



Pharmacological Action of Plant Alkaloids in female Reproductive System of Test Animals and/or Human Beings: A Review

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ABSTRACT

The basis of development of modern medicine is rooted in traditional medicine and therapies. Many studies have been done on the female contraception. The traditional use of medicinal plants to treat different sorts of diseases, including fertility related problems is globally widespread as many plant substances are known for their interference with the female reproductive system. The present review is an attempt to summarise the ovulation regulatory plants with part used, determined dose, medicinal use, reported phytochemical moiety and folkloric preparations. The literature covered more than hundred plants showing pharmacological action of female reproductive system and this review seeks to collate such information from the past few decades in advancing the alkaloidal group as a viable platform for anti-ovulatory/fertility activity.

Keywords: Alkaloids, Antiovolatory, Local use, Traditional medicines.

INTRODUCTION

It has been much debate about the role played by alkaloids in the plant world without having come to give any conclusive reason. Although herbal medicine has existed since the dawn of time, our knowledge of how plants actually affect human physiology remains largely unexplored.¹ Plants are the chief source of medicine to cure many diseases. Even today 25% of all drugs prescribed come from plants.² Biological sources provide an enormous resource of pharmaceuticals much of which is undiscovered. Alkaloids are one of the most abundant and diverse group of secondary metabolites found at a minimum concentration in almost all plants. Some alkaloids focus their range in a particular part of the body, though many of them can act in several fronts at once. Some alkaloids like caffeine exert stimulating role on nervous system and ricinine leads to toxicity in digestive system causing violent irritation with typical manifestations such as diarrhoea, vomiting etc.³ Effect of alkaloid is performed on the circulatory vessels, such as reserpine from *Rauwolfia vomitoria* lowering blood pressure and hence used to treat hypertension. In the same way an alkaloid from *Cytis scoparius* could be useful to increase metabolism and encourage the elimination of fluids in people with obesity. Dilating bronchial tubes allowing an increase of breathing is also a cause of alkaloids. Most of the alkaloids act as antibiotics⁴ and inhibits the translation process in various organisms.⁵ Alkaloids also possess antimetabolic⁶ and allergic⁷ effects at cellular level. These functions of alkaloids are well known for their toxic⁸ and sometimes psychomimetic (E.g. Ergot), euphoric (E.g. Harmala), and hallucinogenic (E.g. tryptamine alkaloids) properties. Many alkaloids, though poisonous, have physiological effect that renders them valuable medicine against various diseases including malaria, diabetics, cancer, cardiac dysfunction etc. These

are also used in local anaesthesia and relief of pain.⁹ This review summarizes traditional uses, hints on the pharmacology of alkaloids and safety in the perspective of traditional medicines in particular, literature from specialized zone of South Odisha that are not readily accessible. Although the underlying molecular mechanisms are not fully understood, activity has been reported. Alkaloids have diverse and important physiological effects on humans and other animals. Class of true alkaloids¹⁰ include pyrrolidine, Tropane, Pyrolizidine, Piperidine, Quinolizidine, Indolizidine, Pyridine, Isoquinoline¹¹, Oxazole, Isoxazole, Thiazole, Quinazoline, Acridine, Quinoline, Indole, Imidazole, Purine, β -Phenyl ethylamine, Colchicine, Muscarine, Benzylamine, Putrescine, Spermidine, Spermine, peptide alkaloids and pseudoalkaloids. Alkaloids may be colorless crystals at ambient conditions, colored, like berberine (yellow) and sanguinarine (orange). The biological role of alkaloids for living organisms that produce them is still unclear.¹² Some examples of Well-known alkaloids include morphine, strychnine, quinine, ephedrine, and nicotine. Day by day the research is on-going and many of the plant isolates are being established as new alkaloids.

Alkaloids are the secondary metabolites of plant origin with unknown /known phytoconstituents. All of we know if any foreign particle is ingested into our body then it is ejected out by the defence mechanism of our body if not accepted. Likewise these alkaloids show some system altering activity in our body. An attempt has been taken to understand the basic principles for which around a number of plants were studied with their known phytochemical moieties. An exhaustive literature study is done with the plants which are locally used and elsewhere. Local plants of Southern Odisha are rich in herbals with many activities which are not yet reported. A glance over it may enlighten the secret activities of plant



alkaloids. Around 100 of medicinal plants with their details are displayed in a tabular form to gain a knowledge which may be helpful in the field of research for new findings. Eastern Ghats of South Odisha is having such type of plants which are never eye viewed for

research. Among many interpretations, the possibility of an effective check up on reported as well as folkloric use of plants by the local people of South Odisha may be realized.

Table 1: Antifertility / Antiovolatory and Related Activities of Some Plants with Their Active Principles and Potion that have been reported from local plants of Malkangiri, Odisha

