

Ferns and Fern Allies of Papikondalu Hills of Eastern Ghats of Andhra Pradesh

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Abstract: *Pteridophytes are a group of vascular cryptogams which constitute ferns and fern allies. Papikondalu hills of Eastern Ghats are distributed in three districts of Andhra Pradesh namely East Godavari, West Godavari and Khammam. Ferns and fern allies of Papikondalu hills of Eastern Ghats are described in this paper.*

Pteridophytes constitute a significant and important group in the plant kingdom. As the first true land plants, they offer a very favourable material for the study of various adaptations that have made the colonization of land possible for the plants. The Pteridophyta are treated as vascular cryptogams as they have a well developed conducting system. The term Pteridophyta has a Greek origin. *Pteron* means a "feather" and the name was originally given to this group because of their pinnate or feather like fronds. Vascular cryptogams are, therefore, as assemblage of seedless vascular plants that have successfully invaded the land and reproduce by means of spores.

The Pteridophytes formed a dominant part of earth's vegetation in the historic past (Two hundred eighty to two hundred thirty million years ago). In the present day flora, excluding the non-vascular plants, they rank only next to the spermatophytes. Although they have been largely replaced by the spermatophytes in the modern day flora, yet they occupy an important and a crucial central position in the evolutionary history of the plant kingdom. No doubt lesser in number, the pteridophytes lend a distinct charm and physiognomy to the landscape. The elegant tree ferns of the warm humid forests of eastern Himalayas, Pachmahri and Nilgiri hills, the epiphytic ferns and the hanging club-mosses of the tropical forests attract ones attention. The lithophytic and terrestrial forms that grow in comparatively larger numbers are also a source of great attraction because of their beautiful foliage. Some of them (about a dozen species) grow in water and form a luxuriant hydrophytic component of the lakes (*Salvinia*), ponds and pools (*Azolla*, *Marsilea*).

Plants have been used both in the prevention and cure of various diseases of humans and their pets. With the advent of human civilization, many systems of therapy have been developed primarily based on plants. Ayurveda, Homeopathy, Sidda, Unani, etc. are our traditional systems of medicines. The plant-based traditional medical systems continue to provide the *primary health care* to more than three-quarters of the world's populace. The World Health Organization has estimated that over 80% of the global population rely chiefly on traditional medicine (Akerle 1992).

The evolution of plant kingdom took place long before the birth of human beings on this earth. The contact of man with plants perhaps was the key point to his development which

enabled him to surpass all the intelligentsia existing on this planet. Thus the human culture has directly or indirectly been influenced by plants. Ethnobotany tries to give a critical understanding of the mode and scope of this influence (Pullaiah, 2003).

Pteridophytes are the seedless vascular cryptogams which occupy a position between the lower non-seed bearing and higher seed bearing plants from generally much neglected group of plants. About 250 million years ago, they constituted the dominant vegetation on earth surface. However, they are now replaced by seed bearing plants in the modern day flora. Pteridophytes grow luxuriantly in moist tropical and temperate forests and their occurrence in different eco-geographically threatened regions from sea level to the highest mountain are of much interest. About 12,000 species of Pteridophytes occur in the world flora of which about more than 1,000 species into 70 families and 191 genera likely to occur in India (Dixit, 1984). Recent studies show that roughly 270 fern species are found in south India.

Enough attention has not been paid towards harnessing the potentialities of pteridophytes towards human welfare. Since a long time pteridophytes have remained the exclusive domain of academicians, rarely heard outside the academic world.

Eastern Ghats are a discontinuous range of mountains along India's eastern coast. The Eastern Ghats run from West Bengal state in the north, through Orissa and Andhra Pradesh to Tamil Nadu in the south passing some parts of Karnataka. They are eroded and cut through by the four major rivers of southern India, the Godavari, Mahanadi, Krishna, and Kaveri. The mountain ranges run parallel to the Bay of Bengal. Its northern boundary is marked by river Mahanadi basin while the southern boundary is the Cauvery and Tamil Nadu uplands and passes through Visakhapatnam, Vijayanagaram, Srikakulam, East Godavari, West Godavari, Khammam, Krishna, Guntur, Mahaboobnagar, Prakasam, Kurnool, Kadapa, Nellore and Chittoor districts. The altitudes range from 300-1600 m above MSL. The Ghats are one of the floristically richest mountains.

