aromatic hydroxy compound [42]. The weight of ovaries of petroleum ether and chloroform extracts treated animal reduced significantly associated with an elevation in the level of cholesterol. Petroleum ether and chloroform extracts inhibited the activity of G-6-PDH indicating anti-steroidogenic activity of the extract [41]. The *Butea monosperma* extracts suggested possessing some estrogen like compounds which may be responsible for anti-estrogenic activity needs to be investigated further.

2. *Cassia fistula* (Golden Shower/Amaltas) (Caesalpinaceae)

Aqueous extract of *Cassia fistula* seeds given to female rats resulted in a mild estrogenic activity but when given conjointly with estradiol valerate, it significantly prevented the estrogen-induced uterotrophic effect, thus showing an anti-estrogenic nature in the presence of a strong estrogen [43]. Phytochemical analysis showed the presence of important classes of phytoconstituents like anthraquinone glycosides, flavonoids, phenolic compounds and carbohydrates [44]. There is also prevention of pregnancy when extract given to mated female rats [43]. Further work is needed to be made to determine the individual phytochemicals causing the antiestrogenic activity and prevention of pregnancy.

3. *Bougainvillea spectabilis* (Great Bougainvillea) (Nyctaginaceae)

Aqueous extract of *Bougainvillea spectabilis* leaves given to Swiss albino mice at a dose level of 300 mg/kg body weight caused a significant decrease in

estrogen level [45]. Phytochemical screening revealed the presence of alkaloids, flavonoides, phlobatannins and terpenoids [46]. It is suggested to find out the dominant phytochemicals which particularly affects the estrogen level.

4. *Piper betle* (Betel Leaf/Paan) (Piperaceae)

Ethanollic extract of *Piper betle* Petiole given to female albino rats at a dose level of 100 mg/kg caused antiestrogenic effects [47]. Phytochemical analysis showed the presence of carbohydrates, alkaloids, gums, oils, steroids, glycosides, tannins, phenols, vitamins, organic acids and inorganic constituents [48]. Extract treatment caused reduction in reproductive organ weights, circulating level of estrogen, fertility, number of litters, serum glucose concentration, enzyme activity of acid phosphatase, SGOT and SGPT Whereas, the concentration of cholesterol and ascorbic acid increased [47]. This is needed to be investigated whether cholesterol is increased due to non-utilization of it or by de novo synthesis.

5. *Ocimum gratissimum* (African Basil/Tulsi) (Lamiaceae)

Acetone extract of *Ocimum gratissimum* stem given to female albino rats at a dose level of 100 mg/kg body weight exhibited weak estrogenic activity when given alone but exhibited slight antiestrogenic activity when administration along with estradiol valerate [49]. Phytochemical analysis revealed the presence of alkaloids, phenolics, glycosides, resins, steroids, and tannins [50]. Administration of the extract to mated female rats resulted in a decline in the fertility index, numbers of uterine implants and live fetuses in a dose dependent manner [49]. It is suggested to find out the specific phytochemical causing the specific effect on reproductive organs and hormonal levels.

Herbal Plants Acts as Anti-Implantation Agents

1. *Hibiscus rosa-sinensis* (China Rose/Guhmohr) (Malvaceae)

Ethanollic extract of *Hibiscus rosa-sinensis* given orally to the rats at a dose of 400mg/kg exhibited a very potent anti-implantation [51]. Phytochemical analysis indicated the presence of Steroid, tannins, saponins and flavonoids [52]. Administration of extract caused a significant increase in uterine weight, diameter of the uterus and thickness of the endometrium. It appears that the extract has estrogenic activity, but no

antiestrogenic activity [51]. *Hibiscus rosa-sinensis* possesses anti-implantation activity and this is needed to establish whether estrogenic property of the extract is responsible for this anticonceptive effect or not.

2. *Ficus religiosa* (Pipal) (Moraceae)

Ficus religiosa fruits extract was tested *in vitro* on goat uterus showed the anti-implantation activity [53]. The phytochemical analysis showed the presence of n-Hexadecanoic acid; 9, 12-Octadecadienoic acid; 9, 12, 15-Octadecatrienoic acid, and Butyl 9, 12, 15-octadecatrienoate [54]. The fruit extract induced decrease in thickness of surface epithelium, diameter of uterine glands, diameter of gland cell and thickness of layer of myometrium according to exposure in time dependent manner [53]. The molecular mechanism of the anti-implantation process need to be investigated.

