

# A review on medicinal plants exhibiting antifertility activity in males

R S Gupta\* and Rakhi Sharma

Center for Advanced Studies, Reproduction Physiology Section  
Department of Zoology, University of Rajasthan, Jaipur 302 004, Rajasthan, India

\*Correspondent author, E-mail: gupta\_rs@hotmail.com

Received 16 June 2005; Accepted 10 April 2006

## Abstract

Fertility control is an issue of global and national public health concern. Many studies have been done on the male contraception. The traditional use of medicinal plants to treat different sorts of diseases, including fertility related problems is widespread throughout the world as many plant substances are known for their interferences with the male reproductive system. The present review is an attempt to summarize the fertility regulatory plants with part used, type of extract/isolated compounds (active principles) along with animal model used. The literature covered is of 25 years i.e. from 1980 to 2005 for 105 plants showing antifertility activity in males.

**Keywords:** Antifertility activity, Spermatogenesis, Testes, Medicinal plants.

**IPC code; Int. cl.<sup>8</sup>** — A61K 36/00, A61P 15/00, A61P 15/16

additionally safe and less expensive method that require infrequent and self administration and should have long lasting but complete reversible antifertility effect.

Recently efforts are being made to explore the hidden wealth of medicinal plants for contraceptive use. With the exciting prospects of gene therapy, herbal medicine remains one of the common forms of therapy, available to much of world's population, to maintain health and to treat diseases.

There has been a steady accumulation of information regarding the screening of plants having antifertility efficacy<sup>3-9</sup>. The folklore information and the ancient literature about the plants and herbs can help the antifertility program. In the recent past a number of plants have been identified and evaluation of extracts and active principles from different parts of plants like seeds, roots, leaves, flowers, stem or stem barks have been done by various researchers. These reports have been exhaustively reviewed by Orzechowski<sup>10</sup>, Brondegaard<sup>11</sup>, Kholkute *et al*<sup>12</sup>, Kamboj and Dhawan<sup>13</sup>, Zhu<sup>14</sup> and Satyawati<sup>15</sup>.

A literature survey for the period of 25 years (1980-2005) revealed that there are about 105 plants which possess antifertility activity in males. They have been discussed in Table I along with plant

## Introduction

Rising human population through out the world more particularly in developing and underdeveloped parts has detrimental effects on the life supporting system on earth. The possibility of an effective check on human fertility may soon be realized through biological means. Fertility regulation comprising contraception and management of infertility forms an important component of reproductive health<sup>1</sup>. Though considerable progress has been made in the development of highly effective, acceptable and reversible methods of contraception among females, progress and possibilities on males are still slow and limited. With recent progress towards a better understanding of male reproductive physiology there is a need to develop new contraceptive modalities for male.

Several potential approaches for induction of infertility have been investigated over a long period including hormonal, chemical and immunological approaches.

The chemical compounds affecting testicular function include different groups like steroidal and non-steroidal among them are: Danazol, Depot medroxy progesterone acetate (DMPA), Cyproterone acetate (CPA), Levenogestral, Melatonin,  $\alpha$ -Chlorohydrin, Metapiron and Serotonin. But application of all these compounds has been seriously questioned owing to various hazards as they were proved toxic or idiosyncratic on both the short as well as long term use in the reproductive organs<sup>2</sup>.

Despite the availability of various contraceptive modalities, one of the most challenging pursuits in the realm of pharmaceutical and medical sciences is search for newer, more potent,

part, type of extract, active principles and animal model used in the study.

The status of the more active plants is briefly described below.

### ***Gossypium herbaceum* Linn.**

(Family- Malvaceae, Levant Cotton)

Gossypol, a yellow phenolic compound isolated from cotton seed oil was proposed as a male contraceptive drug, after the Chinese clinical trials in 1970's. Hadley *et al*<sup>16</sup> found that gossypol treatment reduced the level of serum testosterone (T) and luteinizing hormone (LH) levels in a dose and duration dependent manner. Gossypol acts directly on testes and induces azoospermia or oligospermia<sup>17-19</sup>. Zavos and Zavos<sup>20</sup> demonstrated that gossypol blocked cAMP formation in sperm, which resulted into inhibition of sperm motility. Nair and Bhiwgade<sup>21</sup> have studied the effect of gossypol on pituitary gonadal axis and found the decreased secretory activity of accessory sex glands. Bai and Shi<sup>22</sup> also investigated inhibition of T-type Ca<sup>2+</sup> currents in mouse spermatogenic cells by gossypol. Antifertility activities were also found in hamsters<sup>23</sup> and in rats<sup>24-25</sup>.



*Gossypium herbaceum*

### ***Tripterygium wilfordii* Hook. f.**

(Family - Celastraceae)

A multiglycoside extracted from the root xylem long used in Chinese



*Tripterygium wilfordii*

traditional herbal medicine for treatment of psoriasis and other dermatological conditions were shown to have a reversible antifertility action in male rats in a Task-Force-supported study<sup>26</sup>. Its antifertility activity is well documented in rats<sup>27</sup>, mice<sup>28</sup> and humans<sup>29</sup>. It caused degenerative changes in seminiferous-tubular epithelium and decrease in plasma testosterone<sup>30</sup>. Bai and Shi<sup>31</sup> also investigated inhibition of Ca<sup>2+</sup> channels in mouse spermatogenic cell by GTW, which could be responsible for the antifertility activity of this compound. Triptolide, an active diterpene epoxide isolated from this plant has been reported to cause infertility in male rats. It's action is post-testicular and produced severe impairment in cauda epididymal sperm<sup>32-33</sup>. Tripchlorolide-a derivative of triptolide has significant effect on the fertility in male rats. The primary sites of action are spermatids and testicular as well as epididymal spermatozoa<sup>34</sup>. Tripchlorolide T<sub>4</sub> also inhibited hyaluronidase activities of testes and epididymis in rats<sup>35</sup>.

### ***Carica papaya* Linn.**

(Family - Caricaceae)

Administration of chloroform extract of Papaya seeds showed suppression of cauda epididymal sperm motility and counts in rats and suggested that contraceptive effects are mainly post testicular in nature without influencing toxicological profile and libido of animals<sup>36</sup>. In langur monkey the extract induces long-term reversible azoospermia<sup>37</sup>. An oral dose of crude ripe paw seeds in male albino rats caused degeneration of the germinal epithelium and germ cells reduction in the number of Leydig cells and vacuoles in the tubules<sup>38</sup>. Pathak *et al*<sup>39</sup> reported the sterility in rats due to total suppression of sperm motility. Verma and Chinoy<sup>40</sup> concluded that the papaya seed extract alters cauda epididymal microenvironment. It was also evaluated that it reversibly reduced the contractile responses of cauda epididymal tubules, which possibly retards the sperm transport in cauda epididymis<sup>41</sup>. Manivannan *et al*<sup>42</sup> also observed ultrastructural changes in the testis and epididymis of rats following treatment with the benzene chromatographic fraction of the chloroform extract of the seeds.

### ***Andrographis paniculata* Wall. ex Nees** (Family - Acanthaceae)

It is manifested that extract of Great plant (Hindi — *Kirayat*) showed antispermatogenic and antiandrogenic effect. Dry leaf powder when fed orally to rats (20 mg powder/day/rat) resulted in cessation of spermatogenesis, degeneration in seminiferous tubules and



*Andrographis paniculata*

regression of Leydig cells. Degeneration and reduction has also been seen in the accessory sex organs and its fluid content<sup>43</sup>. Andrographilode, one of the major constituents of this plant also showed antifertility effect. This compound, when administered in male rats affected spermatogenesis by preventing cytokinesis of the dividing spermatogenic cell lines. Sperm counts, motility seems to be decreased and sperm also possess abnormalities<sup>44</sup>.

***Solanum surattense* Burm f.** syn. *S. xanthocarpum* Schrad. & Wendl.  
(Family - Solanaceae)

Crude extract of Yellow berried nightshade (Hindi — *Kateli*) reported to possess spermicidal activity on rat



*Solanum surattense*

epididymal spermatozoa. Solasodine, a steroidal alkaloid of *S. surattense* caused disruptive changes in the acrosomal membrane of sperm and arrest spermatozoal motility<sup>45</sup>. Mali *et al*<sup>46</sup>, found that the root extract caused degenerative changes in seminiferous epithelium and spermatogenic elements in male rats. Oral administration of solasodine to intact dogs significantly decreased the epithelial cell height of the cauda epididymides. Concurrent treatment of solasodine along with testosterone propionate was unable to restore the normal epithelial lumen parameters<sup>47</sup>.

***Embelia ribes* Burm. f.**  
(Family - Myrsinaceae)

Berries of *E. ribes* have been reported to possess antifertility activity. It shows spermicidal activity in male bonnet monkeys- (*Macaca radiata*) as it adversely affects the sperm motility, the quantity and quality of semen, and lowered the hormonal level<sup>48</sup>. Embelin (2, 5-dihydroxy-3-undecyl-1, 4-benzoquinone) isolated from the berries altered the testicular histology and compound is suggested to possess antiandrogenic properties<sup>49</sup>. Gupta *et al*<sup>50</sup> observed that both *in vitro* and *in vivo* treatment caused profound morphological changes.



*Embelia ribes*

***Catharanthus roseus* G. Don** syn. *Vinca rosea* Linn.  
(Family — Apocynaceae)

Antispermatic as well as antiandrogenic actions in male rats have been shown by leaf extract<sup>58</sup>. Vinblastine and Vincristine, the indole-indoline dimeric alkaloids isolated from *C. roseus* (Hindi — *Sadabahar*) affect spermatogenic cell lines other than



*Catharanthus roseus*

spermatogonia<sup>58-59</sup>. Averal *et al*<sup>60</sup> reported the pathological changes in the principal and apical cells of caput and nuclear cells of cauda causing impairment of epididymal function supporting antiandrogenic properties of vincristine. However, side effects like nausea/vomiting, alopecia, hepatocellular damage, pulmonary fibrosis, etc., are also attributed to vincristine treatment<sup>61-62</sup>.

***Abrus precatorius* Linn.**  
(Family - Fabaceae)

It has long been claimed by Ayurvedic physicians in Sri Lanka that the powdered



*Abrus precatorius*

seeds of *A. precatorius* (Indian Liquorice) inhibit conception in humans when taken orally<sup>63</sup>. Degenerative changes were reflected in testes of rats, rabbits and presbyitis monkey after administration of 50% ethanolic extract of seeds. Rao<sup>64</sup> reported that extract-receiving animal showed altered sperm morphology, reduced sperm motility and metabolism, which is correlated with its decreased fertility rate. Dose dependent reduction in testicular weight, sperm count and degeneration in later stages of spermatogenesis were found in the testis of rats treated with steroidal fraction of seeds<sup>65</sup>. Ratnasooriya *et al*<sup>66</sup> found that the seed extracts caused concentration related impairment of sperm motility with the EC<sub>50</sub> concentration being 2.29 mg/ml. According to Sinha<sup>67</sup> it caused post-testicular antifertility effects and suppressed sperm motility in cauda epididymis.