Name of the plant	Family	Local Name (Oriya)	Part used	Medicinal use	preparation and dosage form	Type of use	Reported phytochemical moiety	Author/Year
<i>Abrus precatorius</i>	Fabaceae	Kaincha	Leaves and seed	Reversible alterations in the estrous cycle pattern and completely blocked ovulation in Sprague-Dawley rats	5gm of paste orally used	External/ internal	Indole alkaloid Abrine ¹⁶	Okoko , 2010
<i>Acalypha indica</i>	Euphorbiaceae	Nakachana	Leaves, root, stalk (young shoots) and flowers.	post coital Antifertility	600mg/ kg body wt.	internal	pyranoquinoline alkaloid ¹⁷	Hiremath SP, 1999
<i>Achyranthes aspera</i>	Amaranthaceae	Apamara ng	Whole plant	Abortifacient ¹⁸	various	Internal	Achranthine ¹⁹	Elumalai, (2009)
<i>Aerva lanata</i>	Amaranthaceae	Paunsia	Aerial parts	Abortifacient	No report	Internal	canthin-6-one alkaloids ²⁰	Sasmal, 2011
<i>Ailanthus excelsa</i>	Simarouba ceae	Dakhinak abata	Stem bark	Antiovolatory	No report	external/ internal	Benzoquinoline alkaloid: Alancin ²¹	Saravanan, et al 2012
<i>Alangium salvifolium</i>	Cornaceae (Alangiceae)	Ankula	Stem bark	Contraceptive and abortifacient, antiprogesterogenic activity	No report	internal	Benzopyridoquinoline ²¹	Saravanan, et al 2012
<i>Allium cepa</i>	Alliaceae	Plaja	Bulb	Antifertility, anti implantation effect	300 mg/kg	external and internal	Alliins ²¹	Saravanan, et al 2012
<i>Amaranthus spinosus</i>	Amaranthaceae	Kanta marisha	Leaves	Abortifacient	No report	internal	Alkaloids ²²	Balakrisnan, 2011
<i>Anamirta cocculus</i>	Menispermaceae	Kakamari	Tender leaves	Contraction of uterus	No report	external	Protoberberine alkaloid ²³	http://www.ayushveda.com/herbs/anamirta-cocculus.htm
<i>Annona squamosa</i>	Annonaceae	Sitaphala	seeds, leaves, bark	Abortifacient	No report	Internal	Atrophine alkaloids, Anonaine ²⁴	Vijayalaxmi, et al 2011
<i>Antiaris toxicaria</i>	Moraceae	Bhramaramari	Roots	Antifertility	No report	Internal	Tropane alkaloid Aristolactum glucoside and p-coumaric acid ²⁵	www.niir.org
<i>Areca catechu</i>	Arecaceae	Gua	Fruit / seed	Anti-ovulatory	No report	Internal	Arecaidine ²⁶	Jyoti, et al. 2010
<i>Azadirachta indica</i>	Meliaceae	Nimba	Seeds, leaves, flowers and bark	Contraceptive, Antifertility	No report	External and internal	Cyclopeptide alkaloid ²¹	Saravan, et al. 2012
<i>Balanites roxburghii</i>	Zygophyllaceae	Kampani poi	Bark, fruit seed, leaves of the tree and the oil from seeds	Abortifacient	300/600 mg/kg	Internal	Steroid alkaloid ²⁷	Padmashali, et al 2006
<i>Bambusa vulgaris</i>	Poaceae	Baunsa	Leaves	Abortifacient	250/500 mg/kg	Internal	Alkaloid ²⁸	Musa et al. 2009
<i>Bombax ceiba</i>	Bombacaceae	Simili, Bura	Root	Abortion ³⁸	No report	Internal	No report	Chaudhary et al. 2012
<i>Butea mansperma</i>	Fabaceae	Palasa	Seed	Antifertility	100 mg / kg	Internal	Isoquinoline alkaloid ^{1, 29}	Razdan, et al. 1969
<i>Cannabis sativa</i>	Cannabaceae	Ganjei	Leaves	Antifertility, Abortifacient	125, 200, 400 and 800 mg/kg	Internal	Anhydrocannabinol ³⁰	Sethi, et al. 1991

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<i>Carica papaya</i>	Caricaceae	Amrutabhanda	Seed	Irregular menstruation	No report	Internal	Carpaine ³¹	Burdick, 1971
<i>Carum carvi</i>	Apiaceae	Sajira	Seeds	Oestrous cycle Disruptor ³²	No report	internal	Isoquinoline alkaloid ²¹	Saravanan, <i>et al</i> 2012, Ankush <i>et al</i> 2011
<i>Cassia fistula</i>	Fabaceae	Sunari	Fruits, bark	Anti-implantation activity, estrogenic activity	100mg/kg	Internal	Alkaloid ³³	Panda, <i>et al</i> 2011
<i>Cassia occidentalis</i>	Fabaceae	Kasendri	Root	Antispermatogetic	No report	Internal	Isoquinoline alkaloid ³⁴	Rajendradeep, <i>et al</i> 2011
<i>Cissampelos pareira</i>	Menispermaceae	Akanabinidi	Leaf, root	Antifertility agent	7.3 g/kg	Internal	Thirty seven alkaloids ²¹	Saravanan. <i>et al</i> 2012,
<i>Crataeva nurvala</i>	Capparidaceae	Boruno	Stem bark	Anti-fertility, partial and complete resorption of implants	300 and 600 mg/kg	Internal	Cadabicine ²¹	Saravanan, <i>et al</i> 2012
<i>Crotalaria juncea</i>	Fabaceae	Tumuka	Seeds	Antispermatogetic and antisteroid-ogenic activities, anti-ovulatory	25 mg/100 g body weight	Internal	Riddelliine ³⁵	http://ntp.niehs.nih.gov/go/roc12
<i>Croton roxburghii</i>	Euphorbiaceae	Bhutala	Bark/Latex	anti-ovulatory ²¹	No report	No report	No report	Saravanan, <i>et al</i> 2012
<i>Curcuma longa</i>	zingiberaceae	Haldi	Rhizome	Anti-ovulatory ³⁶	10-15 grams powder per day for 5 days after mense	Internal	Alkaloids ³⁷	Amit, <i>et al.</i> , 2011
<i>Datura stramonium</i>	Solanaceae	Dudura	Leaf	Anti-estrogenic	No report	No report	Alkaloids ³⁸	Soni, <i>et al.</i> , 2012
<i>Daucus carota</i>	apiaceae	Gajoro	Seed	contraceptive	No report	No report	Pseudobenzyl-isoquinoline alkaloid ²¹	Saravanan, <i>et al</i> 2012
<i>Dendrothoe falcata</i>	Loranthaceae	Madanga	Leaf	Contraceptive ³⁹	50/100/200 mg/Rat	Internal	?	Gupta, <i>et al</i> 2007
<i>Derris brevipes</i>	fabaceae	Karanja		Anti-fertility ⁴⁰	200 / 600	Internal	?	Badami, <i>et al</i> 2003
<i>Ferula foetida</i>	Apiaceae	Hingu	Latex	Abortifacient	Variable	Suppository	Oleoresin	Personal collection(Folklore)
<i>Ficus racemosa</i>	Moraceae	Dimiri	Bark	Anti-fertility ⁴¹	50 / 100 mg	Internal	?	Personal collection(Folklore)
<i>Gloriosa superba</i>	Lilaceae	Langalanglia	Rhizome	Abortifacient, Oxytocic ⁴²	550 mg	Internal	1,2 Didemethyl-colchicine: ⁴³	Choudhury, 1993; Arati, <i>et al.</i> , 2011
<i>Gossypium herbaceum</i>	malvaceae	Kapa	Seed/coma	Abortifacient	Variable	Suppository	?	Personal collection(Folklore)
<i>Hibiscus rosasinensis</i>	Malvaceae	Mandara	Root, flower	Anti-implantation activity	400mg/kg	internal	Cyclopeptide alkaloid ⁴⁴	Neeru basudeva, <i>et al</i> 2007
<i>Lawsonia inermis</i>	Lythraceae	Manjuati	leaves	Abortifacient	Variable	Internal	Alkaloid ⁴⁵	Personal collection(Folklore)
<i>Mentha arvensis</i>	Lamiaceae	Pudina	Leaves	Anti-implantation	100mg/kg	Internal	Alkaloid ⁴⁶	Ankush, <i>et al</i> 2011
<i>Mentha pulegium</i>	Lamiaceae	Pudina	Leaves	Contraceptive ⁸	No report	Internal	No report	Verissimo, 2011
<i>Mimosa pudica</i>	Fabaceae	Lajakulilata	Leaf/Root	Abortion	Variable	Internal	No report	Personal collection(Folklore)
<i>Momordica charantia</i>	Cucurbitaceae	Kolora	Seed	Anti-implantation ⁴⁶	No report	No report	No report	Ankush, <i>et al.</i> 2011
<i>Momordica cymbalaria</i>	Cucurbitaceae	Pitta janhi	No report	Estrous cycle disrupturer	250,500mg/kg ³²	Internal	No report	Ankush, <i>et al.</i> 2011

