ISSN 0974 – 5211

Journal of Natural Products

Volume 5 (2012)

www.JournalofNaturalProducts.com

Review

Herbal Aphrodisiac their Need, Biology and Status: Global and Regional Scenario

Manish Mathur*

Plant Ecology Section, Division of Natural Resources and Environment

Central Arid Zone Research Institute (CAZRI), Jodhpur, Rajasthan, India

* Corresponding Author

(Received 08 April 2012; Revised 11-16 April 2012; Accepted 18 April 2012)

ABSTRACT

Modern life style and certain environmental exposures have resulted in male infertility. The causative factors produce different types of derangements that directly or indirectly cause sexual dysfunctions. Male infertility is increasing in almost every part of the world and there resulted consequences are varies. Modern medicines provides nutritional, physiological and psychopharmacological treatments, however many of them produces negative impact on physiological processes. Herbal aphrodisiac provides a safer way to counteract with various problems associated with male infertility. This paper discuss about need, biology, global and regional scenario of herbal aphrodisiac. 32 aphrodisiac plants species that are naturally abound in Rajasthan, (India) their officinal parts, Relative Importance Value (RIV), bioactive molecules, and their various pharmacological properties were discussed. 23 plants have been clinically trialed for their aphrodisiac and other activities, while plants like *Abutilon indicum, Boerhavia diffusa, Citrullus colocythis, Citrullus lanatus, Convolvulus microphyllus, Indigofera linnaei, Crotolaria burhia* and *Mimosa hamata* yet not been clinically evaluated for their aphrodisiac activities, thus exhibiting 28.12% gap between traditional knowledge and pharmacological evidences. The maximum relative importance value (RIV) was shown by *Aloe vara* (1.8) and 31.25% (10 plant species) were versatile in relation to their use, with RIV of 1 and above. On the basis of number of corporeal systems treated by each species Agglomerative Hierarchal Cluster Analysis (AHC) classify 32 plants in three clusters that provide a base work for preparation of a multi-herb product.

Keywords: Male Infertility; Global & Regional Scenario; Herbal Aphrodisiacs; Relative Importance Values; Agglomerative Hierarchal Cluster Analysis.

INTRODUCTION

Aphrodisiac plants: The word 'Aphrodisiac' derived from 'Aphrodite' the Greek goddess of love and the aphrodisiac are the substances, which stimulates sexual desire (Greek-Aphrodisiakos- sexual). According to the Oxford Learners Dictionary (Cowie, 1989) aphrodisiac means substance or drug arousing sexual desire, while Encyclopedia of Medicinal plants (Mnimh, 1996) explained aphrodisiac as the one which excites libido and sexual activity. Foods itself is considered as an aphrodisiac in the Ayuerveda because after nourishing different tissues of the body (muscles, fat, nerves) it nourishing the reproductive fluids; and promote vigor. In general "Aphrodisiac" are the substance which are ingested,

applied topically, smoked snorted or otherwise delivered in to body for improving their sex potentials.

Need of Aphrodisiac (for men): The process of human conception is almost absurdly inefficient and completely depends on chance. There is only one sperm out of billion got the chance to encounter with egg. And if one sperm does finally completing the journey, it may or may not have the energy left for fertilization. There are many forms of male infertility, includes erectile dysfunction, sexual insufficiency, reduction in sperm density and semen volume and abnormal sperm morphology.

There are evidences to show that sperm counts have been declining over the last 50 years, with a consequent increase in male infertility (Olayemi, 2010). The global incidence of couple infertility is estimated at 10 to 15 % (Krausz, et al., 2000). Of men aged 40-70 years, an estimated 34.8% have moderate to complete erectile dysfunction (Patel, et al., 2011). Infertility affects 15 % of all couples and 39% of these couples, male having abnormal semen character (Akondi, et al., 2009). Globally various temporal and spatial trends in declining human sperm density have been reported (Marimuthu, et al., 2003, Urban, et al., 2004). Mean sperm densities are higher in Europe and lowest in non-Western countries, further sperm density decreased with time; no post-1970s rise was seen (Shanna, et al., 1997). Between 20 and 30 million American men suffer from some degree of sexual dysfunction, and a comparative figure generally applies worldwide Hellstrom (1997). Van (1997) compared the men in 1977 to men in 1994 from the Belgium and reported that, in 1977, 39.6 percent of sperm had a normal shape, but in 1994, the percent of normal sperm had dropped to 27.8 percent. The average number of sperm with strong motility dropped from 53.4 percent in 1977 to 32.8 percent in 1994. Pajarinen (1997) reported that in Edinburgh, Scotland the men born after 1970 had a sperm count 25 percent lower than those born before 1959, with an average decline of 2.1 percent per year. Auger (1995) showed 2.1 percent annual decline over the past 20 years.

***Indian Status*:** There is very little evidence on the levels or patterns of male infertility in India, and in South Asia (Jejeebhoy, 1998). Danadevi, et al., (2003) studied semen quality of 57 Indian welders occupationally expose to nickel and chromium and they correlate semen abnormalities with the number of years of exposure to welding fumes containing nickel and chromium. According to Anand Kumar (2004), 50% of infertility in India is related to reproductive abnormalities or disorders in male. Furthermore, in 25% infertility cases their underlying factors can not be tracked through routine tests, which, leaves as unexplained infertility (Highland, et al., 2010). Adiga, et al., (2008) reported that sperm density, sperm morphology and sperm motility are deteriorating in the southern part of the India (1993-2005). Significant decline in the sperm motility parameters as well as in the seminal volume of 3729 male of Kolkata city in between 1981-85 and 2000-06 were reported by Mukhopadhyay, et al., (2009).

***Infertility risk factors:* - (Olayemi, 2010)**

1. **Cigarette smoke**: Sperm counts of smokers are on an average 13-17 per cent lower than non-smokers. Smoking, density of sperm and sperm viability are significant predictors for male infertility and that can be explained by equation (Chia, et al., 2000)

$$\text{Infertility} = 94.70 \times 2.88^{\text{smoking}} \times 0.29^{\text{longdensity}} \times 0.95^{\text{viability}}$$

2. **Pesticides**: Exposure to pesticides results in reduced sperm count and an increase in abnormally shaped sperms.
3. **Air pollution**: Men living in industrial and polluted towns have 6 times more abnormal sperm than living in clean areas.
4. **Chemicals:** Sperm count drops in men exposed to chemicals like DDT, PCB's (Polychlorinated biphenyls), dioxins and some petroleum by- products.
5. **Foods additives**: Food additive like monosodium glutamate (MSG) causes infertility.
6. **Anesthesia:** Animals exposed to the anesthesia enflurane show 50 percent higher sperm damage rate than those not exposed to enflurane.

