# Local Aphrodisiac Plants Available in Sikkim Himalaya for Male Infertility (Traditional Aspects, *in vivo* and *in vitro* Evidences): A Review Insight

Sagarika Khatiwara, Tiewlasubon Uriah Khar, Sonam Bhutia\*

Department of Pharmacognosy, Government Pharmacy College Sajong, Government of Sikkim, Sikkim University, Rumtek-Sajong, Sikkim, INDIA.

#### ABSTRACT

**Objectives:** This review aims to know the status and gaps in male infertility and enhancement measures in term of traditional utility, *In vitro* & *in vivo* studies. **Methodology:** The data were collected through an extensive literature search from reputed online databases such as PubMed, ScienceDirect, ResearchGate, Google Scholar, Willy, 1library and Core. **Results:** The results were summarized in the tables and figures. Through an extensive review where a minimum of 20 local plants including 16 Families were identified with 20 genus wise distribution-Malveaceae and Zingiberaceae, Fabaceae and Poaceae (10%) are frequently used plant families were summarized in Table 1. Roots are the maximum part used followed by seeds and the powdered form of preparation is most consumed. The mood of preparation and their dosage forms were also discussed. **Conclusion:** These plants play a great role in treating infertility issues in males and will continue to be treated in a large populace. However, there is a gap in the studies on ethnomedicinal plants used as a fertility enhancer in males from the northeast part of India, mainly from Sikkim and other states. Therefore, in-depth studies are needed from the landscape to improve the issues of infertility in males and its physiological mechanism.

**Keywords:** Local Aphrodisiac, Fertility enhancer, Male, Medicinal plants, Traditional medicinal, Fertility Management, Sikkim Himalaya.

# INTRODUCTION

The biological meanings of infertility include a person's biological inability to support in conception or a woman's inability to carry a fetus within her. 13-18% of married couples experience infertility, and epidemiological and clinical research point to a growing body of data supporting male reproductive issues.<sup>[1]</sup> Male infertility problem can be caused by two main factors: other erectile dysfunction-ED (male impotence), and abnormal semen quality. A sperm count of less than 12 million/mL is classified as oligospermia in accordance with World Health Organisation (WHO) criteria.<sup>[2]</sup> According to a Global Burden of Disease study, the age-standardized prevalence of infertility rose by 0.291% for men and 0.370% for women yearly between 1990 and 2017.<sup>[3]</sup> In 20-30% of cases, the male is the only cause of infertility, and in another 20% of cases, the male is a contributing factor.<sup>[4,5]</sup> According to WHO estimations, 3.9% to 16.8% of Indians are



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#### Correspondence: Mr. Sonam Bhutia

Department of Pharmacognosy, Government Pharmacy College Sajong, Government of Sikkim, Sikkim University, Rumtek-Sajong-737135, Sikkim, INDIA. Email: sonam.bhutia2024@sikkim.gov.in

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thought to be primarily infertile.<sup>[6]</sup> Furthermore, the predictions of infertility in the various Indian states differ significantly; 15% in Tamil Nadu, 5% in Andhra Pradesh 3.7% in Uttar Pradesh, Himachal Pradesh and Maharashtra.<sup>[7-9]</sup> Similarly, with barely 7 lakhs residents, Sikkim is the least populous state in India. For the last several years, the state has struggled with a low Total Fertility Rate (TFR). According to official figures, the Sikkim state reported the lowest, i.e. 1.1 TFR in the country in 2022.<sup>[10]</sup>

For a long time, medicinal herbs have been researched for their potential to increase fertility as well as their ability to improve the quality of semen in both humans and animals.<sup>[11-13]</sup> Recent research shows a wide range of bioactive elements found in herbs and herbal compounds defend the qualities of semen from free radicals produced by a variety of stressors.<sup>[14-15]</sup> Rat's semen quality is said to be improved by some herbal preparations containing medicinal plants *like*, *Saussurea gossypiphora*, *Enantia chlorantha*, *Sesame radiatum*, *Zingiber officinale*, *Asparagus racemosus*, *Mucuna pruriens*, *Cynomorium coccineum*, *Withania somnifera*, *Panax pseudoginseng*, *Piper longum*, *Bombax ceiba* and *Tribulus terrestris*.<sup>[16]</sup> These plants are aphrodisiacs and boost fertility through a variety of mechanisms, including vasodilatation, elevated testosterone levels, improved sexual function and

erectile dysfunction, brain monoamines, pituitary-gonadal axis effects, and many more.<sup>[17]</sup>