### ***Azadirachta indica* A. Juss.** (Family - Meliaceae)

Extract of neem leaves caused disturbance in structure and function of testis and spermatozoa in male rats<sup>51</sup>. Histological and biochemical changes in the caput and cauda of rats were studied by Kasturi *et al*<sup>52</sup>, who also suggested its possible antiandrogenic property due to reduction in concentration of serum testosterone. Mass atrophy of spermatogenic elements in rats was also reported by Joshi *et al*<sup>53</sup>. Ethanolic extract of neem bark and flowers induced reversible infertility in male rats and spermatogenesis was arrested at late spermiogenesis stage (late XII)<sup>54-55</sup>. Morphological changes occurred in the

head of the sperm and its acrosome, which is due to its androgen deficiency consequent upon its antiandrogenic property<sup>56</sup>. Spermicidal activity of leaf extract was observed by Khillare and Shrivastav<sup>57</sup>. According to them minimum effective concentration of aqueous extract of old leaves attains 100% immobilization and killing of sperm within 20 seconds.

### **Discussion and Conclusion**

Pharmacological effects of many plants have been studied in various laboratories. However, there are many limitations regarding safety and efficacy of these preparations. Knowledge about active principles of herbal preparations is not well defined and information on toxicity and adverse effects of these formulations are lacking. Information regarding pharmacokinetics and bioavailability is not available. Assurance of safety, quality and efficacy of medicinal plants and herbal products are key issues, which needs to be addressed. Selection of plant material should be based on quality, standardization of methods of preparation, enforcement of regulation regarding appropriate labels are measures, which will improve the quality and acceptability of herbal preparation. Ecotype pharmacological evaluation is very essential when the drug is used in crude form. The relative proportion of phytochemical present in medicinal plants can vary in different ecotypes. There is also a need for documentation of research and publication of results in peer-reviewed journals. Most of the information on pharmacological study of plants are incomplete since they are published as abstract presented at conferences.

Standardization of tests and methods of preparation and documentation of adverse effects of herbal medicines merits attention. Standardization of methods, quality control, data on safety and efficacy are needed for proper understanding of the use of the herbal medicines.

The development of better prophylactics requires new breakthroughs of theories about this process that could only be obtained from basic researches in reproductive biology and medicines.

Owing to the belief that post testicular agents have a more rapid antifertility effect and a correspondingly more rapid recovery than would agents that acts on spermatogenesis, a dual approach was pursued. Drugs with post meiotic or post testicular action would not disturb spermatogenesis, libido or any other hormonally related features. Their effects are rapid both in onset and in the return of normal sperm on withdrawal of the drug<sup>68</sup>.

New targets for drug interventions should be pursued through support of basic sciences, taking advantage of modern cellular and molecular biological techniques. The relatively slow emergence of fertility control technologies for practical application clearly reflects the complexities of science and the requirement of multi-disciplinary research approach. Recent biotechnological, biochemical and immunological advances have overcome some of these difficulties and now make the production and use of contraceptive vaccines feasible. They can provide a valuable alternative to currently available methods of family planning. A vaccine that targets sperm represents a promising approach to contraception. Antisperm antibodies (ASA) in men and

women cause infertility, but the antigens that are recognized by ASA are not characterized.

Prostasomes (organelles secreted by human prostatic cells) are one of the major targets for ASA and that several antigens can cause antibody response associated with immunological infertility. Carlsons *et al*<sup>69</sup> suggested

that prostasomes are available after a new set of antigens for research on male immunoinfertility and immunocontraception.

In conclusion the experimental studies summarized in this review may focus researchers' attention for clinical studies which would be of great scientific contribution to the society.

### Acknowledgement

The authors are thankful to the Head, Department of Zoology, Prof. N. K. Lohiya, Coordinator SAP, Department of Zoology, University of Rajasthan, Jaipur for providing necessary facilities, as well as CSIR, New Delhi and U.G.C., Regional Office, Bhopal, M.P. (India) for financial support.

**Table 1: Summary of medicinal plants exhibiting antifertility activity in males (1980-2005)**

S. No.	Name of the plant	Common/English name	Part used	Type of plant extract / active principles	Animal models	Activities	Reference (s)
1.	<i>Abrus precatorius</i> Linn.	Chirmi	Seed	50% Ethanol extract	Rat	Reduces sperm motility and density	70,71
				Steroidal fraction	,,	Antispermato-genic effect and reduced activity of testicular enzyme	65
				50% Ethanol extract	,,	Post-testicular antifertility effect	67
				Alcoholic extract	,,	Reduced sperm motility	64
				Methanol extract	,,	Sperm motility activity	66
-	Langur Monkey	Antispermato-genic and antiandrogenic effect	72				
2.	<i>Acacia concinna</i> DC.	Shikakai	Stem bark	Acacic acid	Rat	Spermicidal and semen coagulating activities	13
3.	<i>Acacia auriculae-formis</i> A. Cunn.	-	-	Triterpene, saponins	-	Sperm immobilizing effect	73
4.	<i>Acacia caesia</i> Wight & Arn.	Aila	Fruit	Saponins	-	Immobilization of spermatozoa	74
5.	<i>Achillea millefolium</i> Linn.	Gandna Yarrow	Flowers	Ethanol and hydro - alcoholic extract	Mice	Antispermato-genic effect	75
6.	<i>Achyranthes aspera</i> Linn.	Kadaladi	Root	50% Ethanol extract	Rat	Spermicidal action	77
7.	<i>Actinopterys dichotoma</i> Kuhn	Morepankhi Peacock's Tail	Whole plant	50% Ethanol extract	Rat	Antifertility effect	76
8.	<i>Aegle marmelos</i> Corr. ex Roxb.	Bael	-	-	Rat	Resist process of spermatogenesis and decrease sperm motility	78,79

S. No.	Name of the plant	Common/English name	Part used	Type of plant extract/ active principles	Animal models	Activities	References (s)
9.	<i>Albizia lebbek</i> (Linn.) Benth.	<i>Siris</i>	Pod	Methanol extract	Rat	Antifertility activity	80
			Bark	Saponins	„	„	81
10.	<i>Albizia procera</i> (Roxb.) Benth.	<i>Safed siris</i>	Seed and root	Proceric acid and leanic acid	Rat	Spermicidal and semen coagulating activities	13
11.	<i>Allium sativum</i> Linn.	<i>Lahsun</i>	Pod	Dry powder	Rat	Antispermato-genic activity	82
12.	<i>Aloe barbadensis</i> Mill.	<i>Gheekunwar</i>	Leaves	50% Ethanol extract	Dog	Antiandrogenic activity	83
13.	<i>Alstonia scholaris</i> R.Br.	<i>Saptaparni</i>	Stem bark	Methanol extract	Rat	Antifertility effect	84
			„	$\alpha$ - Amyrine	Rat	Suppression of fertility with marked decline in germ cell population	85
14.	<i>Anagallis arvensis</i> Linn.	<i>Dhartidhak</i>	Whole plant	-	„	Spermicidal and semen coagulating activities	13
15.	<i>Ananas comosus</i> Merr.	Annanas	Unripe fruit	Alcoholic extract	Rat	Antispermato-genic activity	15
16.	<i>Andrographis paniculata</i> Wall. ex Nees	<i>Kirayat</i>	Leaves	Dry powder	Rat	Antispermato-genic and antiandrogenic	43
			„	Andrographilode	„	Effect on spermatozoa	44
17.	<i>Annona squamosa</i> Linn.	<i>Sitaphal</i>	Seed	Alcoholic	-	Antispermato-genic activity	86
18.	<i>Aristolochia indica</i> Linn.	<i>Hukka bel</i>	Root	Aristolochic acid	Presbytes langur	Antispermato-genic and antiandrogenic effects	87
19.	<i>Austroplenckia populnea</i> (Reiss.) Lundell.	-	-	Hydro-methanol extract	Rat	Affects the sexual behaviour and epididymal sperm concentration	88
20.	<i>Azadirachta indica</i> A. Juss.	Neem	Seed	Seed oil	Rat	Antispermato-genic and antiandrogenic effect	89
			-	Neem oil	Mouse	Antispermato-genic effects	90
			-	„	Rat	Post-testicular antifertility effects	91
			-	„	„	Antispermato-genic effect	15
			-	„	Monkey, Human	Spermicidal activity	92
			-	„	Monkey	Induced azoospermia	93
			„	Seed oil	„	Antispermato-genic and antiandrogenic effect	55
			„	„	Rat	Spermicidal activities	94
			„	Praneem cream	„	„	95
			Leaves	Ethanol extract	„	Antispermato-genic activity	96

S. No.	Name of the plant	Common/English name	Part used	Type of plant extract/ active principles	Animal models	Activities	References (s)
			Seed	Dry powder	„	„	51
			„	Neem oil	„	Antispermato-genic activity	97
			„	Dry powder	„	Antispermato-genic activities and histological changes in testes and epididymides	52
			Leaves	Dry powder	„	Degeneration of fertilizing ability of sperm	53
			„	Aqueous suspension	„	Antian-drogenic activity	56
			Bark and flower	50% Ethanol extract	„	Antispermato-genic and antiandrogenic activity	54
			Bark and seed	50% Ethanol extract and seed oil	„	Leydig cell dysfunction	98
			Leaves	Aqueous extract	„	Spermicidal activity	57
21.	<b>Balanites roxburghii</b> Linn.	<i>Hingan</i>	Fruit	Pulp extract	Dog	Antispermato-genic activity	99
			Fruit pulp	Ethanol extract	„	Testicular necrosis and atrophy	100
22.	<b>Bambusa arundinacea</b> Willd.	<i>Baans</i>	Shoots (tender)	Ethanol extract	Rat	Impaired the structural and functional activity of epididymis	101
			Stem	Stem extract	„	Reduced sperm motility	102
23.	<b>Barleria prionitis</b> Linn.	<i>Vajradanti</i>	Root	Methanol extract	„	Antifertility effect	103
24.	<b>Berberis chitria</b> Buch.-Ham. ex Lindl.	-	Root	Palmitine hydroxide	Dog	Antispermato-genic action	104
25.	<b>Bursera</b> sp.	Mexican copal	Stem, Leaf	Saponins, Leaf extract	Human Bovine	Sperm aggregation	105
26.	<b>Butea monosperma</b> (Lam.) Kuntze	<i>Palash</i>	Seeds	Butin	Rat, Dog and Monkey	Effects on testicular function	106
			Whole Plant	Water soluble ethanol extract	Rat	Antispermato-genic effect	107
27.	<b>Calotropis procera</b> (Ait.) R. Br.	<i>Aak</i>	Root	Calotropin	Gerbil and Rabbit	Antispermato-genic effect and Leydig cell atrophy	108
			Flower	Aqueous ethanol extract	Mice	Functional alteration in the genital organs and inhibition of fertility	109
28.	<b>Cannabis sativa</b> Linn.	<i>Ganja</i>	Leaves	Butin	Presbytis Monkey	Testicular lesions and atrophy of Leydig cells	110
29.	<b>Carica papaya</b> Linn.	<i>Papita</i>	Fruit	Dry powder	Rat	Antispermato-genic activity	111
			Seed	Aqueous extract	Rat	Induced total sterility	112
			Seed Powder	-	Rabbit	Inhibit fertility	113

