Results

CHAPTER - V

5.1 *Taxonomic diversity analysis:*

Since 2013, exclusive and extensive fieldworks were carried out for the collection of pteridophytes and gymnosperms to document the diversity and species richness in different areas of the Gujarat state. This survey, collection, identification and documentation study revealed that the state of Gujarat has a great variety of pteridophytes diversity due to its diverse geographical position and agro-climatic zones. These groups of plants constitute an obvious component in the flora of the entire state and flourish during the rainy season and are at their best from June to October.

The present study resulted in the collection and identification of 47 taxa (6 lycophytes and 41 ferns) belonging to the broader category in the pteridophytes, 21 genera under 13 families in the wild from the state. There are 15 species under 10 genera belonging to 9 families were under cultivation in botanical garden and arboretum. Hence, a total of 62 taxa belonging to 28 genera under 18 families which includes wild and ornamental species of pteridophytes in the state were documented.

On the other side, two species of gymnosperms belonging to one genus (*i.e. Ephedra*) and one family were documented in the wild from the state. Eleven species under 8 genera belonging to 6 families were documented as ornamental or exotic species of gymnosperms cultivated in the botanical gardens and arboretum of the state due to their aesthetic value. Therefore, a total of 13 taxa belonging to 9 genera under 7 families which include wild and cultivated species of gymnosperms in the state are documented. All the biotypes, morphotypes, synonymy and ecologically variable species were merged to the universally accepted taxon.

In the present study, PPG-I (2016) classification was followed for the pteridophytes, which includes two extensive classes *i.e.* Lycopodiopsida and Polypodiopsida which are commonly known as lycophytes and ferns respectively. Lycophytes (Lycopodiopsida) comprises two families' *viz*., Isoetaceae and Selaginellaceae, and both encompassing the members that are mono-generic. Isoetaceae has two taxa, whereas, Selaginellaceae contains four taxa in the state. Ferns (Polypodiopsida) comprise a total of eleven families belonging to 19 genera and 41 species in the state.

Polypodiales is the most species-rich order in the state covering 6 families under 13 genera and 24 species, followed by Ophioglossales with single-family and single genus with 12 species. Afterwards, Selaginellales encompassing single genera and families with 4 taxa. Subsequently, Salviniales covers two families under three genera and species. Isoetales possesses single family, genus and two species. Equisetales and Schizaeales possess only one family belonging from one genus and one species (fig. 4).

All fern families, except Equisetaceae, Ophioglossaceae, Lygodiaceae, Marsileaceae, Athyriaceae, Thelypteridaceae, Hypodematiaceae and Tectariaceae represented with single genera in the study area. The fern families, Salviniaceae (*Azolla* and *Salvinia*) and Polypodiaceae (*Lepisorus* and *Microsorum*) are represented by two genera, whereas, Pteridaceae encompassing seven genera *viz*., *Ceratopteris, Actiniopteris, Anogramma*, *Pteris, Adiantum*, *Aleuritopteris* and *Cheilanthes*.

Pteridaceae is the most specious family, comprises 13 species under 7 genera, followed by Ophioglossaceae shows 12 taxa under a single genus. Thereafter, Athyriaceae shows 5 taxa under a single genus. Subsequently, Selaginellaceae is represented with 4 taxa under a single genus. Afterwards, Salviniaceae and Polypodiaceae encircle 2 species under 2 genera, while, Isoetaceae and Thelypteridaceae encompassing 2 species under a single genus. Equisetaceae, Lygodiaceae, Marsileaceae, Hypodematiaceae and Tectariaceae show single family with single taxa in each (fig. 5).

In diversity point of view, the richest genus in the term of a number of species is *Ophioglossum* (12 taxa) in the state, followed by *Athyrium* (5 taxa), *Selaginella* (4 taxa), *Aleuritopteris* (4 taxa), *Adiantum* (3 taxa), *Isoetes* (2 taxa), *Ceratopteris* (2 taxa) and *Thelypteris* (2 taxa). Only single species were encompassing genera *viz*., *Equisetum*, *Lygodium*, *Azolla*, *Salvinia*, *Marsilea*, *Actiniopteris*, *Anogramma*, *Pteris*, *Cheilanthes*, *Hypodematium*, *Tectaria*, *Lepisorus* and *Microsorum* (fig. 6).

Gujarat is divided into six bio-geographical zones *viz*., 1) Desert; 2) Semi-Arid; 3) the Western Ghats (Malabar Plains); 4) the Western Ghats (Western Mountains); 5) Deccan Peninsula and 6) Coasts [Anonymous 2021c]. The most pteridophyte species-rich bio-geographical zone of the state is Semi-Arid region represents total 41 species under 20 genera from 13 families. Thereafter, the Western Ghats (Malabar Plains) shows 30 species with 15 genera under 11 families and the Western Ghats (Western Mountains) encompassing 26 species under 13 genera with 9 families. Subsequently, 10 species represented by 7 genera under 5 families occurs in Desert. While, the least species are occurring in the Deccan Peninsula and Coastal areas of the state which shows, two taxa representing two genera and families (fig. 7).

Gujarat is divided into five regions *viz*., North, Central, South, Saurashtra and Kachchh. The most species-rich region of the state is central Gujarat, which encompassing 35 species belonging to 18 genera under 12 families. Thereafter, south Gujarat shows 32 species representing 16 genera under 11 families and Saurashtra encircle 24 species belonging to 12 genera under 8 families. Whereas, north Gujarat representing 18 species under 11 genera of 7 families. The least species-rich region is Kachchh, which shows distribution of 9 species representing 6 genera under 4 families (fig. 8).

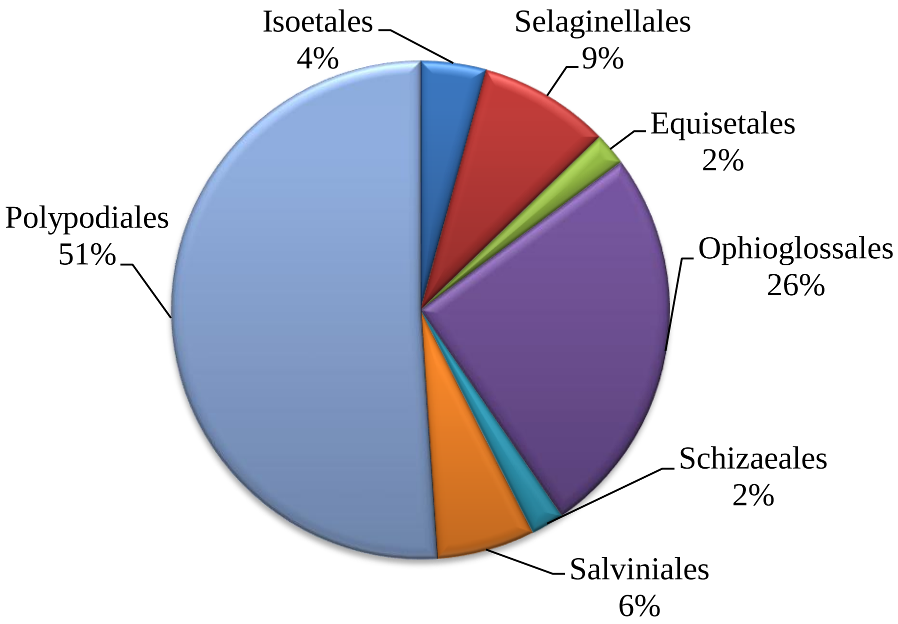


Figure 4: A pie chart showing distribution of species (in %) in various orders of lycophytes and ferns in the wild from Gujarat.

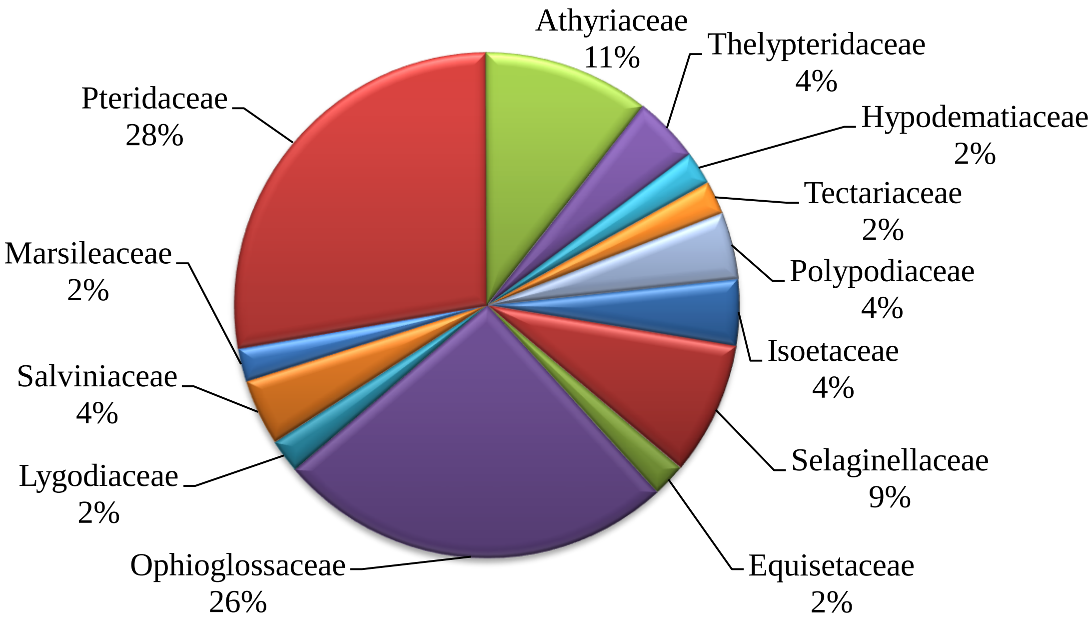


Figure 5: A pie chart showing distribution of species (in %) in various families of lycophytes and ferns in the wild from Gujarat.

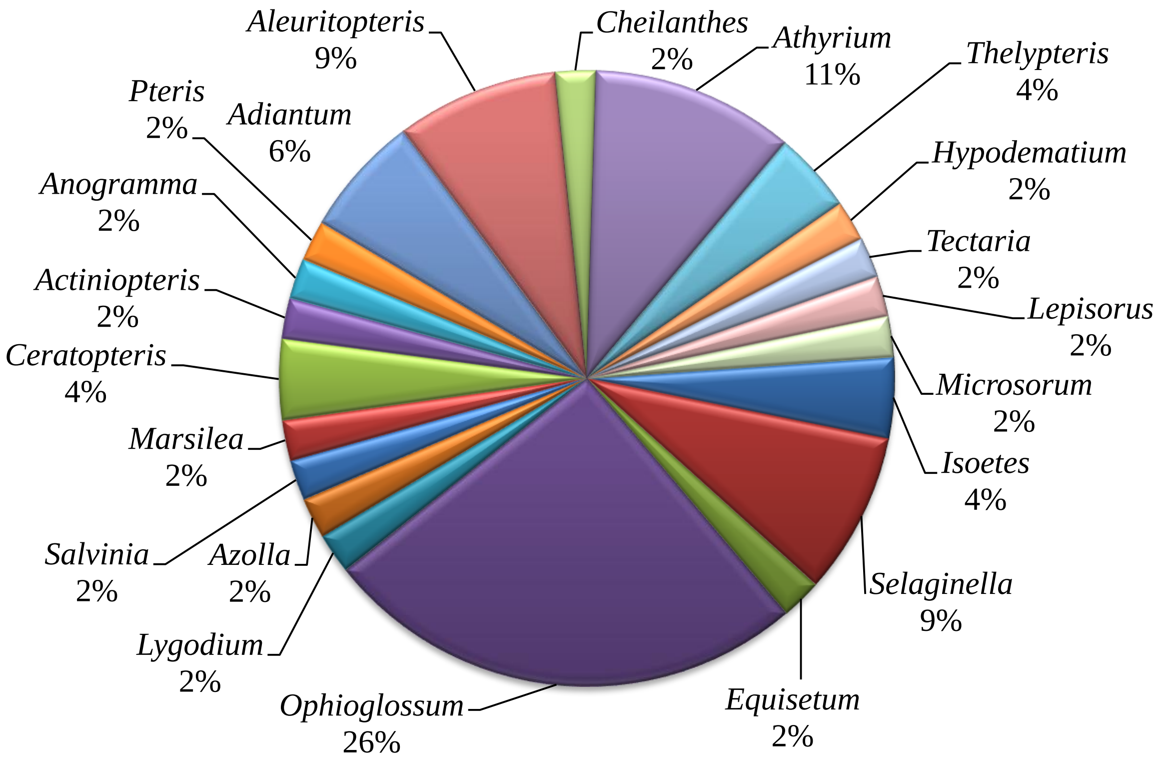


Figure 6: A pie chart showing distribution of species (in %) in various genera of lycophytes and ferns in the wild from Gujarat.