Infertility affects roughly one in five to one in six couples who are in their reproductive years and is referred as the failure to conceive after a fair duration of trying without the use of contraceptives. Infertility can be emotionally taxing even though it is not physically detrimental since many couple's view having children as a major goal.<sup>[18]</sup> A few causes of infertility include delaying starting a family for too long, engaging in harmful behaviours like drinking and smoking, changed lifestyle, demanding living circumstances, a range of chronic illnesses, a variety of environmental contaminants, and several adverse drug reactions, altering the frequency of sexual activity between partners, and disobeying fertility-promoting traditions.<sup>[19]</sup> Infertility affects an estimated 186 million people worldwide, with males making up more than half of those affected. The market for fertility supplements is expected to reach USD 3.53 billion by 2029, growing at a Compound Annual Growth Rate (CAGR) of 6.83% from its estimated USD 2.53 billion in 2024. The COVID-19 pandemic has had a favorable effect on the market for fertility supplements because of its impact on reproductive levels.<sup>[20,21]</sup>

# METHODOLOGY

The data were collected through an extensive literature search from reputed online databases such as PubMed, ScienceDirect, ResearchGate, Google Scholar, Core and Ilibrary. At the initial phase we have use broad keywords on general "FERTILITY ENHANCER PLANTS", followed by specific searches for Plants found in the north east region of India and Sikkim. Only publications published within the last 35 years, starting in the 1980s, were included in the search. To refine our search results, we used Boolean operators such as "AND", "OR", "NOT". We narrowed down the keywords to refine our search results. For example, we used "AND" to find articles with more than one key term, e.g.: "FERTILITY PLANTS AND HERBS AND NORTH EAST INDIA", "SIKKIM HIMALAYA", "LOCAL APHRODISIAC PLANTS", etc. We have used "or" to gather all of the articles containing any one of the specified terms, e.g.: "FERTILITY ENHANCERS" OR "FERTILITY PLANTS" OR "HERBAL FERTILITY SOLUTIONS" "MALE FERTILITY ENHANCERS", "APHRODISIAC", etc. Finally, we have used "NOT" to exclude all the articles containing the terms that were not required for our review search, e.g.: "NOT COSMETIC PRODUCTS", "SYNTHETIC REMEDIES", "SYNTHETIC FORMULATION, SYNTHETIC PRODUCTS", etc. This method helped us select some of the necessary articles from the large volumes of articles. Out of all the articles (Book, Book chapters, research, review), we have selected 83 numbers of articles that were of our interest.

#### Statistics

The data were collected through an extensive literature search from reputed online scientific database such as PubMed, ScienceDirect, Research Gate, Google Scholar, Willy, 1Library, Core, etc. The collected data were presented in a tabular and graphical presentations by using Microsoft excel 2013 application within the manuscript.

# RESULTS

|            |   |                     |              | -   | -  | -  |   |  |
|------------|---|---------------------|--------------|---|--|--|---|--|
| SI.<br>No. | Scientific Name with<br>Family                      | Local Name<br>(N.N) | Part<br>Used | Activity  | Method of<br>preparation   | Dosage<br>(Traditional<br>aspects)   | Geographical<br>Aspect  | References<br>(In vitro<br>& In vivo<br>studies) |
| 1.         | <i>Citrus sinensis</i><br>Family: Rutaceae          | Suntola             | Fruits       | Vitamin C Increases<br>Sperm Count and<br>Motility. | Orange juice and<br>roasted fennel<br>seed powder with<br>warm water on an<br>empty stomach. | Daily consumption<br>of 1-2 cups of<br>orange juice before<br>breakfast.   | Found widely in<br>southern China,<br>Northeast India<br>and Myanmar.   | [22]   |
| 2.         | <i>Hibiscus rosa- sinensis</i><br>Family: Malvaceae | China rose          | Flower       | Potent<br>fertility- enhancing<br>properties.       | Decoction  | Two to three<br>dosages are taken<br>each day, with one<br>dose consisting<br>of four to five<br>blossoms spaced 5<br>to 6 hr apart. | Widely found<br>in tropical and<br>subtropical<br>regions.<br>The plant is<br>native to India,<br>China, Burma,<br>Philippines,<br>Florida, Hawaii<br>and California. | [23, 24]   |

Table 1: Local Aphrodisiac Plants for Male Fertility Management.