S. No.	Name of the plant	Common/English name	Part used	Type of plant extract / active principles	Animal models	Activities	References (s)
			Seed	Aqueous extract	Rat	Reversible post testicular antifertility effects	114
			„	Chloroform extract	Rat	Antifertility activity and reversible sterility	36
			„	Aqueous extract	Rabbit	Contraceptive effect	115
			„	„	Mouse	Antispermatogetic effects	116
			„	Benzene chromatographic sub fraction of chloroform extract	Rabbit	Induced azoospermia and reversible regressive effect	117
			„	„	„	Induced azoospermia and oligospermia	118
			„	„	Human	Spermicidal activity	119
			„	Aqueous extract	Rabbit	No side effects	120
			„	Chloroform extraction	Langur monkey	Induced azoospermia	37
			„	-	Rat	Antifertility effect	38
			„	-	„	Induce sterility due to total suppression of sperm motility	39
			„	-	„	Alter cauda epididymal microenviroment	40
			„	Benzene extract	Rabbit	Ultrastructural changes in the testis and epididymis	42
30.	<b><i>Catharanthus roseus</i> G. Don</b> syn. <i>Vinca rosea</i> Linn.	<i>Sadabahar</i>	Leaves	Extract	Rat	Antispermatogetic activity	229
			„	„	Mice	Antiandrogenic activity	58
			„	Aqueous extract	Mice	Antispermatogetic activity	59
			Whole plant	Vincristin	Rat	Regression of entire reproductive system	230
			„	„	„	Decrease in secretory activity of accessory sex gland	231
			„	„	„	Epididymal dysfunction	60
			-	-	„	Presence of multinucleated giant cells, spermatogenic arrest	232
31.	<b><i>Celastrus paniculatus</i> Willd.</b>	-	Seed	Seed extract	Rat	Antispermatogetic activity	121
32.	<b><i>Cichorium intybus</i> Linn.</b>	<i>Kasni</i>	Whole plant	Aqueous extract	-	Antispermatogetic activity	122
33.	<b><i>Cinnamomum camphora</i> Nees &amp; Eberm.</b>	-	Seed	-	Sparrow	Arrest and inhibition of spermatogenesis	123



S. No.	Name of the plant	Common/English name	Part used	Type of plant extract/ active principles	Animal models	Activities	References (s)
34.	<i>Citrullus colocynthis</i> Schrad.	Tumba	Fruit	50% Ethanol extract	Rat	Impairment of sperm	124
			”	”	”	Induced reversible antifertility effects	125
35.	<i>Colebrookia oppositifolia</i> Sm.	-	Leaves	Ethanol extract	Rat	Antifertility activity	126
36.	<i>Convolvulus microphyllus</i> Sieb. ex Spreng.	Shankh pushpi	Whole plant	Ethanol extract	Rat	Antispermato-genic effect	127
37.	<i>Crotalaria juncea</i> Linn.		Seeds	Ethanol extract	Mice	Arrest of spermatogenesis and antiandrogenic activity	128
38.	<i>Cuminum cyminum</i> Linn.	Jeera	Seed	Ethanol extract	Rat	Antispermato-genic effect	129
39.	<i>Curcuma longa</i> Linn.	Haldi	Root	50% Ethanol extract	Rat	Interference with spermatogenesis at later stages and antiandrogenic effect	130
			-	-	Rat	Arrest of spermatogenesis and antiandrogenic effect	131
40.	<i>Cyclamen persicum</i> Mill.		Whole plant	Saponins	-	Spermicidal activity	132
41.	<i>Cynomorum coccineum</i> Linn.	-	-	Aqueous extract	Rat	Effect on epididymal sperm pattern	133
42.	<i>Daucus carota</i> Linn.		Seed	-	Rat		134
43.	<i>Desmodium gangeticum</i> DC.	Chapot	Whole plant	Gangenticum	Rat	Antifertility effect	135
44.	<i>Diploclisia echinatus</i> Linn.		Stem	Ecdysterone	-	Spermicidal activity	136
45.	<i>Ecballium elaterium</i> A. Rich.			Contrasperm	Rabbit	Decreases sperm motility	137
46.	<i>Echeveria gibbiflora</i> DC.		Whole plant	Aqueous crude extract	Guinea pig	Reduced sperm motility	138
47.	<i>Echinops echinatus</i> Roxb.	Oontkatalo	Root	50% Ethanol extract	Rat	Sperm antimotility. Reduces sperm density in cauda epididymis	139, 140
48.	<i>Embelia ribes</i> Burm. f.	Vidang	Berry	Embelin	Rat	Reduced testosterone level	141
						Antifertility activity	142
						Antispermato-genic and antiandrogenic activity	49
						Spermicidal activity	50
						Antifertility activity	143

S. No.	Name of the plant	Common/English name	Part used	Type of plant extract/ active principles	Animal models	Activities	References (s)
49.	<i>Epilobium angustifolium</i> Linn.	Rosbay	-	Hexane/Aqueous extract	Rat	Reduction in weight of accessory sex organs	144
50.	<i>Eupatorium brevipes</i> DC.	-	-	Brevipenin	-	Spermicidal activity	146
51.	<i>Euphorbia neruifolia</i> Linn.	Thuar	Root	50% Ethanol extract	Rat	Antispermatogetic effects	147
52.	<i>Foeniculum vulgare</i> Mill.	Saunf	Whole plant	Alcoholic extract	Rat	Antiandrogenic activity	148
53.	<i>Gloriosa superba</i> Linn.	Shakar pusphi	Tuber	Ethanol extract	Gerbil	Shrinkage of Seminiferous tubules and Leydig cells	149
54.	<i>Gossypium herbaceum</i> Linn.	Cotton	Seed	Gossypol	Mice	Reduced sperm density and weight of reproductive organs	150
			”	”	”	Spermicidal activity	151
			”	”	Rat	Reduced motility of spermatozoa, histological changes in epididymis	152
			-	”	Human	Antispermatogetic effect, muscular paralysis	153
			”	”	Mice	Reduction in sperm production	154
			”	”	Rat	Antispermatogetic activity	155
			”	”	Hamster	Arrest and inhibition of spermatogenesis	156
			”	”	Human	Reduce sperm motility	157
			”	”	Rat	Alteration in spermatozoa structure	158
			”	”	”	Effect on pituitary reproductive axis and antispermatogetic effect	21
			-	”	Langur monkey	Induce oligospermia, decrease sperm motility	159
			”	”	Rat	Adverse effect on epididymal function	160
			”	”	”	Effect on secretory activity of accessory sex organs	161
			”	”	Human	Antifertility effect	162
-	”	Human	Reduce sperm motility	163			
”	”	Hamster	Inhibition of sperm acrosomal enzyme, decreased fertilizing capacity	23			
”	”	Mouse	Antifertility effect	22			

S. No.	Name of the plant	Common/English name	Part used	Type of plant extract/ active principles	Animal models	Activities	References (s)
55.	<i>Hedera nepalensis</i> K. Koch	-	Inflorescence	-	-	Immobilization of spermatozoa	164
56.	<i>Hibiscus rosasinensis</i> Linn.	Gudhal	Flower	50% Ethanol extract	Rat	Antispermato-genic and antiandrogenic activity	165
„			Benzene extract	Nonscrotal bat	Antispermato-genic activity	166	
„			Benzene/Ether	Mice	Antispermato-genic/ antiandrogenic activity	167	
57.	<i>Hyptis suaveolens</i> Poit.	Wilayati tulsi	Whole plant	Benzene /Ether extract	Mice	Antifertility effect	168
58.	<i>Justicia simplex</i> D. Don	Kala adoosa	Flower	Justicisa saponin	-	Sperm acrosomal membrane stabilizing action	169
59.	<i>Lepidium meyenii</i> Walp.	Maca	Root	Aqueous extract	Rat	Invigorates spermatogenesis by acting on its initial stages (IX-XIV)	170
60.	<i>Malvaviscus conzattii</i> Greenm.	Gercenum	Flower	Methanol extract	Mice	Antifertility activity	171
„			Alcoholic extract	Mouse	Antispermato-genic and antiandrogenic effect	172	
„			50% Ethanol extract	Rat	Antispermato-genic activity	173	
61.	<i>Martynia annua</i> Linn.	Bichchhu	Root	50% Ethanol extract	Rat	Antispermato-genic activity	174
62.	<i>Melodinus fusiformis</i> Champ. ex Benth.	-	-	Solasodine (Plant steroidal alkaloid)	-	Spermicidal activity	175
63.	<i>Mentha arvensis</i> Linn.	Pudhina	Leaves	Aqueous extract	Mouse	Sex organs secretion decreased, antiandrogenic effect	176
„			Pet. Ether extract	Mice	Antifertility activity	177	
„			Methanol extract	„	„	178	
64.	<i>Millettia auriculata</i> Baker. ex Brand.	Ganj	Leaves	Alcoholic extract	Rat	Reduction in implantation sites in female mated with <i>Millettia</i> treated male rats	98
65.	<i>Momordica charantia</i> Linn.	Karela	Seeds	-	Rat	Antispermato-genic, antiandrogenic and antisteroidogenic activity	179
66.	<i>Mondia whiteii</i> Skeels	-	Root bark	-	Rat	Reversible antispermato-genic and antifertility activity	180
67.	<i>Mucuna urens</i> Medik.	Horse eye bean	Seeds	-	Guinea pigs	Effect gonads and sex accessory glands	181

S. No.	Name of the plant	Common/English name	Part used	Type of plant extract/ active principles	Animal models	Activities	References (s)
68.	<i>Myristica fragrans</i> Houtt.	Jaiphal	Seed	Ethanol extract	-	Premature ejaculation	182
69.	<i>Nicotiana tabacum</i> Linn.	Tobacco	Leaves	Nicotine	Rat	Antiandrogenic effects	183
70.	<i>Ochna jabotapita</i> Linn.	Kanakchampa	Plant (without root)	Ethanol extract	-	Semen coagulating activity	184
71.	<i>Ocimum sanctum</i> Linn.	Tulsi	Leaves	Powder	Rat	Arrest of spermatogenesis and atrophy of Leydig cells	185, 186
			Leaves	-	Rat	Reduction of sperm motility and sperm count	187
72.	<i>Ophiopogon intermedius</i> (D. Don) Maxim	-	Rhizome	n-Octacosanal, $\beta$ -sitosterol	-	Spermicidal activity	188
73.	<i>Opuntia dillenii</i> Haw.	Nagphana	Phylloclade	Methanol extract	Rat	Antispermatogetic effect	189
74.	<i>Piper betle</i> Linn.	Pan	Petiole	Ethanol extract	Rat	Reduced sperm motility	72
			”	Water soluble ethanol extract	Rat	Biochemical changes in epididymal fluid	190
			Leaf stalk	Stalk extract	Rat	Antiandrogenic effect, altered testicular histology	191
			”	Alcoholic extract	Mice	Antifertility activity	192
75.	<i>Piper longum</i> Linn.	Long peeper	Flower and bud	Piperine	Rat	Antispermatogetic effect	193
76.	<i>Pittosporum neelgherrense</i> Wight & Arn.	-	Plant (with out root)	Pittosida-A and pittosida-B	-	Spermicidal and semen coagulating activity	194
77.	<i>Plumbago zeylanica</i> Linn.	Chitrak	Root, Stem bark	Plumbagin	Rat	Antiandrogenic activity	196
78.	<i>Plumeria alba</i> Linn.		Leaves	-	Rabbit	Total sterility	195
79.	<i>Polemonium caeruleum</i> Linn.	-	-	-	Mouse	Antispermatogetic effect	15
80.	<i>Portulaca oleracea</i> Linn.	Lunkha	Seed	Alcoholic extract	Mice	Impairment of spermatogenesis	197
81.	<i>Primula vulgaris</i> Huds.	-	-	Saponins	-	Immobilization of spermatozoa	133
82.	<i>Pterocarpus santalinus</i> Linn. f.	-	Stem bark	-	-	Semen coagulating activity	184
83.	<i>Pueraria tuberosa</i> DC.	Vidharikand	Root	Methanol extract	Rat	Inhibition of spermatogenesis	198
84.	<i>Pyrus cuspidata</i> Bertol.	Naspatti	Plant (with out root)	Extract	-	Spermicidal and semen coagulating activity	13
85.	<i>Quassia amara</i> Linn.	-	Stem wood	Methanol extract	Rat	Antifertility activity	199, 200
			Stem bark	Chloroform extract	”	”	201

