International Journal of Current Science Research
www.drbgrpublications.in

Volume: 3; Issue: 3; March-2017; pp 1186-1201. ISSN: 2454-5422

A Review on Ethno-Medicinally Important Species of Pteridophytes

Anamika Pathak[1], Naveen Gaurav[2], Anoop Singh[3], Arun Kumar[4] and A. P. Singh[5]

[1]A. P. S. University Rewa, Madhya Pradesh, India.
[2,4]S G R R P G College Dehradun, Uttarkhand, India.
[3]Jaiprakash Associates Ltd. Jaypee Sidhi Cement Plant Baghwar, Rewa, Madhya Pradesh, India.
[5]Govt. New Science College, Rewa, Madhya Pradesh, India.
[*]Corresponding author email: anamika5june@gmail.com

Abstract

Pteridophyta (pteron = feather, phyton = plants), General named as 'vascular cryptogams,' and found most primitive vascular angiospermic plants. Pteridophytes are known the oldest vascular plant creature on earth and constitute major group of vascular plants. Pteridophytes position known as intermediate between the lower plants and higher plants has made the whole group interesting for research & study. Pteridophytes group have a long connection on our planet and were known as far back as 380 million years ago. Pteridophytes also known for their medicinal value for more than 2000 years, (Parihar and Parihar, 2006). The Greek botanist Theophrastus (327-287 B.C.) had already referred to the ethnomedicinal value of ferns in one of his books. Dioscorides (50 AD) also added in his "De material medica" to a number of ferns including The bracken fern (*Pteridium aquilinum*) and the male fern (*Dryopteris filix- mas (L) schott*) as having medicinal value. In ancient Indian medicine several ferns were in use, Sushruta (100 AD) and charaka (100 AD) recommended the medicinal use of some pteridophytes i.e. *Marsilea minuta Linn. and Adiantum capillusveneris Linn.* in their Samhitas (Chandra, 2000).

Review

These plants are distinct in having alkaloids, flavonoids, glycosides and terpenoids, with many primary and secondary metabolites and these organic constituents utilized in preparation of medicine. Formulations of pteridophytic plants are also reported as stimulants, appetizer, aphrodisiac, as well supplement. However, certain pteridophyte species are reported used for the

ailment of stomach disorder, ulcer as well as diuretic. Many of the Pteridophyties are historically utilized in the Ayurvedi as well as in Homeopathy system of medicines. The *Selaginella ciliaris, Lycopodium clavatum* and *Selaginella bryopteris,* are well known Pteridophytes for the Ayurvedic and homeopathic system of medicine, wherein genus Selaginella prefer for the curing heat stroke effects and certain disorder like neurological disorder. Similarly, the *Lycopodium clavatum* is also ben recommended to those patients who are having splinted bones. The *Helminthostachys zeylinica locally* known as 'Kamraj' is well known ayurvedic herbal as a source of stimulant and aphrodisiac and to increase the sexual efficiency. Chemically many pteridophyte species are screened out and many active novel biomolecules chemicals reported. The marsiline isolated from *Marsilea minuta* has immense utility because of marsiline isolated from the plant and is very favourable in disease like psychopathy, diarrhea, cough, skin diseases, dyspepsia, fever and insomnia. Many other economic values of various other pteridophytes have been extensively used and proved to exhibit great economic value. *Pteris vittata species generally known as* "Braken fern" has shown antimicrobial activities against number of bacterial strains. Pteridophytes are having tremendous vast medicinal scope and importance specially in pharmaceutical area. The immense potentiality of Pteridophytes in modern medicine. Some common known taxa used in ayurvedic and homeopathic and siddha system of pathy are believed by tribal, rural and common people of whole world. This is common known facts that the herbal medicines having no side effect, thus, pteridophytic plants used as better herbal preparation, but before its use requires proper testing, screening, and validity of compounds (Singh, *et al.,* 2010).