7. **Occupational exposure:** Men who work in aircrafts industry, textiles, and plastic, welding, chemical solvent or even antibiotic are more at risk of having abnormal sperms.
8. **Ozone affects:** As the level of ozone in ambient air increases, the sperm concentration goes down. Ozone, once inhaled gets rapidly metabolized, triggering an inflammatory reaction, which could adversely affect the sperm.
9. **Zinc deficiency:** Zinc is involved in every aspect of male reproduction including hormone metabolism, sperm formation, and sperm motility. Zinc deficiencies are characterized by decreased testosterone levels and sperm counts.

***Mechanism involved in Aphrodisiac Potential*:** Sexual desire is controlled and regulated by the central nervous system which integrates tactile, olfactory and mental stimuli (Patel, et al., 2011).

***Role of Nitric Oxide*:** On sexual stimulation (visual (or) otherwise the famines of the axons of parasympathetic nerves release nitric oxide (NO) gas. The gas diffuses into smooth muscle cells that line those arteries of the corpus carvenosum (erectile tissues) and activates the enzymes guanylate cyclase (GC). The later converts the nucleotide guanosine triphoshate (GTP) in to cyclic guanosine monophosphate (C.GMP). The C.GMP in turn causes the smooth muscle cells around the penis to relax, leading to dilation and increased flux of blood into the penile tissues. This blood is essentially trapped in the penis and results in an erection (Palmer, 1999). The erection ceases after a while because C.GMP is hydrolyzed by phosphodiesterase type-5 enzyme (PDE-5) into inactive GMP. (The PDE-5 enzyme resides in the penile tissues). Aphrodisiac potentials inhibit the hydrolyzing action of PDE-5 with the result that active C.GMP can accumulate.

There are two possible approaches, cultural and scientific, for the answering the characteristic feature of a drug or foods as an aphrodisiac (Thakur, et al., 2009). Primary non-scientific themes have mentioned through multiple culture and times. First, genitals of animals have often been deemed aphrodisiac. The Kama Sutra suggests testicle of goat as a source for improving fertility. Second many substance simply resembled human genitalia e.g., rhino horn.

The scientific community explained the biologically significant aphrodisiac into three primary categories.

First: Some aphrodisiac simply provide a burst of nutritional value improving the immediate health or well being of the consumer and consequently improving sexual performance and libido.

Second: This group includes the purported aphrodisiac have more specific physiological affects but are not psychologically active. They may affect blood flow; increase duration of sexual activity by numbing the genital area.

Third: The third group of aphrodisiac is made up compounds that are psychopharmacological, i.e. they actually cross the blood brain barriers and stimulates some area of sexual arousal. This category includes a wide range of neurotransmitters, hormones, pheromones and drugs that interfere with the normal function of these molecules. This category is most difficult to study because knowledge of both sexual arousal and the mechanisms of the psychoactive properties of drugs are limited. Only the most general information about sexual arousal and the brain is understood (Bruce, et al., 2002).

Plants as a source of aphrodisiac: The available drugs and treatments have limited efficacy, unpleasant side effects and contraindications in certain disease conditions. The fact remain that, other than correction of obstruction, infection, varicocele, and certain endocrine abnormalities, in most cases there is particularly no successful therapeutic measure for male infertility. The allopathic drugs used for erectile dysfunction are believed to produce side effects and affect other physiological processes and, ultimately, general health (Vitezic and Pelcic, 2002). Sildenafil Citrate (Viagra) is a successful drug that modifies the heamodynamics in the penis, but side effects with this drug are headache, flushing, dyspepsia and nasal congestion (Lue, 2000), and these side effects of are probably due to its serotonin reuptake inhibitory properties (George, et al., 2003).

Search of natural supplement from medicinal plants as an aphrodisiac substance is significantly increased (Yakubu, et al., 2007). Ayuerveda realized the problem of male sexual dysfunction thousands of years ago it realized, among other thing, the role of nervous system, cardiovascular system, and psychological aspect of fertility and male sexual performances. Vajikaran is a speciality in Ayurvedic system of medicine, possessing rejuvenative and revitalizing properties for improving sexual synamics (Thakur and Dixit, 2007). It fundamental principle of repletion and depletion, consisting of radical and conservation treatments apply to therapy for male sexual dysfunction. Radical therapy adopts techniques to drain the waste materials of different body compartment through the nearest channel in a system – friendly manner. Radical therapy, followed by repletion and reproduction medicine therapy, can probably improve the male reproductive function by creating an optimal environment for spermatogenesis and improving intratesticular availability of nutrients. In Ayuervedic texts aphrodisiacs have been classified into five categories (Singh and Mukherjee, 1998).

1. Drugs, which increase the quantity of semen or stimulate the production of semen e.g.,
   Microstylis wallichii, *Roscoea procera*, *Mucuna pruriens* and *Asparagus racemosus*.
2. Drugs, which purify and improve the quality of semen e.g., *Saussurea lapa*, *Sesamum indicum*, *Vetiveria ziznoides* and *Anthocephalus cadamba*.
3. Drugs, which help sexually and in ejaculation e.g., *Strychnos nux-vomica*, *Cannabis sativa*, *Myristica fragrans*, *Cassia occidentalis* and musk.
4. Drugs delaying the time of ejaculation e.g., *Sida cordifolia*, *Asparagus racemosus*, *Cinnamomum tamala*, *Anacyclus pyrethrum*, *Mucuna pruriens*.
5. Drugs arousing sexual desire viz., *Withania somnifera*, *Datura stramonium*, *Hibiscus abelmoschus*

All over the worlds numerous plants have been reported and traditionally uses as aphrodisiac, among them 79% are dicot, 18% monocot while, fungi, pteridophytes and gymnosperms each represented by 1% only (Mathur and Sundaramoorthy, 2009). Sood et al., (2005) have listed 456 ethnic aphrodisiac plants, belongs to 116 plant families dominated by Papilionaceae (36). Medicinal plants with aphrodisiac potentials have been reported by various Indian works like Sharma and Sood, (1997); Sood, et al., (2005); Mathur (2005); Mathur and Sundaramoorthy (2006, 2008a, 2008b 2009a, 2009b, 2010); Pande and Pathak (2009); Patel, et al., (2011); Malviya, et al., (2011); and Pallavi, et al., (2011). Gap analysis of 138 Indian aphrodisiac plants revealed that only 21.73% plants are currently cultivated through proper scientific techniques, further 56.52% plants have been clinically tested for their aphrodisiac properties while, phytochemical constitutes were evaluated for only 8.64% plant (Table 1).