In the northern portion, the Ghats are highly dissected and intervened by a number of valleys. The Papikondalu range in the north joins with Simhachalam hill range (pullaiah *et al.*,

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2003). Papikondalu hills of Eastern ghats covers the three districts of Andhra Pradesh namely Khammam, East Godavari and West Godavari. The entire area of Papikondalu is covered by tropical semi evergreen forests.

The original name for this hill range was 'Papidi Kondalu'. Papidi is a rough translation for partition in Telugu. Since this range looks like a well designed partition that splits river Godavari, this name was coined. There is also another idea that the range looks like a partition of a typical Indian Woman's hair line. In due course, it settled for 'Papi Kondalu'.

Methodology

Intensive explorations have been carried out for pteridophytes in Andhra Pradesh. Several field trips were made to different localities in Papikondalu hill ranges. The main tribal people in this area are konda reddy and koyadora. The pteridophytes were collected with sori and rhizomes. The collected pteridophytes were poisoned by dipping in a saturated solution of mercuric chloride in ethyl alcohol. The ecology of the study area is noted. The distribution and abundance of the species were also recorded. The specimens were identified with the help of Floras. The collected specimens were deposited at the Department of Botany, Government Degree college, Tadipatri.

Results

The following areas were explored for pteridophytes: Rampachodavaram, Rampa hills, Maredumilli, Kondamodalu, Perantalapalli, Pamuleru, Dharawada, Satlavada, Dummakonda, Ellivada near Pamuleru, Tiger camp, Amruthadhara

Nidadavolu, Tekuru, Koruturu, Kakinada, Eluru. Khammam, Bhadrachalam, Valamuru, Palwancha.

Papikondalu hills of Eastern Ghats are inhabited by a variety of ferns and fern allies. These include Maiden-hair ferns (*Adiantum* species), Brake ferns (*Pteris* species), Climbing ferns (*Lygodium* species), Tree ferns (*Cyathea* species), Xerophytic ferns (*Actiniopteris radiata*), Lithophytic ferns (*Selaginella* species) Hardy ferns (*Blechnum orientale*) and water ferns (*Marsilea*, *Salvinia* and *Azolla* species). Brief descriptions have been given for these species.

1) *Adiantum caudatum* L.

Rhizome erect, densely covered by scales all over; scales lanceolate, dark brown at the centre, pale brown towards the margin, acuminate, entire. Stipes numerous, tufted, dark brown, rounded below, grooved above, densely covered by multicellular, uniseriate hairs all over; lamina oblong-lanceolate, simply pinnate; pinnae about 30 pairs, alternate, sessile, basal few pairs slightly reduced; largest pinna slightly dimidiate, lower half completely excised; veins slightly distinct above and below, dichotomously branched reaching the margin; pinnae pale green; texture herbaceous; rachis covered by long and short hairs all over. Sori marginal orbicular, indusiate, about 1mm in diameter.

2) *Adiantum incisum* Forssk.

Rhizome erect, covered by tuft of wiry roots and linear paleae which are lanceolate, acuminate, entire, uniformly thickened. Stipes long, thick, scaly at the vein base, densely hairy higher up, fronds simply pinnate, linear-lanceolate, distal non-leafy, apex rooting, base slightly narrower than middle part; pinnae shortly petiolate, lower edge straight, upper margin descending towards the apex; lobes serrate; texture herbaceous; pinnae bearing moderately dense appressed hairs below, sparse hairs above, veins distinct below, less distinct above. Sori linear, borne on the under surface of the reflexed flaps of lobes.