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<i>Momordica tuberosa</i>	Cucurbitaceae	Jahni	Leaf	Antiovolatory	Variable	Internal	No report	Personal collection (Folklore)
<i>Nelumbo nucifera</i>	Nymphaeaceae	Padma	Petal, seed, leaves, root	Antioestrogenic ⁴⁶	0.5, 1, 2g/kg	Internal	Bis-benzylisoquinoline alkaloid	Ankush, <i>et al</i> 2011
<i>Papaver somniferum</i>	Papaveraceae	Aphima	Latex	Antiovolatory	5 to 25 days after....	Internal	Noscapine alkaloid ⁴⁷	Ibrahim Bulduk and Fulya Taktak 2013
<i>Plumbago rosea</i>	Plumbaginaceae	Rakta chitaparu	Leaves	Antiovolatory ⁴⁸	200-400mg/kg	Internal	?	Sheeja, <i>et al.</i> , 2009
<i>Plumbago zeylanica</i>	Plumbaginaceae	Swetachit apar	Root bark	Abortion ⁴⁹	200/400 mg	Internal	?	Sheeja, <i>et al.</i> , 2009
<i>Piper betel</i>	Piperaceae	Pana	Stalk	Anti-oestrogenic	Variable	Suppository	No report	Personal collection (Folklore)
<i>Ricinus communis</i>	Euphorbiaceae	Gaba	Seed	Abortifacient, anti-implantation ⁵⁰	0.6g and 1.2g per kg	Internal	Ricine, isoquinoline ⁵¹	Assefa, <i>et al.</i> 1999; Mcneil <i>et al.</i> , 2003
<i>Sesbania sesban</i>	Fabaceae	Agasti	seed	Fertility control ⁵²	100, 250 and 400mg/kg	No report	Alkaloids ⁵³	Mythili, <i>et al.</i> , 2012
<i>Tabernaemontana divaricate</i>	Apocynaceae	Tagara	Root	Abortifacient	Variable	Internal	No report	Personal collection (Folklore)
<i>Tamarindus indica</i>	Caesalpiniaceae	Tentuli	Bark	Abortifacient	Variable	Internal	No report	Personal collection (Folklore)
<i>Tinospora cordifolia</i>	Menispermaceae	Guluchi	Stem	Antifertility ⁵⁴	No report	No report	Protoberberine alkaloid (Isoquinoline)	Gupta, <i>et al</i> 2003
<i>Trigonella foenum-graecum</i>	Fabaceae	Methi	Seed/Leaf	No report	No report	Internal	Trigonelline ⁵⁵	Zhuo <i>et al</i> 2010
<i>Woodfordia fruticosa</i>	Lythraceae	Dhatuki	Flower	Abortifacient ⁵⁶	No report	No report	Matrine type alkaloid ¹⁸	Pakrashi, <i>et al.</i> 1977
<i>Zingiber officinalis</i>	Zingiberaceae	Ada	Rhizome	Abortion	powder 2 gram daily	internal	Alkaloid (Unknown) ⁵⁷	Bhargava <i>et al.</i> , 2012
<i>Zizyphus jujuba</i>	Rhamnaceae	Barakoli	Root bark	Abortion	Powdered root bark 3-5 g twice daily	No report	Cyclopeptide alkaloid ⁵⁸	T. Pullaiah 2003
<i>Acacia polyantha</i>	Fabaceae	Sami kanta	Leaf	hormonal imbalance	150 / 300 / 600mg / kg	External/ internal	claims DMT (dimethyl tripta-mine) in Plant, Psychoactive alkaloid	Brock <i>et al.</i> , 2002
<i>Ananas cosmosis</i>	Bromiliaceae	Sapuri	Leaf	Abortifacient	Variable	Internal	No report	Personal collection (Folklore)
<i>Apium graveolens</i>	Apiaceae	Bana juani	Aerial parts	Anti-ovulatory ⁵⁹	No report	No report	Unidentified	Open homeo encyclopaedia project
<i>Bauhinia racemosa</i>	Caesalpiniaceae	Kanchana	Stem bark	Abortifacient	Variable	Internal	No report	Personal collection (Folklore)
<i>Calotropis gigantea</i>	Asclepiadaceae	Akanda	Root	abortifacient	Variable	Suppository	No report	Personal collection (Folklore)
<i>Calotropis procera</i>	Asclepiadaceae	Arakha	Root	antiovolatory	(25, 50 and 100 mg/kg of dry roots)	Internal	steroidal alkaloid ⁶⁰	Circosta, <i>et al</i> 2001
<i>Citrullus colocynthis</i>	Cucurbitaceae	Mahankala	Fruit, seed	Abortifacient	No report	No report	Alkaloids ⁶¹	Agrawal, Natural Drugs