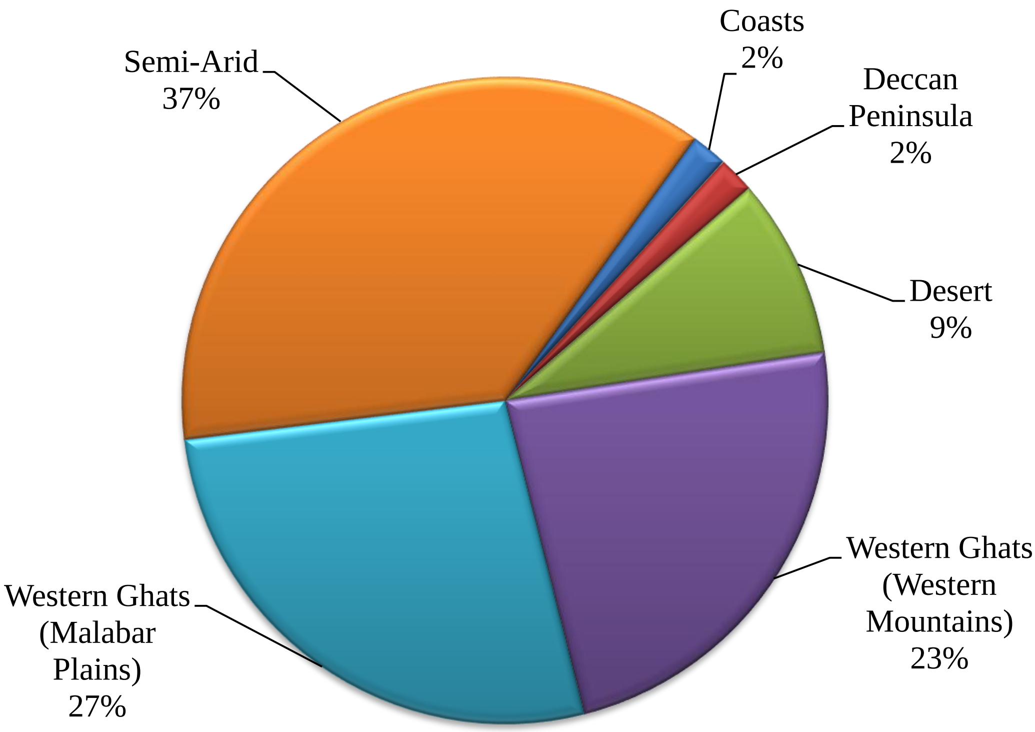


Figure 7: A pie chart showing distribution of pteridophyte species (in %) in various bio-geographic zones of Gujarat state.

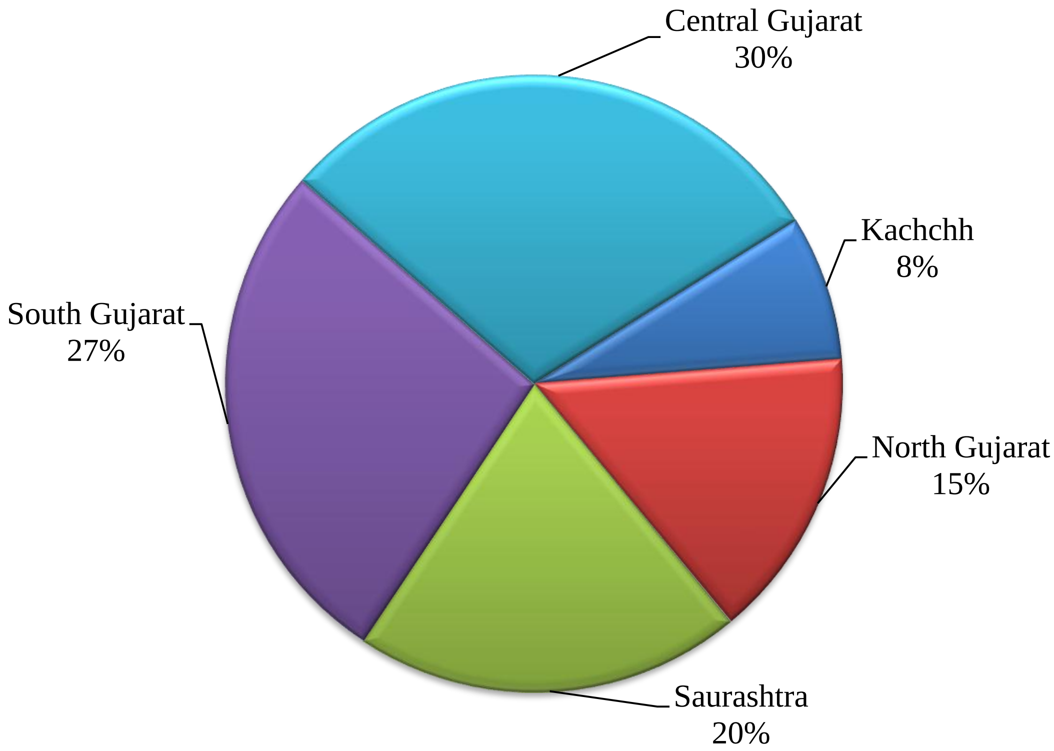


Figure 8: A pie chart showing distribution of pteridophyte species (in %) in various regions of Gujarat state.

Table 5: List of pteridophytes and gymnosperms occurring in wild and under cultivation in Gujarat state (* = Not seen in the field).

Class	**Order**	**Family**	**Genus**	**Taxa**
List of pteridophytes occurring in wild from Gujarat state				
Lycopodiopsida	Isoetales	Isoetaceae	*Isoetes*	*Isoetes coromandeliana* subsp. *coromandeliana*
				Isoetes coromandeliana subsp. *thanensis* S.K. Shukla, S.K. Singh, P.K. Shukla, N.K. Dubey, H. Khanam & G.K. Srivastava
	Selaginellales	Selaginellaceae	*Selaginella*	*Selaginella ciliaris* (Retz.) Spring
				Selaginella delicatula (Desv. ex Poir.) Alston
				Selaginella repanda (Desv. ex Poir.) Spring
				Selaginella reticulata (Hook & Grev.) Spring
Polypodiopsida	Equisetales	Equisetaceae	*Equisetum*	*Equisetum ramosissimum* Desf.
	Ophioglossales	Ophioglossaceae	*Ophioglossum*	**Ophioglossum aletum* Patel, Reddy & Goswami
				Ophioglossum costatum R. Br.
				Ophioglossum gramineum Willd.
				Ophioglossum gujaratense SM Patil, RN Kachhiyapatel, R Patel & KS Rajput
				**Ophioglossum hitkishorei* M. Patel & M. N. Reddy
				Ophioglossum indicum B. L. Yadav & H. K. Goswami

				Ophioglossum jaykrishnae S.M. Patil, S.K. Patel, Raole & K.S. Rajput
				Ophioglossum lancifolium C. Presl
				Ophioglossum lusitanicum L.
				**Ophioglossum malviae* Patel & Reddy
				Ophioglossum nudicaule L. f.
				Ophioglossum parvifolium Grev. & Hook
				Ophioglossum reticulatum L.
				Ophioglossum rubellum A. Braun
				Ophioglossum thermale Kom.
	Schizaeales	Lygodiaceae	*Lygodium*	*Lygodium flexuosum* (L.) Sw.
	Salviniales	Salviniaceae	*Azolla*	*Azolla pinnata* subsp. *asiatica* R.M.K. Saunders & K. Fowler
			Salvinia	*Salvinia molesta* D.S. Mitch.
		Marsileaceae	*Marsilea*	*Marsilea minuta* L.
	Polypodiales	Pteridaceae	*Ceratopteris*	*Ceratopteris thalictroides* (L.) Brongn. subsp. *thalictroides*
				Ceratopteris thalictroides (L.) Brogn. subsp. *gaudichaudii* (Brongn.) Fraser-Jenk. & Pariyar
			Actiniopteris	*Actiniopteris radiata* (Sw.) Link
			Anogramma	*Anogramma reichsteinii* Fraser-Jenk.

			Pteris	*Pteris vittata* L. subsp. *vittata*
			Adiantum	*Adiantum capillus-veneris* L.
				Adiantum incisum Forssk.
				Adiantum philippense L. subsp. *philippense*
			Aleuritopteris	*Aleuritopteris albomarginata* (C.B. Clarke) Ching
				Aleuritopteris anceps (Blanf.) Panigrahi
				Aleuritopteris bicolor (Roxb.) Fraser-Jenk.
				Aleuritopteris formosana (Hayata) Tagawa
			Cheilanthes	*Cheilanthes tenuifolia* (Burm. f.) Sw.
		Athyriaceae	*Athyrium*	*Athyrium falcatum* Bedd.
				Athyrium hohenackerianum T. Moore
				Athyrium micropterum Fraser-Jenk.
				Athyrium parasnathense (C.B. Clarke) Ching ex Mehra & Bir
				Athyrium schimperi subsp. *biserrulatum* (Christ) Fraser-Jenk.
		Thelypteridaceae	*Thelypteris*	*Thelypteris dentata* (Forssk.) E.P. St. John
				Thelypteris prolifera (Retz.) C.F. Reed
		Hypodematiaceae	*Hypodematium*	*Hypodematium crenatum* (Forssk.) Kuhn. subsp. *crenatum*
		Tectariaceae	*Tectaria*	*Tectaria coadunata* (J. Sm.) C. Chr.
		Polypodiaceae	*Lepisorus*	*Lepisorus nudus* L.

			Microsorum	*Microsorum membranaceum* (D. Don) Ching
List of gymnosperms occurring in wild from Gujarat state				
Gnetopsida	Ephedrales	Ephedraceae	*Ephedra*	*Ephedra foliata* Boiss. ex C.A. Mey.
				Ephedra karumanchiana S.K. Patel, S.M. Patil, R.S. Patel, R.N. Kachhiyapatel & K.S. Rajput
List of pteridophytes under cultivation in Gujarat state				
Polypodiopsida	Psilotales	Psilotaceae	*Psilotum*	*Psilotum nudum* (L.) P.Beauv.
	Marattiales	Marattiaceae	*Angiopteris*	*Angiopteris helferiana* C. Presl
	Polypodiales	Lindsaeaceae	*Lindsaea*	*Lindsaea ensifolia* Sw.
				Lindsaea heterophylla Dryand.
		Pteridaceae	*Adiantum*	*Adiantum peruvianum* Klotszch
		Blechnaceae	*Blechnum*	*Blechnum orientale* L.
		Athyriaceae	*Diplazium*	*Diplazium esculentum* (Retz.) Sw.
		Nephrolepidaceae	*Nephrolepis*	*Nephrolepis cordifolia* (L.) C.Presl
				Nephrolepis exaltata (L.) Schott
		Tectariaceae	*Tectaria*	*Tectaria fuscipes* (Wall. ex Bedd.) C.Chr.
				Tectaria paradoxa (Fee) Sledge
				Tectaria polymorpha (Wall. ex Hook.) Copel.
				Tectaria wightii (C.B.Clarke) Ching

		Polypodiaceae	*Leptochilus*	*Leptochilus decurrens* Blume
			Microsorum	*Microsorum scolopendria* (Burm.f.) Copel.
List of pteridophytes under cultivation in Gujarat state				
Cycadopsida	Araucariales	Araucariaceae	*Araucaria*	*Araucaria columnaris* (J.R. Forst.) Hook.
	Cupressales	Cupressaceae	*Juniperus*	*Juniperus bermudiana* L.
			Platycladus	*Platycladus orientalis* (L.) Franco
	Cycadales	Cycadaceae	*Cycas*	*Cycas circinalis* L.
				Cycas revoluta Thunb.
		Zamiaceae	*Zamia*	*Zamia furfuracea* Aiton
				Zamia pumila L.
				Zamia vazquezii D.W. Stev., Sabato & Moretti
			Dioon	*Dioon* sp.
	Pinales	Pinaceae	*Pinus*	*Pinus roxburghii* Sarg.
	Podocarpales	Podocarpaceae	*Podocarpus*	*Podocarpus* sp.