About 12000 species of pteridophyte in the world are represented and today they are highly-evolved group of plants with a high diversity in world, characteristics that were present when these pteridophytes first introduced out of the sea and onto land in past of 400 million years ago. They were found in dominant form of vascular plants until the Silurian period when seed bearing plants came into existence. True ferns play a significant role in many of the plant communities found in the province. A variety of ferns dominante the ground vegetation cover under hardwood throughout the province. The Wood Fern is an important component of forest while Bracken Fern is common in the ground vegetation of open forest stands. Cinnamon Fern is common in swamps and wet places. Hay scented Fern is found on grazed land and in disturbed forests. Ostrich Fern is prevalent in the understory vegetation of fertile, river floodplain forests. The

evergreen leaves of Christmas Fern are conspicuous in rich hardwood stands. The grape-ferns are a small group of uncommon and generally obscure ferns with succulent leaves and sporangia clustered like tiny grapes. Pteridophytes existed from Paleozoic era and they have faced many natural disturbances that led them to adapt to many serious changes of environment (Wallace, *et.al.,* 1991).

Juli and Llorenc (2000) has completed phytociological study introducing new grid system with 10×10 km cell-size and studied the richness and coexistence of pteridophyte species at the mesoscale level in the Iberian Peninsula of North-East. A significant relationship between richness of pteridophyte and maximum altitude (related positively), bedrock type (siliceous types, higher richness), and distance to the coast. Pteridophytes are significant component in the forest ecosystem. Pteridophytes have measurable indications and they may reflect the environmental factors changes (Verma and Khullar, 2010).

The general facts about the pteridophytic ecology are that their presence is interdependent on the micro climatic conditions that, at least seasonally, allow the gametophytes development, reproduction and second is that they are rarely dominant in climatic vegetation of pteridophytes.

Ferns are often reported as habitat specialists. A few studies have been completed in detailed and quantitative studies of fern ecology. Some examples of high habitat fidelity includes in New Guinea Trigonospora genus, of Cyathea species. The pteridophytes are highly vulnerable making changes in ecosystem processes and vegetation and at scales from local and small and, to regional and large. This reflects that pteridophytes are having potential to provide useful indicators of ecological processes and disturbance especially in forests (Soare, *et al.,* 2013).

Pteridophytes are beautiful ornamental flora occurs in the temperate and sub tropics of the Globe. They prefers to grow along the running streams, waterfalls of cool zones where air temperature is below 25ºC. Tropical ever green forest offers shelter for the Pteridophytes as epiphytes on trunks and branches of the wild plants. In India luxuriant Pteridophytes flora reported from Himalayas and Northern parts of the country. Several authors (Dixit, 1975) have studied the pteridophytic flora and its medicinal properties. The distribution and quantitative study of Pteridophytes of Punyagiri hill near Vizianagaram of Eastern Ghats was studied in detail (Murty, *et al.,* 2011).

Edward and Michael, (2000) concluded that natural selection along environmental gradients must play major factor in determining the genetic and ecological associations along with hybrid zone. The study results that the context of the pteridophyte life cycle and compared to the assumptions of models explaining the establishment and maintenance of hybrid zones, which vary in the role attributed to environmentally mediated natural selection.

Ruthlessly destruction of natural habitat and over-collection by men, many pteridophytes especially *Psilotum* and tree pteridophyte have become extinct and rare at several natural habitat. Pteridophytes are having many advantages as a focal community, and a number of previous studies have been completed in comparison of dispersal and environmental effects of pteridophyte (Tuomisto, *et al.,* 2003; Gilbert and Lechowicz, 2004). Many biotic factors (herbivores, pests, pathogens,) that are important in determining the abundance and distribution of other plant groups have no influence or little on ferns, which simplifies the assessment of environmental influence (Lellinger, 1985; Barrington, 1993).