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<i>Cocos nucifera</i>	Arecaceae	Nadia	Fruit fibre	Abortifacient	No report	No report	No report	Obidoa , 2010
<i>Lantana camara</i>	Verbenaceae	Bhutiari kanta	Leaf	Antifertility/ Embryo toxicity ⁶²	Noreport	Internal	No report	Mello <i>et al.</i> , 2005
<i>Melia azadirachta</i>	Meliaceae	Mahanimba	Seed	Reduction in fertility index ⁶³	5/10/20 mg/kg	Internal	No report	Dhaliwal, <i>et al.</i> 2007
<i>Mimosa pudica</i>	Fabaceae	Lajakuli	root	Anti ovulatory	No report	No report	mimosine	Ankush, <i>et al.</i> 2011
<i>Moringa oleifera</i>	Moringaceae	Sajana / Muniga	Flowers	Abortifacient	Variable	Internal	No report	Personal Collection (Folklore)
<i>Nerium indicum</i>	Apocynaceae	Karabira	Leaves	Abortifacient	Variable	Internal	No report	Personal Collection (Folklore)
<i>Pergularia daemia</i>	Asclepiadaceae	Uturudi	root	Anti-fertility	Variable	Internal	No report	Personal Collection (Folklore)
<i>Phyllanthus amarus</i>	Euphorbiaceae	Bhuinimba	Whole plant	Arrests normal oestrous cycle	Variable	Internal	No report	Personal Collection (Folklore)
<i>Polygonum hydropiper</i>	Polygonaceae	Pani saga	Root powder	Anti-oestrogenic	Variable	Internal	No report	Kapoor, <i>et al.</i> 1974
<i>Prosopis cineraria</i>	Mimosaceae	Sami	Fruit, root	Abortion	Variable	Internal	Spicigerine ⁶⁴	(Jewers, <i>et al.</i> , 1976).
<i>Stephania japonica</i>	Menispermaceae	Dahidahia	Leaf	Abortifacient	Variable	No report	Hasubanan alkaloid	Yasuo, <i>et al</i> 1975
<i>Trichosanthes cucumerina</i>	Cucurbitaceae	Banapotola	Whole plant	Anti-ovulatory ⁶⁵	200/400mg	Internal	not clearly identified	Kage, <i>et al.</i> 2009
<i>Dysoxylum binectariferum</i>	Meliaceae	Bandar-dewa	Stem bark	Anti-implantation	10mg/kg	Internal	Rohitukine ⁶⁶	Keshri <i>et al.</i> , 2007
<i>Solanum tuberosum</i>	Solanaceae	Alu	Leaves, Stem, Shoot	No report	No report	No report	Solanine ¹⁵	Alexander <i>et al.</i> , 2009
<i>Solanum lycopersicum</i>	Solanaceae	Tomoto	Leaves, Stem, Unripe fruit	No report	No report	No report	Tomatine ⁶⁷	Mendel <i>et al.</i> , 1995
<i>Solanum melongena</i>	Solanaceae	Baigana	Flower, Leaves	No report	No report	No report	Solanine ¹⁴	Sharma <i>et al.</i> , 2009
<i>Solanum dulcamara</i>	Solanaceae	Bheji baigana	Fruit, Flower, Root	No report	No report	No report	Solanine, solasodine, beta-solamarine ¹⁴	Sharma <i>et al.</i> , 2009
<i>Tylophora indica</i>	Apocynaceae	Antamula	Root	Abortifacient	No report	No report	Tylophorine ⁶⁸	chandigarh.nic.in/pdf/medicinal-plants.pdf
<i>Mucuna pruriens</i>	Fabaceae	Baidanka	All parts	No report	No report	No report	mucunine, mucunadine, prurienine and prurienine ⁶⁹	Sharma <i>et al.</i> , 2012
<i>Tridax procumbens</i>	Asteraceae	Bisalyakarani	Leaves	No report	No report	External	Thirty nine alkaloids ⁷⁰	Jude Chigozie Ikewuchi, 2012
<i>Cuscuta reflexa</i>	Convolvulaceae	Nirmuli	Entire plants	No report	No report	No report	Alkaloids ⁷¹	Baumel <i>et al.</i> , 1995

A short review of plants is presented and it was found that alkaloids are the only phytoconstituents in every reported plant, may be responsible for altering the reproductive systems in test animals and/or human.

The particular plant parts of *Senecio jacobaea*, *Striga orobanchioides*, *Petroselinum hortense* and *Momordica cymbalaria* containing alkaloid have no information about the antiovolatory use.¹³

The plants like *Senecio jacobaea*, *Bombax ceiba*, *Tinospora cordifolia* and *Trigonella foenum-gracecum* rich in alkaloids have no clear-cut medicinal use.

The plants such as *Aerva lanata*, *Ailanthus excella*, *Alangium salvifolium*, *Amaranthus spinosus*, *Anamirta coculus*, *Annona squamosa*, *Antiaris toxicaria*, *Areca catechu*, *Azadirachta indica*, *Bombax ceiba*, *Carica papaya*, *Carum carvi*, *Cassia occidentalis*, *Croton*

roxburghii, *Datura starmonium*, *Daucus carota*, *Mentha pulegium*, *Momordica charantia*, *Tinospora cordifolia*, *Trigonella foenum-gracecum*, *Woodfordia fruticosa*, *Apium graveolens*, *Citrullus colocynthis*, *Cocos nucifera*, *Lantana camara*, *Mimosa pudica*, *Aspilia Africana*, *Bombax ceiba*, *Cimicifuga racemosa*, *Cnidoseola*

aconitifolius, *Coulophyllum thalictroides*, *Malvaviscus conzattii*, *Peganum harmala*, *Petroselinum hortense*, *Rhynchosia minima*, *Senecio jacobaea* and *Taxus baccata* have no established reports relating to its preparation, dose determination and dosage forms.

Table 2: Antifertility / Antiovulatory and related activities of some plants with their active principles and potion that have been reported from elsewhere.