| SI.<br>No. | Scientific Name with<br>Family                               | Local Name<br>(N.N) | Part<br>Used   | Activity  | Method of<br>preparation   | Dosage<br>(Traditional<br>aspects)   | Geographical<br>Aspect  | References<br>(In vitro<br>& In vivo<br>studies) |
|------------|--|---------------------|----------------|---|--|--|---|--|
| 3.         | <i>Cordyceps sinensis</i><br>Family:<br>Ophiocordycipitaceae | Yarsagumba          | Whole<br>plant | Sexual<br>function-restorative<br>activity.   | The raw material<br>is smashed<br>and extracted<br>to obtain a<br>concentrated<br>solution then<br>rock candy<br>and yeast are<br>added finally<br>slurry residue<br>separation is<br>performed and a<br>finished product<br>of <i>Cordyceps</i><br><i>sinensis</i> vinegar<br>with healthcare<br>efficacy is<br>obtained through<br>blending<br>It is administered<br>with honey,<br>milk, and water<br>through infusion. | Athlete (from 1 to<br>4.5 g daily).  | Found in<br>the Tibetan<br>Plateau of Asian<br>region and<br>the Himalayas<br>between 3000m<br>and 5000m in<br>height.  | [25-28]  |
| 4.         | <i>Aspargus racemosus</i><br>Family:<br>Asparagaceae         | Satavari            | Roots          | Strong fertility<br>booster in females.   | fresh root is<br>administered<br>with milk to treat<br>leucorrhea and<br>spermatorrhea.<br>As an<br>aphrodisiac,<br>powdered tubers<br>are consumed<br>every day with<br>milk and honey.   | Doses of 500 mg<br>daily have been<br>used safely for up<br>to 8 weeks.                  | widespread in<br>the Himalayas,<br>India, and Sri<br>Lanka. May and<br>June are good<br>months for<br>plantations, and<br>it can reach a<br>height of one to<br>two meters. | [29, 30,31]                                      |
| 5.         | Withania somnifera<br>Family:<br>Solanaceae                  | Ashwagandha         | Roots          | Elevated serum<br>testosterone levels<br>and daily sperm<br>production from the<br>testicles. | Powdered roots<br>are administered<br>to treat<br>spermatorrhea<br>and weakness.<br>The powdered<br>plant root is<br>combined with<br>crystal sugar,<br><i>Curculigo</i><br><i>orchioides</i> , and<br><i>Bombax ceiba</i> .<br>Powdered roots<br>are taken and<br>mixed with milk<br>to increase libido.  | Doses up to 100<br>gm daily, with<br>rectified butter or<br>honey for up to 12<br>weeks. | This little<br>evergreen plant<br>is indigenous<br>to the Middle<br>East, Africa, and<br>India.   | [32-36]  |