3. *Ocimum sanctum* (Basil/Tulsi) (Lamiaceae)

Ocimum sanctum leaves have been shown to possess anti-implantation activity in experimental albino rats [55]. Phytochemical analysis revealed the presence of alkaloids, saponins, tannins, steroids, terpenoids, flavonoids, glycosides, carbohydrates, proteins and coumarins [56]. *Ocimum sanctum* leaves disrupt the estrus cycle and estrus stage is prolonged. It also causes decrease in number of endometrium glands [55]. It is suggested to be further work on *Ocimum sanctum* to find out the exact phytochemicals causing these effects.

4. *Striga orobanchioides* (Missi) (Scrophulariaceae)

Ethanollic extract of *Striga orobanchioides* given to albino rats induced significant anti-implantation activity [57]. Antioxidant activity of the ethanollic extract suggests the presence of flavonoids in *Striga orobanchioides* [58]. The extract also showed estrogenic activity. Further research is suggested to determine the mechanism of action of drug causing antifertility activity.

5. *Calotropis procera* (Sodom apple/Aak) (Asclepiadaceae)

Ethanollic extract of *Calotropis procera* roots administrated to female albino rats at the dose level of 250 mg/kg showed strong anti-implantation activity [59]. The phytochemical screening revealed the presence of alkaloids, flavonoids, tannins, saponins, and cardiac glycosides with a very high

content in water extracts [60]. However no antiestrogenic activity could be detected from extract treatment [59]. Further work is needed to determine the specific phytochemical fraction inducing the anti-implantation activity.

6. *Lawsonia inermis* (Hina/Mehndi) (Lythraceae)

Lawsonia inermis root extract was given to female Wistar rats caused loss of implantation sites [61]. Phytochemical screening of the extracts showed the presence of glycosides, phytosterol, steroids, saponins, tannins and flavonoids [62]. It is suggested to screen specific phytochemical components from *Lawsonia inermis* which particularly induces loss of implantation sites.

7. *Ricinus communis* (Castor Bean/Arand) (Euphorbiaceae)

Methanolic extract of *Ricinus communis* seeds was given to albino mice at a dose level of 200 mg/kg body weight induced anti-implantation activities [63]. Phytochemical screening indicated the presence of alkaloids, saponins, phenols, flavonoids and tannins [64]. The exact phytochemical causing the anti-implantation activity yet to be establish to make suitable antifertility drug from *Ricinus communis*.

8. *Terminalia bellerica* (Baheda) (Combretaceae)

Ethanol extract of *Terminalia bellerica* bark given to female albino rats at the dose level of 25mg/100g body weight cause loss of implantation [65]. The phytochemical showed the presence of phytosterols, carbohydrates, flavanoids, phenolic compounds and tannins [66]. The loss of implantation caused by the extract may be due to antizygotic, blastocytotoxic or anti-implantation activity [67]. Further work on *Terminalia bellerica* is needed to find out exact mechanism of loss of implantation.

9. *Physalis alkekengi* (Bladder cherry/Kaknaji) (Solanaceae)

Physalis alkekengi plant extract was given to female albino rats at the dose level of 150 mg/kg induced significantly decreased the number of implantation sites [67]. Phytochemical screening revealed the presence of tannins, saponins, alkaloids, flavonoides and glycosides [68]. According to the importance of progesterone and estrogen hormones in the maintenance of implanted embryo, the anti-fertility activity of this plant seems to be due to this fact that *P. alkekengi* is an antagonist for this hormones and

can interfere with fertility [67]. But the exact mechanism of this observed anti-fertility activity of the plant extract is still required to be investigated.

10. *Allium cepa* (wild onion/Piyaz) (Liliaceae)

Ethanol extract of *Allium cepa* given to female Wistar rats at a dose level of 300 mg/kg showed significant inhibition of number of implant sites [69]. Phytochemical screening revealed the presence of alkaloids, flavonoides, cardiac glycosides, terpenes and resins [70]. Further detailed study is required to establish its antifertility activity and also to understand underlying cellular and molecular mechanism of action.