The pteridophyte are highly distributed in Indian sub-continent, due to specificity in micro climate and widely distributed in Indian continent and availability of favourable climatic conditions. Pteridophytes prefer to grow on moisture, soil type, humidity, temperature, etc. and in many cases are very specific indicators for the conditions (Shaikh and Dongare, 2009). Though many studies have been done completed on different habits and habitats of pteridophytes. The pteridophytes mostly grow in different habitats like as hydrophytes in lakes, dry rocks boulders or in moist or on tree trunks, ponds, etc., on forest floors and edges, along perennial streams and deep ravines, etc. Ecologically many members of ferns and fern allies found in region can be classified into different depending upon their habits and habitats. Some pteridophytes prefer to grow as epiphytes on the branches and stem of the trees in shady and moist evergreen forests. The epiphytic pteridophyte species such as *Drynaria quercifolia, Lepisorus nudus, Microsorum punctatum, Asplenium nidus* and *Huperzia squarrosum,* etc. grow on tree trunk. On higher altitudes, the whole plants of trees are mostly covered with moist bryophytes surface and leafy liverworts. Consequently, provide an ideal condition for the growth of pteridophytes (Dixit, 2000).

Many studies deal with the relationships between diversity or distribution and attributes of the physical environment. Japanese ferns and their allies study is one of the best well-known pteridophyte literature in the world. 600 species of Japanese pteridophytes reported in this study specially on distribution, reproduction, and chromosome number (Qinfeng, *et al.,* 2003).

The pteridophytes dominated the earth during carboniferous period are survived in modern time by about 12,000 species in 305 genera. Amongst them most numerous are the homosporous ferns comprised of approximately 11,500 species, while 500 as fern-allies known globally. In India the Pteridophytes have been found to grow in almost all climatic zones under different microclimatic habitats and represented by 1200 species falling under 191 genera. In addition to these species composition the Pteridophytes are very diverse in their habitat. Being one of the twelve mega biodiversity countries of the world, India portraits three hotspots across its territory. The north east regions of the country comprised of seven provinces are a major component of the Eastern Himalayas which is richest in the Pteridophytic wealth. About 845 taxa reported belonging to 179 genera are known from these regions followed by the species composition of south India (Eastern and Western Ghats) from where approximately 345 taxa under 110 genera, the Western Himalayas of the North India stand at the third position contain 340 taxa belonging to 100 genera. This trend of diversity and species composition has enforced the Indian subcontinent to be very specific in respect of presence of Pteridophytes. About 17% of the total species known from the country are in the category of endemic species which needs quick attention for their conservation and management (Singh, *et al.,* 2010).

India is extremely rich in the diversity of Pteridophytes flora due to its remarkable variation in eco-climatic condition, soil types and attitudes. Recent assessments reveal that about 900-1000 species of Pteridophytes occur in India (Chandra, *et al.,* 2008).

India is a mega biodiversity country with 13,000 species of vascular plants with 1000 species of ferns and ferns allies (Benniamin, *et al.,* 2008). The Western Ghats is one of the major hotspots of the world and also one of the significant geographical regions. Around 233 species of ferns occur in south India (Manickam and Irudayaraj, 1992).

The pteridophytes are the second largest component of this world flora. The pteridophyte are one of the oldest and primitive vascular plant groups grow on the earth. Pteridophytes prefer to

grow in shady and moist area with moderate temperature, mostly occur throughout diverse range of specific habitats. About 12,000 pteridophytes reported occur in the world flora in which about more than 1200 species likely to be reported from Indian Continent (Dixit, 1984; Chandra, 2000).

Marquez, *et al.,* (1997) reported that water availability was an important factor for fern distributions on the Iberian Peninsula, Spain, and a humidity gradient was the important factor influencing differentiation of fern species in Rwanda (Sharma, 1988).

Rajagopal and Bhat (1998) listed 174 species of pteridophytes. Ramachandra, *et al.,* (2010) reported 54 species of pteridophytes from the Gundia river basin in Hassan district. Deepa, *et al.,* (2011) reported 19 pteridophytes in Maduguni forest of Bhadra Wildlife sanctuary, Chikmagalur district.

The Western Ghats of the Indian peninsula constitute one of the 34 global biodiversity hotspots along with Sri Lanka, contain large number of pteridophytes (Radhakrishna, 2001).

A list of narrowly distributed Asian pteridophyte taxa towards an assessment of globally threatened species is provided. Of the total 886 taxa (835 species and 51 infraspecific taxa) enumerated, 577 occur in Southeast Asia, 215 in East Asia and 101 in South Asia (Atsushi, *et.al.,* 2012).