3) *Adiantum lunulatum* Burm.

Rhizome suberect, scales ovate-lanceolate, apex acuminate, margin entire, pale brown. Stipes tufted, wiry, dark brown, scaly at the basal most part, glabrous above. Lamina lanceolate, simply pinnate; pinnae upto 10 pairs, alternate, stalked, pinnae fan-shaped, dimidiate, the lower edge nearly in line or oblique with the petiole, upper edge rounded, lobed, acroscopic base truncate, margin entire; veins dichotomously flabellately branched, free, reaching the margin; pinnae pale green, glabrous above and below; texture herbaceous. Sori continuous along the edge of the lobe, crescent-shaped.



4) *Actiniopteris radiata* (Sw.) Link.

Rhizome suberect, hard, densely covered by scales; scales lanceolate, acuminate, entire. Stipes numerous, tufted, pale brown at the base, pale green above; laminae flabellate, repeatedly, dichotomously divided into six times; segments rachiform, upto 1mm wide, apex acute, margin entire; veins obscure in mature fronds, slightly distinct in younger ones, sub parallel; costa and veins indistinct; lamina pale green; texture coriaceous; pale brown scales distributed densely in younger-laminae, sparsely in older ones especially at the basal most part. Sporangia borne in intramarginal grooves throughout, protected by the reflexed margin of the segments.

5) *Cyathea gigantea* (Wall. ex Hook.) Holttum.

Trunk about 10 cm in diameter, about a meter high with persistent swollen bases of stipes, bearing crown of fronds at the apex; trunk densely covered by scales; scales oblong, lanceolate uniformly dark brown, glossy, acuminate, entire. Stipes tufted, brown, glossy, densely scaly at the swollen base. Lamina bipinnate, deltoid, primary pinnae about 12 pairs, spreading, alternate, distinctly stalked, oblong lanceolate, apex acuminate, base truncate; secondary pinnae about 25 pairs, catadromous, spreading, alternate, about 2 cm apart, shortly stalked, oblong-lanceolate, apex acuminate, base truncate, margin usually lobed, crenate, lobes about 10 pairs, oblong or broadly deltoid, apex rounded; lamina with pale brown, soft, acicular hairs densely

distributed on the adaxial side of the secondary rachis. Sori exindusiate medianly superficial on each ultimate veinlet, forming an inverted 'V' on each lobe.

6) *Cyathea spinulosa* Wall. ex Hook.

Rhizome trunk like, 10-20 cm thick, covered with a thick mat of clinging roots and persistent leaf bases and the younger regions covered with dark brown paleae, Fronds crowded with stipes, dark brown, shining, muricate, shallowly grooved on the abaxial side, lamina ovate-oblong, 2-pinnate-3-pinnatifid with the rachis similar to stipe, bearing 10 pairs of primary pinnae of which the larger ones are ovate-oblong, secondary pinnae 20-25 pairs per primary pinna, narrowly oblong, subsessile and the margin pinnatisect into oblong, subfalcate subsessile lobes with sharply toothed margin having a narrow thickened revolute cartilaginous edge, secondary rachis spinulose below, muricate; lamina thin and herbaceous. Sori restricted to lateral veinlets in basal half of the lobes protected by an urn-shaped indusium.



Cyathea spinulosa

7) *Hemionitis arifolia* (Burm.) Moore

Rhizome erect or suberect, unbranched; scales lanceolate, acuminate, entire, gland-tipped, dark brown. Stipes tufted, dark, glossy with short scales at base, long, deciduous scales and multiseriate spreading hairs higher up. Lamina dimorphous, simple; sterile fronds deeply cordate, margin entire, apex rounded; fertile lamina sagittate, apex obtuse or acute, base forming an inverted 'V'; texture coriaceous; sori continuous along the veins, filling the entire surface of lamina when mature, intermixed with copious hairs and scales.