11. *Asparagus africanus* (Climbing asparagus) (Asparagaceae)

Ethanol extract of *Asparagus africanus* leaves and roots given to rats at a dose level of 300 mg/kg of body weight resulted in significant reduction in the number of implants [71]. Phytochemical screening showed the presence of saponins, carbohydrates, glycosides and mucilages [72]. This study demonstrated anti-implantation activity of *A. africanus* however, further study on the phytochemicals profile, safety and active principles of the plant need to be carried out.

12. *Caesalpinia pulcherrima*

(Peacock Flower/Guletura) (Caesalpinaceae)

Ethanol extract of *Caesalpinia pulcherrima* leaves given to albino mice at a dose level of 400 mg/kg body weight caused inhibition of implantation [73]. Phytochemical screening showed the presence of alkaloids, steroids, flavonoids, saponins, gums and tannins [73-74]. Further studies are recommended for establish the exact phytochemicals constituting causing the inhibition of implantation.

13. *Curcuma aromatic* (Wild Turmeric/Jangli Haldi) (Zingiberaceae)

Ethanol extract of *Curcuma aromatic* rhizomes given to female rats show strong anti-implantation activity [75]. Phytochemical screening showed the presence of alkaloids, carbohydrates, phytosterols, fixed oils, fats, proteins, amino acids, glycosides, flavonoids, saponins and tannins [75-76]. Further work is needed to done to determine the specific phytochemical causing the anti-implantation activity.

14. *Leonotis ocymifolia*

(Sun-Bird Flower)(Lamiaceae)

Ethanol extract of *Leonotis ocymifolia* leaves given to female rats reduced the number of implants significantly [77]. Phytochemical screenings showed the presence of phenols, flavonoids, alkaloids, saponin, glycoside and tannins [78]. It is suggested that further research on *Leonotis ocymifolia* need to be carried out to determine how reproductive functions are modulated and with specific phytochemical constituents.

15. *Gloriosa superba* (Glory Lily)(Liliaceae)

Hydroalcoholic extract of *Gloriosa superba* tuber given to female albino rats showed significant anti-implantation activity [79]. Phytochemical screening revealed the presence of alkaloids, glycosides, steriods, terpenoids and tannins [80]. Further studies on mechanism of action and isolation of active components responsible for anti-fertility effect is needed to work upon.

16. *Citrus limonum* (Lemon)(Rutaceae)

Alcoholic extract of *Citrus limonum* seeds given to female albino mice showed significant anti-implantation activity [81]. Phytochemical screening revealed the presence of steriods, glycosides, flavonoids, fats and oils [82]. Further detailed phytochemical analysis of *Citrus limonum* and more research work will possibly make this a prospective antifertility agent for clinical trial.

17. *Achyranthes aspera* (Devil's Horsewhip/Phutkanda)(Amaranthaceae)

Methanolic extract of *Achyranthes aspera* leaves given to female Wistar rats reduced significantly the number implantation sites [83]. Phytochemical screening revealed the presence of alkaloids, carbohydrates, saponins, tannins, phenolic compounds, proteins, amino acids, flavanoids and volatile oil [84]. Further research work is needed to determine the specific phytochemical causing the anti-implantation activity.

Herbal Plants Acts as Abortifacient agents

1. *Coriandrum sativum*

(Coriander/Dhania)(Apiaceae)

Aqueous extract of *Coriandrum sativum* seeds given to female rats at the doses level of 250 and 500 mg/kg showed the abortifacient activity [85]. Phytochemical screening revealed the presence of

carbohydrates, proteins, phenolic compounds, tannins and flavonoids [86]. The extracts produced a significant decrease in serum progesterone levels on day-5 of pregnancy which is suggested to be responsible for the anti-implantation effect [85]. Further studies on mechanism of action and isolation of active components responsible for abortifacient activity are required to work upon.

2. *Guaiaecum officinale*

(Tree of Life)(Zygophyllaceae)

Hot aqueous extract of *Guaiaecum officinale* given to female rats at a dose level of 480.75 mg/kg caused abortion [87]. Phytochemical screening revealed the presence of farrigenin, sitosterol and oleanolic acid [88]. It is suggested to work upon further on *Guaiaecum officinale* to determine the particular phytochemical causing the abortion activity.