S. No.	Name of the plant	Common/English name	Part used	Type of plant extract/ active principles	Animal models	Activities	References (s)
86.	<i>Ricinus communis</i> Linn.	-	-	50% Ethanol extract	Rat	Alteration in the motility, mode of movement and morphology of sperms	202
87.	<i>Rubus ellipticus</i> Sm.	Katsan	Whole plant	-	-	Antifertility activity	203
88.	<i>Salvia fruticosa</i> Mill.	Satari	Leaves	Aqueous/Ethanol extract	Rat	No. of implantation site and viable fetuses reduced in female in pregnant by treated male rats	204
89.	<i>Sapindus mukorossi</i> Gaertn.	Ritha	Fruit Pericarp	Aqueous extract pericarp	Rat	Alters the sperm membrane physiology	206
90.	<i>Sapindus trifoliatus</i> Linn.	Ritha	Fruit	Ethanol extract	Gerbils	Adverse effect on spermatogenesis	205
91.	<i>Sarcostemma acidum</i> Voigt	Somlata	Stem	Methanol extract	Rat	Arrest of spermatogenesis	207
92.	<i>Semecarpus anacardium</i> Linn. f.	Bhilawa	Seed powder	Aqueous suspension	Rat	Antiandrogenic effect, degeneration of germ cells	208
			Fruit	Ethanol extract	-	Antiandrogenic and antispermatogenic activity	209
			"	"	"	Arrest of spermatogenesis	210
93.	<i>Solanum surattense</i> Burm. f. syn. <i>S. xanthocarpum</i> Schrad. & Wendl.	Kantkari	Berries	Solasodine	Dog	Impairment of spermatogenesis	211, 45
			"	"	Rat	Reversible antifertility activity	212
			"	"	Dog	Epididymal dysfunction due to its antiandrogenic potency	47
			Seed	Alcoholic extract	Rat	Reduced testosterone level and effect on testes and maturing sperms	213
			Root	50% Ethanol extract	Rat	Antispermatogenic effect	46
94.	<i>Stephania hernandifolia</i> Willd.	Aknadi	Leaf	Aqueous extract	Rat	Deminution of the activities of testicular androgenic key enzymes and plasma testosterone with spermatogenesis	215
95.	<i>Stevia rebaudiana</i> Bertoni	-	Whole plant	Aqueous extract	Rat	Decrease in testosterone level	214
96.	<i>Striga orobanchoides</i> Benth.	Lalagia	Whole plant	Ethanol extract	Rat	Antispermatogenic effect and reduced weight of sex organs	216

SNo.	Name of the plant	Common/English name	Part used	Type of plant extract/ active principles	Animal models	Activities	References (s)
97.	<i>Syzygium cumini</i> Linn. syn. <i>Eugenia jambolana</i> Lam.	<i>Jamun</i>	Seed	Alcoholic extract	-	Antispermato-genic effect	72
			Flower	Oleanolic acid	Rat	Antifertility effect	145
98.	<i>Terminalia arjuna</i> Wight & Arn.	<i>Arjun</i>	Bark	50% Ethanol extract	Rat	Antispermato-genic effect	217
99.	<i>Tinospora cordifolia</i> (Willd.) Miers ex Hook. f. & Thoms.	<i>Neem giloy</i>	Stem	70% methanol extract	Rat	Antifertility activity	218
100.	<i>Trigonella foenum-graecum</i> Linn.	-	Seed	-	Rat	Antiandrogenic effect	219, 220
101.	<i>Tripterygium hypoglaucum</i> (Level) Hutch	-	Root xylem	-	Human	Reversible regressive effect	221
102.	<i>Tripterygium wilfordii</i> Hook f.	-	Root	Glycoside	Human and Rat	Antifertility activity	27
			„	GTW	Rat	Reduced motility of spermatozoa and sperm count	222
			„	Glycoside	Mice	Plasma level of testosterone decreased	28, 223
			„	GTW	Rat	Degenerative changes in seminiferous tubules	30, 224
			„	Tripchlorolide T4 Monomers and T II	Rat	Antispermato-genic activity	225
			„	GTW	Mouse	Antifertility activity	31
			„	„	-	Immunosuppressive effect	226
			„	Tripchlorolide	Rat	Antifertility activity	34
„	-	„	No side effect	227			
103.	<i>Tylophora asthmatica</i> Wight & Arn.	<i>Damabel</i>	Leaf and Stem	Pure alkaloid	Rat	Antispermato-genic activity	228
104.	<i>Vigna unguiculata</i> (Linn.) Walp.	Cowpea	-	-	Rat	Antifertility effect	233
105.	<i>Vitex negundo</i> Linn.	-	Seed	Seed extract	Dog	Induced azoospermia	234

## References

1. Allag IS and Rangari K, Extragenomic action of steroids on spermatozoa: Prospects for regulation of fertility, *Health Popul*, 2002, **25** (1), 38-44.
2. Prasad MRN, Control of fertility in the male, *In: Pharmacology and the future of man, Proceedings 5th International Congress of Pharmacology, San Francisco, Karger S, Basel, 1973, 1*, pp. 208-220.
3. Henshaw PS, Physiological control of fertility, *Science*, 1953, **117**, 572-582.
4. Chopra RN, Nayar SL and Chopra IC, Glossary of Indian Medicinal Plants, CSIR, New Delhi, 1956, pp 222.
5. Chopra RN, Chopra IC, Handa KL and Kapur LD, Indigenous Drugs of India, UN Dhar and Sons Pvt, 1958, Calcutta.
6. Casey RCD, Alleged antifertility plants of India, *Indian J Med Sci*, 1960, **14**, 590-600.
7. Bhakuni DS, Dhar ML, Dhar MM, Dhawan BN and Mehrotra BN, Screening of Indian plants for biological activity Part 2, *Indian J Exp Biol*, 1969, **7**, 250-262.
8. Farnsworth NR, Bingel AS, Cordell GA, Crane FA and Fong HHS, Potential value of plants as source of new antifertility agents I, *J Pharm Sci*, 1975, **64**, 535-549.
9. Farnsworth NR, Bingel AS, Cordell GA, Crane FA and Fong HHS, Potential value of plants as source of new antifertility agents II, *J Pharm Sci*, 1975, **64**, 717-736.
10. Orzechowski G, Nature against nature, *Deut Apoth*, 1972, **24**, 277-278.
11. Brondegaard VJ, Contraceptive plant drugs, *Planta Med*, 1973, **23**, 167-172.
12. Kholkute SD, Mudgal V and Deshpande PJ, Screening of indigenous medicinal plants for antifertility potentiality, *Planta Med*, 1976, **29**(2), 151-155.
13. Kamboj VP and Dhawan BN, Research on plants for fertility regulation in India, *J Ethnopharmacol*, 1982, **6**, 191-193.
14. Zhu D, Plant constituents with biological activity reported in recent years, *Zhongcaoyao*, 1982, **13**, 377-382.
15. Satyawati GV, Indian Plants and Plant Products with Antifertility Effect [A review of literature between 1975-1982], ICMR, New Delhi, 1983.
16. Hadley MA, Lin YC and Dym M, Effects of gossypol on the reproductive system of male rats, *J Androl*, 1981, **2**, 190-199.
17. Xue SP, Studies on antifertility effect of gossypol, a new contraceptive for males *In: Recent advances in fertility regulation*, by CF Chang, D Griffin and A Woolman (Eds), Geneva: ATAR SA, 1980, pp. 122-146.
18. Xue SP, Gossypol contraception and mechanism of action *In: Male fertility and its Regulation*, by T Lobl, Es Hafez (Eds), Boston: MTP Press Limits, 1985, pp. 155-174.
19. Taitzoglou IA, Tsantarliotou M, Kouretas D and Kokolis NA, Gossypol – induced inhibition of plasminogen activator activity in human and ovine acrosomal extract, *Andrologia*, 1999, **31**(6), 355-359.
20. Zavos PM and Zavos ZPN, The inhibitory effect of gossypol on human sperm motility characteristics: possible modes of reversibility of those effects, *Tohoku J Exp Med*, 1996, **179**, 167-175.
21. Nair IN and Bhiwgade DA, Effect of gossypol on pituitary reproductive axis: Ultrastructural and biochemical studies, *Indian J Exp Biol*, 1990, **28**(8), 724-732.
22. Bai J and Shi Y, Inhibition of T-type Ca(2+) currents in mouse spermatogenic cells by gossypol, an antifertility compound, *Eur J Pharmacol*, 2002, **440**(1), 1-6.
23. Yuan YY and Shi QX, Inhibition of hamster sperm acrosomal enzymes by gossypol is closely associated with the decrease in fertilization capacity, *Contraception*, 2000, **62**, 203-209.
24. Chaddha S, Sanyal SN and Kanwar U, Reversibility of the effects of gossypol acetic acid, an antispermatogenic/ antifertility agent on the intestinal structure and functions of male albino rats, *Res Exp Med*, 1989, **189**, 205-219.
25. Ye WS, Dan L, Guo Y, Qian XJ, Ying J and Xue SP, The antifertility effect of gossypol plus testosterone and estrogen, *Yao Xue Xue Bao*, 1996, **31**(4), 313-315.
26. Qian SZ, *Tripterygium wilfordii*: A Chinese herb effective in male fertility regulation, *Contraception*, 1987, **36**, 247-263.
27. Qian SZ, Xu Y and Wei ZJ, Recent progress in research on *Tripterygium* : A male antifertility plant, *Contraception*, 1995, **51**, 121-129.
28. Zheng ZR, Fang JL and Gao HZ, Effects of total glycosides of *Tripterygium wilfordii* on reproductive organs of experimental animals III Dynamic observation on reproductive organs and fertility in mice, *Acta Acad Med Sin*, 1986, **8**, 19-23.
29. Qian SZ, Antifertility effect of *Tripterygium wilfordii* in men, *Adv Contraception*, 1986, **23**, 22-24.
30. Lu QX, Shen XM, Chen K, Chen XM and Xue SP, Effect of glycosides of *Tripterygium wilfordii* Hook. on the reproductive system and major organs of male rats, *Acta Acad Med Sin*, 1990, **12**, 203-207.
31. Bai JP and Shi YL, Inhibition of Ca(2+) channels in mouse spermatogenic cells by male antifertility compounds from *Tripterygium wilfordii*, *Contraception*, 2002, **65**(6), 441-445.
32. Lue Y, Sinha HAP, Wang C, Leung A, Baravarian S, Reutrakul V, Sangsawan R, Chaichana S and Swerdloff RS, Triptolide : a potential male contraceptive, *J Androl*, 1998, **19**(4), 479-486.
33. Hikim AP, Lue YH, Wang C, Reutrakul V, Sangsuwan R and Swerdloff RS, Post testicular antifertility action of triptolide in the male rat : evidence for severe impairment of cauda epididymal sperm ultra structure, *J Androl*, 2000, **21**(3), 431-437.
34. Wang ZP, Gu ZP, Cao L, Xu Y, You GD, Mao BY and Qian SZ, Effects of triptolide on the epididymides and testes of rats, *Asian J Androl*, 1999, **1**(3), 121-125.
35. Zou X and Wang N, Study on antifertility mechanism of triptolide (T<sub>4</sub>), *Acta Acad Med*, 1995, **17**(5), 387-388.