5.2 SYSTEMATIC TREATMENT OF PTERIDOPHYTE

5.2.1 Key to the Genera of pteridophyte

1 Leaves with single unbranched vein

2 Leaves spirally arranged or in 4 whorls, stems solid, not grooved

3 Plants aquatic or in ephemeral, leaves grass like, sporangia in leaf bases cavity, oval or elliptic……………………………………………………………………….**Isoetes**

3 Plants terrestrial, leaves blade dorsiventrally flattened, sporangia terminal, superficial, globose……………………………………………………….**Selaginella**

2 Leaves in whorls, 6-14, tubular sheaths at the nodes, stems hollow, longitudinally ridged……………………………………………………………………….**Equisetum**

1 Leaves complex, veins branched

4 Plants aquatic or semi-aquatic

5 Fronds dimorphic, homosporous……………………………………….**Ceratopteris**

5 Fronds monomorphic, heterosporous

6 Plants free floating on water, fronds sessile, not clover-like……………...**Marsilea**

6 Plants free floating on water, fronds sessile, not clover-like

7 True roots absent, leaves alternate, minute papillae on surface, sporocarp solitary or in pairs…………………………………………………………………**Azolla**

7 Roots present, leaves opposite, hairs in groups of 4 with fused bases, sporocarps in chain…………………………………………………………………**Salvinia**

4 Plants terrestrial, epipetric or epiphytic

8 Sporangia borne on erect spike-like structure, arranged in two alternate rows, arising from base of the trophophyll……………………………………...**Ophioglossum**

8 Sporangia borne on back side or the terminal portions of the blade, sometimes borne on part of modified blade

9 Rachis climbing, sporangia born in the strobilus, finger-like projections, subtended by an indusium…………………………………………………...…**Lygodium**

9 Rachis not climbing, indusia covering clusters of sporangia, sometimes absent

10 Fronds fan-shaped, semi-circular, pinnae linear…………...………**Actiniopteris**

10 Fronds not fan-shaped, simple, pinnate or palmate

11 Fronds <5 cm, persistent gametophyte at base………….……….**Anogramma**

11 Fronds >5 cm, without persistent gametophyte

12 Sporangia borne on marginal indusia, protected by reflexed margins.

13 Lamina 1 pinnate, pinnae linear, sporangia continuous along the reflexed margin…………………………………………………...……………**Pteris**

13 Lamina 2-3 pinnate, pinnae orbicular-flabellate or ovate, sporangia dis-continuous along the reflexed margin

14 Pinnae or pinnules without costule…………………...………**Adiantum**

14 Pinnae with costule

15 Lamina with white farina on underside………………......**Aleuritopteris**

15 Lamina with white farina on underside.................................**Cheilanthes**

12 Sporangia borne on under surface of the lamia tissues, indusia present or absent

16 Plants terrestrial or epipetric

17 Sori hooked over vein, horseshoe-shaped or liner......................**Athyrium**

17 Sori simple, orbicular or reniform

18 Fronds 1-2 pinnate, indusia simple……………………….....**Thelypteris**

18 Fronds 2-3 pinnate-pinnatifid, indusia reniform

19 Rhizome subterranean, scales reddish brown, indusia without hairs…………………………………………………………**Tectaria**

19 Rhizome above ground, densely covered with golden yellow scales, indusia with needle-like hairs………………………….**Hypodematium**

16 Plants epiphytic

20 Fronds coriaceous, linear to narrowly lanceolate, sori arranged in single row in either side of midrib…………………………………..**Lepisorus**

20 Fronds membranaceous, lanceolate, sori scattered………..…**Microsorum**

ISOETACEAE Dumort., Anal. Fam. Pl. 67. 1829 (*Isoetineae*)

Type**:** *Isoetes* L.

Monophyletic, 1 genus, *ca*. 250 species worldwide and *ca*. 4 species in India

Isoetes L., Sp. Pl. 2:1100. 1753

Lectotype**:** *Isoetes lacustris* L., designated by: Jonsell & Jarvis, Reg. Veg. 127:57. 1993.

Etymology: The genus *Isoetes* is derived from the Greek words *isos* ‘equal’ and *etos* ‘year’, a reference to the circumstance that some species remain unchanged throughout the year.

Common name: Quillwort; Isoete

Monophyletic, *ca*. 250 species worldwide, *ca*. 4 species in India

Key to the subspecies of Isoetes coromandelina

1 Plants *ca*. 50 cm height, microspores rugose..

....**I. coromandeliana subsp. coromandeliana**

1 Plant *ca*. 40 cm in height, microspore levigate…………………………………………..

....**I. coromandeliana subsp. thanensis**

Isoetes coromandeliana L. f., Suppl. PI. Syst. Veg. ed. 2:447. 1781; Pant & Srivatsava, Proc. Nat. Inst. Soc. India 23(3):251. 1962; Sledge, Bot. J. Linn. Soc. 84:8. 1982; Dixit & Vohra, Dict. Pterid. India 23. 1984; Dixit, Cens. Ind. Pterid. 18. 1984; Manickam & Irudayaraj, Pterid. FI. Western Ghats 43. Pl. 23. 1992; Shrivastava *et al*. Fern Gaz. 15(3):101-108. 1996. *Calamaria coromandelina* (L.f.) Kuntze, Revis. Gen. Pl. 2:828. 1891.

Type: Tamil Nadu, Coromandel coast, *J.G. Koenig*, 1774, LD1119241; ***Isotype***: BM.

Isoetes coromandeliana subsp. coromandeliana, Kim *et. al*., American Fern J. 100(1):46-48, 51. 2010; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:55. 2017.

Figure: 9, 10

Plants helophytic, submerged or emergent, herb, *ca*. 50 cm high; *rhizomorph* 3-lobed, subterranean, obconical to hemispherical, *ca*. 2 x 10 mm, fleshy, bearing *ca*. 6 cm long numerous fibrous roots; *leaves* 5-65 in number, 5-49 cm x 0.5-1 mm, erect to spreading, spirally arranged, liner, membranous or tufted, moderately firm in texture, dark green, glabrous, apex long acuminate, rounded, base broadly sheath like, dilated, flattened, copious stomata in upper region, peripheral strands present; *ligules* 2-4 x 1-3 mm, conspicuous, ovate-subtriangular, delicate, pointed when young; *velum* absent; *sporangia* 4-10 x 2-5 mm, born at the base of the leaves, apically connected with ligule, elliptic, heterosporangiate, whitish yellow when young, greyish at maturity; *megasporangia* 4-10 x 2-5 mm, circular to oval or elliptic, common, sporangial wall very thin, membranaceous, whitish yellow, many horizontal trabaculae on the inner surface; *megaspores* dimorphic, trilete, numerous, triradiate ridges simple, straight commissural ridge, larger ones 450-500 µm in diam., hemispherical-subglobose, tuberculate proximally and distally, tubercle ends rounded, grey when moist, white when dry, smaller ones 350-450 µm in diam, hemispherical, tuberculate; *microsporangia* similar to megasporangia, rare; *microspores* monolet, 20-35 µm in diam., surface smooth to rugose, brownish or paler at maturity, whitish when dry, greyish when wet.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: July-January

Distribution: World: Australia, Bangladesh, India, Myanmar, Nepal, Sri Lanka, Thailand, Vietnam; ***India***: Andhra Pradesh, Bihar, Chhattisgarh, Goa, Gujarat, Haryana, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Odisha, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal; ***Gujarat***: Sabarkantha, Panchmahal & Surendranagar.

Ecology: This species growing luxuriously in temporary pools, streams and ditches in seasonally wet, open grassland.

IUCN category: Least Concern (LC)

BOLD ID: MIPDG008-15

Specimen examined: INDIA, Gujarat, Vadodara Dt. (Bombay state), Baroda, 1953, *L.K. Gaekwad & Y.S. Deshmukh* (K 25028.000); Sabarkantha Dt., Talod, Ujediya, 23°20.05333'N 72°57.2033'E, 106m, 30.12.2014, *R.N. Kachhiyapatel & K.S. Rajput* 133 (BSJO 40974; BSI 140154; CNH!; BLAT!; BARO!); Maharashtra, Kasachiwadi, Choukul, 2069 ft., 17.9.2013, *A. Benniamin* 195231 (BSI 134132); Panchagani, 800m, 25.9.2013, *A. Benniamin* 195331 (BSI 134134, 134135).

Isoetes coromandeliana subsp. thanensis S.K. Shukla, S.K. Singh, P.K. Shukla, N.K. Dubey, H. Khanam & G.K. Srivastava, Taiwania 62(2):121. ***Figure*: 89 (A)**

Plants helophytic, submerged or emergent, herb, *ca*. 40 cm high; *rhizomorph* 3-lobed, subterranean, globose, tri-lobed, *ca*. 2 x 9 mm, fleshy, bearing *ca*. 5 cm long numerous fibrous roots; *leaves* 4-60 in number, 5-40 cm x 0.5-1 mm, spreading, spirally arranged, liner, membranous, dark green, apex long attenuate, base broadly sheath like, dilated, flattened, copious stomata in upper region, peripheral strands present; *ligules* 1-3 x 0.5-2 mm, cordate-triangular, delicate, apically serrate, basally broad; *velum* absent; *sporangia* 3-8 x 1-4 mm, born at the base of the leaves, embedded in leaf cavity, adaxially arranged, apically connected with ligule, elliptic, heterosporangiate; *megasporangia* 3-8 x 1-4 mm, elliptic, common, sporangial wall membranaceous, whitish yellow, many horizontal trabaculae on the inner surface; *megaspores* dimorphic, trilete, triradiate ridges simple, straight commissural ridge, larger ones 450-580 µm in diam., pyramidal-globose, postulate ornamentation, grey when wet, white when dry, smaller ones 250-400 µm in diam, hemispherical; *microsporangia* similar to megasporangia, rare; *microspores* monolet, 30-50 µm in diam., surface smooth, levigate ornamentation, brownish or paler at maturity, whitish when dry, greyish when wet.

Phenology: Annual; ***Sterile phase***: June-October; ***Fertile phase***: September

Distribution: World: India; ***India***: Gujarat; ***Gujarat***: Surendranagar.

Ecology: This species growing luxuriously in the natural pond on marshy places.

IUCN category: Data Deficient (DD)

Specimen examined: INDIA, Gujarat, Rajkot Dt., Than, Jamvali, Chotila-Thangadh Rd., 21.9.2018, *R.N* 8401 (CAL!); Surendranagar Dt., 22°32.1733'N 71°13.4266'E, 154m, *R.N. Kachhiyapatel & K.S. Rajput* 356-A (BARO!).

SELAGINELLACEAE Willk., Anleit. Stud. Bot. 2:163. 1854.

Type: *Selaginella* P. Beauv.

Monophyletic, 1 genus, *ca*. 700 species worldwide and *ca*. 55 species in India

Selaginella P. Beauv., Mag. Encycl. 9(5):478. 1804

Type: *Selaginella spinosa* P. Beauv.

Etymology: The genus *Selaginella* is derived from *Selago*, an ancient name for *Lycopodium*, a genus resembling *Selaginella* taken up by Linnaeus, and Latin '*-ella*' diminutive suffix.

Common name: Spikemoss; Dwarf Club moss.