Name of the plant	Family	Local Name (Oriya)	Part used	Medicinal use	preparation and dosage form	Type of use	Reported phytochemical moiety	Author/Year
<i>Achillea millefolium</i>	Asteraceae	No report	Herb	Emmenagogue	3 gm daily	internal	Bitter glycol alkaloid Achilleine ⁷²	European Medicines Agency
<i>Aspilia africana</i>	Asteraceae	No report	Leaf	Inflammation of fallopian tube, degeneration in ovarian cortex (stroma cells) and disruption of the endometrial uterus	No report	No report	6% Active principles ⁷³	Abii <i>et al.</i> 2011
<i>Bombax ceiba</i>	Bombacaceae	No report	Stem	No report	No report	No report	Some alkaloids ⁷⁴	Himalayan drug company, herbal monograph
<i>Cimicifuga racemosa</i>	Ranunculaceae	No report	Roots, rhizomes	Antioestrogenic/antioovulatory	No report	No report	Cimipronidine, a cyclic guanidine alkaloid ⁷⁵	Xu H <i>et al.</i> / 2005
<i>Cnidoseola aconitifolius</i>	Euphorbiaceae	No report	Leaves	Adverse effect on the maturation and ovulation of follicles	No report	internal	alkaloids, saponins, phenolics, tannins, flavonoids, anthraquinones phlobatannins, triterpenes ²¹	Saravanan, <i>et al.</i> 2012
<i>Coulophyllum thalictroides</i>	Berberidaceae	No report	Herb	Abortive, contraceptive, embriotoxic	No report	No report	Taspine ⁷⁶	http://www.naturalstandard.com
<i>Gracinia kola</i>	Clusiaceae	No report	Seed	Alters oestrous cycle ⁷⁷	350 / 1500 / 2000 mg	Internal	alkaloid	Braide <i>et al.</i> 2003
<i>Malvaviscus conzattii</i>	Malvaceae	No report	Flower	Anti-ovulatory ⁷⁸	No report	Internal	No report	Banaree, <i>et al.</i> 1999
<i>Peganum harmala</i>	Nitrariaceae	No report	Seed, root	Abortifacient ⁷⁹	2.5g/kg ¹⁶	Internal	No report	Shapira, <i>et al.</i> 1989
<i>Petroselinum hortense</i>	Apiaceae	No report	No report	Anti ovulatory	No report	Internal	peculiar alkaloid ⁸⁰	MysticWays Wiki Pagan Knowledgebase
<i>Rhynchosia minima</i>	Fabaceae	No report	Leaves	Abortifacient ⁸¹	No report	No report	No report	Tarafdar <i>et al.</i> 1983
<i>Rivea hypocrateriformis</i>	Convolvulaceae	No report	Aerial parts	Anti-implantation ⁸²	200/400mg/kg	Internal	No report	Shivalingappa, <i>et al.</i> 2001
<i>Rosmarinus officinalis</i>	Lamiaceae	No report	Leaves	Abortifacient	large quantity	Internal	Indole alkaloid ⁸³ (rosmarinic acid)	PFAF database
<i>Rumex steudellii</i>	Polygonaceae	No report	Root	Ovarian follicular genesis ⁸⁴	3gm/kg	Internal	No report	Solomon <i>et al.</i> 2010
<i>Salvia fructosa</i>	Lamiaceae	No report	Leaves	Reproductive toxicity potentials ⁸⁵	200,400 and 800mg	Internal	No report	Al-Hamood <i>et al.</i> 1998
<i>Senecio jacobaea</i>	Asteraceae	No report	No report	No report	No report	External	Pyrolizidine ⁸⁶	www.herbvibes.com
<i>Striga orobanchioides</i>	Scrophulariaceae	No report	No report	Increase in uterine weight	25 mg/kg	Internal	No report	Ankush <i>et al.</i> 2011
<i>Taxus baccata</i>	Taxaceae	No report	Leaves	Anti-ovulatory	No report	Internal	Three Pseudo alkaloids (taxane?) ⁸⁷	Giovanni <i>et al.</i> 1993
<i>Nigella sativa</i>	Ranunculaceae	Kalazira	Seeds	Antioxytocic ⁸⁸	Variable	Internal	Nigellimine ⁸⁹	Rahman <i>et al.</i> 1992

Table 2: Antifertility / Antiovolatory and related activities of some plants with their active principles and potion that have been reported from elsewhere.

Name of the plant	Family	Local Name (Oriya)	Part used	Medicinal use	preparation and dosage form	Type of use	Reported phytochemical moiety	Author/Year
<i>Cissampelos pareira</i>	Menispermaceae	Akanabindi	Leaf, root	Antifertility agent	7.3 g/kg	Internal	Thirty seven alkaloids ⁴	Saravanan. <i>et al</i> 2012,
<i>Lepidium sativum</i>	Brassicaceae	Chandasara	mature explants	Anti-ovulatory	Variable	No report	Lepidine ⁹⁰	Srivastava <i>et al.</i> , 2002
<i>Tussilago farfara</i>	Asteraceae	?	coltsfoot	?	?	?	Senecionine ⁹¹	EFSA 2011

Note: (?) Indicates unconfirmed data; **No report:** indicates unspecified items in the literature; **Variable:** indicates varied used potions.

The internal or external use of constituents from *Croton roxburghii*, *Datura starmonium*, *Daucus carota*, *Momordica charantia*, *Sesbania sesban*, *Tinospora cordifolia*, *Woodfordia fruticosa*, *Zizyphus jujube*, *Apium graveolens*, *Citrullus colocynthis*, *Cocos nucifera*, *Mimosa pudica* and *Stephania japonica* are not yet optimized.

Similarly the phytochemical moieties of *Bombax ceiba*, *Croton roxburghii*, *Mentha pulegium*, *Mimosa pudica*, *Momordica charantia*, *Momordica cymbalaria*, *Momordica tuberosa*, *Piper betel*, *Tabernaemontana divaricate*, *Tamarindus indica*, *Ananas cosmosis*, *Bauhinia racemosa*, *Calotropis gigantia*, *Cocos nucifera*, *Lantana camara*, *Melia azadirachta*, *Moringa oleifera*, *Nerium indicum*, *Pergularia daemia*, *Phyllanthus amarus*, *Polygonum hydropiper*, *Malva viscosa*, *Peganum harmala*, *Rhynchosia minima*, *Rivea hypocrateriformis*, *Rumex steudelii*, *Salvia frutescens* and *Striga orobanchioides* are not investigated thoroughly.

Here, some plants having routine use of human beings are personally collected viz : *Ferula foetida*, *Gossypium herbaceum*, *Lawsonia inermis*, *Mimosa pudica*, *Momordica tuberosa*, *Piper betel*, *Tabernaemontana divaricate*, *Tamarindus indica*, *Ananas cosmosis*, *Bauhinia racemosa*, *Calotropis gigantia*, *Moringa oleifera*, *Nerium indicum*, *Pergularia daemia* and *Phyllanthus amarus*. Folkloric use of these plants are very popular for their active phytoconstituents may be with alkaloid as chief constituent which definitely alters the reproductive system of test animals and/or human beings. These plants should be more explored in future for the new findings.

Latest scientific introspection

Tussilago farfara belonging to family Asteraceae contains tumorigenic pyrrolizidine alkaloids. There are documented cases of Coltsfoot tea causing severe liver problems in an infant, and in another case, an infant developed liver disease and died because the mother drank tea containing coltsfoot during her pregnancy. Hence the alkaloid Senecionine may be researched for antiovolatory potentials.

Solanine occurs naturally in many species of the genus *Solanum*, including the potato (*Solanum tuberosum*), tomato (*Solanum lycopersicum*). Scant evidence for tomato toxicity is reported in the medical and veterinary literature and the same alkaloid Solanine is found in

eggplant (*Solanum melongena*), and bittersweet nightshade (*Solanum dulcamara*).

The alkaloids from *Solanum dulcamara*, solanine (from unripe fruits), solasodine (from flowers) and beta-solamarine (from roots) inhibited the growth of *E. coli* and *S. Aureus*.¹⁴ Although fatal human poisonings are rare, several cases have been documented. The poison is believed to be solanine.¹⁵ The review suggests that unlike medicines every food or vegetable must be within therapeutic index for its safe use. Further any food or vegetable which contains alkaloids must be analysed and a threshold is to be fixed for their safe.