36. Lohiya NK and Goyal RB, Antifertility investigations on the crude chloroform extract of *Carica papaya* Linn. seeds in male albino rats, *Indian J Exp Biol*, 1992, **30**, 1051-1055.
37. Lohiya NK, Manivannan B, Mishra PK, Pathak N, Sriram S, Bhande SS and Panneerdoss S, Chloroform extract of *Carica papaya* seeds induces long-term reversible azoospermia in langur monkey, *Asian J Androl*, 2002, **4**(1), 17-26.
38. Udoh P and Kehinde A, Studies on antifertility effect of pawpaw seeds (*Carica papaya*) on the gonads of male albino rats, *Phytother Res*, 1999, **13**(3), 226-228.
39. Pathak N, Mishra PK, Manivannan B and Lohiya NK, Sterility due to inhibition of sperm motility by oral administration of benzene chromatographic fraction of the chloroform extract of the seeds of *Carica papaya* in rats, *Phytomedicine*, 2000, **7**(4), 325-333.
40. Verma RJ and Chinoy NJ, Effect of papaya seed extract on microenvironment of cauda epididymis, *Asian J Androl*, 2001, **3**, 143-146.
41. Verma RJ and Chinoy NJ, Effect of papaya seed extract on contractile response of cauda epididymal tubules, *Asian J Androl*, 2002, **4**(1), 77-78.
42. Manivannan B, Mishra PK, Pathak N, Sriram S, Bhande SS, Panneerdoss S and Lohiya NK, Ultrastructural changes in the testis and epididymis of rats following treatment with the benzene chromatographic fraction of the chloroform extract of the seeds of *Carica papaya*, *Phytother Res*, 2004, **18**, 285-289.
43. Akbarsha MA, Manivannan B, Hamid KS and Vijayan B, Antifertility effect of *Andrographis paniculata* (Nees) in male albino rats, *Indian J Exp Biol*, 1990, **28**(5), 421-426.
44. Akbarsha MA and Murugaian P, Aspects of the male reproductive toxicity/male antifertility property of andrographilode in albino rats: Effects on the testis and the cauda epididymidal spermatozoa, *Phytother Res*, 2000, **14**(6), 432-435.
45. Kanwar U, Batla A, Ranga A and Sanyal SN, Effect of Solasodine on morphology, motility and glycolytic enzymes of Buffalo Bull spermatozoa, *Indian J Exp Biol*, 1988, **26**, 941-944.
46. Mali PC, Chaturvedi M and Dixit VP, Antispermatogetic activity of *Solanum xanthocarpum* Schrad. & Wendl. root (50% EtOH-extract) in rats, *J Phytol Res* 1996, **9**(1), 13-17.
47. Gupta RS and Dixit VP, Effects of short term treatment of solasodine on cauda epididymis in dogs, *Indian J Exp Biol*, 2002, **40**, 169-173.
48. Purandare TV, Kholkute SD, Gurjar A, Joshi UM, Dattatreya MB, Sheth AR, Swamy XR, Jayaraman S and Munshi R, Semen analysis and hormonal levels in bonnet macaques administered *Embelia ribes* berries, an indigenous plant having contraceptive activity, *Indian J Exp Biol*, 1979, **17**, 935-936.
49. Agarwal SS, Chauhan S and Mathur R, Antifertility effects of Embelin in male rats, *Andrologia*, 1986, **2**, 125-131.
50. Gupta S, Sanyal SN and Kanwar U, Antispermatogetic effect of embelin, a plant benzoquinone on male albino rats *in vivo* and *in vitro*, *Contraception*, 1989, **39**(3), 307-320.
51. Shaikh PD, Manivannan B, Pathan KM, Kasturi M and Ahmed RN, Antispermatic activity of *Azadirachta indica* leaves in albino rats, *Curr Sci*, 1993, **64**(9), 688-689.
52. Kasturi M, Manivannan B, Ahamed RN, Shaikh PD and Pathan KM, Changes in epididymal structure and function of albino rat treated with *Azadirachta indica* leaves, *Indian J Exp Biol*, 1995, **33**(10), 725-729.
53. Joshi AR, Ahamed RN, Pathan KM and Manivannan B, Effect of *Azadirachta indica* leaves on testes and its recovery in albino rats, *Indian J Exp Biol*, 1996, **34**, 1091-1094.
54. Purohit A, Joshi VB and Dixit VP, Contraceptive efficacy of *Azadirachta indica* (flower and bark) in male rats: a biochemical and sperm dynamics analysis, *J Curr Biosci*, 1990, **7**(4), 129-133.
55. Dixit VP, Jain P and Purohit AK, Medicinal uses of neem (*Azadirachta indica*) in fertility regulation, diabetes and atherosclerosis, *Rec Adv Med Arom Spice Crops*, 1992, **2**, 463-471.
56. Aladakatti RH and Ahamed RN, Effect of *Azadirachta indica* leaves on rat spermatozoa, *Indian J Exp Biol*, 1999, **37**, 1251-1254.
57. Khillare B and Shrivastav TG, Spermicidal activity of *Azadirachta indica* (neem) leaf extract, *Contraception*, 2003, **68**, 225-229.
58. Murugavel T and Akbarsha MA, Antispermatogetic effect of *Vinca rosea* Linn., *Indian J Exp Biol*, 1991, **29**, 810-812.
59. Murugavel T, Ruknudin A, Thangavelu S and Akbarsha MA, Antifertility effect of *Vinca rosea* (Linn.) leaf extract on male albino mice- A sperm parametric study, *Curr Sci*, 1989, **58**, 1102-1103.
60. Averal HI, Stanley A, Murugaian P, Palanisamy A and Akbarsha MA, Specific effect of vincristine on epididymis, *Indian J Exp Biol*, 1996, **34**, 53-56.
61. Morganfeld MC, Pavlovsky A, Suarez A, Somoza N, Pavlovsky S, Palau M and Barros CA, Combined cyclophosphamide vincristine, procarbazine and prednisone (COPP) therapy of malignant lymphoma Evaluation of 190 patients, *Cancer*, 1975, **36**, 1241-1249.
62. Sherines RJ and Howard SS, Male infertility, *In: Campbells Urology*, by JH Harrison, RF Gittes, ADPerlmutter, TA Stamey and PC Walsh (Eds), vol 1, 4<sup>th</sup> edn, WB Saunders Co Philadelphia, 1978, pp. 715.
63. Jayaweera DMA, Leguminosae, *In: Medicinal plants (Indigenous and Exotic) used in Ceylon Part III*, The National Science Council of Srilanka Colombo, 1981, pp. 135-260.
64. Raji U and Bolarinwa AF, Antifertility activity of *Quassia amara* in male rats *in vivo* study, *Life Sci*, 1997, **61**(11), 1067-1074.



65. Kulshreshtha SS and Mathur RS, Effect of steroidal fraction of seeds of *Abrus precatorius* Linn. on rat testis, *Indian J Exp Biol*, 1990, **28**, 752-756.
66. Ratnasooriya WD, Amarasekera AS, Perera NSD and Premakumara GAS, Sperm antimotility properties of a seed extract of *Abrus precatorius*, *J Ethnopharmacol*, 1991, **38**, 85-90.
67. Sinha R, Post-testicular antifertility effects of *Abrus precatorius* seed extract in albino rats, *J Ethnopharmacol*, 1990, **28**(2), 173-181.
68. Geoffrey MH and Waites SD, Development of methods of male contraception: impact of the World Health Organization Task Force, *Fertil Steril*, 2003, **80**, 1-14.
69. Carlsson L, Nilsson BO, Ronquist G, Lundquist M and Larsson A, Identification of prostasomal antigens recognized by autoantibodies from immune infertile man: Abstract of the Third European Congress of Andrology, *Andrologia*, 2004, **36**, 141-261.
70. Bajaj A, Mathur RS, Wadhwa M and Bahel S, Effect of steroidal fraction of *Abrus precatorius* on testes of albino rats, *Geobios*, 1981, **8**, 29-31.
71. Dixit VP, Sinha R and Gupta I, Inhibition of sperm production and sperm dynamics in *Abrus precatorius* treated males, *The Indian Zoologist*, 1987, **11** (1-2), 115-118.
72. Sinha R, Gupta I, Tark R and Dixit VP, Antispermato-genic activity of *Abrus precatorius* Linn. seed extract in Langur Monkey (*Presbytis entellus entellus*), In: National Symposium on the Use of Primates in Biochemical Research Jaipur, India, 1986, pp. 53.
73. Pakrashi A, Ray H, Pal BC and Mahato SB, Sperm immobilizing effect of triterpene saponins from *Acacia auriculiformis*, *Contraception*, 1991, **43**, 475-483.
74. Banerji R and Nigam SK, Chemistry of *Acacia coccinea* and *A. caesia* bark, *J Indian Chem Soc*, 1980, **57**, 1043-1049.
75. Montanari T, Ernesto de Carvalho J and Dolder H, Antispermato-genic effect of *Achillea millefolium* Linn. mice, *Contraception*, 1998, **58**, 309-313.
76. Sharma A, Mathur A, Verma P, Joshi SC and Dixit VP, Effects of *Actinopteris dichotoma* (Sw.) on reproductive function of male rat, *J Endocrinol Reprod*, 1999, **3**(1), 47-59.
77. Sandhyakumary K, Boby RG and Indira M, Impact of feeding ethanolic extracts of *Achyranthes aspera* Linn. on reproductive functions in male rats, *Indian J Exp Biol*, 2002, **40**, 1307-1309.
78. Sur TK, Pandit S and Pramani KT, Antispermato-genic activity of leaves of *Aegle marmelos* Corr. in albino rats: A Preliminary report, *Biomedicine*, 1999, **19**, 199-202.
79. Sur TK, Pandit S, Pramanik T and Bhattacharyya D, Effect of *Aegle marmelos* leaf on rat sperm motility: an *in vitro* study, *Indian J Pharmacol*, 2002, **34**, 246-277.
80. Gupta RS, Kachhawa JB and Chaudhary R, Antifertility effects of methanolic pod extract of *Albizia lebbek* (L) Benth in male rats, *Asian J Androl*, 2004, **6**(2), 155-159.
81. Gupta RS, Choudhary R, Yadav RK, Verma SK and Dobhal MP, Effect of Saponins of *Albizia lebbek* (Linn.) Benth. bark on the reproductive system of male albino rats, *J Ethnopharmacol*, 2005, **96**(1-2), 31-36.
82. Dixit VP and Joshi S, Effects of chronic administration of garlic (*Allium sativum* Linn) on testicular function, *Indian J Exp Biol*, 1982, **20**, 534-536.
83. Dixit VP and Joshi S, Effect of *Aloe barbadensis* and *Clofibrate* in triton induced hyperlipidaemic presbytis monkeys, *Ind J Med Res*, 1983, **78**, 417-421.
84. Gupta RS, Sharma R, Sharma A, Bhatnagar AK, Dobhal MP, Joshi YC and Sharma MC, Effect of *Alstonia scholaris* bark extract on testicular function of wistar rats, *Asian J Androl*, 2002, **4**(3), 175-178.
85. Gupta RS, Bhatnagar AK, Joshi YC, Sharma R and Sharma A, Suppression of fertility in male albino rats following  $\alpha$ -myrin acetate administration, *Pharma Biol*, 2004, **42**(2), 98-104.
86. Jain GC and Dixit VP, Effect of *Annona squamosa* EtOH extract and testicular function of dogs (*Canis indicus* Linn.), II Annual Session of Science, Abstr-15 Bhavnagar, 1982, pp. 22.
87. Gupta RS, Dobhal MP and Dixit VP, Morphometric and biochemical changes in testes of *Presbytis entellus entellus* Dufresne (langur monkey) following aristolochic acid administration, *Ann Biol*, 1996, **12**(2), 328-334.
88. Mazaro R, Stasi LC and Kempinas WG, Effects of hydromethanolic extract of *Austroplenckia populnea* (Celastraceae) on reproductive parameters of male rats, *Contraception*, 2002, **66**, 205-209.
89. Sharma JD, Jha RK, Gupta I and Jain P, Antiandrogenic properties of neem seed oil *Azadirachta indica* in rat and rabbit, *Ancient Sci life*, 1987, **1**, 30-38.
90. Deshpande VY, Mendulkar KN and Sadre NL, Antifertility activity of *Azadirachta indica* in mice, *J Postgrad Med (Bombay)*, 1980, **26**, 167-170.
91. Khare AK, Sharma MK and Tiwari JP, Antifertility activity of neem oil in rabbits and rats, *Probe*, 1984, **23**, 90-94.
92. Sinha KC, Rair SS, Bardhan J, Thomas P, Jain AK and Jain RK, Anti-implantation effect of neem oil, *Indian J Med Res*, 1984, **80**, 708-710.
93. Suri A, Chhabra S and Talwar GP, An intracaudal injection with neem oil induces azoospermia in monkeys, In: Animal Reproduction, National Institute of Immunology, 1990, pp. 28.
94. Riar SS, Bardhan J, Thomas P, Kain AK and Parshad R, Mechanism of antifertility action of neem oil, *Indian J Med Res*, 1988, **88**, 339-342.
95. Sharma VP, Praneem polyherbal cream for contraception: Safety in malaria endemic countries, *Curr Sci*, 1996, **71**(6), 430-435.