The present Composition and distribution of Pteridophytes in G.Madugula Mandal of the Visakhapatnam District and maximum density was reported for the species *Selaginella involvense* and minimum density was recorded for the species *Cyathea gigantean* has been made by Rao and Lohitasyudu (2012).

Fern and fern allies were identified and classified by several characters such as on spore size, morphology, spore growth, venation, rhizome, habitat, and habit (Chandra, *et.al.,* 2008).

The total twelve thousand species of Pteridophytes occur in the world flora of which about more than 1,000 species classified into 70 families and 191 genera from India (Dixit, 1984).

Chowdhary (1973) noted an account of pteridophytes from Upper Gangetic plains, which include parts of Uttarakhand, plains o f Uttar Pradesh, Bihar and part of West Bengal.

Dixit and Kumar (2002) listed 487 species and 32 infra specific taxa belonging to 108 genera under 50 families. Eighteen species are endemic to Uttarakhand, out of these, 10 species and 2 varieties confined to Uttarakhand state and remaining six taxa also show their occurrence in other parts of India beside. About 57 species are relatively of rare occurrence found as endemic, rare and endangered due to other anthropogenic factors. 34 species of ferns and fern allies belonging to 25 genera and 20 families were recorded (Patil and Dongare, 2011). A total 134 ferns and fern allies have been reported from Central India, out of which 35 species are from Achanakmar-Amarkantak Biosphere Reserve (Shukla and Singh, 2009).

The Pteridophyta include over 12,000 species, many of which are ornamental species, medicinal species, species of an ethno-botanical importance with a role in habitat conservation etc. Medicinal value of pteridophytes is known to man is reported for more than 2000 years. The rare and economically important pteridophyte species should be treated as our natural heritage and this must properly conserved (Singha, *et al.,* 2013).

Some species of ferns and fern allies can be found in more than one vegetation type. Fourteen species such as *Huperzia squarrosa, Aglaomorpha coronans* and *Christella parasitica* can be found in both tropical rain forest and hill evergreen forest. *Lygodium salicifolium* can be found in tropical rain forest, grassland and secondary forest. It was found that three fern (*Dicranopteris linearis var. linearis, Lindsaea ensifolia* and *Pteridium aquilinum subsp. caudatum var. yarrabense*), and two fern ally (*Lycopodiella cernua and Selaginella siamensis*) species can be found in all forest types.

Mallayya, *et.al.,* (2014) studied describes the distribution of the Pteridophyte flora. Twenty-seven species pteridophytes were collected belongs to 22 genera and 16 families. Taxonomically Pteridaceae reported as dominant family with four genera and six species followed by Lomariopsidaceae was the codominent family represented by two species. Pteridophytes have wide distribution but habitat specificity. Ferns have worldwide distribution growing in all continents except Antarctica and most islands favouring moist temperate and tropical regions.

The phytosociological studies in the forest ecosystems can help botanists in better planning and management practices, identified indicator species for soil, climate, phisiography (Hosseini, *et.al.,* 2007).

Tuomisto, *et.al.,* (2003) have recently shown dispersal and distribution in spatial scale. Descriptive treatments considering ecological aspects of ferns and lycophytes have been organized geographically and by vegetation types and/or growth forms (Holttum, 1938; Tryon, 1964).

The classification of Fraser-Jenkins (2010a) has been used in the list, with some modifications according to more recent work. In general this is similar to that of Kramer and Green (1990) and Smith, *et.al.,* (2006).

Bearing in mind the observations made by Clausen (1938), Pichi-Sermolli (1954), Nishida (1959) and Wieffering (1964), on the nomenclature and description of the taxa and their distribution, and in pursuance of the scheme for bringing out an illustrated manual on the fern flora of India, we have had the occasion to re-examine all the specimens of this family of ferns deposited in various herbaria of the Botanical Survey of India. By considering Leptosporamgiate ferns as true ferns and the other three groups as fern allies, numerous classification schemes have been little consensus among them, A new classification by Smith, *et.al.,* 2006 is based on recent molecular systematic studies in addition to morphological characters.

Besides, they also contain unique phytochemicals, yet not found in higher plants (Shinozaki, *et.al.,* 2008). Pteridophytes are resistant to microbial infection which may be one of the crucial factors for their evolutionary success and the fact that they lasted for more than 350 million years (Sharma and Vyas, 1985).