| SI.<br>No. | Scientific Name with<br>Family                           | Local Name<br>(N.N) | Part<br>Used | Activity  | Method of<br>preparation   | Dosage<br>(Traditional<br>aspects)  | Geographical<br>Aspect   | References<br>(In vitro<br>& In vivo<br>studies) |
|------------|--|---------------------|--------------|---|--|---|--|--|
| 6.         | <i>Zingiber officinale</i><br>Family:<br>Zingiberaceae   | Aaduwa              | Rhizome      | Antioxidant property<br>that protects sperm<br>damage from<br>oxidative stress.   | The ginger<br>extracted mixed<br>with honey.   | Three<br>tablespoonfuls<br>thrice daily.  | Located in<br>southwest and<br>northeastern<br>India, these<br>regions are<br>most suited for<br>growing ginger<br>because of their<br>warm, humid<br>environment,<br>regular rainfall,<br>and ample land<br>area. | [37, 38]   |
| 7.         | <i>Cinnamomum<br/>zeylanicum</i><br>Family:<br>Lauraceae | Elaichi             | Bark         | Increases the level<br>of sex hormones<br>in humans thus<br>enhancing fertility<br>character.   | Decoction of bark  | Ground cinnamon<br>is generally given<br>at the dose of 1 to<br>3 g/day.  | It is indigenous<br>to the West<br>Indies, South<br>America, India,<br>and Sri Lanka.  | [39,40]  |
| 8.         | <i>Mucuna pruriens</i><br>Family:<br>fabaceae            | Kaauso              | seeds        | Increases semen<br>volume, improves<br>sperm quality, and<br>regresses unspecific<br>generation of reactive<br>oxygen species in<br>infertile subjects. | Seed extract,<br>Cooked seeds,<br>Seed decoction.  | Seeds powder<br>is typically 1/4<br>to1/2teaspoon<br>mixed with honey<br>or lukewarm milk.<br>This can be taken<br>once or twice a day<br>after meal. | Native to tropical<br>Asia and Africa,<br>tropical legumes<br>are widely grown<br>and naturalized.   | [41-43]  |
| 9.         | Chlorophytum<br>borivilianum<br>Family:<br>Liliaceae     | Musli               | Roots        | Elevation in serum<br>testosterone levels.  | Dry the roots and powder it.   | Consuming spoon<br>full of powdered<br>roots of white<br>musli, 20-30 mL<br>twice a day with<br>milk is a part of the<br>daily healthcare<br>regime.  | It was brought<br>to India from<br>South Africa<br>and is said to be<br>native to tropical<br>and subtropical<br>Africa.   | [44,45]  |
| 10.        | <i>Sesamum radiatum</i><br>Family:<br>Pedaliaceae        | Til                 | Seeds        | Used to improve<br>sperm count and<br>sperm motility.   | Either the<br>seeds or the<br>seed extract is<br>consumed orally.  | Two teaspoonfuls<br>daily.  | It is native<br>to West and<br>Central Africa.   | [46-48]  |
| 11.        | <i>Panax ginseng</i><br>Family:<br>Araliaceae            | Ginseng             | Roots        | stimulate<br>spermatogenesis, as<br>well as to improve<br>testicular functions,<br>sperm quality, and<br>motility.                                      | Chewed or taken<br>as a powder,<br>liquid extract,<br>decoction, or<br>infusion.   | 3 g/d for 10 days<br>and 4 g/d for 12<br>weeks.   | Seven major<br>species are<br>distributed<br>in East Asia,<br>Central Asia,<br>and North<br>America.   | [49-53]  |
| 12.        | <i>Allium sativum</i> L.<br>Family:<br>Liliaceae         | Lasuun              | Bulb         | Increase libido   | Ten pieces of<br>red pepper, two<br>onion bulbs,<br>five garlic bulbs,<br>and ginger are<br>crushed and<br>combined with<br>water and honey. | Three table<br>spoonfuls thrice<br>daily.   | It is native to the<br>Middle East and<br>Central Asia.  | [54-56]  |

| SI.<br>No. | Scientific Name with<br>Family                      | Local Name<br>(N.N) | Part<br>Used           | Activity  | Method of<br>preparation   | Dosage<br>(Traditional<br>aspects)   | Geographical<br>Aspect   | References<br>(In vitro<br>& In vivo<br>studies) |
|------------|---|---------------------|------------------------|---|--|--|--|--|
| 13.        | <i>Cymbopogon citratus</i><br>Family:<br>Poaceae    | Lemon grass         | Leaf                   | Increase sperm<br>quality   | The leaves'<br>decoction mixed<br>with honey.  | Twice a day, half a<br>glass.  | It is native to<br>Asia, Africa, and<br>the America.   | [57]   |
| 14.        | Zea mays<br>Family:<br>Poaceae                      | Makai               | Seeds                  | Increase male motility  | A sufficient<br>amount of palm<br>wine is combined<br>with two cups of<br>powdered maize<br>grains or seeds,<br>then filtered.<br>The filtrate is<br>consumed by<br>mouth.                           | Twice a day, one<br>glass.   | Central America<br>and Mexico.   | [58,59]  |
| 15.        | Alpenia galanga<br>Family:<br>Zingiberaceae         | Sugandhamula        | Root<br>and<br>rhizome | General infertility ailments.   | One spoon of<br>galanga powder<br>with water.  | One glass daily  | Native to<br>Indonesia and<br>across Asia.   | [60,61]  |
| 16.        | <i>Musa sapientum</i> L.<br>Family:<br>Musaceae     | Kola                | Root                   | Increase the mobility<br>of sperm and help in<br>sperm production.  | Wine is used to moisten the roots.   | Two shots twice daily.   | Native of<br>Bihar and E.<br>Himalayas,<br>cultivated in<br>India in the<br>tropics.   | [62,63]  |
| 17.        | <i>Moringa oleifera</i><br>Family:<br>Moringaceae   | Sajana              | Leaves<br>and<br>seeds | Good sources of<br>antioxidants that<br>aid in preventing<br>oxidative damage that<br>might harm sperm<br>DNA or interfere with<br>sperm development. | Fresh, mature<br>leaves are<br>collected, and<br>then shed drying<br>them after that<br>powdered it. add<br>a teaspoon of<br>powder to a mug<br>and stir it in a<br>luke warm water<br>and drink it. | 7 g daily for 90<br>days.  | Thrive globally<br>in almost all<br>tropical and<br>subtropical<br>regions, but it<br>is believed to<br>be native to<br>Afghanistan,<br>Bangladesh,<br>India, and<br>Pakistan. | [64-69]  |
| 18.        | <i>Cucurbita pepo</i><br>Family:<br>Cucurbits       | Pharshi             | seeds                  | Improve sperm<br>quality  | In raw form or roasted.  | Handful of<br>pumpkin seeds 2-3<br>times a week.   | West Bengal,<br>Odisha,  | [70,71]  |
| 19.        | Trigonella<br>foenum-graecum<br>Family:<br>Fabaceae | Methi               | seeds                  | It has shown to have<br>positive effects on<br>sperm count, sperm<br>quality, testosterone<br>levels, and increased<br>libido.                        | Pour a glass<br>of water over<br>some fenugreek<br>seeds and let it<br>sit overnight.<br>Drink the water<br>first thing in the<br>morning after<br>removing the<br>seeds.                            | 300 mg of<br>fenugreek twice<br>daily for 8 weeks.   | It is a native of<br>Eastern Europe<br>and West Asia.  | [72,73]  |
| 20.        | <i>Tribulus terrestris</i><br>Family:<br>Malvaceae  | Gokhru              | Roots                  | It is rich in<br>antioxidant and help<br>to reduce oxidative<br>stress.   | Lady finger root<br>powder diluted<br>in a cup of cow<br>milk.   | Taking a mixture<br>of 15-10 g<br>of powdered<br>ladyfinger root<br>diluted with one<br>cup of cow's milk. | Originated in<br>East Africa in<br>Ethiopia, and<br>Eastern Sudan.   | [74-78]  |