96. Choudhary CN, Singh JN, Verma SK and Singh BP, Antifertility effects of leaf extracts of some plants in male rats, *Indian J Exp Biol*, 1990, **28**, 714-716.
97. Upadhyay SK, Dhawan S and Talwar GP, Antifertility effects of Neem (*Azadirachta indica*) oil in male rats by intra-vas administration: An alternate approach to vasectomy, *J Androl*, 1993, **14**, 275-281.
98. Purohit A and Dixit VP, Antispermaticogenic efficacy of neem (*Azadirachta indica* A. Juss) materials in male rats, *Neem Newsletter*, 1991, **8**(2), 13-14.
99. Dixit VP, Bhargava SK and Gupta RA, Hyperglycemia induced testicular dysfunction after chronic administration of *Balanites roxburghii* Planch fruit pulp extract in dog (*Canis indicus*), *Indian J Exp Biol*, 1981, **19**, 918-921.
100. Agarwal M and Dixit VP, Effect of *Balanites roxburghii* on male reproductive tract of Langur Monkey, 52<sup>nd</sup> Annual Session of National Academy Science, Allahabad, 1982, pp. 56.
101. Manonayagi S, Vanithakumari G, Padma S and Malini T, Effect of bamboo buds: Structural and functional changes in the epididymis of rats, *J Ethnopharmacol*, 1989, **25**, 201-212.
102. Vanitha Kumari G, Manonayagi S, Padma S and Malini T, Effect of bamboo structural and functional changes in the epididymis of rats, *J Ethnopharmacol*, 1989, **25**, 201-207.
103. Gupta RS, Kumar P, Dixit VP and Dhobhal MP, Antifertility studies of root extract of *Barleria prionitis* Linn. in male albino rats with special reference to testicular cell population dynamics, *J Ethnopharmacol*, 2000, **70**(2), 111-117.
104. Gupta RS and Dixit VP, Testicular cell population dynamics following palmitine hydroxide treatment in male dogs, *J Ethnopharmacol*, 1989, **25**, 151-157.
105. Serrano H and Garcia-Suarez MD, Sperm aggregation by water extracts from two *Bursera* species, *Arch Androl*, 2001, **46**, 15-20.
106. Dixit VP, Agarwal M, Bhargava SK, Gupta RS and Jain GC, Effect of *Butea monosperma* seed extract fraction (Butin) on the testicular function of rats, dogs and presbytis monkey, *Iugoslav Physiol Pharmacol Acta*, 1981, **17**(3), 151-162.
107. Awati BT and Verute AT, *Butea monosperma* leaf extract induced alterations in the testicular function of albino rats: A histological and biochemical study, In: International Symposium on Recent Advances in Male Reproduction, Hyderabad, 1988, July 12-14, pp. 16.
108. Gupta RS, Sharma N and Dixit VP, Calotropin — A novel compound for fertility control, *Ancient Sci Life*, 1990, **9**(4), 224-230.
109. Sharma N and Jacob D, Inhibition of fertility and functional alteration in the genital organs of male Swiss albino mouse after administration of *Calotropis procera* flower extract, *Pharm Biol*, 2001, **39**(6), 403-407.
110. Dixit VP, Effects of *Cannabis sativa* extract on testicular function of *Presbytis entellus* Dufresne, *Planta Med*, 1981, **41**, 288-294.
111. Das RP, Effect of papaya seeds on the genital organs and fertility of male rats, *Indian J Exp Biol*, 1980, **18**, 408-409.
112. Chinoy NJ and George SM, Induction of functional sterility in male rats by low dose *Carica papaya* seed extracts treatment, *Acta Eur Fertil*, 1983, **14**, 425-432.
113. Vyas DK and Jacob D, Effect of papaya (*Carica papaya*) seeds on the reproductive structure and fertility of the male rabbits, *Indian Zool*, 1984, **8**, 105-108.
114. Chinoy NJ, Geetha Ranga M, Rao MV, Verma RJ, Sam VG, Patel KG and D'Souza JM, The reversible antifertility effects of extracts of *Carica papaya* seeds on male rats: In: Method for the regulation of male fertility, by TC Anand Kumar and GMH Waits (Eds), Indian Council Med Res, 1985, New Delhi, pp. 95-106.
115. Lohiya NK, Goyal RB, Jayaprakash D, Ansari AS and Sharma S, Antifertility effects of aqueous extract of *Carica papaya* seeds in male rats, *Planta Med*, 1994, **60**, 400-404.
116. Chinoy NJ, D'Souza JM and Padman P, Contraceptive efficacy of *Carica papaya* seed extracts in male mice (*Mus musculus*), *Phytother Res*, 1995, **9**, 30-36.
117. Lohiya NK, Phatak N, Mishra PK and Manivannan B, Reversible contraception with chloroform extract of *Carica papaya* seeds in male rabbits, *Reprod Toxicol*, 1999, **13**, 59-66.
118. Lohiya NK, Mishra PK, Pathak N, Manivannan B and Jain SC, Reversible azoospermia by oral administration of the benzene chromatographic fraction of the chloroform extract of the seeds of *Carica papaya* in rabbits, *Adv Contracept*, 1999, **15**, 141-161.
119. Lohiya NK, Kothari LK, Manivannan B, Mishra PK and Pathak N, Human sperm immobilization effect of *Carica papaya* seed extracts an *in vitro* study, *Asian J Androl*, 2000, **2**, 103-109.
120. Lohiya NK, Phatak N, Mishra PK and Manivannan B, Contraceptive evaluation and toxicological study of aqueous extract of the seeds of *Carica papaya* in male rabbits, *J Ethnopharmacol*, 2000, **70**, 17-27.
121. Bidwai PP, Wangoo D and Bhullar N, Antispermaticogenic action of *Celastrus paniculatus* seed extract in the rat with reversible change in the liver, *J Ethnopharmacol*, 1990, **28**(3), 293-303.
122. Roychoudhary A and Venkatakrishna BH, Impairment of spermatogenesis by *Cichorium intybus* plant extract, *Naturwissenschaften*, 1983, **70**, 365-369.
123. Singh SP, Effect of *Cinnamomum camphora* leaf extract on testicular function of house sparrow (*Passer domesticus* L), *Indian J Phy Nat Sci*, 1990, **10** (A), 22-25.
124. Chaturvedi M and Dixit VP, Antifertility effect of *Citrullus colocynthis* Schrad. in male albino rats, *Indian J Environ Sci*, 1997, **1**(2), 89-92.