3. *Melia azedarach*

(Chinaberry/Darek)(Meliaceae)

Melia azedarach seed extract given to female albino rats caused loss of implantation [89]. Phytochemical screening revealed the presence of alkaloids, tannins, saponins, phenols, glycosides, steroids, terpenoids and flavonoids [90]. Histological studies showed a significant reduction in myometrial thickness, uterine gland diameter, luminal diameter of uterine glands and luminal epithelial cell height in rats treated with *Melia azedarach* [89]. More research work is needed to clearly establish the relation of specific phytochemicals with above activities.

4. *Dodonea viscosa* (Hopbush)(Sapindaceae)

Methanolic extract of *Dodonea viscosa* leaves given to female rats at a dose level of 250 mg/kg body weight showed early abortifacient activity [91]. Phytochemical screening revealed the presence of phytochemicals such as flavonoids, saponins, tannins, reducing sugar and steroids [91-92]. Further studies on *Dodonea viscosa* are suggested determining the specific phytochemical causing abortifacient activity.

5. *Trianthema portulacastrum*

(Horse Purslane)(Aizoaceae)

Trianthema portulacastrum extract was given to female albino rats showed the abortifacient activity [93]. Phytochemical screening reveals the presence of alkaloids, flavonoids, saponins, phenolic compounds and terpenoids [93-94]. Administration of extract caused significant increase in uterine weight,

diameter of the uterus and thickness of endometrium, suggesting mild estrogenic activity of the extract [93]. To determine which particular phytochemical is causing abortifacient activity further research work is needed to carry out.

6. *Ailanthus excels*

(Indian Tree of Heaven/Urru) (Simaroubaceae)

Hydroalcoholic extract of *Ailanthus excelsa* stem bark given to Wistar albino rats at a dose level of 400 mg/kg body weight showed abortifacient activity [95]. Phytochemical screening reveals the presence of glycosides, saponins, phenol, lignin, and tannins [96]. The extract also shows significant increase in uterine weight and administration of extract with ethinyl estradiol cause significant antiestrogenic activity [95]. Further studies on mechanism of antifertility action and isolation of the active components responsible for antifertility effect are suggested to be investigated.

7. *Balanites roxburghii*

(Desert Date)(Zygophyllaceae)

Ethanol extract of *Balanites roxburghii* fruits given to female albino rats at a dose level of 300 and 600 mg/kg body weight caused significant abortifacient activity [97]. Phytochemical analysis revealed the presence of alkaloids, saponins, tannins, flavonoids, phenolic compound, gum and mucilage [97-98]. Administration of the ethanol extract caused significant increase in uterine weight, diameter of the uterus, thickness of endometrium, and height of endometrial epithelium [97]. To identify the specific phytochemical causing the abortifacient activity further research work is suggested to be done on *Balanites roxburghii*.

8. *Cannabis sativa*

(Hemp/Bhang)(Cannabaceae)

Alcoholic extract of *Cannabis sativa* leaves given to female albino rats at a dose level of 400 mg/kg body weight was found to be causing strong abortifacient activity [99]. Phytochemical analysis revealed the presence of flavonoids, simple phenolics, alkaloids, steroids, saponins, terpenoids, tannins and reducing sugars [99-100]. 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 [99]. Further studies are required to identify the bioactive principle of abortifacient activity of the extract.

9. *Plumeria rubra*

(Frangipani/Gulechin)(Apocynaceae)

Alcoholic extract of *Plumeria rubra* pods given to female albino rats at a dose level of 200 mg/kg body weight was found to be highly abortifacient [101]. Phytochemical screening of *Plumeria rubra* revealed the presence of alkaloids, flavonoids, simple phenolics, steroids, tannins and saponins [101-102]. Administration of extract caused a significant increase in the uterine weight [101]. Further studies to identify the bioactive principles responsible for estrogenic and abortifacient activity of the extract are suggested to be explored.

10. *Portulaca oleracea*

(Purslane/Kulfa)(Portulacaceae)

Ethanol extract of *Portulaca oleracea* given to female albino rats at a dose level of 250 and 500 mg/kg body weight showed abortifacient activity [103]. Phytochemical evaluation revealed the presence of alkaloids, tannins, flavonoids, saponins and triterpenoids [104]. Further studies on mechanism of abortion and identification of the active components responsible for abortion are suggested to investigate.