CONCLUSION

Medicinal plants constitute the base of health care systems in many societies. The recovery of the knowledge and practices associated with these plant resources are part of an important strategy linked to the conservation of biodiversity, exploring new medicines and getting a new pathway for awareness of health systems. The folkloric use of such potion with several aspects is discussed. However the problems related to efficacy, isolation of active phytoconstituents, dose determination etcetera are required to be tested and established for their right use. The research in pharmacokinetics and pharmacodynamics of such plant moieties are necessary to be established in a newer dosage form and must be safe for its use. The list of medicinal plants used to alter the reproductive system as antifertility/ antiovolatory/ any other agents presented in this review which is useful to researchers, as well as practitioners. Emphasis should be laid to investigate plant species that have not been subject of pharmacological studies, although the folkloric uses are popular. It may be concluded that the plants rich in alkaloidal moiety may be explored for its hidden activities in the field of research.

REFERENCES

1. Priyashree S, Jha S, Pattanayak SP, A review on *Cressa cretica* Linn.: A halophytic plant. *Pharmacogn Rev.*, 4(8), 2010, 161–166.
2. S.M.K. Rates, Review, Plants as source of drugs, *Toxicon*, 39(5), 2001, 603–613.
3. www.botanical-online.com/english/alkaloids.htm
4. García MT, Blázquez MA, Ferrándiz MJ, Sanz MJ, Silva-MN, Hermoso JA, de la Campa AG, New alkaloid antibiotics that

- target the DNA topoisomerase I of *Streptococcus pneumonia*, *J Biol Chem.*, 286(8), 2011, 6402-6413.
5. Fresno M, Jiménez A, Vázquez D, Inhibition of translation in eukaryotic systems by harringtonine, *Eur J Biochem.*, 72(2), 1977, 323-330.
 6. Tits M, Desai C, Marnette JM, Bassleer R, Angenot L, Antimitotic activity of strychnopentamine, a bisindolic alkaloid, *J Ethnopharmacol*, 12(3), 1984, 287-292.
 7. Chukaew A, Ponglimanont C, Karalai C, Tewtrakul S. Potential anti-allergic acridone alkaloids from the roots of *Atalantia monophylla*, *Phytochemistry*, 69(14), 2008, 2616-2620.
 8. Verissim LF, Andre D, Bacchi TZ, Gustavo HOP, Estefania GM, Herbs of interest to the Brazilian Federal Government: female reproductive and developmental toxicity studies, *Brazilian Journal of Pharmacognosy*, 21(6), 2011, 1163-1171.
 9. Takrouri MSM, Mohamad Said Maani MB, ChB, Anesthetic Uses of Hyoscine and Atropine Alkaloids in Surgical Arabic Book, *Anesthesiology*, 90(6), 1999, 1795.
 10. Plemenkov, VV, Introduction to the Chemistry of Natural Compounds, Kazan, 2001, 223.
 11. Kenneth WB, "β-Phenylethylamines and the isoquinoline alkaloids", *Nat. Prod. Rep*, 14 (4), 1997, 387-411.
 12. Tadeusz Aniszewski, *Alkaloids - Secrets of Life -1st Edison*, 2007, 142.
 13. Kapoor M, Garg SK, Mathur VS, Antiovolatory activity of five indigenous plants in rabbits, *Ind J Med Res.*, 62(8), 1974, 1225-1227.
 14. Sharma B, Kumar P, Bakshi N, "Biological activity of alkaloids from *Solanum dulcamara*", *Natural Product Research*, 23(8), 2009, 719-723.
 15. Alexander RF, Forbes GB, Hawkins ES, "A Fatal Case of Solanine Poisoning", *British Medical Journal*, 2 (4575), 1984, 518.
 16. Okoko II, Osinubi AA, Olabiyi OO, Kusemiju TO, Noronha CC, Okanlawon AO, "Antiovolatory and anti-implantation potential of the methanolic extract of seeds of *Abrus precatorius* in the rat", *Endocrine practice, official journal of the American College of Endocrinology and the American Association of Clinical Endocrinologists*, 16(4), 2010, 554-560.
 17. Hiremath SP, Rudresh K, Badami S, Patil SB, Patil SR, Post-coital antifertility activity of *Acalypha indica* Linn., *J Ethnopharmacol*, 67(3), 1999, 253-258.
 18. Pakrashi A, Bhattacharya N, ABIM - An Annotated Bibliography of Indian Medicine abortifacient activity; Abortifacient principle of *Achyranthes aspera* Linn, *IJEB*, 15(10), 1977, 856-858.
 19. Elumalai EK, Chandrasekaran N, Thirumalai T, Sivakumar C, Therasa SV, David E, *Achyranthes aspera* leaf extracts inhibited fungal growth, *International Journal of PharmTech Research*, 1(4), 2009, 1576-1579.
 20. Sasmal D, Goyal M, Pareek A, Nagori BP, *Aerva lanata*: A review on phytochemistry and pharmacological aspects. *Pharmacogn Rev*. 5(10), 2011, 195-198.
 21. Saravanan, Priya G, Renuka C, Medicinal plants with potential antifertility activity – A review of sixteen years of herbal medicine research (1994-2010), *IJPTR*, 1(1), 2012, 481-494.
 22. Sangameswaran B, Balakrishnan N, Balasubramaniam, Arumugam, Hariram BV, Pharmacognostical evaluation of *Amaranthus spinosus* L. *Pharmacognosy Journal*, 3 (19), 2011, 13-18.
 23. <http://www.ayushveda.com/herbs/anamirta-cocculus.htm>.
 24. Vijayalakshmi K, Vanitha V, Umadevi KJ, Determination of Bioactive Components of *Annona squamosa* L Leaf by GC- MS Analysis, *International Journal of Pharmaceutical Sciences and Drug Research*, 3(4), 2011, 309-312.
 25. www.niir.org
 26. Jyoti S, Tara S, Smita S, Arul A, Krishanananda P, Stuti S, Samik B, Sajala K, Antiovolatory and abortifacient effects of *Areca catechu* (betel nut) in female rats, *Indian Journal of Pharmacology*, 42(5), 2010, 306-311.
 27. Padmasali S, Vaidya P, Vagdevi HM, Sathyanarayana MD, Antifertility effect of the plant *Balanites Roxburghii* (Balanitaceae) in female albino rats, *Indian J Pharmacol*, 68 (3), 2006, 347-351.
 28. Musa TY, Bimbo BB, Abortifacient potentials of the aqueous extract of *Bambusa vulgaris* leaves in pregnant Dutch rabbits, *Contraception*, 80 (3), 2009, 308-331.
 29. Razdan MK, Kanti K, Bhide NK, Antifertility effect and some pharmacological actions of *Butea frondosa* seed extracts, *Ind Jour of Physiol and Pharmacol*, 13(4), 1969, 239-249.
 30. Sethi N, Nath D, Singh RK, Srivasta RK, Antifertility and Teratogenic Activity of *Cannabis Sativa* In Rats, *PAGINATION/COLLATION*, 62(1), 1991, 69-73.
 31. Burdick EM, "Carpaine. An alkaloid of *Carica papaya*, Chemistry and pharmacology." *Economic Botany*, 25(4), 1971, 363-365.
 32. Ankush R, Singh A, Sharma A, Singh N, Kumar P, Bhatia V, Antifertility activity of Medicinal plants on Reproductive System of Female Rats, *Internat Jour of Bio Engineering Sci and Tech*, 2(1), 2011, 44-50.
 33. Panda SK, Padhi LP, G Mohanty G, Antibacterial activities and phytochemical analysis of *Cassia fistula* (Linn.) leaf. *J Adv Pharm Technol Res*, 2(1), 2011, 62-67.
 34. Rajandeep K, Sharma A, Kumar R, Khar R, Plant Resour, Rising Trends towards Herbal Contraceptives, *J. Nat. Prod*, 1(4), 2011, 5-12.
 35. <http://ntp.niehs.nih.gov/go/roc12>
 36. Ghosh AK, Das AK, Patra KK, Studies on antifertility effect of rhizome of *curcuma longa* linn, *Asian Journal of Pharmacy and Life Science*, 1(4), 2011, 349-353.
 37. Saraf DK, Shweta T, Bhavana B, Aditi D, Durgesh N, Nagendra SC, Effect of *Carum carvi* and *Curcuma longa* on hormonal and reproductive parameter of female rats, *International Journal of Phytomedicine*, 1(1), 2009, 31-38.
 38. Soni V, Soni P, Siddiqui AA, Dwivedi J, Antiovolatory and estrogenic activity of leaves of *Datura stramonium* Linn. in female albino rats, *Asian Pacific Jour of Trop Biomed*, 2012, 1-5.
 39. Gupta RS, Kachhawa JB, Sharma A, Effect of methanolic extract of *Dendrophthoe falcata* stem on reproductive function of male albino rats, *J Herb Pharmacother*, 7(2), 2007, 1-13.
 40. Badami S, Aneesh R, Sankar S, Sathishkumar MN, Suresh B, Rajan S, Antiferility activity of *Derris brevipes* variety *coriacea*, *J. Ethnopharmacol*, 84(4), 2003, 99-104.
 41. Ahirwar D, Kharya MD, Ahiwar B, Reversible Antifertility Activity of Hydroalcoholic Extract of *Ficus Racemosa* L. in Male Mice, *Journal of Reproduction and Contraception*, 22(8), 2011, 37-44.
 42. Bodhankar SL, Malpani AA, Aswar UM, Kushwaha SK, Zambare GN, Effect of the Aqueous Extract of *Gloriosa superba* Linn