125. Chaturvedi M, Mali PC and Ansari AS, Induction of reversible antifertility with a crude ethanol extract of *Citrullus colocynthis* Schrad. fruit in male rats, *Pharmacology*, 2003, **68**, 38-48.
126. Gupta RS, Yadav RK, Dixit VP and Dobhal MP, Antifertility studies of *Colebrookia oppositifolia* Smith leaf extract in male albino rats with special reference to testicular cell population dynamics, *Fitoterapia*, 2001, **72**, 236-245.
127. Chaturvedi M, Sharma S and Dixit VP, Effect of *Convolvulus microphyllus* Sieb. ex Spreng. on the testicular cell population dynamics, *J Environ Pollut*, 1995, **2**(3), 143-146.
128. Vijaykumar B, Sangamma I, Sharanabassapa A, Patil A and Saraswati B, Antispermatogetic and hormonal effects of *Crotalaria juncea* Linn. seed extract in male mice, *Asian J Androl*, 2004, **6**, 67-70.
129. Sharma J, Sharma S and Jain R, Antifertility activity of *Cuminum cyminum* on reproductive organs of male albino rats (*Rattus norvegicus*), In: National Symposium Reproductive Biology and Comparative Endocrinology Vadodara, Gujarat, 2001, pp. 69.
130. Purohit A, Contraceptive efficacy of *Curcuma longa* (50% EtOH extract) with special emphasis on testicular population dynamics, *J Curr Biosci*, 1991, **8**(4), 129-134.
131. Bhagat M and Purohit A, Kinetics of the testicular cell population following various *Curcuma longa* rhizome extract administration in male albino rats, A morphometric approach, In: National Symposium of the society for Reproductive Biology and Comparative Endocrinology, Vadodara, Gujarat, 2001, pp. 81.
132. Primorac M, Sekulovic D and Antonic S, *In vitro* determination of the spermicidal activity of plant saponins, *Pharmazie*, 1985, **40**, 585-590.
133. Qian SZ, Zhong CQ and Xu Y, Effect of *Tripterygium wilfordii* Hook. f. on the fertility of rats, *Contraception*, 1986, **33**, 105-110.
134. Shah NV and Varute AJ, Effect of *Daucus carrota* seed extract on male reproductive organs of albino rats (testis II), In: All India Symposium in Life Sciences, Nagpur, 1980, **91**, pp. 217.
135. Pillai NR, Alam M and Purushothaman KK, Studies on antifertility activity of oleanolic acid 3 $\alpha$ -glucoside (RDG-D), *J Res Indian Med Yoga Homeop*, 1982, **12**, 26-29.
136. Bandara BMR, Jayasinghe L and Karunaratne V, Ecdysterone from stem of *Diploclisia glaucescens*, *Phytochemistry*, 1989, **28**, 1073-1075.
137. Nassar MF, Male oral contraceptive, *United State Patent*, 1979, **4**, 148.
138. Delgado NM, Taboada RJ and Hernandez AO, Effects of a purified fraction from *Echeveria gibbiflora* aqueous crude extract on guinea pig spermatozoa, *Phytother Res*, 1999, **13**, 46-49.
139. Chaturvedi M, Mali PC and Dixit VP, Antifertility effects of the roots of *Echinops echinatus* Roxb in male rats, *J Environ Pollut*, 1995, **2**(4), 153-157.
140. Chaturvedi M, Mali PC and Dixit VP, Fertility regulation in male rats with the help of *Echinops echinatus* Roxb root extract, *J Phyto Res*, 1995, **8**(2), 115-118.
141. Dixit VP and Bhargava SK, Reversible contraception like activity of Embelin in male dogs (*Cannis indicus* Linn.), *Andrologia*, 1983, **15**(5), 486-494.
142. Seth SD, Johri N and Sundaram KR, Antispermatogetic effect of embelin from *Embelia ribes*, *Indian J Pharmacol*, 1982, **14**, 207-211.
143. Kamboj VP and Dhawan BN, Fertility regulating plants on Indian scene-update, In: Contraceptive Research Today and Tomorrow, by GS Toteja, S Mokkapatil, BK Singh, RS Sharma and BN Saxena (Eds), ICMR, New Delhi, 1989, pp. 115-125.
144. Hiermann A and Bucar F, Studies of *Epilobium angustifolium* extracts on growth of accessory sexual organs in rats, *J Ethnopharmacol*, 1997, **55**, 179-183.
145. Rahman HAA, Elbadry AA, Mahmoud OH and Harraz FA, The effect of the aqueous extract of *Cynomorium coccineum* on the epididymal sperm pattern of rat, *Phytother Res*, 1999, **13**, 248-250.
146. Guerrero C, Campos G and Toboada J, Chemical studies on *Eupatorium brevipes* and some biological activity of brevipenin, *Rev Latinoam Quim*, 1988, **19**, 147-149.
147. Mali PC, Antifertility activity of *Euphorbia neriifolia* Linn. root extract in male rats, *Indian J Environ Sci*, 1999, **3**(2), 185-190.
148. Farooq T, Vanitha Kumari G, Bhuvanewari G and Malini T, Effects of anethole on accessory sex tissue of albino rats, *J Res Ayurv Siddha*, 1997, **15**, 161-170.
149. Dixit VP, Joshi S and Kumar A, Possible antispermatogetic activity of *Gloriosa superba* (EtOH-extract) in male gerbil (*Meriones hurrianac Jerdon*): A preliminary study, *Comp Physiol Ecol*, 1983, **8**, 17-22.
150. Coulson PB, Snell RL and Parise C, Short term metabolic effects of the antifertility agent, gossypol on various reproductive organs of male mice, *Int J Androl*, 1980, **3**, 507-518.
151. Shi QX and Zhang YG, Studies on antifertility effect of gossypol I Effects of gossypol on androgen dependent organs of mice and rats, *Acta Zool Sin*, 1980, **116**, 311-316.
152. Zhou LF, Chen CC, Wang NG and Lei HP, Observations on long-term administration of gossypol acetic acid to rats Document of Fourth National Conference on Male-antifertility Agents, Suzhou (1975), *Chin Med J*, 1980, **60**, 343-344.
153. Liu ZQ, Liu GZ, Hei LS, Zhang RA and Yu Z, Clinical trial of gossypol as a male antifertility agent, In: Recent Advances in Fertility Regulation Symposium, Beijing, CF Chang, D Griffin and A Woolman (Eds), 1981, pp. 160-163.
154. Shandilya LN and Clarkson TB, Antireproductive and hypolipidaemic effect of gossypol in male cynomolgus monkey (*Macaca fascicularis*)

- (expanded abstract), *Arch Androl*, 1982, **9**, 32-33.
155. Ke YB and Tso WW, Variations of gossypol susceptibility in rat spermatozoa during spermatogenesis, *Int J Fert*, 1982, **27**(1), 42-46.
  156. Chang CC, Gu ZP and Tsung YY, Studies on gossypol I Toxicity, antifertility and endocrine analysis in male rats, *Int J Fert*, 1982, **27**, 213-218.
  157. Aitken RJ, Liu J, Best FSM and Richardson DW, Analysis of the direct effects of gossypol on human spermatozoa, *Int J Androl*, 1983, **6**, 157-167.
  158. Soufir JC, Radigue C, Dantec MC, Garnier D and Jegou B, Gossypol induced modifications in the microenvironment of rat epididymal spermatozoa, *J Reprod Fertil*, 1989, **86**, 427-434.
  159. Lohiya NK, Sharma K, Kumar M and Sharma S, Limitations in developing gossypol acetic acid as a male contraceptive, *Contraception*, 1990, **41**, 141-161.
  160. Wong JM, Gu CH, Tao L, Wu XL and Qiu JP, Electrolyte composition of rete testis fluid and cauda epididymal plasma and spermatozoa from rats following gossypol treatment, *Andrologia*, 1986, **18**, 43-49.
  161. Monsees TK, Winterstein U, Schill WB and Miska W, Influence of gossypol on the secretory function of cultured rat Sertoli cells, *Toxicol*, 1998, **36**(5), 813-816.
  162. Wu F, Zhang Z, Ye W and Qian X, Comparative study on the effect of gossypol and T7 on human spermatozoa ATPase activity, *Zhongguo Yi Xue Ke Xue Yuan Xue Bao*, 1998, **20**(4), 267-270.
  163. Gu ZP, Mao BY and Wang YX, Low dose gossypol for male contraception, *Asian J Androl*, 2000, **2**, 283-287.
  164. Pant G, Panwar MS, Rawat MSM and Negi DS, Spermicidal glycosides from *Hedera nepalensis* K. Koch (inflorescence), *Pharmazie*, 1988, **43**, 294-296.
  165. Gupta I, Tank R and Dixit VP, Fertility regulation in males: Effect of *Hibiscus rosa-sinensis* and *Malvaviscus* flower extract on male albino rats, *Proc Nat Acad Sci India*, 1985, **55**(B), 262-267.
  166. Singhvi MS and Lall SB, Effect of *Hibiscus rosa-sinensis* on testicular dehydrogenase of *Rhino Poma kinneari* Wroughton, *Curr Sci*, 1981, **50**, 360-362.
  167. Reddy CM, Murthy DRK and Patil SB, Antispermatogenic and androgenic activities of various extracts of *Hibiscus rosa-sinensis* in albino mice, *Indian J Exp Biol*, 1997, **35**, 1170-1174.
  168. Saluja AJ and Santarin DD, Hormonal profile of *Hyptis suaveolens* (Linn.) Poit, *Indian J Pharm Sci*, 1983, March-April, pp. 97-99.
  169. Ghoshal S, Srivastava AK, Srivastava SK, Chattopadhyay S and Mitra M, Justicisaponin-I, a new triterpenoid from *Justica simplex*, *Planta Med*, 1981, **42**, 279-283.
  170. Gonzales GF, Ruiz A, Gonzales C, Villegas L and Cordova A, Effect of *Lepidium meyenii* (maca) roots on spermatogenesis of male rats, *Asian J Androl*, 2001, **3**, 231-233.
  171. Verma OP, Joshi BC and Kumar S, Antifertility effects of *Malvaviscus konzattii* green flower extract (Sc) on male albino mice, *Indian J Exp Biol*, 1980, **18**, 561-564.
  172. Joshi BC, Kumar S, Verma OP, Chatterji SN and Jacob D, Antifertility effects of chronically administered *Malvaviscus konzattii* flower extract on male albino mice, *Planta Med*, 1981, **41**, 274-280.
  173. Pakrashi A, Sanyal S, Banerjee R and Sen NR, Effect of *Malvaviscus konzattii* flower extract on male fertility, *Contraception*, 1985, **31**, 101-104.
  174. Mali PC, Ansari AS and Chaturvedi M, Antifertility effect of chronically administered *Martynia annua* root extract on male rats, *J Ethnopharmacol*, 2002, **82**, 61-67.
  175. He X, Zhou Y and Huang Z, Study on the alkaloids of *Melodinus fusiformis*, *Huaxue Xuebao*, 1992, **50**, 96-101.
  176. Sharma N and Jacob D, Antifertility efficacy of leaf extract of *Mentha arvensis* in the male albino, *J Adv Zool*, 1996, **17**, 71-73.
  177. Sharma N and Jacob D, Antifertility investigation and toxicological screening of the petroleum ether extract of the leaves of *Mentha arvensis* Linn. in male albino mice, *J Ethnopharmacol*, 2001, **75**, 5-12.
  178. Sharma N and Jacob D, Assessment of reversible contraceptive efficacy of methanol extract of *Mentha arvensis* Linn. leaves in male albino mice, *J Ethnopharmacol*, 2002, **80**, 9-13.
  179. Naseem MZ, Patil SR, Patil SR and Patil SB, Antispermatogenic and androgenic activities of *Momordica charantia* (Karela) in albino rats, *J Ethnopharmacol*, 1998, **61**(1), 9-16.
  180. Watcho P, Kamtchouing P, Sokeng S, Moundipa PE, Tantchou J, Essame JL and Koueta N, Reversible antispermatic and antifertility activities of *Mondia whitei* Linn. in male albino rat, *Phytother Res*, 2001, **15**(1), 26-29.
  181. Udoh P and Ekpenyong J, Effect of *Mucuna urens* (horse eyes bean) on the gonads of male guinea pigs, *Phytother Res*, 2001, **15**(2), 99-102.
  182. Misra DN and Shukla GD, Vitafix in premature ejaculation A controlled trial, *Indian Pract*, 1980, **33**, 81-86.
  183. Londonkar RL, Srinivasreddy P, Somanathreddy P and Patil SB, Nicotine induced inhibition of activities of accessory reproductive ducts in male rats, *J Ethnopharmacol*, 1998, **60**(30), 215-221.
  184. Dhawan BN, Dubey MP, Mehrotra BN, Rastogi RP and Tandon JS, Screening of Indian plants for biological activity: Part-IX, *Indian J Exp Biol*, 1980, **18**, 594-602.
  185. Seth SD, Johri N and Sundaram KR, Antispermatogenic effect of *Ocimum sanctum*, *Indian J Exp Biol*, 1981, **19**, 975-976.
  186. Singh SP, Male contraception through an indigenous plant *Ocimum sanctum* Linn, *Int J Androl*, 1997, **20**, 14-18.
  187. Khanna S, Gupta SR and Grover JK, Effect of long term feeding of tulsi (*Ocimum sanctum* Linn.) on reproductive