Monophyletic, 6 or 7 subgenera, *ca*. 700 species worldwide and *ca*. 55 species in India

Key to the species of Selaginella

1 Strobilus dorsiventral

2 Rhizophores up to 2/3 lower part of main stem and branches, sporophylls margin long ciliolate..**S. ciliaris**

2 Rhizophores basally on main stem, sporophylls margin basally ciliolate, apically denticulate...**S. reticulata**

1 Strobilus terminal or erect

3 Plants procumbent, main stem base reddish, tufted.....................................**S. repanda**

3 Plants erect, main stem base green, membranaceous…………………........**S. delicatula**

Selaginella ciliaris (Retz.) Spring, Bull. Acad. Roy. Sci. Brux. 10(1):231 (sep. p. 31). no. 136. 1843; Alston, Proc. Nat. Inst. Sci. India 11:227. 1945; Panigrahi & Dixit, Proc. Nat. Inst. Sci. India. 34B(4):194. 1968; Bir & Vasudeva, Plant Sci. 5:74. 1973; Dixit, Cens. Indian Pterid. 12. 1984; Dixit, Selaginellaceae India. 79. fig. 41 A-G, PI. 40. 1992; Dixit & Sinha, Pterid. Andam. & Nico. Islands 34. 2001; Pande & Pande, Phytotax. 3:69. 2003; Ghosh *et al*. Pterid. Fl. East. India 3. 122. f. 42. 2004; Fraser-Jenkins, Revi. Three Hund. Ind. Subcont. Pterid., 13 and 523. 2008; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:31. 2017. *Lycopodium ciliare* Retz., Obs. Bot. 5:32. 1789; Sw., Syn. Fil. 188. 1806; Willd., Sp. PI. 5:46. 1810; Desv., Lam. Encyl. Suppl. 3:553. 1814; Hook. & Grev. In Hook. Bot. Misc. 1:402. 1831. ***Figure***: 11, 12

Type: Sri Lanka (Ceylon), *J.G. Koenig*, LD, K (K000009115).

Plants annual mesophytic herbs, 0.5-12 cm long, terrestrial, epilithic, short creeping rarely, rooting at base only, prostrate or ascending, glabrous, green; *rhizophores* 5-50 x 0.2-0.8 mm, cylindrical, slender, up to 2/3 lower part of erect branches or to middle of main stem of prostrate branches, on ventral side in axil of branches, branched profusely, whitish yellow; *main stems* 05.-11.5 cm x 0.2-1 mm, branched throughout in lower part, terete, erect-decumbent, cylindrical, glabrous, fertile, terminating into strobilus or leafy, pale green; *primary leafy branches* 2-5 cm long, 2-4 pairs, simple or forked or once pinnately branched, branched throughout; *branchlets* 0.5-2 cm, sparse, contiguous primary branches on main stem; *leaves* heteromorphic, distantly positioned on the main stem and compact on branches, single mid-vein reaching the apex, membranous, ciliolate, green; *lateral leaves* 2.5 x 1.6 mm, asymmetrical, membranous, obovate or ovate-oblong, oblique, midrib prominent, apex acute, base rounded, basiscopic margin sub-entire or denticulate to apex, acroscopic margin subentire, lateral leaves on branches spreading; *axillary leaves* 2 x 1 mm, elliptic-ovate, equally sided (bisymmetrically) or slightly asymmetrical, apex acute, base oblique, margins ciliolate in basal half, denticulate above, single mid-vein; *median leaves* 1.8 x 1 mm, symmetrical or asymmetrical, membranous, ovate, apex acute, base obtuse or rounded, margin ciliate; *strobili* 1-3 x 0.3-1 mm, dorsiventral, flattened, terminal, solitary, rarely branched, sessile, compact, megasporangia and microsporangia in the same strobilus; *sporophylls* dimorphic, membranaceous, dorsal sporophylls larger than ventral sporophylls; *dorsal sporophylls* 2.5-12 x 1-4 mm, symmetric, sterile, membranous, oblong-lanceolate, oblique, spreading, midrib prominent, apically denticulate margin, basally ciliolate, adaxial side pteryx incomplete (ending midway to apex), ciliolate; *ventral sporophylls* 1-7 x 0.8-3 mm, fertile, dimorphic, megasporophylls arranged in basal portion of strobilus, microsporophylls arranged apical portion of strobilus, symmetric, membranous, ovate-triangular, apex acuminate, base cordate, margin apically denticulate, basally ciliolate; *megaspores* 300 x 350 µm, 4 per sporangium, trilete, tetrahedral-subglobose, reticulate, rugose, white or pale yellow; *microspores* 30-40 x 30-37.5 µm, numerous, trilete, hemispherical, verrucate, orange or bright red.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: July-November

Distribution: World: Australia, Bangladesh, Bhutan, China, India, Indonesia, Malaysia, Myanmar, Nepal, New Guinea, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam; ***India***: Andaman & Nicobar, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Odisha, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand, West Bengal; ***Gujarat***: Banaskantha, Chhota Udaipur, Dahod, Junagadh, Narmada, Navsari, Panchmahal, Sabarkantha, Tapi, Dangs & Valsad (common throughtout state).

Ecology: This species is luxuriously growing on terrestrial moist clay at river banks in seasonally dry areas, or on soil, cliffs and rocks in moist forest.

IUCN category: Least Concern (LC)

Specimen examined: INDIA, Maharashtra, Dudhganga dam, 2069 ft., 19.9.2013, *A. Benniamin* 195235 (BSI 133913); Gujarat, Valsad Dt., Wilson hills, 20°30.8316'N 73°16.4433'E, 190m, 23.8.2014, *R.N. Kachhiyapatel & K.S. Rajput* 35 (BSJO 40976; BARO!); Dangs Dt., Baripada, 20°39.25830'N 73°40.95500'E, 381m, 5.10.2014, *R.N. Kachhiyapatel & K.S. Rajput* 69 (BSJO 40970; BSI 140173; CNH!; BLAT!).

Selaginella delicatula (Desv. ex Poir.) Alston, J. Bot. 70:282. 1932; & Proc. Nat. Inst. Sci. India 11(3):232. 1945; Panigrahi & Dixit, Journ. India Bot. Soc. 46:226. fig. 5. 1967; Dixit, Seleginellaceae India 65. fig. 29 A-G. PI. 29. 1992; Manickam & Irudayaraj, Pterid. FI. Western Ghats 40. PI. 20. 1992; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:32. 2017. *Lycopodium delicatulum* Desv. Ex Poiret, Lam. Encycl. Suppl. 5:554. 1814. ***Figure*: 13, 14**

Type: India, South India

Plants annual mesophytic herb, 5-20 cm long, terrestrial, rooting at base, erect-suberect, pale green; *rhizophores* 2-10 x 0.2-0.7 mm, slender, confined to base, rarely arising from middle of the main stem, branched, whitish yellow; *main stems* 5-19 cm x 0.3-2 mm, branched from lower part or middle upward, pinnately branched, erect-suberect, cylindrical, glabrous, fertile, terminating into strobilus or leafy, whitish yellow to pale green; *primary leafy branches* 3-6 cm long, 3-10 pairs, alternate, simple or once pinnately branched at basal pairs, secondary branches not forked, branched throughout; *branchlets* densely leafy, fertile; *leaves* dimorphic except strobilus, distally packed along main stem, scattered, contiguous along branches and branchlets, single mid-vein reaching the apex, membranous, pale green; *lateral leaves* 2-3 x 1-2 mm, symmetrical, membranous, slightly ascending, spreading, ovate, oblique, midrib prominent, apex acute, base rounded, margin entire, basiscopic margin rarely denticulate; *axillary leaves* 2-3 x 1-1.5 mm, symmetrical, membranous, ovate-lanceolate or ovate, axillary leaves on branches narrowly elliptic, base oblique, apex acute, base oblique, margins entire, single mid-vein; *median leaves* 1.5-2 x 0.5-1.2 mm, symmetrical, membranous, oblique, ovate-lanceolate, apex acuminate, base obtuse or round, margin entire; *strobili* erect, terminal, compact, solitary, rarely branched, sessile, quadriangular, megasporangia and microsporangia in the same strobilus, megasporangia toward base, microsporangia apically; *sporophylls* 1.5-2.2 x 0.8 x 1.5 mm, monomorphic, spiral, membranaceous, ovate or ovate-elliptic, margins entire, apex acuminate, base oblique; *megaspores* 320 x 380 µm, 4 per sporangium, trilete, tetrahedral, verrucose, yellow to pale brown; *microspores* 30-40 x 30-37.5 µm, numerous, trilete, hemispherical, verrucate, yellowish to brown.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: July-December

Distribution: ***World***: Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Laos, Malaysia, Myanmar, New Guinea, Papua New Guinea, Philippines, Taiwan, Thailand, Vietnam; ***India***: Andaman & Nicobar, Assam, Goa, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Mizoram, Nagaland, Tamil Nadu, Tripura, West Bengal; ***Gujarat***: Narmada, Dangs & Valsad.

Ecology: This species growing on terrestrial or epipetric on shaded trail cliffs.

IUCN category: Least Concern (LC)

Specimen examined: PHILIPPINES, Luzon Mt. Banajao, Luzon Province, 14°4’N 121°29’E, 5.3.1910, *C.B. Robinson* 9769 (K000888210); INDONESIA, Sulawesi Sopu Valley, 1°16’S 120°16’E, 29.4.1979, *Hennipman E.* 5106A (K000429696); INDIA, Maharashtra, Khandala, 20.9.1902, *G.A. Gammie* 15415 (BSI); Maharashtra, Londa, 3.11.1902, *G.A. Gammie* 15867 (BSI 5107) Determined by *R.D. Dixit* 21.12.1976; Maharashtra, Chaukul, 17.9.2013, *A. Benniamin* 195218 (BSI 133922); Gujarat, Valsad Dt., Wilson hills, 20°29.6600’N, 73°21.8116’E, 363m, 24.8.2014, *R.N. Kachhiyapatel & K.S. Rajput* 37 (BSJO 40977; BARO!); Valsad Dt., Kaprada, Shahuda, 20°14.27667’N 73°19.24000’E, 223m, 30.11.2014, *R.N. Kachhiyapatel & K.S. Rajput* 123 (BLAT!; BARO!).

Selaginella repanda (Desv. ex Poir.) Spring, Voy. Bonite, Bot., 3:329. 1846; Alston, Bull. Fan. Mem. Inst. Biol. 5:293. 1934; Alston, Proc. Nat. Inst. Sci. India, 11(3):217. 1945; Panigrahi & Dixit, J. Ind. Bot. Soc. 46:231. 1967; Dixit, Cens. Ind. Pterid. 16. 1984; Bir *et al*. Indian F. J. 36. 1989; Dixit, Selaginellaceae India 62. fig. 27af, PI. 27. 1992; Manickam & Irudayaraj, Pterid. FI. Western Ghats 38. 1992; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:44. 2017. *Lycopodium repandum* Desv. ex Poir., Lamarck, Encycl. Suppl. 3:558. (1813) 1814. *Selaginella barbata* (Kaulf.) Spring, Bull. Acad. Brux. 10:226. 1843. ***Figure*:** 15, 16

Type: Philippines, *A.N. Desvaux*, P.

Plants annual, mesophytic herb, 10-30 cm long, terrestrial or epilithic, rooting at base only, procumbent stem, pale green seasonally, yellowish brown during dryer; *rhizophores* 2-6 x 0.2-0.6 mm, slender, branched, confined to base only, whitish yellow; *main stems* 7-30 cm x 1-2.5 mm, much branched from basal part, dichotomous branched, branches procumbent, cylindrical, glabrous, fertile, terminating into strobilus, whitish yellow to pale green, stem base reddish; *branches* 5-18 cm long, 3-12 pairs, alternate, pinnately compound branched, branched throughout; *secondary branches* once or twice forked; *branchlets* densely leafy, fertile; *leaves* dimorphic except strobilus, compact on the stem and branches, coriaceous, single mid-vein reaching the apex, membranous, thin, greenish-brown, pale green, drying brown in colour; *lateral leaves* 2-4 x 1-2.5 mm, asymmetrical, coriaceous, slightly ascending, spreading, ovate to ovate-lanceolate, oblique, midrib prominent, apex acute, base rounded, margin minutely denticulate apically, ciliolate basally; *axillary leaves* 1-2.5 x 1-1.2 mm, asymmetrical, membranous, ovate, axillary leaves on branches narrowly elliptic, apex acute, base obtuse, margins ciliolate, single mid-vein; *median leaves* 1-1.5 x 0.5-1 mm, asymmetrical, median leaves on branches larger than main branch leaves, alternate on leafy branches, membranous, oblique, ovate or elliptic-oblong, apex acuminate, base subcordate, margin ciliolate, apically denticulate; *strobili* 2-6 x 1-3 mm, erect, terminal, compact, solitary, tetragonous to subtetragonal, megasporangia and microsporangia in the same strobilus, megasporangia toward base, microsporangia apically; *sporophylls* 1-2 x 0.4 x 1 mm, submonomorphic, sometimes dorsal sporophyll larger than ventral sporophyll, membranaceous, ovate or ovate-cordate, margins denticulate, apex long acuminate, base oblique, rounded; *megasporangia* towards apex; *microsporangia* globose-orbicular, thin, cells uniform; *megaspores* 200 x 250 µm, 4 per sporangium, trilete, subglobose, verrucose, yellow; *microspores* 30-40 x 30-37.5 µm, numerous, trilete, hemispherical, verrucose, orange-red or red.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: July-December

Distribution**: **World: Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Philippines, Taiwan, Thailand, Vietnam; ***India***: Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Meghalaya, Mizoram, Nagaland, Odisha, Rajasthan, Sikkim, Tamil Nadu, Uttar Pradesh, Uttarakhand, West Bengal; ***Gujarat***: Narmada, Navsari, Tapi, Dangs & Valsad.