Aphrodisiac Plants Abound In Rajasthan: The natural flora of this region comprises 682 plant species belongs to 352 genera and 87 families and the biodiversity of this region is intimately associated with habitat diversity (Khan, et al., 2003). Ethno-botanicals surveys of this region have been conducted by many researchers that, reported 63 plants of aphrodisiac potentials and amongst them, 32 plant species are naturally growing in arid and semi arid region of the Thar Desert (Mathur, 2005). So called aphrodisiac plants species that are naturally abound in this region, their parts use for preparation of aphrodisiac drug, their Relative Importance Value (RIV), their active principals, pharmacological properties for aphrodisiac and other then aphrodisiac are listed in Table 2. Out of 32 plants 23 plants have been clinically trialed for their aphrodisiac and other activities, while plants like *Abutilon indicum*, *Boerhavia diffusa Citrullus colocythis*, *Citrullus lanatus*, *Convolvulus microphyllus*, *Indigofera linnaei*, *Crotolaria burhia* and *Mimosa hamata* clinically yet not been evaluated for their aphrodisiac activities. While, *Cucumis callosus* need various clinical trials to establish their pharmacological activities. The above analysis revealed that for these 32 aphrodisiac plants there is 28.12% gap between traditional knowledge and pharmacological evidences.

Out of 32 plants 22 and 12 plants contains specific alkaloids and steroidal sapogenin, respectively while, one species *Blepharis edulis* known to contain only one alkaloid Blepharin. Therefore, a correlation can be established between steroidal sapogenin, alkaloids and their pharmacological properties (Ramawat, et al., 1998; Mathur, 2005; Thakur and Dixit, 2007 and Jain, et al., 2010).

Relative Importance Value (RIV): The RIV for each species was calculated to assess their cultural importance and was calculated accordingly Bennett and Prance, (2000). In this calculation, "2" is the largest value that a species can attain:

$$RIV = NCS+NP,$$

- Where, NCS = Number of corporeal system. It is given by the number of corporeal system treated by a species (NCSC) over the total number of corporeal system treated by the most versatile species (NSCSV).

$$NCS = \frac{NSCS}{NSCSV}$$

- NP = number of properties attributed to a specific species (NPS) over the total number of properties attributed to the most versatile species (NPSV).

$$NP = \frac{NPS}{NPSV}$$

Plants were classified into categories by following the standard developed by Cook, (1995). Research tally method of Boom, (1990) was utilized for quantitative evaluation of plant uses.

For assessing cultural importance of medicinal plants of this region following Ethnomedicinal reports (from 1986 to 2011) of Jodhpur, Barmer, Jaisalmer, and Bikaner districts were examined (Shekhawat, 1986; Paranjpe, 1999; Kotia and Kumar, 2003; Billore, 2002; Kumar et al., 2003; Katewa et al., 2004; Kumar et al., 2005; Chodhary et al., 2008; Kumar, et al., 2008 and Sharma and Kumar, 2011). RIV is an important tool for assessing and grading the medicinal plants used in a particular region Bennett and Prance, (2000), Luiz, et al., (2005) and Fatima, et al., (2006)

The maximum relative importance value was shown by *Aloe vara* (1.8), followed by *Boerhavia diffusa* (1.4). The lowest RIV was showed by *Blepharis edulis* (0.2). Approximately 31.25% (10 plant species) were versatile in relation to their use, with RIV of 1 and above (Table 2).

Agglomerative Hierarchal Cluster Analysis (AHC): Generally, multivariate methods aim at making large data sets mentally accessible, with recognizable structures and explicable patterns. In present study multivariate analyses were performed by binary datasets with Statsoft software. Agglomerative Hierarchal Cluster Analysis (AHC) was performed with the help of Ward method. The objective of cluster analysis is to develop sub grouping such that objects within a particular subgroup are more alike than those in a different sub-group. AHC was performed by Ward method with the help of Euclidean distance. Hierarchical clustering do not only cluster sample, but also cluster the various clusters that were formed earlier in the clustering process. Agglomerative clustering algorithms start by treating each sample or variable as a cluster of 1. The closest two clusters are joined to form a new cluster. Euclidean distance dissimilarity was followed for grouping the plants useful for treatment in 17 different corporeal systems.

For present investigation binomial data set were used to homogenate the variables (17 corporeal system and 32 plants). The AHC grouped the heterogeneous variables into three different groups or clusters (Figure 1). Within class variance revealed that (Table 3) cluster 2 is comparatively more homogenous then the other two clusters. In each cluster the central plants (initial starting points) are as follows *Withania sonnifera* (1), *Cucumis callosus* (2), and *Peganum harmala* (3). Cluster 1 consists of maximum number of plants (15), while clusters 2 and 3 consists 12 and 5 plants, respectively (Table 3). Grouping of plants under a particular cluster was based on the traditional use of plants for supplementary disease other than aphrodisiac (or reproductive tract). AHC results revealed that plants belong to cluster 1 are mostly useful for treatment of digestive and urinary disorders except *Blepharis sindica* and

Cissus quadrangularis, respectively. While plants of cluster 2 are not use in disorders related with ear, heart, tissues, skin, feet and fever. In contrast, all plants of cluster 3 are useful in fever and skin, while they are not useful for liver, blood, feet, eye and body related disorders. Cluster analysis revealed that plants belong to cluster 1 are useful for almost every corporeal system, while plants of clusters 2 and 3 uses for 11 and 12 corporeal systems, respectively. Such grouping also supported by our Relative Importance Value (Table 2). RIV values of plants belonging to cluster 1 ranges from 0.9 to 1.8, while plants of cluster 2 shows lowest RIV that ranges from 0.2 to 0.6, however RIV for plants of cluster 3 ranges from 0.7 to 0.9. From the pharmacological point of view such types of classification having practical utility for clinical validation and for preparation of a multi-herb product that may be useful in various corporeal systems. Such multivariate analyses can provides a basic groundwork for preparation of multi-herb combination and this attribute is supported by the finding of Sahoo, et al., (2011), that during 2001-2010 most Indian Patent Claims on herbal drugs are on multi-herb composition.

Several multi-herb products/preparations commonly available in market and they intended for strength, vigor and vitality etc. Ramawat, et al., (1998) have listed 27 aphrodisiac drugs that consisting *Withania sonifera, Asparagus racemosus, A. ascendense, Curculigo orchioides* and *Chlorophytum borivilianum*. For present study many formulas /products were electronically searched with Google, search was restricted for only those products containing herbs that are naturally growing in Rajasthan simultaneously for those products that are clinically validated through scientific methods. As many as 35 different products are available consisting many herbal plants growing in this part of India, however most of products yet not been clinically trialed and their mode of action still not confirmed. Only 5 products suits our criteria and most of them possessed plants like *Withania somnifera, Asparagus racemosus, Mucuna pruriens, Tribulis terrrestris* and *Chlorophytum borivilium* with varying concentration (Table 4). Mode of action of these herbal products revealed that product MAK 5 is helpful in curing erectile dysfunction by stimulating nitric oxide, while product Libilov^{R} is a protodioscin extracted from *Tribulis terrestris* and it improved spermiogenesis, SA-1 increase ejaculation latency and mount frequency (Table 4). This analysis revealed that amongst 32 plants *Withania somnifera, Asparagus racemosus, Mucuna pruriens, Tribulis terrestris* and *Chlorophytum borivilium* are highly valued herbs which, supported by their annual requirements in state Ayuervedic Rasayanshalas that ranges from 4600 - 621 kg/year (Mishra and Shukla, 2009). However, rest of plants requires more scientific efforts to establish them as a potential aphrodisiac plant.