- (Langli) Roots on Reproductive System and Cardiovascular Parameters in Female Rats, *Tropical Journal of Pharmaceutical Research*, 10(2), 2011, 169-176.
43. Chaudhuri PK, Thakur RS, 1,2-Didemethylcolchicine: A New Alkaloid from *Gloriosa superba*, *J. Nat. Prod.*, 56(7), 1993, 1174-1176.
 44. Neeru V, Sharma SK, Post-Coital Antifertility Activity of *Hibiscus rosa-sinensis* Linn. Roots, *Evid Based Complement Alternat Med.*, 5(1), 2008, 91-94.
 45. CKR Y, Sandya L, Sandeep D, Ruth SK, Nagarjuna S, Reddy PY, Evaluation of diuretic activity of aqueous and ethanolic extracts of *Lawsonia inermis* leaves in rats, *Asian Journal of Plant Science and Research*, 1(3), 2011, 28-33.
 46. Ankush R, Singh A, Sharma A, Singh N, Kumar P, Bhatia V, Antifertility activity of medicinal plants on reproductive system of female rats, *Int Jour of Bio Engineering Sci. and Tech*, 2(3), 2011, 44-50.
 47. Ibrahim B, Fulya T, Isolation and Characterization of Antitumor Alkaloid from Poppy Capsules (*Papaver somniferum*), *Journal of Chemistry*, 2013, Article ID 493870, 4.
 48. Sheeja E, Joshi SB, Jain DC, Antioviulatory and estrogenic activity of *Plumbago rosea* leaves in female albino rats, *Indian J Pharmacol*, 41(6), 2009, 273-277.
 49. Edwin S, Joshi SB, Jain DC, Antifertility activity of leaves of *Plumbago zeylanica* in female albino rats, *Eur J Contracept Reprod. Health Care*, 14(3), 2009, 33-239.
 50. McNeil RT, Noronha CC, Kusemiju TO, Okanlawon AO, The Anti-ovulatory Effect of a Seed Extract of *Ricinus Communis*, *Nig. Jnl Health & Biomedical Sciences*, 2(1), 2003, 31-34.
 51. Makonnen E, Zerihun L, Assefa G, Rostom AA, Antifertility activity of *Ricinus communis* seed in female guinea pigs, *East Afr Med J*, 76(6), 1999, 335-337.
 52. Singh SP, Fertility control of female through *Sesbania sesban* seeds, *Jour of Res and Edu in Ind Med*, 9(4), 1990, 27-32.
 53. Mythili T, Ravindhran R, Phytochemical Screening And Antimicrobial Activity Of *Sesbania Sesban* (L.), *Asian Journal of Pharmaceutical and Clinical*, 5(4), 2012, 179-182.
 54. Gupta RS, Sharma A, Antifertility effect of *Tinospora cordifolia* (Willd) stem extract in male rats, *Indian J Exp Biol*, 41(8), 2003, 885-889.
 55. Zhuo R, Wang L, Wang L, Xiao H, Cai S, Determination of trigonelline in *Trigonella foenum-graecum* L. by hydrophilic interaction chromatography, *Chinese Journal of Chromatography*, 28 (4), 2010, 379-382.
 56. Khushalani H, Tatke P, Singh KK, Antifertility activity of dried flowers of *Woodfordia fruticosa* kurz, *Indian Journal of Pharmaceutical Sciences*, 68(4), 2006, 528-529.
 57. Bhargava S, Kshipra D, Amla B, Asha S, Bharti M, Zingiber Officinale: Chemical and phytochemical screening and evaluation of its antimicrobial activities, *Journal of Chemical and Pharmaceutical Research*, 4(1), 2012, 360-364.
 58. Antidiabetic Plants in India and Herbal Based Antidiabetic Research, By T. Pullaiah and K. Chandrasekhar Naidu, *Regency*, 2003, vi, 321.
 59. Open homeo encyclopaedia project.
 60. Circosta C, Sanogo R, Occhiuto F, Effects of *Calotropis procera* on estrous cycle and on estrogenic functionality in rats, *Farmaco*, 56(5-7), 2001, 373-378.
 61. Agrawal, *Natural Drugs*
 62. Mello BF, Jacobus D, Carvalho K, Mello JRB, Effects of *Lantana camara* (Verbenaceae) on general reproductive performance and teratology in rats, *Toxicol*, 45(4), 2005, 459-466.
 63. Dhaliwal PK, Reshu Mandal, Antifertility effect of *Melia azedarach* Linn. (dharek) seed extract in female Albino rats, *Indian Journal of Experimental Biology*, 45(10), 2007, 853-860.
 64. Jewers K, Nagler MJ, Nirvi KA, Amir F, Lipids, sterols, and a piperidine alkaloid from *Prosopis spicigera* leaves, *Phytochemistry*, 15, 1976, 238-240.
 65. Kage DN, Malashetty VB, Seetharam YN, Suresh P, Patil SB, Effect of ethanol extract of whole plant of *Trichosanthes cucumerina* var *cucumerina* Linn. on Gonadotropin, ovarian follicular kinetics and oestrous cycle for screening of antifertility activity in albino rats, *Int J Morphol*, 27 (1), 2009, 173-182.
 66. Keshri G, Oberoi RM, Lakshmi V, Pandey K, Singh MM, Contraceptive and hormonal properties of the stem bark of *Dysoxylum binectariferum* in rat and docking analysis of rohitukine, the alkaloid isolated from active chloroform soluble fraction, *Contraception*, 76(5), 2007, 400-407.
 67. Mendel F, Carol EL, alpha-Tomatine Content in Tomato and Tomato Products Determined by HPLC with Pulsed Amperometric Detection, *J. Agric. Food Chem.*, 43(6), 1995, 1507-1511.
 68. chandigarh.nic.in/pdf/medicinal-plants.pdf.
 69. Sharma BK, Ahmad S, Rahul S, Verma RK, Kumar N, A review on *Mucuna pruriens*: Its phyto constituents and therapeutic uses, *Novel Science International Journal of Pharmaceutical Science*, 1(6), 2012, 308 -312.
 70. Ikewuchi JC, Alteration of plasma biochemical, haematological and ocular oxidative indices of alloxan induced diabetic rats by aqueous extract of *Tridax procumbens* linn (Asteraceae), *EXCLI journal*, 11, 2012, 291-308.
 71. Baumel P, Jeschke WD, Rath N, Czygan FC, Proksch P, Modelling of quinolizidine alkaloid net flows in *Lupinus albus* and between *L. albus* and the parasite *Cuscuta reflexa*: new insights into the site of quinolizidine alkaloid synthesis, *Journal of experimental botany*, 46(292), 1995, 1721-1730.
 72. European Medicines Agency, 12 July 2011, EMA/HMPC/290309/2009 Committee on Herbal Medicinal Products.
 73. Abii TA, Onuoha EN, The Chemical Constituents of the Leaf of *Aspilia africana* as a Scientific Backing to its Tradomedical Potentials, *Agricultural Journal*, 6(1), 2011, 28-30.
 74. Himalayan drug company, herbal monograph.
 75. Xu H, Fabricant DS, Pierson CE, Bolton JL, A preliminary RAPD-PCR analysis of *Cimicifuga* species and other botanicals used for women's health, (Review), 2005.
 76. <http://www.naturalstandard.com/indexabstract.asp?createabstract=bluecohosh.asp&title=Blue%20cohosh>.
 77. Braide VB, Agube CA, Essien GE, Udoh FV, Effect of *Garcinia kola* seed alkaloid extract on levels of gonadal hormones and pituitary Gonadotropin in rat serum, *Physiological Society of Nigeria*, 18(2), 2003, 59-64.
 78. Banaree R, Pal AK, Kabir SN, Antioviulatory faculty of the flower of *Malva viscosa* conzatti, *Phytother Res.*, 13(2), 1999, 169- 171.
 79. Shapira Z, Terkel J, Egozi Y, Nyska A, Friedman J, Abortifacient potential for the epigeal parts of *Peganum harmala*, *J Ethnopharmacol*, 27 (3), 1989, 319-325.