11. *Trigonella foenum graecum*

(Methi) (Fabaceae)

Methanolic extract of *Trigonella foenum graecum* seeds administrated to female Wistar albino rats at a dose level of 200 mg/kg body weight showed abortifacient activity [105]. Phytochemical evaluation revealed the presence of alkaloids, carbohydrates, glycosides, tannins, flavonoids, amino acids, proteins, mucilage and starch [106]. Further detailed phytochemical analysis of *Trigonella foenum graecum* and more research work will possibly make this a prospective antifertility agent for clinical trial.

12. *Stachys lavandulifolia*

(Wood Betony)(Lamioidae)

Stachys lavandulifolia extract was injected intraperitoneally to the pregnant mice resulting in failure of fetus survival and consequently, abortion [107]. Phytochemical evaluation revealed the presence of flavonoids, saponins and bitter

compounds [108]. Further studies on *Stachys lavandulifolia* are suggested carried out to determine

the specific phytochemical causing abortifacient activity.

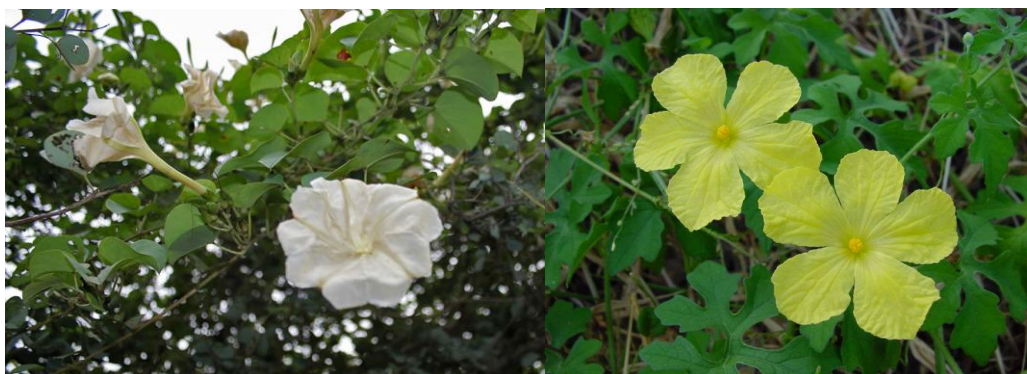


Fig. 1: *Rivea hypocrateriformis* (Night Glory/Vaividang) (Convolvulaceae) Fig. 2: *Momordica charantia* (Bitter Melon/ Karela) (Cucurbitaceae)



Fig. 3: *Garcinia kola* (Bitter Kola/Akuinu) (Guttiferaceae) Fig. 4: *Aspilia africana* (Wild Sunflower) (Compositae)



Fig. 5: *Anethum graveolens* (Dill/sowa) (Umbelliferae) Fig. 6: *Cissampelos pareira* (Abuta/Harjeuri) (Menispermaceae)



Fig. 7: *Citrus medica* (Lemon/Nimbu)
(Rutaceae)



Fig. 8: *Azadirachta indica* (Neem)
(Meliaceae)



Fig. 9: *Cnidioscolous aconitifolius* (Miller/Chaya)
(Euphorbiaceae)



Fig. 10: *Plumbago zeylanica* (Laurel/Chitra)
(Plumbaginaceae)



Fig. 11: *Curcuma longa* (Turmeric/Haldi)
(Zingiberaceae)



Fig. 12: *Jatropha gossypifolia* (Bellyache Bush/Ratan jyoti)
(Euphorbiaceae)



Fig. 13: *Acacia leucophloea*(Reonja)
(Mimosaceae)



Fig. 14: *Tabernaemontana divaricata* (Jasmine/Chandni)
(Apocynaceae)



Fig. 15: *Cynodon dactylon*(Bermuda Grass/Doob)
Plant/Chuimui) (Graminae)



Fig. 16: *Mimosa pudica*(Shameful
(Fabaceae)