CONCLUSION

Herbal drugs and remedies have been a part of the lexicon of traditional system of medicines throughout the world and numbers of herbs have been used in one form or other for improving the sexual performance. It would be apt to state that utilization of herbal medicine and safer herbal products for improving sexual dynamics could serve the purpose for providing ameliorative effects of sexual dysfunction.

REFERENCES

Adiga, S. K., Jayaraman, V., Kalthur, G., Upadhya, D., Kumar, P., (2008): Declining semen quality among south Indian infertile men: A retrospective study. *J. Hum. Reprod. Sci*., 1:15-8.

Adimoelja, A., (1997): Clinical application of Asian medicine in erectile dysfunction (ED). *IJIR*., 9: 1-18.

Akonidi, R.B., Pawar, K.M., Challa, R.S., (2009): Natural compounds to treat male infertility. Pharmacologyonline. 2: 240-251.

Auger, J., (1995): Decline in sperm quantity among fertile men in Paris during the past 202 years. *New. Eng. J. Med.*, 332: 281-285.

Babu, M. A., (2011): Antioxidant activity of *Pedalium murex* fruit in carbon tetra chloride induced hepatopathy in rat. *Int. J. Pharm. Biosci*., 2(1): 622-628.

Balamurugan, G., Muralidharan, P., Polapala, S., (2010): Aphrodisiac activity and curative effects of *Pedalium murex* (L.) against ethanol induced infertility in male rats. *Turk. J. Biol.*, 34: 153-163.

Bankole, H. A., Magbagbeola, O. A., Adu, O. B., Fatai, A. A., James, B. A., (2011): Biochemical Effect of Ethanolic Extract of *Phyllanthus amarus* (Euphorbiaceae) on Plasma Nitric Oxide and Penile Cyclic Guanosine Monophosphate (cGMP) in Mature Male Guinea Pigs. *Asian. J. Biochem.*, 6*: 291-299.*

Bennett, B. C., Prance, G. T., (2000): Introduced plants in the indigenous pharmacopoeia of Northern South America. *Econ. Bot.*, 54: 90-102.

Billore, K. V., (2002): Ethnobotanical studies in Rajasthan, India- an Update. In: Surender, S., Govil, J. N., Singh, V. K., (Eds.), Recent Progress in Medicinal Plant Phytochemistry and Pharmacology. Stadium Press, USA.

Boom, B. M., (1990): Useful plants of the Panare Indians of the Venezuelan Guayana. *Econ. Bot.,* 8: 57-65.

Bruce. A. A., John, E. D., Linda, L. B., Gary, H. G., Ari, S., Mary, L.P. Tom, F. L., Scott, W. A., (2002): Brain activation and arousal in healthy heterosexual males. Brain, 125: 1014-1023.

Chia, S. E., Lim, S.T.A., Tay, S.K., Lim, S. T., (2000): Factor associated with male infertility: a case – control study of 218 infertile and 240 fertile men. *BJOG*., 107 (1): 55-61.

Chodhary, K., Singh, M., Pillai, U., (2008): Ethnobotanical survey of Rajasthan-an update. *AEJB.*, 1(2): 38-45.

Choudhary, G., Dantu, P. K., (2011): Morphological, phytochemical and pharmacological studies on *Boerhaavia diffusa* Linn. *J. Med. Plants Res.*, 5 (11): 2125-2130.

Cook, F. E. M., (1995): Economic botany data collection standard. (Royal Botanic Garden, Kew, United Kingdom).

Cowie, A. P., (1989): Oxford Advance Learner Dictionary of Current English. Oxford Univ. Press. Oxford: *NPR.*, 3(4): 284-292.

Danadevi, K., Rozati, R., Reddy, P. P. Grover, P., (2003): Semen quality of Indian welders occupationally exposed to nickel and chromium. *Reprod. Toxicol.*, 17 (4): 451-456.

Faher, J. W., (2005): *Moringa oleifera*: A review of the medicinal evidence for its nutritional, therapeutic and prophylactic properties. *Tree for Life Journal*. 1 (5): 1-15.

Fatima, C., Elba, L. C., Ulyssess, P. A., (2006): Medicinal plants popularly used in the Xingo region- a semi arid location in Northeastern Brazil. *JEE.,* 2: 2-15.

George, H., Nuraberg, M. D., Paula, L., Hansely, M. D., (2003): Sildenafil citrate for management of antidepressant-associated erectile dysfunction. *J. Clinical Phsychiatr.,* 64 (10): 20-25.

Guathaman, K., Adaikan, P. G., Prasad, R. N., (2003): Sexual effects of puncturvine (*Tribulus terrestris*) extract (Protodioscine) an evaluation using a rat model. *J Altern. Complem. Med*., 9: 257-265.

Haque, R., Saha, S., Bera, T., (2011): A peer reviewed of general literature on *Chlorophytum borivilianum* commercial medicinal plant. *Int. J. Drug Develp. Res.,* 3 (1): 140-155.

Highland, H. N., Kalaria, B., George, L. B., (2010): A study of the trend in semen parameters of males from Ahmedabad city (Gujarat), over a two-decade period. *Ethno Medicine,* 199-202.

Hukkeri, V. I., Akki, K. S. Surben, R. R. Gopalakrishna, B., Byahatti, V. V., Rasendra, S. N., (2006): Hepatoprotective activity of leaves of *Nyctanthes arbor-tristis* Linn. *Indi. J. Pharm. Sci*., 68: 542-543.

Inabal, R., Mohammad, M., Sugiura, H., (2005): Effect of maharishi amrit kalash 5 as an ayurvedic herbal food supplement on immune functions in aged mice. *J. Altrn. Complem. Med*., 5 (8): 1-10.

Jain, A., Choube, V. S., Singour, P. K., Raja, K. H., Pawar, R. S., (2011): *Sida cordifolia* (Linn)- an overview. *J. Appl. Pharma. Sci,*. 1(2): 23-31.

Jain, N., Goyal, S., Ramawat, K. G., (2010): Biotechnological approaches to aphrodisiac plants of Rajasthan, India, In: Ramawat, K.G., (Ed.), Desert Plants, Biology and Biotechnology, Springer-Verlag Berlin Heidelberg: pp. 479-501.

Jain, S. C., Jain, R., Vlietinck, A. J., (2004): In vivo and in vitro antimicrobial efficacy of *Mimosa hamata*. *IJBT*., (3): 271-273.