Sushruta and Charaka (100 A.D.) mentioned medicinal uses of Marsilea minuta Linn. and Adiantum capillusveneris Linn. in their Samhitas (Chandra, 2000; Parihar, *et.al.,* 2004).

Pteridiphytes are have been effectively used in the different systems of medicines like Ayurvedic, Unani, Homeopathic and other systems of medicines. Chopra, *et.al.,* (1956), have included 44 species. Nadkami (1954) recorded 11 species and Nayar (1959) recorded 29 species of medicinal ferns and their allies from India.

Out of 1000 species of pteridophytes occurring in India, 170 species have been reported to be used as food, flavor dye, medicine, bio fertilizers, oil fiber and biogas production. The medicinal value of pteridophytes against bacteria, Fungi, Virus, Cancer rheumatism, diabetes,

inflammation, consultant, fertility, diuretic pesticides, hepatoprotective and sedative has been reported besides sugar, starch, proteins and amino acids ferns contain a variety of alkaloids , glycosides, flavonoids, terpenoids, sterols, phenols, sesquitorpens etc. as potential components used in various industries (Manickam and Iradayaraj, 1992).

The knowledge about the use of medicinal plants has been accrued through centuries and such plants are still valued even today, although synthetics, antibiotics etc. have attained greater prominence in modern medicine. It is however a fact that these synthetics and antibiotics although they often show miraculous and often instantaneous results, prove basinful in the long sun and that is why many synthetics and antibiotics have now gone out of use or suggested to be used under medicinal supervision, in the case of most medicinal plants, however no such cumulative derogatory effects has been recorded and many of the medicines obtained from plants are widely used (Parihar and bohra, 2003).

Pteridophytes are used medicinally from ancient time (Kumar and Kaushik 1999; Benjamin and Menickam, 2007).

In USA, Europe, South Africa, China and Canada, the ferns are used as medicines to cure diseases such as chest complaints, cancer, rheumatism, bowel disorder, ulcer, cough, fever and Alzheimer disease. In China alone, 401 kinds of pteridophytic medicines have been used for various ailments (Luo 1998; Zeng-fu, *et.al.,* 2005)

Karthik, *et.al.,* (2011) 30 species of medicinally important Pteridophytes belonging to 16 families distributed in 27 genera.

Kirtikar, *et.al.,* (1935) recorded 27 species of ferns having diverse medicinal uses. Chopra, *et.al.,* (1956) have published 44 species of pteridophytes having medicinal importance. Nayar (1959) recorded 29 medicinal ferns. May (1978) published a detailed review of the various uses of ferns and listed 105 medicinal ferns.

Traditional utilization of pteridophytes in the treatment of Women's health and beauty care practices by the tribal people of Achanakmar-Amarkantak Biosphere Reserve has been published from Central India. Latin names (Singh and Singh, 2013).

Conclusion

Present work would be helpful for developing database to undertake specific project based on conservation strategies. During the last many years, most of the botanical study done exploration in Govindgarh region has been focused on evolved plants and usually no detailed studies have been taken on pteridophytes. The work taken on pteridophytes in forest area of Govindgarh region is indeed concrete step to conserve, propagate, use and restore the ecosystem of the region. The study exploration also helpful to asses new species and assess the microlimatic and edaphic condition of the habitat. The study gives information on the diversity and distribution of Pteridophytic flora in Vindhyan region. Therefore, in the present study area of first time preliminary check list of pteridophytes in Govindgarh region, Rewa (M.P.).

References

Atsushi Ebihara, Christopher Roy Fraser-Jenkins, Barbara S. Parris, Xian-Chun Zhang, Yue-Hong Yang, Wen-Liang Chiou, Ho-Ming Chang, Stuart Lindsay, David Middleton, Masahiro Kato, Titien Ngatinem Praptosuwiryo, Victor B. Amoroso, Julie F. Barcelona, Rajapaksha Haddokara Gedara Ranil, Chan-Ho Park, Noriaki Murakami and Akihiko Hoya. 2012. Rare and Threatened Pteridophytes of Asia 1. An Enumeration of Narrowly Distributed Taxa; Bull. Natl. Mus. Nat. Sci., Ser. B, 38(3): 93-119.