Ecology: This species founded luxuriously growing on terrestrial slopes, shaded moist soil or epipetric shaded, wet rocks, crevices in moist forest.

IUCN category: Data Deficient (DD)

BOLD ID: MIPDG063-21

Specimen examined: PHILIPPINES, Luzon Mt. Momtalban, 14°44'N 121°7'E, 26.10.1890, *A. Loher* 975 (K000896282); TAIWAN, Formosa, 1963, *A. Henry* (K001067385); INDIA, Gujarat, Dangs, Bhavandgarh, 22.11.1959, *B.M. Wadhwa* 60619 (BSI 46721); Rajasthan, Banswara Dt., 8.10.1961, *K.C. Kanodia* 75619 (BSI 79215); Gujarat, Navsari Dt., Vansada, 20°45.76330'N 73°29.02330'E, 140m, 24.7.2014, *R.N. Kachhiyapatel & K.S. Rajput* 4 (BSJO 40979; BSI 140184; CNH!).

Selaginella reticulata (Hook. & Grev.) Spring, Bull. Acad. Roy. Sci. Bruxelles 10(1): 233. 1843; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:45. 2017. *Lycopodium reticulatum* Hook. & Grev., Bot. Misc. 2:402. 1831. ***Figure*:** 89 (B)

***Type*:** Myanmar, Mountains of Ava, *Wallich*, K.

Plants annual herbs, 0.5-2 cm long, terrestrial, epilithic, rooting at base only, prostrate, glabrous, green; *rhizophores* 0.5-1.5 mm, cylindrical, slender, borne on ventral side, branched profusely, whitish yellow; *main stems* 0.4-1.9 cm x 0.2-1.5 mm, branched, alternate, cylindrical, glabrous, pale to dark green; *primary leafy branches* 0.4-1.5 cm long, 1-3 pairs, simple; *leaves* heteromorphic, distantly positioned on the main stem and compact on branches, single mid-vein reaching the apex, membranous, ciliolate, dark green; *lateral leaves* 1 x 1.5 mm, asymmetrical, spreading, membranous, oblong-elliptic, midrib prominent, apex acute, base rounded, margin denticulate; *axillary leaves* 0.5 x 1 mm, ovate-cordate, equally sided (bisymmetrically) or slightly asymmetrical, apex acute, base oblique, margins denticulate; *median leaves* 1.8 x 1 mm, symmetrical or asymmetrical, membranous, ovate-cordate, apex acute, base rounded, margin denticulate; *strobili* 0.5-2 x 0.2-1 mm, dorsiventral, flattened, terminal, solitary, sessile, compact, megasporangia and microsporangia in the same strobilus; *sporophylls* dimorphic, membranaceous, dorsal sporophylls larger than ventral sporophylls; *dorsal sporophylls* 1.8 x 1 mm, symmetric, sterile, membranous, oblong-elliptic, spreading, denticulate margin; *ventral sporophylls* 1.2 x 0.5 mm, fertile, dimorphic, symmetric, membranous, ovate-elliptic, apex acuminate, base cordate, basal margin ciliolate, apically denticulate; *megaspores* 300-350 µm, 4 per sporangium, trilete, tetrahedral-subglobose, reticulate, white or pale yellow; *microspores* 150-200 µm, numerous, trilete, hemispherical, sparsely tuberculate, orange.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: July-September

Distribution**: **World: Bangladesh, Bhutan, India, Myanmar, Nepal, Thailand; ***India***: Arunachal Pradesh, Assam, Chhattisgarh, Gujarat, Jammu & Kashmir, Kerala, Madhya Pradesh, Meghalaya, Odisha, Rajasthan, Sikkim, Tamil Nadu, Uttarakhand, West Bengal; ***Gujarat***: Dangs.

Ecology: This species founded luxuriously growing on terrestrial habitat, wet rocks, crevices in moist forest on slopes, shaded moist soil or epipetric shaded.

IUCN category: Data Deficient (DD)

Specimen examined: INDIA, Rajasthan, Sitamata Wildlife Sanctuary, 06.9.2009, *Yadav & Meena* 3007 (MLVGCB); Gujarat, Dangs Dt., Baripada, 20°39.25833'N 73°40.9550'E, 381m, 26.8.2017, *R.N. Kachhiyapatel & K.S. Rajput* 272-A (BARO!).

EQUISETACEAE Michx. ex DC., Essai Propr. Med. Pl. 49. 1804

Type*: *Equisetum L.

One extant genus, *ca*. 15 species worldwide, 3 species and 1 subspecies in India

Equisetum L., Sp. Pl. 2:1061. 1753

Lectotype: *Equisetum fluviatile* L. designated by: Hauke, Nova Hedwigia 30:414. 1978

Etymology: The genus *Equisetum* is derived from the Latin words *equis* 'horse' and *seta* 'bristle' in reference to the coarse black roots of *E. fluviatile*.

Common name: Horsetail; Scouring rush; Prele

Monophyletic, 15 species worldwide, 3 species and 1 subspecies in India

Equisetum ramosissimum Desf., Fl. Atlant. 2:398-399. 1799; Chowdhury, Pterid. Fl. Upper Gangetic Plain 12. 1973; Manickam & Irudayaraj, Pterid. Fl. W. Ghats. S. Ind. 44-45. 1992; Vasudeva & Bir, Indian Fern J. 9:167. 1992; Ghosh *et al*. Pterid. Fl. E. Ind. Vol. 1 37:40-42. 2004; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:63. 2017. *Hippochaete ramosissima* (Desf.) Borner, Fl. Deut. Volk 282. 1912. *Equisetum debile* Roxb. ex Vaucher, Mem. Soc. Phys. Geneve 1(2):387. 1822. *Equisetum ramosissimum* subsp. *debile* (Roxb. ex Vaucher) Hauke, Amer. Fern J. 52(1):33. 1962. *Hippochaete debilis* (Roxb. ex Vaucher) Holub, Preslia 44:128. 1972. ***Figure*:** 17, 18

Type: North West Africa, Tunisia, 'Mont. Zowan apud Tunetanos, *R. Desfontaines*', ?FI.

Plants perennial, terrestrial, homosporous, reaching up to height 40-130 cm; *roots* fibrous, arranged whorls at nodal region of rhizome; *rhizome* 05-20 cm long, subterranean, erect-suberect, blackish-brown, branched, having nodes and internodes;

aerial stem 35-110 cm long, 1-5 mm in diameter, tuft, perennial, erect, green at young, become off white at maturity, having node and internodes with longitudinal ribs forming arc shaped stem; *leaves* 8-16 mm long, 06-14, whorls, small, scaly, green at young, black-brown at maturity, thin, membranous, apex acute-acuminate, fused at base, arising from the nodal region; *leaf sheath* 5-10 mm, narrow, green at young, become brown at maturity; *teeth* 03-06 mm long, 06-14 per node, linear-lanceolate, central basal portion green at young, brownish brown-black in maturity, membranous, abaxially arc-shaped, persistent, *lateral branches* green at young, white at maturity, arising at the base of node sheath, 5-10 ridged; *strobili* 1-2 cm long, terminal on main branches and lateral branches, sessile, clavate, small acute tip; *sporangiophore* 20-40 per strobili; paltate disc, 4-6 angled, green at young, off white-brown at maturity; *sporangia* 5-6 per disc, elongate, longitudinally dehiscence; *spores* green, spheroidal, 4 spathulate hygroscopic elaters.

Phenology: Perennial; ***Sterile phase***: January-October; ***Fertile phase***: November-December

Distribution*: *World*:** Afghanistan, Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Japan, Laos, Malaysia, Mongolia, Myanmar, Nepal, Pakistan, Philippines, Russia, Saudi Arabia, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam; ***India; Andhra Pradesh, Arunachal Pradesh, Bihar, Chhattisgarh, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Panjab, Rajasthan, Sikkim, Tamil Nadu, Uttar Pradesh, Uttarakhand, West Bengal; ***Gujarat*:** Vadodara (Ornamental) & Dangs.

Ecology: A terrestrial fern luxuriously growing on rock cliffs of Purna River, near Maya Devi temple (Dangs), and also found in grassy flats moist soil of riverine area, in between 120-130 m elevation. Vegetative reproduction by the branched rhizome.

IUCN category: Data Deficient (DD)

BOLD ID: MIPDG037-18, MIPDG064-21, MIPDG065-21, MIPDG066-21

Specimen examined: TANZANIA, 20 miles East of Songea, 930m, 8.2.1956, *E. Milne-Redhead & P. Taylor* 8715 (K 56440.000); INDIA, Rajasthan, Sawaimadhupur, Bank of Ban Ganga river, Balahedi, Mahuwa R.F., 9.1.1985, *S.N. Das* 10110 (BSJO 17170); Karawali dt., Ramathra Dam, 240m, 26.10.2001, *S.L. Meena* 17416 (BSJO 25595); Gujarat, Dangs Dt., Bhenskatri, Maya Devi Temple, Purna river banks, 20°55.7811’N 73°32.0001’E, 127m, 29.4.2018, *R.N. Kachhiyapatel & K.S. Rajput* 341 (BSJO 40980; BSI 140152; CNH!; BLAT!; BARO!).

OPHIOGLOSSACEAE Martinov, Tekhno-Bot. Slovar. 438. 1820

Type*: *Ophioglossum L.

Four subfamilies, 10 genera and *ca*. 112 species worldwide, 3 genera and 24 species in India

Ophioglossum L., Sp. Pl. 2:1062. 1753

Lectotype: *Ophioglossum vulgatum* L., designated by: J. Sm., Hist. Fil.:369. 1875.

Etymology: The genus *Ophioglossum* is derived from the Latin words '*ophis*' snake like and '*glossa'* tongue referring to the fertile spike.

Common name: Adder's Tongue fern or Moonworts

Monophyletic, 41 species worldwide, 16 species in India

Key to the species of Ophioglossum

1 Persistent leaf base present..**O. gujaratense**

1 Persistent leaf base absent

2 Rhizomorph globose…………………………………………………...**O. costatum**

2 Rhizomorph sub-globose or erect

3 Rhizomorph sub-globose

4 Trophophylls linear, grass like……………………………………...**O. gramineum**

4 trophophylls lanceolate or ovate

5 Trophophylls lanceolate, reddish margins and fertile part……………**O. indicum**

5 Trophophylls ovate

6 Common stalks subterranean and above ground…………………..**O. nudicaule**

6 Common stalks strictly subterranean

7 Trophophylls green...**O. parvifolium**

7 Trophophylls reddish green……………………………………**O. rubellum**

3 Rhizomorph tuberous

8 Trophophylls cordate...**O. reticulatum**

8 Trophophylls elliptic-lanceolate

9 Common stalks subterranean...**O. lusitanicum**

9 Common stalks above ground

10 Trophophylls brownish-pink………..…………………………**O. jaykrishnae**

10 Trophophylls green

11 Trophophylls oblanceolate-oblong..**O. thermale**

11 Trophophylls narrowly elliptic...**O. lancifolium**

Ophioglossum costatum R. Br., Prod. FI. Nov. Holl. 163. 1810; Balakrishnan *et al*. Bull. Bot. Survey India 2(3&4):33. 1960; Panigrahi & Dixit, Proc. Nat. Inst. Sci. India 35:249. 1969; Rajagopal & Bhat, Indian Fern J. 15. t. 1998; Patil & Dongare, Indian Fern J. 31:17-24. 2014. *Ophioglossum fibrosum* Schum., Besk. Guinee. Plant 452. 1827 (Kong. Dansk. Vid. Selsk. Nat. Math. Afh. 4: 226. 1829); Beddome, Handb. Ferns Brit. India 465. t. 289. 1883; Blatter & d' Almedia Ferns Bombay 202. PI. 15. 1922; Chavan *et al*. Cont. Fl. Devgadh hills, Devgadh Baria 55. 1961; Thaker *et al*. Cont. Fl. Veg. Chhotaudepur Guj. India 100. 1971; Gandhi *et al*. Occ. *O. fibrosum* Schum Junagadh Saurashtra 878. 1974; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:74. 2017.