Jaiswal, S., Singh, S. V., Singh, B., Singh, H. N., (2004): Plants used for tissue healing of animals *NPR.,* 3(4): 284-292.

Jejeebhoy, S. J., (1998): Infertility in India- levels, pattern and consequences priorities for social science research. *J. Family Welfare,* 44 (2): 15-24.

Jhade, D., Paarkash, P. M., Gavani, U., (2009): Isoloation of phytoconstitutes from leaves of *Chenopodium album* Linn., *Journal of Pharmacy,* 2 (7): 1192-1193.

Josepha, B., Raj, S. J., (2010): Pharmacognostic and phytochemical properties of *Aloe vera* Linn- an overview. *IJPSR.,* 4 (2): 106-110.

Kataria, S., Shrivastava, B., Khajuria, R. K. Suri, K. A. Sharma, P., (2010): Antimicrobial activity of *Crotalaria burhia* Buch.-Ham. Root. *IJNPR.,* 1 (4): 481-484.

Katewa, S. S., Choudhary, B. L., Jain, A., (2004): A floristic survey of ethnomedicinal plants occurring in the tribal area of Rajasthan. *J. Ethnopharmacol*., 92 (1): 41-46.

Katzenschlager, R.. Evans, A., Manson, A., Patsalos, P., Ratnaraj, N., Watt, H., Timmermann, L., Giessen, R. V. Less, A., (2004): *Mucuna pruriens* in Parkinson disease: a double blind clinical and pharmacological study. J. Neurol. *Neurosurg. Psychiatry.,* 75 (12): 1672-1677.

Khadabadi, S. S., Bhajipale, N. S., (2010): A review on some important medicinal plants of *Abutilon* spp., *Res. J. Pharm. Biol. Chem. Sci.*, 1 (4): 718-729.

Khadem, S., Marls, R. J., (2010). Monocyclic phenolic acid; hydrooxy-and polyhydroxybenzoic acid: occurrence and recent bioactivity studies. *Molecules,* 15: 7985-8005.

Khan, T. I., Dular, A. K., (2003): Solomon DK. Biodiversity conservation in the Thar desert; with emphasis on endemic and medicinal plants. *The Environmentalist*, 23: 137-144.

Kotia, A., Kumar, A., (2003): Ethnobotanical studies of some medicinal plants collected from semi-arid wastelands of Rajasthan, In: Mathur, A.K., Dwivedi, S., Patra, D.D., Bagchi, G.D., Sharma, A., Khanuja, SPS (Eds.), (CIMAP, Lucknow India). Proceedings of First National Interactive Meet on Medicinal and Aromatic plants. pp.119- 125.

Krausz, C., Fortie, G., (2000): Clinical aspects of male infertility. In: McElreavery K. editor The Genetic Basis of Male Infertility. Springer-Verlag: New York.

Kulsheshtha, S. S., Mathur, R. S., (1990): Effect of steroid fraction of seeds of *Abrus precatorius* Linn on rat testis. *Indian J. Exp. Biol*., 28: 752-756.

Kumar, G. G., Gali, V., Dwivedi, S. C., (2011): Phytochemical investiagion of *Crotolaria burhia* Hamilt. *IJPBR.,* 2 (4): 1721-1724.

Kumar, R. S., Rajkapoor, B., Perumal, P., (2011): Antitumor and cytotoxic activites of methanol erxtract of *Indigofera linnaie* Ali. *APJCP*., 12: 613-618.

Kumar, S., Parveen, F., Narain, P., (2005): Medicinal Plants in the Indian Arid Zone. CAZRI, Jodhpur, India. 64.

Kumar, S. P., Sucheta, S., Deepa, V. S., Selavamani, P., Latha, S., (2008): Antioxidant activity in some selected Indian medicinal plants. *AJB.,* 7 (12): 1826-1828.

Kumaradoss, M, Raja, M. M., Mishra, H., (2010): Comprehensive review of *Clerodendrum phlomidis:* a tradinally used bitter. *JCIM.,* 8 (6): 510-524.

Lakshmayya, N. N. R., Kumar, P., Agarwal, N. K., Gouda, T. S., Setty, S. R., (2003): Phytochemical and pharmacological evaluation of leaves of *Abutilon indicum*. *IJTK.,* 2 (1): 79-83.

Lgwe, C.V., Waogu, L.A., Usuwondu, C.O., (2007): Assessment of the hepatic effect, phytochemical and proximate composition of *Phyllanthus amarus*. *AJBT.*, (6): 728-731.

Lue, T. F., (2000): Erectile dysfunction. *Nat. Engl. Med*., 342: 1802-1813.

Luiz, R.P., Reinaldo, F. P., Ulyssess, P. A., (2005): Knowledge and use of medicinal plants by local specialist in a region of Atlantic forest in state of Pernambuco Northeastern Brazil. *Acta. Bota. Bras*., 19: 17-26.

Madhavan, V., Yoganarasimhan, S. N., Gurudeva, M. R., (2008): Pharmacognostical studies on Sankhanpushpi (*Convolvulus microphyllus*) Sieb.ex Spreng. and *Evolvulus alsinoides* (L.) L. *IJTK*., 7 (4): 529-541.

Malviya, N., Jain, S., Gupta, V. B., Vyas, S., (2011): Recent studies on aphrodisiac herbs for the management of male sexual dysfunction- a review. *Acta. Pol. Phearm. Drug Res.,* 68 (1): 3-8.

Mathur, M., Sundaramoorthy, S., (2008a): Ecological and pharmacological studies of an aphrodisiac plant *Corchours depressus* (Linn.), *Hamd. Med*., 51 (4): 73-92.

Mathur, M., Sundaramoorthy, S., (2008b): Ecological studies on seedling parameter of three aphrodisiac medicinal plants of the Indian Thar Desert. *JMAP*., 30: 105-108.

Mathur, M., (2005): Ecology and Prospecting of some Medicinal Plants of Aphrodisiac Potential, Ph.D. Thesis. Jai Narain Vyas University. Jodhpur.

Mathur, M., Sundaramoorthy, S., (2006): Ecological and aphrodisiac properties of *Blepharis sindica*. *Nig. J. Nat. Prod. and Med*., 10: 17-25.

Mathur, M., Sundaramoorthy, S., (2009a): Mineral composition in *Corchorus depressus* at heterogenous environmental conditions and their relationships with bottom-up, to down and plant metabolite factors. *Comm. Soil Sci. Plant Anal.,* 40 (13): 2028-2043.

Mathur,M., Sundaramoorthy, S., (2009b): Plants with aphrodisiac potentials-the knowledge and the gaps. In: Trivedi, P.C., (Ed.), Indian Medicinal Plants. Aavishkar Publisher, Jaipur, India. pp.1-31

Mathur, M., Sundaramoorthy, S., (2010): Spatial and temporal impacts on mineral composition and their nutrient efficiency in an endangered medicinal plant-*Blepharis sindica. JMAP*., 32 (3): 245-250.