(\*N.N=Nepali name).



Figure 1: Family-wise percentage of ethnomedicinal plants used as fertility enhancer in males.



Figure 2: Plants parts used for treatment of male infertility.

# DISCUSSION

Both men and women may have infertility issue. Male infertility is specifically a disorder that affects individuals who were Assigned Male at Birth (AMAB) and interferes with their reproductive system's ability to conceive A Female at Birth (AFAB). This review explores several fertility enhancers natural agents/local Aphrodisiac plants endemic to the biodiverse region of North east region of India especially from Sikkim. This study highlights 20 notable plants with their local name (Nepali name), part used, general activities, method of preparation, dosage forms and geographical aspects summarized in (Table 1), distributed across 16 botanical families (Figure 1), representing 20 genera, with Zingiberaceae, Malvaceae, Poaceae and Fabaceae contributing 10% each to the total. The primary plant parts used are roots (30%), followed by Seed (25%) (Figure 2). As compared to previous study,<sup>[79]</sup> approximately 70 well-known natural aphrodisiacs and fertility-boosting herbs and plants were found to be useful in promoting male physiology's sexual behaviour. Likewise,<sup>[80]</sup> In this review, they discussed the pharmacologically tested aphrodisiac herbs (in humans, animals, or both) that have made claims regarding their usefulness and gave information

about 17 medicinal plants. This study highlights the new scientific evidence supporting the usage of herbal plants that have been used for centuries as aphrodisiacs to treat erectile dysfunction, a sexual disease.<sup>[81,82]</sup> reported 64 numbers of plants used in Ayurveda as Vajikaran Rasayan with Hindi names, families, part used, and in the same paper also reported the various popular herbs with ethnopharmacological backing for being used as aphrodisiac with botanical names, families, extract used, mechanism of action, along with lead molecules with scientific findings and source description, etc.<sup>[83]</sup> reported 19 medicinal plants, mechanism of actions and crude extracts for different pharmacological activities including fertility enhancers in male. As far as research and review concerned, there is no work published or discussed in the specific selected topic from Sikkim Himalaya till today. This review work will serve as basic fundamental evidence for the researchers/ scholars in the future.

## CONCLUSION

These natural plants play a great role in treating infertility issues in males and will continue to be treated in a large populace. However, there is a gap in the studies on natural plants used as a fertility enhancer in males from the northeast parts of India, Sikkim and other states. Therefore, in-depth studies are needed from the landscape to improve the issues of infertility in males.

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# **CONFLICT OF INTEREST**

The authors declare that there is no conflict of interest.

#### **AUTHOR CONTRIBUTIONS**

The selection of this review work and the primary data gathering from the online scientific repositories were handled by SB & SK. S.B. and TLK were in charge of overseeing the project through to completion and helped with the drafting, designing, formatting, and referencing of this review article. They also communicated with prestigious journals that have a solid reputation in the scientific community. The paper has been read and approved by all authors.

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