***Figure*:** 19, 20

Type: Australia, Queensland, Arnhem North Bay, *Brown* 118.

Lectotype: Australia, Arnheim Bay, *R. Brown* 118, 14/2/1803, BM (BM001038204); designated by: Pichi Sermolli, Webbia 9:626. 1954; ***Isolectotype***: E (E00208945).

Plants annual, *ca*. 10 cm high, green to pale-green, terrestrial, herb; *rhizomorph* 2-5 mm in dia., disc like or globose, short, bearing numerous fleshy yellow-brown roots, tufted, without stoloniferous roots, bearing 1-6 trophophylls apically; *common stalk* 2-3 cm x 2-4 mm, base white, apex pale green, cylindrical; *trophophylls* 3-12 x 2-6 cm, 1-6 simple, sub-erect, elliptic-lanceolate, ovate-round, apex acute to apiculate or obtuse-round, cuneate-cordate base, entire margin, thick fleshy, green, glabrous on each sides, coriaceous, midrib prominent; *fertile segment* 5-10 cm long, 1-3 mm thick, grooved, unbranched (rarely branched), glabrous, inserted on adaxial position of leaf; *strobili* 2-6 cm x 0.5-2 mm, liner, apex acuminate, base round,10-30 sporangia arranged in two alternate rows, rarely twisted, pale green to pale yellow, unbranched (rarely branched); *sporangium* 0.5-1.5 mm, horizontally dehiscent, *spores* 20-40 μm in diameter, trilete, spherical, feveolate.

Phenology: Annual; ***Sterile phase***: June-August; ***Fertile phase***: July (end) - September (rarely in October).

Distribution: ***World***: Africa, Bangladesh, India, Indonesia, Madagascar, Malaysia, Philippines, Sri Lanka, Thailand; ***India***: Andhra Pradesh, Assam, Chhattisgarh, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal; ***Gujarat***: Banaskantha, Chhota Udaipur, Dahod, Jamnagar, Junagadh, Narmada, Navsari, Panchmahal, Porbandar, Sabarkantha, Tapi, Dangs & Valsad (common throughtout the state).

Ecology: This species is common on terrestrial in damp meadows, pastures of forest floors.

IUCN category: Least Concern (LC)

BOLD ID: MIPDG018-15

Specimen examined: INDIA, Kerala, near Palghat, 25.6.1954, *A. Abraham* 103 (K5609.000); Wight 79 (K000740336); Rajasthan, Jalor Dt., Sunda Hills, Rajpura, 340m, 11.8.1978, *B.L. Vyas* 6311 (BSJO 16200, 16201); Rajasthan, Jalor Dt., Sunda Hills, Rajpura, 340m, 15.9.1979, *B.L. Vyas* 6867 (BSJO 16202, 16203); Maharashtra, Mohili R.F., Gihotere Bhivandi range, 20.7.1968, *K.V. Billore* 116247 (BSI 75772); Gujarat, Panchmahal Dt., Jambughoda, Dhanpuri, 22°21.4760'N 73°42.8810'E, 123m, 18.8.2014 *R.N. Kachhiyapatel & K.S. Rajput* 16 (BSJO 40982).

Ophioglossum gramineum Willd., Nov. Act. Acad. Erf. 2:18. t.1. f.1. 1802; Beddome, Handb. Ferns Brit. India Suppl. 108. 1892; Dixit, Cens. Indian Pterid. 23. 1984; Nair *et al*. J. Econ. Tax. Bot. 12:207. 1988; Manickam & Irudayaraj, Pterid. Fl. W. Ghats 48. t.26. 1992; Rajagopal & Bhat, Indian Fern J. 15:7. 1998; Chandra, Ferns India 14. 2000; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:74. 2017. *Ophioglossum clietrichiae* Prantl, Ber. Deut. Bot. Ges. 1:352. 1883. ***Figure*:** 21, 22

Type: West Africa, St. Thomae (Sao Tome), *De Friedland*, B.

Plants annual herb, *ca*. 9 cm height, slender, pale-green, terrestrial; *rhizomorph* 1-4 mm in dia., sub-globose-tuberous, very short, tufted, subterranean, bearing few fleshy yellow-brown roots *ca*. 2-6, sometimes stoloniferous roots, bearing 1-2 trophophylls apically; *common stalk* 0.5-3.5 cm x 0.5-2 mm, white basally, pale green apically, cylindrical; *trophophylls* 1-5 x 0.5-3 mm, 1-2 per plant, linear, erect, apex acuminate, base attenuate, margin entire, fleshy, glabrous; *fertile segment* 3-6.5 cm long, 0.5-2 mm thick, arising from the base of the trophophylls, slender, sometimes widened, unbranched (rarely branched), glabrous, pale green; *strobili* 2-8 x 0.5-2.5 mm, liner-lanceolate, apex acuminate, base round, 5-12 sporangia arranged in two alternate rows, pale green to pale yellow, unbranched (rarely branched); *sporangium* 0.25-1.25 mm, horizontally dehiscent; *spores* 20-40 µm in diameter, trilete, spherical in amb, reticulate.

Phenology: Annual; ***Sterile phase***: June-August; ***Fertile phase***: July (end)-September (rarely in October)

Distribution: World: Africa, Cambodia, India, Indonesia, Malaysia, Myanmar, New Guinea, Philippines, Sri Lanka, Thailand, Vietnam; ***India***: Andhra Pradesh, Chhattisgarh, Gujarat, Kerala, Madhya Pradesh, Maharashtra, Maharashtra, Meghalaya, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand, West Bengal; ***Gujarat***: Chhota Udaipur, Junagadh, Panchmahal, Porbandar & Sabarkantha.

Ecology: This species is found in association with grasses and growing luxuriously on moisten shaded grassy forest floors along with *O. nudicaule*, *O. petiolatum*, *O. reticulatum*, *O. gujaratense* and *O. costatum*.

IUCN category: Least Concern (LC)

Specimen examined: ANGOLA, Pungo Adongo, 1.1857, *Welwitsch* 36 (K000351315); INDIA, Maharashtra, Kolhapur Dt., Shivaji University, campus, alt. 700 m., *Patil S.S.* (SUK); Karnataka, Belgaum Dt., alt. 800 m, *Mahamuni R.J.* (SUK); Andhra Pradesh, Karimnagar Dt., Aklaspur, *Subbarao* (MH20238); Maharashtra, Shahanur, Akot, Akola Dt., 25.6.1978, *S.Y. Kamble* 153830 (BSI 106506); Gujarat, Panchmahal Dt., Jambughoda, Dhanpuri, 22°21.4660’N 73°42.8710’E, 124m, 18.8.2014, *R.N. Kachhiyapatel & K.S. Rajput* 24 (BSJO 40984; BLAT!); Panchmahal Dt., Jambughoda, Dhanpuri, 22°21.4660’N 73°42.8710’E, 124m, 18.8.2014, *R.N. Kachhiyapatel & K.S. Rajput* 25 (BSI 140148); Panchmahal Dt., Jambughoda, Dhanpuri, 22°21.4660’N 73°42.8710’E, 124m, 18.8.2014, *R.N. Kachhiyapatel & K.S. Rajput* 26 (CNH!; BARO!); Panchmahal Dt., Jambughoda, Dhanpuri, 22°21.51333’N 73°42.86333’E, 126m, 30.7.2017, *R.N. Kachhiyapatel & K.S. Rajput* 209 (BARO!); Panchmahal Dt., Jambughoda, Lafni, 22°19.43500’N 73°41.24833’E, 114m, 30.7.2017, *R.N. Kachhiyapatel & K.S. Rajput* 218 (BLAT!; BARO!); Panchmahal Dt., Jambughoda, Zand Hanuman, 22°19.5430’N 73°41.0150’E, 116m, 4.8.2017, *R.N. Kachhiyapatel & K.S. Rajput* 237 (BSJO 40983); Panchmahal Dt., Jambughoda, Lafni, 22°19.5430’N 73°41.0150’E, 116m, 8.9.2017, *R.N. Kachhiyapatel & K.S. Rajput* 276 (BARO!).

Ophioglossum gujaratense SM Patil, RN Kachhiyapatel, R Patel, KS Rajput, Phytotaxa 351(4):273-280. 2018; Yadav & Meena, *O. gujaratense* Patil, Kachhiyapatel, Patel & Rajput (Ophioglossaceae) - New Rec. Rajasthan, India 36(1&2):236. 2019.

***Figure*:** 23, 24

Type: INDIA, Gujarat, Panchmahal Dt., Jambughoda, Dhanpuri, 214m, 30.07.2017, *S.M. Patil, R.N. Kachhiyapatel & K.S. Rajput* 215. (CAL); ***Isotype***: BARO, SUK, BSI and MH

Plants annual, *ca*. 10 cm height, green to pale-green, terrestrial, herbaceous; *rhizomorph* 2-8 mm in dia., sub-globose-tuberous, numerous fleshy borne around the rhizomorph, yellow-brown, tufted, roots numerous, bearing 1-5 trophophylls apically; *common stalk* 0.5-1.5 cm x 2-4 mm, base white, pale green apically, subterranean, cylindrical, glabrous, covered with leaf sheath (brown or white); *trophophylls* 0.5-3 x 0.5-1.5 cm, 1-5 simple, horizontally attached to substratum, elliptic-lanceolate or ovate-elliptic, apex acute to acuminate, cuneate base, entire margins, green-dark green, glabrous, tough, slightly coriaceous; *fertile segment* 2-8 cm long, 1-2.5 mm thick, round, unbranched, glabrous, inserted on adaxial position of trophophyll; *strobili* 0.5-2 x 0.5-2 cm, liner-lanceolate, apex acuminate, base round, 5-15 sporangia arranged in two alternate rows, greenish yellow; *sporangium* 0.5-1.5 mm, arranged in two alternate rows, horizontally dehiscent; *spores* 30-40 µm in diameter, trilete, spherical, verrucose.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: August-September

Distribution: ***World***: So far reported from India; ***India***: Gujarat, Rajasthan; ***Gujarat***: Chhota Udaipur, Panchmahal & Sabarkantha.

Ecology: Terrestrial species growing on hill slopes ca. 250-350 m, with *Ophioglossum costatum, O. gramineum O. parvifolium* and *O. reticulatum*.

IUCN category: Least Concern (LC)

BOLD ID: MIPDG023-18; ***NCBI Accession No.:*** MH229473, MH229474, MH229475 and MH229476

Specimen examined: INDIA, Gujarat, Panchmahal Dt., Jambughoda, Dhanpuri, 22°21.486'N 73°42.871'E, 124 m, 30.07.2017, *S.M. Patil, R.N. Kachhiyapatel & K.S. Rajput* 215 (BARO) BARO0070041; Panchmahal Dt., Jambughoda, Dhanpuri, 22°21.4860'N 73°42.8710'E, 214m, 30.7.2017, *R.N. Kachhiyapatel & K.S. Rajput* 215 (BSJO 40971); Panchmahal Dt., Jambughoda, Dhanpuri, 22°21.44167'N 73°42.89167'E, 122m, 4.8.2017, *R.N. Kachhiyapatel & K.S. Rajput* 226 (BARO!); Panchmahal Dt., Jambughoda, Zand Hanuman, 22°22.264'N 73°40.022'E, 154m, 4.8.2017, *R.N. Kachhiyapatel & K.S. Rajput* 234 (BSJO 40972; BARO!); Panchmahal Dt., Halol, Shivrajpur, 22°24.23500'N 73°37.07667'E, 195m, 11.8.2017, *R.N. Kachhiyapatel & K.S. Rajput* 241 (BARO!); Rajasthan, Chittorgarh Dt., Mainal, 25^{0}5'15"N 75^{0}10'01"E, 513m, 4.8.2018, *B. L. Yadav* 016MUCR (Mewar University, Chittorgarh, Rajasthan).