- performance of adult albino rats, *Indian J Exp Biol*, 1986, **24**, 302-304.
188. Rawat MSM, Negi DS, Pant G and Panwar MS, Spermicidal potential and chemical analysis of *Ophiopogon intermedius* (rhizomes), *Pharmazie*, 1988, **43**(2), 143-144.
189. Gupta RS, Sharma R, Sharma A, Chaudhary R, Bhatnagar AK, Dobhal MP, Joshi YC and Sharma MC, Antispermatic effect and chemical investigation of *Opuntia dillenii* Haw, *Pharm Biol*, 2002, **40**, 411-415.
190. Hiremath BC, Kshirsagar VG and Toro YS, Studies on effect of *Piper betle* petiole extract on testis of rat with reference to acid and alkaline phosphatase, In: 1<sup>st</sup> Annual Conference of Indian Society for the Study of Reproduction and Fertility, ICMR, Bombay, 1988, pp 41.
191. Adhikary P, Choudhary D, Anup KR and Das CC, Antifertility effect of *Piper betle* Linn. extract on ovary and testis of albino rat, *Indian J Exp Biol*, 1989, **27**, 868-870.
192. Sarkar M, Gangopadhyay P, Basak B, Chakrabarty K, Banerji J, Adhikary P and Chatterjee A, The reversible antifertility effect of *Piper betle* Linn. on Swiss albino male mice, *Contraception*, 2000, **62**, 271-274.
193. Malini T, Manimoran RR, Arunakaran J, Aruldas MM and Govindarajulu P, Effects of piperine on testis of albino rats, *J Ethnopharmacol*, 1999, **64**(3), 219-225.
194. Jain GK, Pal R and Khanna NM, Spermicidal saponin from *Pittosporum nighirensis* Wight et al Apriott, *Indian J Pharm Sci*, 1980, **42**, 12-13.
195. Vyas DK and Jacob D, Effect of oral administration of Champa (*Plumeria alba*) leaves on implantation, male fertility and male reproductive system of the rabbit, *Exp Clin Endocrinol Life Sci Adv*, 1986, **5**, 121-123.
196. Bhargava SK, Effects of Plumbagin on reproductive function of male dog, *Indian J Exp Biol*, 1984, **22**, 153-156.
197. Verma OP, Kumar S and Chatterjee SN, Antifertility effect of common edible *Portulaca olearacea* on reproductive organs of male rats, *Indian J Med Res*, 1982, **75**, 301-310.
198. Gupta RS, Sharma R, Sharma A, Choudhary R, Bhatnagar AK and Joshi YC, Antifertility effects of *Pueraria tuberosa* root extract in male rats, *Pharm Biol*, 2004, **42**(8), 603-609.
199. Njar VC, Alao TO, Okogun JI, Raji Y, Bolarinwa AF and Nduka EU, Antifertility activity of *Quassia amara* : quassin inhibits the steroidogenesis in rat Leydig cells *in vitro*, *Planta Med*, 1995, **61**(2), 180-182.
200. Rajasekaran M, Bapna JS, Lakshmanan S, Nair AGR, Veliath AJ and Panchanadam M, Antifertility effect in male rats of oleanolic acid, a triterpene from *Eugenia jambolana* flowers, *J Ethnopharmacol*, 1988, **24**, 115-121.
201. Parveen S, Das S, Kundra CP and Pereira BM, A comprehensive evaluation of the reproductive toxicity of *Quassia amara* in male rats, *Reprod Toxicol*, 2003, **17**(1), 45-50.
202. Sandhyakumary K, Bobby RG and Indira M, Antifertility effects of *Ricinus communis* Linn. on rats, *Phytother Res*, 2003, **17**(5), 508-511.
203. Sharma BB, Gupta DN, Vaishney MD and Prakash AO, *Rubus ellipticus* - A potential antifertility plant, *Indian Vet Med J*, 1981, **5**, 125-128.
204. Elbetieha A, Al-Hamood MH, Alkofahi A and Bataineh H, Reproductive toxicity potentials of *Salvia fruticosa* (Labiatae) in rats, *J Ethnopharmacol*, 1998, **61**(1), 67-74.
205. Dixit VP and Gupta RS, Antispermatic and antiandrogenic activity of *Sapindus trifoliatus* fruit extract in intact and castrated male gerbils, *Planta Med*, 1982, **46**, 242-246.
206. Nivasarkar M, Shrivastava N, Patel M, Padh H and Bapu C, Sperm membrane modulation by *Sapindus mukorossi* during sperm maturation, *Asian J Androl*, 2002, **4**, 233-235.
207. Verma PK, Sharma A, Mathur A, Sharma P, Gupta RS, Joshi SC and Dixit VP, Effect of *Sarcostemma acidum* stem extract on spermatogenesis in male albino rats, *Asian J Androl*, 2002, **4**(1), 43-47.
208. Singh SP, Regulation of fertility in male through an indigenous plant *Semecarpus anacardium* Linn., *J Res Edu Indian Med*, 1985, **4**(384), 9-20.
209. Sharma A, Mathur R and Dixit VP, Antifertility effects of *Myristica fragrans* (seed extract) and *Semecarpus anacardium* (fruit extract) in male rats, *Frontiers in Repro Biol Res*, Abstract ICMR, New Delhi, 1995, pp 22.
210. Sharma A, Verma PK and Dixit VP, Effect of *Semecarpus anacardium* fruits on reproductive function of male albino rats, *Asian J Androl*, 2003, **2**, 121-124.
211. Dixit VP and Gupta RS, Antispermatic, antiandrogenic properties of solasodine (C<sub>27</sub>H<sub>43</sub>O<sub>2</sub>N) obtained from *Solanum xanthocarpum* berries on the male genital tract of dog (*Cannis familiaris*): A histophysiological approach, *Int J Androl*, 1982, **5**, 295-307.
212. Malini T, Venkatesh NS, Govindarajulu P and Aruldas MM, Solasodine: a plant alkaloid impairs LH binding in Leydig cells of adult albino rats, In: National Symposium of the Society for Reproductive Biology and Comparative Endocrinology, Vadodara, Gujrat, 2001, pp. 83.
213. Rao MV, Effects of Alcoholic extract of *Solanum xanthocarpum* seeds in adult male rats, *Indian J Exp Biol*, 1988, **26**, 95-98.
214. Melis MS, Effects of chronic administration of *Stevia rebaudiana* on fertility in rats, *J Ethnopharmacol*, 1999, **167**, 157-161.
215. Ghosh D, Jana D and Debnath JM, Effects of leaf extract of *Stephania hernandifolia* on testicular gametogenesis and androgenesis in albino rats: a dose dependent response study, *Contraception*, 2002, **65**, 379-384.
216. Hiremath SP, Badami S, Swamy HKS, Patil SB and Lonodonkar RL, Antiandrogenic effect of *Striga orobanchoides*, *J*

- Ethnopharmacol*, 1997, **56**(1), 55-60.
217. Jha RK and Dixit VP, Inhibition of spermatogenesis after chronic administration of *Terminelia arjuna* and *Sapindus trifoliatus* (50% EtOH extract) in male albino rats, *Proc Nat Acad Sci*, 1986, **56**(3), 94-99.
218. Gupta RS and Sharma A, Antifertility effect of *Tinospora cordifolia* Willd. stem extract in male rats, *Indian J Exp Biol*, 2003, **41**, 885-889.
219. Kamal R, Yadav R and Sharma JD, Efficacy of the steroidal fraction of Fenugreek seed extract on fertility of male albino rats, *Phytother Res*, 1993, **7**(2), 134-138.
220. Kamal R, Sharma JD and Mathur L, Contraceptive efficacy of steroidal extract of Fenugreek on male albino rats: EM, withdrawal symptoms and bioassay, *In: The 41<sup>st</sup> Annual Meeting of the American Society of Pharmacognosy*, 2000, July 22-26, pp. 1-16.
221. Qian SZ, Hu YZ and Wang SM, Effect of *Tripterygium hypoglaucum* (Levl) Hutch on male fertility, *Adv Contraception*, 1988, **4**, 307-310.
222. Qian SZ, *Tripterygium wilfordii*, A New Lead in Male Fertility Regulation Today and Tomorrow by E Diczfalusy and M Bygdeman (Eds), Raven Press, New York, 1987, pp. 217-232.
223. Zheng JR, Fang JL, Xu LF, Effects of total glycosides of *Tripterygium wilfordii* on animal reproductive organ I Experiments of male rats, *Acta Acad Med Sin*, 1985, **7**, 1-5.
224. Lan ZJ, Gu ZP, Lu RF and Zhuang LZ, Effects of multiglycosides of *Tripterygium wilfordii* (GTW) on rat fertility and Leydig and Sertoli cells, *Contraception*, 1992, **45**, 249-261.
225. Ye WS, Deng YC, Huang YL and Xu SP, Antispermatic effect of *Tripterygium wilfordii* and tripchlorolide (T<sub>4</sub>) on rat gametogenesis and spermatozoa, *Chin Med Sci J*, 1994, **9**(2), 110-113.
226. Qian SZ, Jing GW, Wu XY, Xu Y, Li YQ and Zhou ZH, Gossypol related hypokalaemia, clinico pharmacologic studies, *Chin Med J*, 1980, **93**, 477-482.
227. Sun XY, Study of the pathologic changes in rat testis by total alkaloids of *Tripterygium wilfordii*, *Reprod Contracept*, 1989, **9**, 20-24.
228. Dikshith TSS, Raizada RB and Mulchandani NB, Toxicity of pure alkaloid of *Tylophora asthmatica* in male rats, *Indian J Exp Biol*, 1990, **28**(3), 208-212.
229. Chinoy NJ and Ranga G, Antiandrogenic and antifertility effects of *Vinca rosea* leaf extract, *Comp Physiol Ecol*, 1983, **8**, 41-52.
230. Stanley A, Averal HI and Akbarsha MA, Reproductive toxicity of vincristine in male rats, *Indian J Exp Biol*, 1993, **31**, 380-382.
231. Akbarsha MA, Stanley A and Averal HI, Effect of vincristine on Leydig cell and accessory reproductive organs, *Curr Sci*, 1995, **68**(10), 1053-1057.
232. Stanley A and Akbarsha MA, Giant spermatogonial cells generated by vincristine and their uses, *Curr Sci*, 1992, **63**, 144-147.
233. Umopathy E, Antifertility effects of cowpeas on male rats, *Cent Afr J Med*, 1993, **39**(3), 52-56.
234. Bhargava SK, Antifertility effects of the flavonoids (VI-VII) of *Vitex negundo* Linn. seeds in dogs, *Plant Med Phytother*, 1986, **20**, 188-198.