Barrington, D. 1993. Ecological and historical factors in fern biogeography. J. Biogeography 20: 275-280.

Benjamin, A. and Manickam, V. S. 2007. Medicinal pteridophytes from the Western Ghats, Indian J. Traditional Knowledge, 6(4)10: 611-618.

Benniamin, A., Irudayaraj., V. and Manickam, V. S. 2008. How to identify rare and endangered ferns and fern allies. Ethnobotanical Leaflets 12: 108-117.

Chandra, S., Fraser-Jenkins, C. R., Kumari, A. and Srivastava, A. 2008. A summary of the status of threatened Pteridophytes of India. Taiwania 53: 170-209.

Chandra, S. 2000. The Ferns of India (Enumeration, Synonyms and Distribution). International Book Distributors, Dehra Dun, India.

Chopra, R. N., Nayar, S. L. and Chopra, L. C. 1956. Glossary of Indian Medicinal Plants. CSIR. New Delhi.

Chowdhary, N. P. 1973. The Pteridophytic flora of the Upper Gangetic Plain. Navyug Traders, New Delhi.

Clausen, R. T. 1938. A monograph of the Ophioglossaceae. Mem. Torrey hot. Club, 19 (2): 177.

Deepa, J., Parashurama, T. R., Krishnappa, M. and Nataraja, S. 2011. Enumeration of Pteridophytes in Madhuguni Forest , Central Western Ghats, Karnataka, South India, Indian Fern J, 28: 112-119.

Dixit, R. D. 2000. Conspectus of Pteridophytic diversity in India. Indian Fern J. 17: 77-91.

Dixit, R. D. 1984. A Census of the Indian Pteridophytes. Flora of India, Series- 4, Botanical Survey of India, Howrah (Calcutta), India 1-177.

Dixit, R. D. 1975. Ferns much- neglected group of medicinal plants I, J Res. Ind. Med., 10, 1975, 74-90.

Dixit, R. D. and Kumar, R. 2002. Pteridophytes of Uttaranchal- A check list. Bishen Singh Mahendra Pal Singh, Dehradun.

Edward, K. K. and Michael, R. M. 2000. Evidence For Natural Selection In A Fern Hybrid Zone, American J. Botany 87(8): 1168-1174.

Fraser-Jenkins, C. R. 2010a. A brief comparison of modern Pteridophyte classifications (families and genera in India). Indian Fern J. 26: 107-131.

Gilbert, B. and M. J. Lechowicz. 2004. Neutrality, niches, and dispersal in a temperate forest understory. Proceedings of the National Academy of Sciences, USA 101:7651-7656.

Holm, L. G., Pancho, J. V., Herberger, J. P. and D. L. Plucknett. 1979. A Geographical Atlas of World Weeds. Wiley, New York. pp. 391.

Holttum, R. E. 1938. The ecology of tropical pteridophytes. In Manual of Pteridology, ed. F. Verdoorn. The Hague: M. Nijhoff, pp. 420-450.

Hosseini, Seyed Mohsen, Einollah Rouhi Moghaddam, Moslem Akbarinia, Seyed Gholam Ali Jalali. 2007. Phytosociological Study of Ferns in the Central Caspian Forests of Iran, Ekoloji, 16, 64, 74-8.

Juli, G. P. and Llorenc, S. 2000. Pteridophyte richness in the NE Iberian Peninsula: biogeographic; Plant Ecology 148: 195-205, Patterns.

Karthik, V., Raju, K., Ayyanar, M., Gowrishankar, K. and T. Sekar . 2011. Ethnomedicinal Uses of Pteridophytes in Kolli Hills, Eastern Ghats of Tamil Nadu, India; J. Nat. Prod. Plant Resour., 2011, 1 (2): 50-55; ISSN : 2231-3184.

Kirtikar, K.R., Basu, B.O. and An I.C.S. 1935. Indian medicinal plants. 4 vols. (2nd ed.), Bishen Singh Mahendra Pal Singh, Dehra Dun.