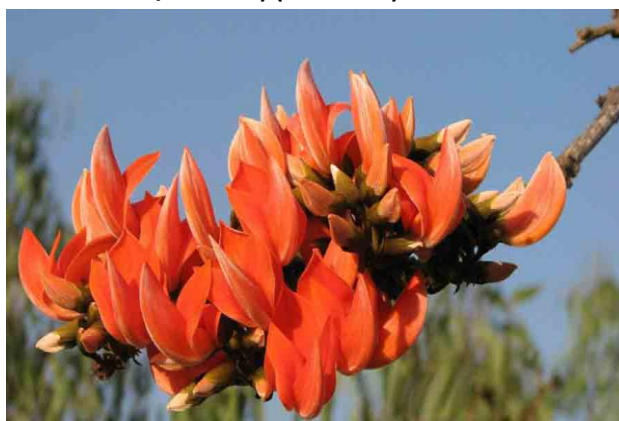


Fig. 17: *Butea monosperma* (Flame of the Forest/Dhak)
(Fabaceae)



Fig. 18: *Cassia fistula*(Golden Shower/Amaltas)
(Caesalpinaceae)



Fig. 19: *Bougainvillea spectabilis* (Great Bougainvillea)
(Nyctaginaceae)



Fig. 20: *Piper betle* (Betel Leaf/Paan)
(Piperaceae)



Fig. 21: *Ocimum gratissimum* (African Basil/Tulsi)
(Lamiaceae)



Fig. 22: *Hibiscus rosa-sinensis* (China Rose/Guhmohr)
(Malvaceae)



Fig. 23: *Ficus religiosa* (Pipal)
(Moraceae)



Fig. 24: *Ocimum sanctum* (Basil/Tulsi)
(Lamiaceae)



Fig. 25: *Striga orobanchioides* (Missi)
(Scrophulariaceae)



Fig. 26: *Calotropis procera* (Sodom apple/Aak)
(Asclepiadaceae)



Fig. 27: *Lawsonia inermis* (Hina/Mehndi)
(Lythraceae)



Fig. 28: *Ricinus communis* (Castor Bean/Arand)
(Euphorbiaceae)



Fig. 29: *Terminalia bellerica* (Baheda)
(Combretaceae)



Fig. 30: *Physalis alkekengi* (Bladder cherry/Kaknaji)
(Solanaceae)



Fig. 31: *Allium cepa* (wild onion/Piyaz)
(Liliaceae)



Fig. 32: *Asparagus africanus* (Climbing asparagus)
(Asparagaceae)



Fig. 33: *Caesalpinia pulcherrima* (Peacock Flower)
(Caesalpiaceae)

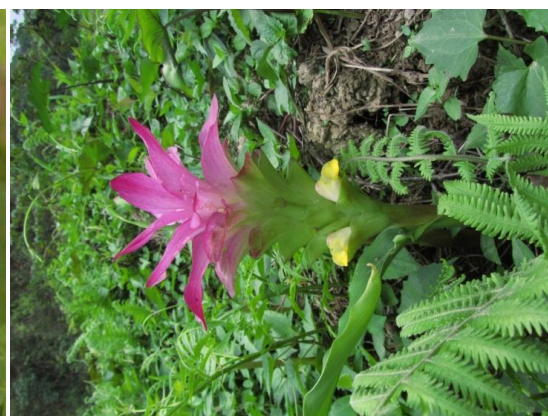


Fig. 34: *Curcuma aromatica* (Wild Turmeric)
(Zingiberaceae)



Fig. 35: *Leonotis ocymifolia* (Sun-Bird Flower)
(Lamiaceae)



Fig. 36: *Gloriosa superba* (Glory Lily)
(Liliaceae)



Fig. 37: *Citrus limonum* (Lemon)
(Rutaceae)



Fig. 38: *Achyranthes aspera* (Devil Horsewhip/Phut kanda)
(Amaranthaceae)



Fig. 39: *Coriandrum sativum* (Coriander/Dhania)
(Apiaceae)