Ophioglossum indicum B.L. Yadav & H.K. Goswami, Bull. Natl. Mus. Nat. Sci., Tokyo, B36(4):155. 2010. ***Figure*:** 89 (C)

Type: India, Rajasthan, Chittorgarh Dt., Mainal, *B. L. Yadav* 3011, 14.8.2009, Herbarium of MLV Government College, Bhilwara, Rajasthan; ***Isotypes: Isotype***: Rajasthan, Chittorgarh Dt., Mainal, 14.8.2009, *B. L. Yadav* 3011 (CAL 0000063559).

Plants annual, *ca*. 4 cm height, slender, reddish brown to pale green, herbaceous, terrestrial; *rhizomorph* 0.5-1 mm in dia., sub-globose, very short, subterranean, bearing few fleshy yellowish brown roots, *ca*. 2-5, sometimes stoloniferous roots, bearing 1-2 trophophylls apically; *common stalk* 2-8 mm x 0.5-1 mm, white basally, pinkish red apically or reddish green, cylindrical; *trophophylls* 1-3 x 0.1-0.5 cm, 1-2 per plant, elliptic or elliptic-lanceolate, erect, apex acuminate, base attenuate, margin entire, pinkish red to reddish green, fleshy, glabrous; *fertile segment* 1-3 cm long, 0.5-1 mm thick, arising from the base of the trophophylls, round, unbranched, glabrous, pinkish red; *strobili* 2-10 x 0.5-2 mm, liner-lanceolate, apex acuminate, base round, 5-7 sporangia arranged in two alternate rows, reddish brown; *sporangium* 0.25-1 mm, horizontally dehiscent; *spores* 20-35 µm in diameter, trilete, spherical, verrucose.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: July-September.

Distribution: World: Endemic to India; ***India***: Gujarat, Rajasthan; ***Gujarat***: Panchmahal.

Ecology: This species growing on terrestrial in open, moist meadows and pastures along with *O. thermale*, *O. parvifolium*, *O. gramineum*.

IUCN Category: Data Deficient (DD)

Specimen examined: INDIA, Rajasthan, Chittorgarh Dt., Mainal, *B. L. Yadav* 3011, 14.8.2009, Herbarium of MLV Government College, Bhilwara; Chittorgarh Dt., Mainal, 14.8.2009, *B. L. Yadav* 3011 (CAL 0000063559); Gujarat, Panchmahal Dt., Jambughoda W.S., Lafni, 22°19.5430'N 73°41.0150'E, 116m, 8.9.2017, *R.N. Kachhiyapatel & K.S. Rajput* 277 (BSJO 40927; BSI 140147; CNH!; BLAT!; BARO!).

Ophioglossum jaykrishnae S.M. Patil, S.K. Patel, Raole & K.S. Rajput. ***Figure*****:** 25, 26

Type: India, Gujarat, Lafni, Jambhughoda wildlife sanctuary, altitude <300 m asl, 20/07/2018, Patil & Rajput, 1082. (CAL; ***Isotype***: BARO; SUK; BSJO)

Plant terricolous, small-medium sized, dark brown-pink colour, 4-10 cm in height; *rhizomorph* 0.2-0.4 cm, subterranean, tuberose-subglobose, arises few fibrous roots (sometimes stoloniferous); *common stalk* 0.8-1.1 cm, subterranean-terranean, white; *trophophylls* 0.5-2 x 0.5 cm, 1-2 (rarely >3) per rhizomorph, brownish-pink, forming 30°- 60° angle to the fertile stalk, lanceolate, apex acute, base almost truncate, margin entire, pseudo-costa present, brown coloured, sheathing leaf base absent; *venation* simple, parallel areoles, not visible; *fertile segment* 3-8.5 cm long, inserted at the base of the lamina, round, abaxially grooved, dark brownish (sometimes pinkish); *strobili* 0.5-2 cm long, thick, apex acute-acuminate, dark brown-pink; *sporangia* 4-8 pairs, arranged in two alternate rows; *spores* 20-35 µm dia., trilete, exine tuberculate-varicose.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: August-September

Distribution: ***World***: So far reported from India; ***India***: Gujarat; ***Gujarat***: Panchmahal.

Ecology: Seasonal plant growing in open grass land or on the floor of deciduous forest at an altitude 200-300 m asl., associated with *O. costatum* and *O. gramineum*.

IUCN category: Data Deficient (DD)

Specimen examined: INDIA, Gujarat, Panchmahal dt., Dhanpuri, 200m, 12.07.2019, *SMP & KSR* 1082 (BARO); Panchmahal dt., Lafni, 200m, 12.07.2019, *SMP & KSR* 1083 (BARO).

Ophioglossum lancifolium C.Presl, Suppl. Tent. Pterid.:50. 1845; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:76. 2017. *Ophioglossum braunii* Prantl, Ber. Deutsch. Bot. Ges. 1:351. 1883. ***Figure*: 89 (D)**

Type: Mascarenes, Mauritius, Maurice, *L-M.A.A. du Petit-Thouars*, (PR, P).

Plants annual, 2-8 cm height, pale-green, terrestrial, herb; *rhizomorph* 1-5 mm in dia., erect, subterranean; *common stalk* 0.5-1.5 cm x 0.5-1.5 mm, white basally, pale green apically, cylindrical; *trophophylls* 1-5 cm x 0.5-2.5 mm, 1-2 per plant, narrowly elliptic, apex acuminate, base narrow, margin entire, fleshy, herbaceous, glabrous; *fertile segment* 1-4 cm long, 0.5-1.5 mm thick, slender, unbranched, glabrous, pale green; *strobili* 1-1.5 cm x 0.5-2.5 mm, liner-lanceolate, apex acuminate, base round, 5-10 sporangia arranged in two alternate rows, pale green; *sporangium* 0.4-1.3 mm, horizontally dehiscent; *spores* 20-40 µm in diameter, trilete, spherical in amb, reticulate.

Phenology: Annual; ***Sterile phase***: June-August; ***Fertile phase***: August-September.

Distribution**: **World: Comoros, India, Madagascar, Mascarenes, South Africa; ***India***: Assam, Gujarat, Madhya Pradesh, Maharashtra; ***Gujarat***: Panchmahal.

Ecology: This taxon is growing in patches on shaded areas of grassland associated with *Ophioglossum costatum, O. parvifolium* and *O. reticulatum.*

IUCN category: Data Deficient (DD)

Specimen examined: CAPE VERDE, Gipfel des Monte Gurdo, S. Nicolau, 1851, *C.A. Bolle* (FR0030324); INDIA, Gujarat, Panchmahal Dt., Lafni, 22°19.5430’N 73°41.0150’E, 116m, 8.9.2017, *R.N. Kachhiyapatel & K.S. Rajput* 277-A (BARO!).

Ophioglossum lusitanicum L. Sp. Pl., 2:1063. 1753; Clausen, Mem. Torry Bot. Club 19(2):159. 1938; Mahable, Bull. Bot. Surv. India 4:71. 1962; Panigrahi & Dixit, Proc. Nat. Inst. Sci. India 35:251. 1969; Patil & Dongare, Indian Fern J. 31:17-24. 2014; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:76. 2017. *Ophioglossum loureirianum* C. Presl, Suppl. Tent. Pterid. 55. 1845. *Ophioglossum braunii* Prantl, Ber. Deutsch. Bot. Ges. 1:351. 1883. ***Figure:*** 89 (E)

Type: Portugal, Terceira, Azores, *Anon*, BM (BM001038207)

Plants annual, ca. 6 cm high, dark green to brownish green, terrestrial, herb; *rhizomorph* 2-8 mm in dia., sub-globose to tuberous, short, bearing fleshy yellowish brown roots, tufted, without stoloniferous roots, bearing 1-2 trophophylls apically; *common stalk* 0.5-2 cm x 1-3 mm, subterranean, white, cylindrical; *trophophylls* 1-3 x 0.5-1 cm, 1-2 simple, sub-erect, linear lanceolate, spathulate, apex acute to acuminate, base cuneate-attenuate, margin entire, fleshy, glabrous on both sides; *venation* simple reticulate; *fertile segment* 2-4 cm long, 1-2 mm thick, round, unbranched, glabrous; *strobili* 0.5-1 cm long x 1-2 mm, liner of liner-lanceolate, apex acuminate, base round, 4-8 sporangia arranged in two alternate rows, pale green to pale yellow; *sporangium* 0.5-1 mm, horizontally dehiscent, *spores* 20-35 µm in diameter, trilete, spherical, reticulate.

Phenology: Annual; *Sterile phase*: June-August; *Fertile phase*: July-August

Distribution**: **World: Africa, Australia, India, Iran, Vietnam; ***India***: Andhra Pradesh, Assam, Bihar, Goa, Gujarat, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal; ***Gujarat***: Panchmahal.

Ecology: Uncommon species, collected from grassy plateaus at Jambughoda and Zand Hanuman, associated with *O. costatum, O. nudicaule, O. parvifolium* and *O. reticulatum.*

IUCN category: Data Deficient (DD)

Specimen examined: **INDIA**, **Kerala**, Trivandrum, forest area between Thura and Bonasoore, 525 m, *J. Joseph* (MH90512); Maharashtra, Kolhapur dt. near Doodhsagar Dam, Radhanagari, 10.09.2013, *SM Patil* (2002), **Gujarat**, Panchmahal Dt., Jambughoda, Dhanpuri, 22°21.4860’N 73°42.8910’E, 121m, 18.8.2014, *R.N. Kachhiyapatel & K.S. Rajput* 27-A (BSJO 40985; BARO!).

Ophioglossum nudicaule L. f. Suppl. Syst. PI. 443. 1781; Blatter & d’ Almeida, Ferns Bombay 200. 1922; Dixit, Cens. Ind. Pterid. 23. 1984; Manickam, Fern Fl. Palani Hills 12. 1986; Manickam & Irudayaraj, Pterid. Fl. West Ghats 48-49. t.27. 1992; Nayar & Geevarghese, Fern Fl. Malabar 75-76. 1993; Rajagopal & Bhat, Indian Fern J. 15, 6-7. 1998; Chandra, Ferns India 9. 2000; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:77, 78. 2017. ***Figure*****:** 27, 28

Type: South Africa, Cape of Good Hope

Plants annual, 4-10 cm height, pale-green, terrestrial, herb; *rhizomorph* 1-8 mm in dia., sub-globose, short, tufted, subterranean, bearing fleshy yellow-brown roots; *common stalk* 0.5-2.5 cm x 0.5-2 mm, white basally, pale green apically, cylindrical;

trophophylls 1-5 cm x 0.5-3 mm, 1-2 per plant, ovate or elliptic, slightly procumbent of sub-erect, apex acuminate, base broad, margin entire, fleshy, herbaceous, glabrous; *fertile segment* 3.5-7.5 cm long, 0.5-2 mm thick, slender, unbranched (rarely branched), glabrous, pale green; *strobili* 1-2.5 cm x 0.5-3 mm, liner-lanceolate, apex acuminate, base round, 5-10 sporangia arranged in two alternate rows, pale green to pale yellow, unbranched (rarely branched); *sporangium* 0.2.5-1.5 mm, horizontally dehiscent; *spores* 20-45 μm in diameter, trilete, spherical in amb, reticulate.

Phenology: Annual; ***Sterile phase***: June-August; ***Fertile phase***: August-September.

Distribution**: **World: China, Colombia, India, Indonesia, Malaysia, Thailand; ***India***: Andhra Pradesh, Gujarat, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Maharashtra, Sikkim, Tamil Nadu, West Bengal; ***Gujarat***: Banaskantha, Chhota Udaipur, Dahod, Junagadh, Narmada, Navsari, Panchmahal, Porbandar, Sabarkantha, Tapi, Dangs & Valsad (common throughout the state).