80. MysticWays Wiki Pagan Knowledgebase.
81. Tarafdar CR, Ethno gynaecology in relation to plants – (ii) Plants used in abortion, Jour Econ.Tax. Bot., 4, 1983, 507-516.
82. Shivalingappa H, ND Satyanarayan, Antiimplantation and pregnancy interruption efficacy of Rivea hypocrateriformis in the rat, Journal of Ethnopharmacology, 74(3), 2001, 245–249.
83. PFAF database.
84. Solomon T, Largesse Z, Mekbebe A, Eyasu M, Asfaw D, Effect of Rumex steudellii methanolic root extract on ovarian folliculogenesis and uterine histology in female albino rats, Afr Health Sci, 10(4), 2010, 353-361.
85. Al-Hamood MH, Elbetieha A, Alkofahi A, Bataineh H, Reproductive toxicity potentials of Salvia fruticosa (Labiatae) in rats, Journal of Ethnopharmacology, 61(1), 1998, 67-74.
86. www.herbvideos.com
87. Giovanni A, Hasan CÖ, Ivana F, Pierluigi G, Bruno G, Ezio B, Pseudoalkaloid taxanes from Taxus baccata, Phytochemistry, 33(6), 1993, 1521-1523.
88. Agrawal M, Yadav S, Effect of Nigella sativa on the estrous cycle and ovarian activity in albino rats, pharmacology online, 3, 2011, 997-1006.
89. Rahman A, Sohail M, Khurshid Z, Nigellimine: A New Isoquinoline Alkaloid from the Seeds of Nigella sativa, J. Nat. Prod., 55(5), 1992, 676–678.
90. Pande D, Malik S, Bora M, Srivastava PS, A rapid protocol for in vitro micropropagation of Lepidium sativum linn.and enhancement in the yield of lepidine, In Vitro Cellular & Developmental Biology – Plant, 38(5), 2002, 451-455.
91. Scientific Opinion on Pyrrolizidine alkaloids in food and feed, EFSA Journal, 9(11), 2011, 2406.

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