Mehar, A., Agrahari, A. K., Pradhan, A. R., (2010); Indian medicinal plants *Cissus quadrangularis* Linn.: an ethnobotanical and ethnomedicinal review. *Herbal Tech. Industry*., 1-3.

Mishra, D. K., Shukla, J. K., (2009): Trading of Medicinal Plants In: Rajasthan. AFRI, Jodhpur. 43.

Mishra, L., Wagner, H., (2004); Alkaloid constitutes of *Mucuna pruriens* seeds. *Phytochemistry*, 65 (8): 2565-2567.

Mnimh, A. C., (1996): The Encyclopedia of Medicinal plants. A Practical references guide to over 550 Key herbs and Their Medicinal Use. Dorling Kindersley.

Mohammed, S., Kasera, P.K., Shukla, J. K., (2004): Unexploited plants of potential medicinal values from the Indian Thar Desert. *NPR.*, 3(2): 69-71.

Mukhopadhyay, D., Banerjee, S. K., Sharma, R. K., (2009): Semen quality and age-specific changes: a study between two decads on 3729 male partners of couples with normal sperm count and attending an andrology laboratory for infertility- related problems in an Indian city. *Fertil. and Steril*., 1-8.

Murugan, M., Mohan, V. R., (2011): Antibacterial activity of *Mucuna pruriens* (L.) Dc. Var. *Pruriens* – an ethnomedicinal plant. *Science Research Report*, 1 (2): 69-72.

Olayemi, F. O., (2010): A review on some causes of male infertility. *AJBT*., 9 (20): 2834-3842.

Ono, M., Nishida, Y., Masuoka, C. L. J., Okawa, M., Ikeda, T., Nohara, T. (2004): 'Lignan derivatives and a norditerpene from the seeds of *Vitex negundo*. *J. Nat. Prod*., 67: 2073-2075.

Pallavi, K. J., Singh, R., Singh, S., Singh, K., Farswan, M., Singh, V., (2011): Aphrodisiac agents from medicinal plants: a review. *J. Chem. Pharma. Res*., 3 (2): 911-921.

Pande, M., Pathak, A., (2008): Sexual function improving effect of *Chenopodium album* (Bathura sag) in normal male mice. *Biomed. Pharma. J.*, 1: 325-332.

Pande M. Pathak A., (2009): A. Investigation of aphrodisiac potential of *Blepharis edulis Linn.* (Utangan) claimed by tribal's of *Malwa* region of Madhya Pradesh. *Int. J. Chem. Tech. Res.*, 1 (3): 769-776.

Paranjpe, P., (1999): Indian Medicinal Plants- Forgotten healers. (New Delhi, India).

Park, S. D., Lee, C. H., Shin, D. H., Bang, N. S., Lee, S. M., (2006): Effect of SA 1, a herbal formulation, on sexual behavior and penile erection. *Biol. Pharm. Bul.*, 29 (7): 1383-1386.

Patel, D. K., Kumar, R., Prasad, S. K., Hemalatha, S., (2011): Pharmacologically screened aphrodisiac plant- A review of current scientific literature. *Asia Pac. J. Trop. Biomed.*, 2011. 131-138.

Potterat, O., (2010): Goji (*Lycium barbarum* and *L. chinense*): phytochemistry, pharmacology and safety in the perspective of traditional knowledge and recent popularity. *Plant Medica*, 76: 7-19.

Prakesh, J., Chanda, V. S., (2007): In-vitro antimicrobial activity and phytochemical analysis of some Indian Medicinal Plant. *Turk. J. Biol.*, 31: 53-58.

Ramawat, K. G., Jain, S., Suri, S. S., Arora, D. K., (1998): Aphrodisiac plants of aravalli hills with specie reference to Safed Musli, In: Khan I, Khanum A editors. Role of Biotechnology in Medicinal and Aromatic Plants. Ukaaz Publication, Hayderabad: p 210-223.

Sahoo, N., Manchikant, P., Dey, S. H., (2011): Herbal drug patenting in India; IP potential. *J. Ethnopharmacol*., 137: 289-297.

Sandhar, K. H., Kaur, M., Kumar, B., Prasher, S., (2011): An update on *Nyctanthes arbor-tristis* Linn. *Int. J. Pharma. Scien.*, 1 (1): 77-86.

Sermakkani, M., Thangapandian, V., (2010): Phytochemical screening for active compound in *Pedalium murex* L. *Recent Res. Sci. Tech*., 2 (1): 110-114.

Shahla, N., Sanadgol, N., Nejad, B. S., Beiragi, M. A., Sanadgol, E., (2010): Phytochemical screening and antibacterial activity of *Citrullus colocynthis* (Linn.) Schrad against *Staphylococcus aureus. J. Med. Plants. Res.*, 4(22): 2321-2325,

Shanna, H., Swan, E. P., Fnester, L., (1997): Have sperm densities declined? A reanalysis of global trend data, *Environ. Health Perspect*., 11 (105): 1228-1231.

Sharma, H., Kumar, A. K., (2011): Ethnobotanical studies on medicinal plants of Rajasthan (India): a review. *JMPR.*, 4: 1107-1112.

Sharma, K. R., Sood, M., (1997): *Important Medicinal Plants of Himachal Pradesh.College. I &II*, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni Solan (H.P.)

Shekhawat, G. S., (1986): Ethnobotincal survey of desert area of Rajashtan, [PhD Thesis] University of Jodhpur; India.

Siddiqui, M. Z., (2011): Guggul: an excellent herbal panacea. *Asian Pharm. Health Sci*., 35-39.

Silva, J. F. M., Garden, S. J., Pinto, A. C., (2001): The chemistry of Isatins: a review from 1975 to 1999. *J. Braz. Chem. Soc.*, 12 (3): 273-324.

Singh, G., Mukherjee, T., (1998): Herbal aphrodisiac: A review. *Indian Drug*, 35: 175- 182.

Sood. S. K., Rana, S., Lakhnpal, T. N., (2005): Ethnic Aphrodisiac Plants. Scientific Publishers, Jodhpur, pp.190.

StatSoft, Inc. (2011): Electronic Statistics Tulsa, StatSoft. WEB: http://www.statsoft.com.

Subhan, F., Sultan, S., Alam, W., Tahir, F., Dil, A. S., (1998): Aphrodisiac potential of *Peganum harmala* seed. *Hamd. Med*., 4: 69-72.

Sukanaya, D. H., Lokesh, A. N., Datta, G., Himabindu. G., (2010): Phytochemical diversity in aswagandha (*Withania sonifera*). *JMAP*., 2: 12-17.