Kramer, K. U. & Green, P. S. 1990. Pteridophytes and Gymnospermes. In: Kubitzki, K. (ed.). The Families and Genera of Vascular Plants, vol. 1. pp 404 Springer-Verlag, Berlin.

Kumar A. and Kaushik P. 1999. Antibacterial effect of Adiantum capillaris veneris Linn. Indian Fern J., 16:72-74.

Luo, G.H. 1988. Medicinal pteridophytes in China, pp. 309-312. In Singh, K.H. & K.C. Kramer (eds.). Proceedings of the International symposium on systematic pteridology China Science and Technology Press, Beijing, China.

Ma, L. Q., Komar, K. M., Tu, C., Zhang, W. H., Cai, Y., Kennelley, E. D. 2001. A fern that hyperaccumulates arsenic: a hardy, versatile, fast-growing plant helps to remove arsenic from contaminated soils. Nature. 409: 579-579.

Mallayya, B. K., Deepa, J. and Parashurama, T. R. 2014. Pteridophytic survey in forest region of Sirsi taluk, Uttara Kannada district, South India. Int. J. Curr. Microbiol. App. Sci. 3(1): 38-44.

Manickam, V. S. and Irudayaraj, V. 1992. Pteridophytes flora of the Western Ghats- South India, BI., Publications, New Delhi Theuerkauf, W.D. Preserving south Indian Pteridophytes. J. Archives. 2(3): 4-8.

Marquez, A. L., Real, R., Vargas, J. M. and Salvo, A. E. 1997. On identifying common distribution patterns and their causal factors: a probabilistic method applied to pteridophytes in the Iberian Peninsula. J. Biogeography. 24:613-631.

May, L. W. 1978. The economic uses and associated folklore of ferns and fern allies, Bot. Rev. 44: 491-528.

Murty, P. Prayaga; D. Srinivasa Rao, S V.V.S. N. Dora, G. M. Narasinha Rao. 2011. Diversity and Distribution of Pteridophytic flora of Punyagiri hill, Vizianagaram District, Andhra Pradesh, India; Current Botany 2(7): 01-04.

Nadkami, B. K. 1954. Indian Materia Medica with Ayurvedic. Unantibii. Siddha. Allopathic. Homeopathic. Naturopathic and home remedies. Popular Book Depot. Bombay.

Nayar, B. K. 1959. Medicinal ferns of India. Bulletin of National Botanical Garden. Lucknow. India. 29: 1-36.

Nishida, M. 1959. Studies on systematic position and constitution of Pteridophyta No. 11.Ophioglossales, with special reference to Japanese species. Bull. Nat. Sci. Mus., 4 (3),325-335.

Parihar, P. and Bohra, A. 2003. Antibacterial activity of Cyclosorus dentatus against various human pathogenic organisms, Eco-research J Bio-Sci, 2(1), 61-64.

Parihar, P. and Bohra, A. 2002. Screening of some ferns for their antimicrobial activity against Salmonella typhi. Adv Plant Sci. 15:365-368.

Parihar, P., Parihar, L. and Bohra, A. 2004. Antifungal activity of Cheilanthes albomarginata Clarke and Marsilea minuta Linn. Against Aspergillus flavus, Indian Fern J,21, 140-143.

Parihar, P. and Parihar, L. 2006. Some pteridophytes of medicinal importance from Rajasthan, Natural Product Radiance 5(4). 297-301.

Patil, Satish, and Meena, D. 2011. Pteridophytes of Chandgad Forest of Kolhapur District (Maharashtra) Indian Streams Res. J. 1(5): Botany; ISSN:-2230-7850.

Pichi-Sermolli, R. E. G. 1954. Adumbratio Florae Aethiopicae. 3.Ophioglossaceae, Osmundaceae, Schizaeaceae. Webbia, 9, 623-660.

Qinfeng, G., Masahiro, K. and Robert E. R. 2003. Life history, diversity and distribution: a study of Japanese pteridophytes; ECOGRAPHY 26: 129-138.

Radhakrishna, B. P. 2001. The Western Ghats of the Indian peninsula. Memoir Geological Society of India 47: 133-144.