8) *Pityrogramma calomelanos* (L.) Link

Rhizome erect, densely scaly at the apex; scales lanceolate, dark brown, apex acuminate, margin entire; stipes tufted, dark brown, scaly at the very base, glabrous and glossy above, abaxially rounded, adaxially grooved. Lamina obovate, bipinnate, apex acuminate, base broadly cuneate; pinnae about 20 pairs, progressively reduced towards apex, alternate, shortly stalked, ovate-lanceolate, apex acuminate, base truncate; pinnules about 20 pairs, ovate, adnate with the costa, apex acute, margin entire; pinnae dark green, glabrous and glossy above, covered by silvery farina below. Sori along veins, covered by entire surface when mature.



9) *Lygodium microphyllum* (Cav.) R. Br.

Climber, rhizome long creeping, covered by dark hairs. Stipe and rachis brown, glabrous. Primary branches up to 10 cm apart, bearing a dormant apex with dense short hairs, a pair of secondary branches borne sub apically, secondary rachis branches pinnate; oblong, geniculate, with a terminal pinnule similar to the lateral ones; lateral pinnules upto four pairs, alternate, cordate, margin finely crenate in sterile pinnules, apex rounded; veins flabellately branched, distinct on both the surfaces, free, reaching the margin; pinnules pale green, glabrous above and below. Sporangia borne on the surfaces of the finger like lobes all round the margin of the pinnules except at the cordate base.

10) *Selaginella involvens* (Sw.) Spring

Stem erect, rooting at base only, terete, quadripinnate; lateral branches about 3 pairs, alternate, ascending, lanceolate with secondary and tertiary branches. Leaves on main stem uniform, scattered, appressed, ovate, acute, entire. Cones terminal on ultimate branches, quadrangular; sporophylls uniform, ovate.



11) *Blechnum orientale* L.

Stock erect, apex covered by dense long scales. Stipes tufted, erect, densely towards base and apex, paleaceous at base but glabrous when mature, green when young. Laminae pinnate, ovate (when young), elliptic-lanceolate (when mature), slightly narrowing terminated by a lobed, acuminate pinna smaller than the lateral ones; lateral pinnae about 30 pairs, sub-opposite, about 0.6 cm apart, sessile, basiscopically adnate, lanceolate, cuneate at base; pinnae glossy, pale green when young. Sori continuous along the costule, except towards the base and apex, covering the costule when mature.



12) *Marsilea minuta* L.

Rhizome long creeping, branched, subterranean, green in aquatic plants, dark brown in terrestrials, covered by soft slender hairs all over the plant parts; stipes scattered, usually

green, glabrous. Leaves quadrifoliate, leaflets sessile, arranged at the tip of the stipe in clover leaf model, obovate, base cuneate, lateral margin above and below, flabellately branched; leaves dark green, glabrous with few hairs; texture thin, soft, herbaceous. 2-4 sporocarps in each cluster; sporocarps adnate to the peduncle laterally and perpendicularly.

13) *Salvinia molesta* Mitch.,

Aquatic free floating plants; stem spongy with nodes and internodes, bearing submerged leaf which is modified into root-like organ covered by brown, septate hairs. Normal leaves borne at the nodes in two opposite pairs, erect, floating, sessile, oblong, entire, pale green, lower surface glabrous, upper surface with dense hairs borne on the interveinal areas, erect with a common stalk, branched into four septate branches; veins anastomose; normal leaves spongy, sporocarps in clusters on submerged leaves.

14) *Azolla pinnata* R. Br.

Free floating aquatic plants, very small; stem horizontal, branched profusely, zig-zag, roots densely covered by about 1mm long hairs. Leaves alternate, arise from the dorsal lobe, aerial, more or less rectangular, sessile, margin entire with a narrow transparent membranaceous border, grey – green, thick, upper surface of the aerial lobe with whitish trichomes; veins indistinct; ventral lobes submerged, broadly ovate, base cuneate, margin entire; microsporocarps globose, megasporocarps smaller than the microsporocarp, ovate.

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