Tandon, V. R., (2005): Medicinal uses and biological activities of *Vitex negundo. NPR*., 4(3): 162-165.

Thakur, A., Jain, V., Hingorani, L., Laddha, K. S., (2009): Phytochemical studies on *Cissus quadrangularis* Linn. *Pharmaco. Res*., 1 (4): 213-215.

Thakur, M., Chauhan, N. S., Bhargava, S., Dixit, V. K., (2009): A comparative study on aphrodisiac activity of some Ayurvedic herb in male Albino rat. *Arch. Sex Behav*., 38: 1009-1015.

Thakur, M., Dixit, V. K., (2006): Effect of *Chlorophytum borivilianum* on androgenic and sexual behavior of male rats. Indian Drugs, 43: 300.6.

Thakur, M., Dixit, V. K., (2007): Effect of some Vajikaran herbs on pendicualation activities and in vitro sperm count in male. *Sex Disabil.*, 2007; 25: 203-207.

Tyagi, R. M., Aswar, U. M., Mohan, V., Bodhankar, S. L,. Zambare, G. N., Thakurdesai, P. A., (2008): Study of furostenol glycoside fraction of *Tribulus terrestris* on male sexual function in rat. *Pharm. Biol*., 46: 191-198.

Urban, J. A., Souza, D. M., Vilma, M., D'Souza, Narayana, K., (2004): Is today male population really less fertile? Declining semen quality-a global phenomenon. *Indian J. Med. Sci.*, 58 (7): 305-306.

Van, K. W., (1997): Deterioration of sperm quantity in young Belgian men during recent decades. *Hum. Reprod*., 9: 73.

Vandal, R., (2011): An investigation of cardioprotective activity of *Citrullus lanatus* (Thunb.) seed powder suspension on experimentally induced cardiotoxicity in rats. B. Pharma Thesis. Rajiv Gandhi University of Health Science, Karnataka, Bangalore.

Venugopal, S. N., (2002): Simple formulation for primary health care uses based on Ayurveda, *FRLGHT. Report*, 1-38.

Vitezic, A., Pelcic, J. M., (2002): Erectile dysfunction: oral pharmacotherapy option. *Int. J. Clin. Phstmscol. Ther.*, 40: 393-403

Wani, J. A., Achur, R. N., Nema, R. K., (2011): Phytochemical screening and aphrodisiac activity of *Asparagus racemosus*. *Int. J. Pharma. Sci. Drug Res*., 3 (2): 112-115.

Yakubu, M. T., Akanjii, M. A., Oladiji, A., (2007): Male sexual dysfunction and methods used in assessing medicinal plants with aphrodisiac potential. *Pharmacogn. Rev*., 11: 49-56.

Ziyada, A. K., Elhussien, S. A., (2008): Phytochemcial characterization of *Citrullus lanatus* Var. Colocynthoide seed oil. *J. Phys. Sci*., 19 (2): 69-75.

Table -1: Gap Analysis of 138 Aphrodisiac Plants Reported form India.

Parameters	India
Total number of plants regarded as aphrodisiac	138
Plant cultivated through scientific methods	27.3%
Plants for which Phytochemistry have been done	8.69%
Clinical Validation Done Aphrodisiac Other then aphrodisiac	 56.52% 31.15%

- *Source = Mathur and Sundaramoorthy, 2009b.

Table-2: Some naturally growing aphrodisiac plants of Rajasthan.

S.N.	Plant Name	Relative Importance Value	Plant part used	Phyto-chemistry	Clinical validation
1	*Abrus precatorious*	1.1	Seed	Arbin A, saponin Prakesh et al., (2007)	Aphrodisiac, Kulsheshtha and Mathur (1999)
2	*Abutilon indicum*	1.2	Seeds, root bark, leaf	β-sitosterol, gossypetin-8- and -7- glucosides, cyanidin-3-rutinoside, Lalshmayya et al., (2003).	Urinary disorders, Khadabadi and Bhajipale (2010)
3	*Aloe vera*	1.8	Leaves	Cholesterol, campesterol, *β*-sitosterol, Joseph and Raj (2010).	Aphrodisiac, Gundidza et al., (2009) Antitumor, antioxidant and skin disease, Joseph and Raj (2010).
4	*Asparagus racemosus*	1.3	Roots	Shatavarien IV, Saponins, steroids, flavonoids Wani et al., (2011)	Aphrodisiac, health tonic Wani et al., (2011).
5	*Blepharis edulis*	0.2	Seeds and leaves	Blepharin, Silva et al, (2001)	Aphrodisiac Pande and Pathak (2009).
6	*Blepharis sindica*	0.8	Seeds	Steroidal sapogenin,Alkaloid and Phenol, Mathur (2005)	Aphrodisiac, Mathur and Sundaramoorthy (2006).
7	*Boerhavia diffusa*	1.4	Seed	Punarnavine and Boeravinone, Choudhary and Dantu (2011)	Diuretic, Antinflametory, Choudhary and Dantu (2011)
8	*Chenopodium album*	1.0	Leaf	Steroid, saponin and flavonoid, Jhade et al., (2011).	Aphrodisiac Pande and Pathak (2008)
9	*Chlorophytum borivilium*	0.7	Roots	Carbohydrate, saponin and alkaloid, Handa and Rasayana (1996).	Anticancer, Antioxidant, Haque et al., (2011) Aphrodisiac Thakur and Dixit (2006) and Patel et al., (2011)
10	*Cissus quadrangularis*	0.9	Edible stemmed vine	Delta-amyrin acetate, Thakur et al., (2009) Alkaloid- quadrangularine and phytosterol, Joseph and Raj (2010)	Aphrodisiac, Mehar et al., (2010)
11	*Citrullus colocythis*	0.8	Fruit and Seed	Saponin, alkaloid, glycoside, Shahla et., (2010)	Jaundice, Arthritis, Venugopal (2002)
12	*Citrullus lanatus*	0.4	Seed	Colocynthoide, Ziyada and Elhussien (2008)	Antidiabetic, hyperplasia and dyslipidemia, Vandal (2011).
13	*Clerodendrum phlomoidis*	0.5	Root	Clerodin, clerodendrin, scutellarein, pectolinaringenin, Kumaradoss et al, (2010).	Aphrodisiac, Akondi et al., (2009).
14	*Commiphora wightii*	1.1	stem	Guggulsterone, Guggulipid, Masten (2005)	Aphrodisiac and Cholesterol lowering agent Siddiqui (2011)