Rajagopal and Bhat. 1998. Pteridophytic flora of Karnataka State- 1998.

Ramachandra, T. V., Subash Chandran, M. D., Harish. R. B., Rao, G. R., Sumesh, D., Vishnu M. and Boominathan, M. 2010. Biodiversity, Ecology and Socio-Economic Aspects of Gundia River Basin in the context of proposed Mega Hydro Electric Power Project, CES Technical Report 122, CES. IISc, Bangalore.

Rao, Narasimha, G. M. and Lohitasyudu, K. 2012. Distribution And Species Abundance of Pteridophytic Flora of G.Madugula Mandal, Visakhapatnam District, Andhra Pradesh, India, Ijbpas, June, 2012, 1(5): 730-736.

Shaikh, S. D. and Dongare, M. 2009. The influence of microclimatic conditions on the diversity and richness of some ferns from the North-Western Ghats of Maharashtra. Indian Fern J. 26, 128-131.

Sharma, B. D. and Vyas, M. S. 1985. Ethanobotanical studies on the fern and fern allies of Rajasthan. Bull of Bot Survey of India. 27:90-91.

Sharma, B. D. 1988. Tracheary elements in pteridophytes. Bionature 8:113-134.

Shinozaki, J., Shibuya, M., Masuda, K. and Ebizuka, Y. 2008. Squalene cyclase and oxidosqualene cyclase from a fern. FEBS Lett. 582:310-318.

Shukla, A. N. and Singh, K. P. 2009. Pteridophytic flora of Achanakmar-Amarkantak Biosphere Reserve. Central India. Indian Forester. :135(2):270-280.

Singh, S. and Singh, R. 2012. Ethnomedicinal Use Of Pteridophytes In Reproductive Health Of Tribal Women Of Pachmarlii Biosphere Reserve. Madhya Pradesh. India. LTPSR. 2012; 3(12): 4780-4790.

Singh, A. P., Vineet, K. R., Sandip, K. B. and Prem, B. K. 2010. Perspectives of Pteridophytes Biodiversity: A Source of Economy Elevation, National Conference on Biodiversity, Development and Poverty Alleviation, Pteridology Laboratory, National Botanical Research Institute, Lucknow 226001.

Singh, B. S., Singh, S., Singh, L., Ali, and Ritu, M. 2010. Ethnobotanical Significance And Antimicrobial Activity Of Blumea Lacera (Roxb.) Dc; Int. J. Pharmaceutical & Biological Archives. 1(3):314-316.

Singha, K. B., Dutta, C. M. and Mazumder, P. B. 2013. In Vitro Propagation in Pteridophytes: A Review; Int. J. Res. Ayurveda Pharm. 4(2).

Smith, A. R., Pryer, K. M., Schuettpelz, E., Korall, P., Schneider, H. and Wolf, P. G. 2006. A classification for extant ferns. Taxon 55: 705-731.

Soare, L. C., Dobrescu, C.Mihaela., Popescu, A. G. 2013. The Influence Of A Copper-Containing Funcicide On The Gametophyte Of Some Non-Target Pteridophyte Species; Acta Horti Bot. Bucurest. , 40: 49-56; DOI: 10.2478/ahbb--0006.

Tryon, R. M. 1964. Evolution in the leaf of living ferns. Bulletin of the Torrey Botanical Club, 21, 73-85.

Tuomisto, H., Ruokolainen, K. and Yli-Halla, M. 2003. Dispersal, environment and floristic variation of western Amazon forests. Science 299:241-244.

Verma, S. C. and Khullar S. P. 2010. Book Review on Fern Ecology, Indian Fern J. 27(1-2): 383-387.

Wallace, R. A., Sander, G. P. and Ferl, R. J. 1991. Biology: the science of life. New York: Harper Collins, pp. 547-555.

Wieffering, J. H. 1964. A preliminary revision of the Indo-Pacific species of Ophioglossum (Ophioglossaceae). Blumea, 12, 321-337.

Zhang, G., Zhang, X. and Cen, Z. 2005. Phylogeny of cryptogrammoid ferns and related taxa based on rbcL sequences. Nordic J. Botany. 23: 485-493.