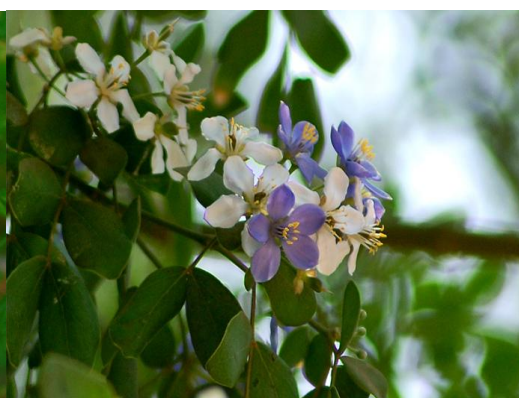


Fig. 40: *Guaiacum officinale* (Tree of Life)
(Zygophyllaceae)

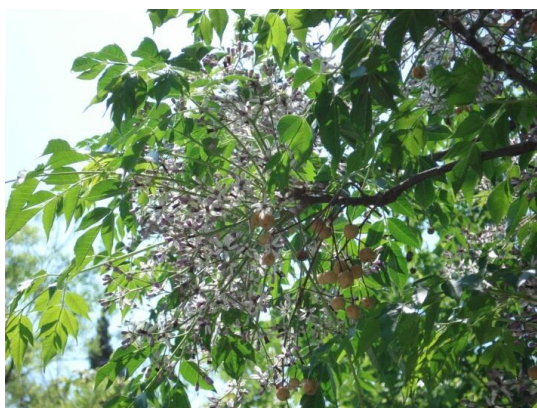


Fig. 41: *Melia azedarach* (Chinaberry/Darek)
(Meliaceae)



Fig. 42: *Dodonea viscosa* (Hopbush)
(Sapindaceae)



Fig. 43: *Trianthema portulacastrum* (Horse Purslane)
(Aizoaceae)



Fig. 44: *Ailanthus excels* (Indian Tree of Heaven/Urru)
(Simaroubaceae)



Fig. 45: *Balanites roxburghii* (Desert Date)
(Zygophyllaceae)



Fig. 46: *Cannabis sativa* (Hemp/Bhang)
(Cannabaceae)



Fig. 47: *Plumeria rubra* (Frangipani/Gulechin)
(Apocynaceae)



Fig. 48: *Portulaca oleracea* (Purslane/Kulfa)
(Portulacaceae)



Fig. 49: *Trigonella foenum graecum* (Methi)
(Fabaceae)



Fig. 50: *Stachys lavandulifolia* (Wood Betony)
(Lamiaceae)

CONCLUSION

This review summarized update scientific proven information about phytochemicals constituents and antifertility activity of various medical plants which is being traditionally used. The plants cause antifertility in females by acting as estrous cycle disruptors includes the *Rivea hypocrateriformis*, *Momordica charantia*, *Garcinia kola*, *Aspilia africana*, *Anethum graveolens*, *Cissampelos pareira*, *Citrus medica*, *Azadirachta indica*, *Cnidioscolous aconitifolius*, *Plumbago zeylanica*, *Curcuma longa*, *Jatropha gossypifolia*, *Acacia leucophloea*, *Tabernaemontana divaricata*, *Cynodon dactylon* and *Mimosa pudica*. Other plants like *Butea monosperma*, *Cassia fistula*, *Bougainvillea spectabilis*, *Piper betle* and *Ocimum gratissimum* act as anti-estrogenic agents. The *Hibiscus rosa-sinensis*, *Ficus religiosa*, *Ocimum sanctum*, *Striga orobanchioides*, *Calotropis procera*, *Lawsonia inermis*, *Ricinus communis*, *Terminalia bellerica*, *Physalis alkekengi*, *Allium cepa*, *Asparagus africanus*, *Caesalpinia pulcherrima*, *Curcuma aromatica*, *Leonotis ocymifolia*, *Gloriosa superba*, *Citrus limonum* and *Achyranthes aspera* have anti-implantation activity. Abortifacient agents include the *Coriandrum sativum*, *Guaicum officinale*, *Melia azedarach*, *Dodonea viscosa*, *Trianthema portulacastrum*, *Ailanthus excelsa*, *Balanites roxburghii*, *Cannabis sativa*, *Plumeria rubra*, *Portulaca oleracea*, *Trigonella foenum graecum* and *Stachys lavandulifolia*.

The biochemistry and molecular mechanism of these different pathways is complex, and the research of plants having such effects may reveal novel methods of fertility regulation. Further research is required to make preparation of these botanicals in scientific manner to make them safe and effective.

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