15	*Convolvulus microphyllus*	0.3	Leaves	Coumarins, alkaloids, Madhavan et al., (2008).	Use in Central nervous disorders , Mohammed et al., (2004)
16	*Corchorus depressus*	0.5	Whole plant	Steroidal sapogenin, Zinc, phytosterol, Mathur and Sundaramoorthy (2009a).	Aphrodisiac, Mathur (2005)
17	*Crotalaria burhia*	0.6	Whole plant	Alkaloid, steroid, glycosides, Kumar et al., (2011)	Antimicrobial, Kataria et al., (2010).
18	*Cucumis callosus*	0.2	Fruit	Lectins, Dinant et al., (2003).	Not evaluated
19	*Grewia tenax*	0.3	Fruit	β-sitosteryl acetate , β-amyrin, β-amyrin acetate, 5α,8α-epidioxyergosta-6,22-diene-3β-ol betulin , stigmasterol, 3-*O*-β-D-glucoside, Ahmed et al., (2011)	Aphrodisiac, Jaiswal et al., (2004).
20	*Indigofera linnaei*	0.5	Leaves and Seed	1,2,6-tri-O-(3-nitropropanoyl)-β-D-glucopyranose,2,3,4,6-tetra-O-(3-nitropropanoyl) α-D-glucopyranose, Kumar et al., (2011)	Antitumor activity, Kumar et al., (2011).
21	*Lycium barbarum*	0.3	Fruit	Poliysaccharides, Potterat (2010).	Aphrodisiac, Patel et al., (2011).
22	*Mimosa hamata*	1.1	Seeds	Hydroxy-and polyhydroxybenzoic acid, Khadem and Marls (2010)	Antimicrobial activity, Jain et al., (2004)
23	*Moringa oleifera*	1.1	Leaves	4-(4'-*O*-acetyl-α-L-rhamnopyranosyloxy)benzyl isothiocy-anate , 4-(α-L-rhamnopyranosyloxy)benzyl isothiocy-anate , niazimicin , pterygospermin , benzyl isothiocyanate, Fahey (2005).	Anti-inflammatory, Abirtufacient, Goyal et al., (2007) and anticancer, antibacterial Aphrodisiac, (Fahey),2005
24	*Mucuna pruriens*	0.8	Seed	Dopamine, L-Dopa, (Mishra and Wagnen), 2004	Aphrodisiac, Patel et al., (2011), Anti-Parkinson's Katzenshlager et al., (2004).
25	*Nyctanthes arbartristis*	0.8	Flower and Seed	ß-sitosterol, ß-amyrin, hentri-acontane, benzoic acid, glycosides, nyctanthoside-a iridoid Sandhar et al., (2011).	Hepatoprotective, Hukkeri et al., (2006), Stimulates libido, Patel et al., (2011).
26	*Pagenum harmala*	0.9	Seed	Harmaline Alkaloid, Asif (2006)	Aphrodisiac, Subhan et al, (1998)
27	*Pedalium murex*	0.5	Fruits	Flavanoid, Steroidal saponin, Sermakkani and Thangapandian (2010)	Aphrodisiac Balamurugan et al., 2010. Antioxidant Babu, 2011
28	*Phyllanthus amarus*	0.7	Leaves	Phyllanthin, Saponin, Tanin, Cyanogenic glycosides, Lgwe et al., 2007	Aphrodisiac Bankole et al., (2011), Hepatic effect, Lgwe et al., (2007).
29	*Sida cordifolia*	0.9	Whole plant	Alkaloid like Ephedrine, Ephedra SP, Vasicinol Jain et al., (2011).	Tonic, Aphrodisiac, Carminative, Jain et al., (2011)
30	*Tribulis Terristris*	0.6	Fruit, leaves, plant ash	Steroidal sapogenin, Zinc, Mathur (2005).	Stimulates spermatogensis and libido, Gautharman et.al. (2003), Tyagi et al., (2008)

31	Vitex negundo	1.2	Fruit	vitedoin-A; vitedoin-B; a phenylnaphthalene-type lignan alkaloid, vitedoamine-A; five other lignan derivatives, (Ono 2004)	CNS stimulator, Aphrodisiac, Tandon, (2005)
32	*Withania somnifera*	1.1	Roots	Witheniolide, glycowithanolides, Sukanya et al., (2010)	Improve sperm count, Use for erectile dysfunction, Anti-depressant, anxiolytic, Patel, (2011)

Table- 3: Results of Agglomerative Hierarchal Cluster Analysis.

Cluster	**1**	**2**	**3**
Within- Class Variance	3.124	1.173	2.8
Minimum distance from centroid	1.24	0.182	1.24
Average distance from centroid	1.688	1.23	1.48
Maximum distance from centroid	2.25	1.63	1.72
Size	15	12	5
	Abrus precatorious	*Blepharis edulis*	*Citrullus colocnyths*
	Abutilon indicum	*Citrullus lanatus*	*Clerodendrum phlomoides*
	Aloe vera	*Corchorus depressus*	*Nyctanthes arbor-tristris*
	Asparagus racemosus	*Crotalaria burhia*	*Paganum harmala*
	Blepharis sindica	*Cucumis callosus*	*Phyllanthus amarus*
	Boerhavia diffusa	*Grewia tenex*	
	Chenopodium album	*Indigofera linnaei*	
	Cissus quadrangularis	*Lycium barbarum*	
	Commiphora wightii	*Pedalium murex*	
	Mimosa hamata	*Tribulis terrestris*	
	Moringa oleifera	*Convolvulus microphyllus*	
	Mucuna pruriens	*Chlorophytum borivilium*	
	Sida cordifolia		
	Vitex negundo		
	Withania somnifera		

- Bold letters represents the plants which are the central observation of the cluster analysis

Table- 4: Principal plant based ingredients and their mode of action of aphrodisiac drug available in market.

Product Name	Composition (mg)						Mode of action	References
	W. somnifera	***A. racemosus***	***M. pruriens***	***T. Terristris***	***S. cordifolia***	***C. borivilium***		
Herbagra	100	50	100	50	50	-	L-Arginine or *Tribulus*, used for dilation of the blood vessels and supporting testosterone respectively.	http://www.performanceinsiders.com/herba-gra.html, Herba Gra Overview
Vigorex SF	100	-	100	25	-	50	Improve libido, disturbed due to psychological fear and emotional imbalance. Control premature ejaculation and frigidity.	Murugan and Mohan, (2011)
MAK-5	100	10	-	-	-	-	1. Stimulate nitric oxide production. 2. Prevention of the immunosenescence.	Inabal et al., (2005)
Libilov (protodioscin)	-	-	-	150	-	-	1. Restoration of sex drive and enhancement of the quality of erection by protodioscin seem to involve its conversion to DHEA and testosterone. 2. Increased DHEA level, in turn prevents the loss of epididymal cells which results in the improved spermiogenesis and increased fertility.	Adimoelja, (1997)
SA -1	50	-	50	100	-	-	1. Increase in the ejaculation latency and mount frequency. 2. Enhanced the relaxation responsed to acetycholine	Park et al., (2006)

Figure- 1: Dendrogram of Agglomerative Hierarchal Cluster Analysis.