Ecology: This taxon is growing in patches on shaded or exposed areas of meadows and grassland associated with *Ophioglossum costatum, O. gramineum, O. parvifolium, O. thermale* and *O. reticulatum.*

IUCN category: Least Concern (LC)

BOLD ID: MIPDG062-21, MIPDG067-21

Specimen examined: COLOMBIA, Tolima, *F.C. Lehmann* 6124 (K000589308); INDIA, Madhya Pradesh, Hoshangabad Dist., Kesla, 500m, 22.7.1961, *J. Joseph* (MH25305); Tamil Nadu, Ramnad Dist., Erani forest, 100m, 19.8.1964, *R. D. Dixit* (MH39459); Gujarat, Panchmahal Dt., Jambughoda, Dhanpuri, 22°21.4760'N 73°42.8810'E, 123m, 18.8.2014, *R.N. Kachhiyapatel & K.S. Rajput* 15 (BSJO 40928; BARO!).

Ophioglossum parvifolium Grev. & Hook., Bot. Misc. 3:218. 1833. Patil & Dongare, Indian Fern Journal 31:18. 2014; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:77. 2017. *O. macrorrhizum* Kunze, Farrnkrauter 1:57, t.29, f.1. 1840. *O. vulgatum* L. var. *macrorrhizum* (Kunze) Luerss., J. Mus. Godeffroy 3:242-244. 1875. *O. nudicaule* var. *macrorrhizum* (Kunze) R.T. Clausen, Mem. Torrey Bot. Club 19(2):150. 1938. *O. schmidii* Kunze, Linnaea 24:246. 1851. *O. luerssenii* Prantl, Ber. Deutsch. Bot. Ges. 1:352. 1883. *O. tenerum* Mett. ex Prantl, Ber. Deutsch. Bot. Ges. 1:352. 1883.

***Figure*:** 29, 30

Lectotype: India, Gujarat, Valsad Dt., Wilson Hills, 24/8/2014, *Patil & Kachhiyapatel* 38 BARO (BARO123450070019); designated by Mazumdar *et al*. 2018.

Plants annual herb, 1-7 cm height, pale-green, terrestrial; *rhizomorph* 1-3 mm in dia., sub-globose-tuberous, very short, subterranean, bearing few fleshy roots, *ca*. 2-5, sometimes stoloniferous roots, bearing 1-2 trophophylls apically; *common stalk* 0.1-0.5 mm x 0.05-0.5 mm, white, cylindrical; *trophophylls* 0.5-4 x 0.4-3.5 cm, 1-2 per plant, rarely 3, horizontally attached to the substratum, ovate-lanceolate, apex acute-apiculate, base cordate, margin entire, fleshy, glabrous; *fertile segment* 0.5-3 mm long, 0.5-1.5 mm thick, arising from the base of the trophophylls, glabrous, pale green to green; *strobili* 0.5-1 cm long x 0.5-1.5 mm thick, liner-lanceolate, apex acuminate, base round, 5-10 sporangia arranged in two alternate rows, pale green to pale yellow, unbranched; *sporangium* 0.25-0.5 mm, horizontally dehiscent; *spores* 20-40 μm in diameter, trilete, spherical, reticulate.

Phenology: Annual; ***Sterile phase***: June-August; ***Fertile phase***: July-September

Distribution**: **World: China, India, Indonesia, Japan, Madagascar, Malaysia, Myanmar, Nepal, Philippines, Singapore, South Africa, Sri Lanka, Taiwan, Thailand, Vietnam; ***India***: Andhra Pradesh, Arunachal Pradesh, Assam, Gujarat, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttarakhand, West Bengal; ***Gujarat***: Banaskantha, Chhota Udaipur, Dahod, Junagadh, Narmada, Navsari, Panchmahal, Porbandar, Sabarkantha, Tapi, Dangs & Valsad.

Ecology: This species is commonly found in meadows on moist areas from low land to high land areas.

IUCN category: Least Concern (LC)

BOLD ID: MIPDG022-18; ***NCBI Accession No.:*** MH205947

Specimen examined: INDIA, Maharashtra, Kolhapur Dt., Near Radhanagri Dam, 10.9.2013, *SM Patil* (2002); Satara Dt. Kas Plateau, 5.8.2014. *SM Patil* (2003); Gujarat, Panchmahal Dt., Jambughoda, Dhanpuri, 22°21.4660’N 73°42.8710’E, 124m, 18.8.2014, *R.N. Kachhiyapatel & K.S. Rajput* 30 (BSJO 40930); Valsad Dt., Wilson hills, 20°29.7000’N 73°21.7666’E, 402m, 24.8.2014, *R.N. Kachhiyapatel & K.S. Rajput* 38 (BSJO 40929; BARO!).

Ophioglossum reticulatum L. Sp. PI. 2. 1063. 1753; Clausen, Mem. Torrey Bot. Club 19(2):130. 1938; Panigrahi & Dixit, Proc. Nat. Inst. Sci. India 35B:257. 1969; Dixit, Cens. Ind. Pterid. 24. 1984; Chandra & Kaur, Nomen. Guide 8. 1987; Manickam & Irudayaraj, Pterid. Fl. West Ghats 51. t.29. 1992; Khullar, Ill. Fern Fl. West Him. 1:28, t.12. 1994; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:80. 2017.

Ophioglossum vulgatum L. var. *reticulatum* (L.) D.C. Eaton, Mem. Amer. Acad. Art. Sci., n.s. 8:218. 1861. *Ophioglossum peruvianum* Presl, Suppl. Tent. Pterid 52. 1845.

Figure**:** 31, 32

Type: Mauritius.

Lectotype: Central America, *Ophioglossum cordatum* et *reticulatum* in Plumier, Traite Foug. Amer., 141, t.164, 1705; designated by: Tardieu Blot, *in* Aubreville, Flor. Gabon 8:30. 1964.

Plants annual herb, 8-25 cm high, green to pale-green, terrestrial; *rhizomorph* 2-8 mm long, 1-5 mm in dia., tuberous, erect, bearing numerous roots, tufted, bearing 1-2 trophophylls apically; *common stalk* 2-10 cm x 2-4 mm, base white, apically pale green to green, cylindrical; *trophophylls* 8-12 x 2-6 cm, 1-2 simple, procumbent, broadly cordate, apex round, base cordate, entire margin, thick fleshy, sometimes coriaceous, green when young, glabrous; *fertile segment* 5-15 cm long, 1-4 mm thick, round, unbranched, rarely branched, glabrous, inserted on adaxial position of leaf; *strobili* 1-5 cm x 0.5-4 mm, liner-lanceolate, apex acuminate, base round, 10-25 sporangia arranged in two alternate rows, rarely twisted, pale green to pale yellow, unbranched, rarely branched; *sporangium* 0.5-1.5 mm, sunken, horizontally dehiscent, *spores* 30-45 µm in diameter, trilete, spherical, feveolate.

Phenology: Annual; ***Sterile phase***: June-August; ***Fertile phase***: August-October

Distribution*:* ***World***: Africa, Australia, Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Japan, Madagascar, Malaysia, Myanmar, Nepal, Pakistan, Philippines, South Korea, Sri Lanka, Taiwan, Thailand, Vietnam; ***India***: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Mizoram, Odisha, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand, West Bengal; ***Gujarat***: Banaskantha, Chhota Udaipur, Dahod, Junagadh, Narmada, Navsari, Panchmahal, Porbandar, Sabarkantha, Tapi, Dangs & Valsad (common throughout the state).

Ecology: This species is very common, found under beneath of trees in the forest or grassy plateaus along with *Ophioglossum costatum*, *O. nudicaule* and *O. parvifolium.*

IUCN category: Least Concern (LC)

Specimen examined: **PERU**, In monte Campana, prope Tarapoto, Peruviae orientalis, 8.1856, *R. Spruce* 4709 (K000006884); **INDIA, Maharashtra**, Marnala fort, Akot, Akola Dt., 24.6.1978, *S.Y. Kamble* 153798 (106514); Uttarakhand, Dehradun, Lachhiwala forest, November 1991, *R.S. Rawat* 1, (BLAT 109706); **Gujarat**, Panchmahal Dt., Jambughoda, Dhanpuri, 22°21.4960'N 73°42.8510'E, 128m, 18.8.2014, *R.N. Kachhiyapatel & K.S. Rajput* 29 (BSJO 40932); Dahod Dt., Dhanpur, Kanjeta, 22°33.9685'N 74°07.1592'E, 387m, 24.8.2014, *R.N. Kachhiyapatel & K.S. Rajput* 50 (BSJO 40931; BSI 140179, 140144; BARO!).

Ophioglossum rubellum Welw. ex A.Braun, Kuhn Fil. Afric. 179-180. 1868; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:81. 2017. ***Figure*:** 89 (H-J)

Type: Angola, Pungo Andongo, Candumba, *F.M.J. Welwitsch* 33, 1857 (BM).

Plants annual, herbaceous, 1-5 cm height, reddish green, terrestrial; *rhizomorph* 1-2.5 mm in dia., sub-globose, very short, subterranean, bearing 1-2 trophophylls apically; *common stalk* 0.1-0.7 x 0.05-0.5 mm, white, cylindrical; *trophophylls* 0.5-2.5 x 0.4-3.5 cm, 1-2 per plant, horizontally attached to the substratum, ovate-lanceolate, apex acute, base cordate, margin entire, fleshy, glabrous, reddish green; *fertile segment* 0.5-3 cm long, 0.5-1.5 mm thick, arising from the base of the trophophylls, pale green to reddish green; *strobili* 4-9 x 0.5-1.5 mm, liner-lanceolate, apex acuminate, base round, 6-10 sporangia arranged in two alternate rows, pale green to reddish green; *sporangium* 0.22-0.55 mm, horizontally dehiscent; *spores* 20-42 μm in diameter, trilete, spherical, reticulate.

Phenology: Annual; ***Sterile phase***: June-August; ***Fertile phase***: August-September

Distribution: World: Africa, India; ***India***: Gujarat, Rajasthan; ***Gujarat***: Panchmahal.

Ecology: This taxon is uncommon, growing under the tree shed along with *Ophioglossum gramineum*, *O. lusitanicum* and *O. parvifolium*.

IUCN category: Data Deficient (DD)

Specimen examined: INDIA, Gujarat, Panchmahal Dt., Lafni, 22°19.5430'N 73°41.0150'E, 116m, 4.8.2017, *R.N. Kachhiyapatel & K.S. Rajput* 236-A (BARO!).

Ophioglossum thermale Kom., Fedde Repert. 13:85. 1914. Panigrahi & Dixit, Proc. Nat. Inst. Sci. India 35. 257. 1969; Dixit, Cens. Ind. Pterid. 24. 1984; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:76, 81. 2017. *Ophioglossum nipponicum* T.Miyabe & Kudo, Trans. Sapporo Nat. Hist. Soc. 6:122. 1916. *Ophioglossum thermale* var. *nipponicum* (T. Miyabe & Kudo) M. Nishida, Tagawa, J. Jap. Bot. 33:202. 1958. *Ophioglossum bucharicum* O. Fedtsch. & B. Fedtsch., Not. Syst. Herb. Hort. Bot. Petropol. 4:8. 1923.*Ophioglossum japonicum* Prantl, Ber. Deutsch. Bot. Ges. 1:353. 1883. ***Figure*:** 33, 34

Type: Russia, Kamtchatka, *Komarov, Vladimir L*, 24/8/1909, S (S-P-2964).

Plants annual herb, 8-15 cm tall, green to pale-green, terrestrial; *rhizomorph* 0.2-4 mm long, 1-4 mm in dia., tuberous, erect, bearing tuft unbranched fleshy roots, stoloniferous, bearing 1-2 trophophylls apically; *common stalk* 1-4 cm x 1-3 mm, white basally, apically pale green to green, cylindrical; *trophophylls* 1-2 x 0.25-0.75 cm, 1-2 simple, sub-erect, broadly oblanceolate-oblong, apex acute, base cuneate, margin entire, thin, green, sometimes reddish, glabrous; *veins* reticulate, indistinct; *fertile segment* 5-9 cm long, 1-4 mm thick, unbranched, rarely branched, glabrous; *strobili* 2-3.5 cm x 0.15-0.25 cm, liner-lanceolate, apex acuminate, base round, 10-18 sporangia arranged in two alternate rows, pale green to pale yellow, unbranched, rarely branched; *sporangium* 1-1.5 mm, sunken, horizontally dehiscent, *spores* 30-40 μm in diameter, trilete, spherical, sub-reticulate.

Phenology: Annual; ***Sterile phase***: June-August; ***Fertile phase***: August-September

Distribution: World: China, India, Japan, Korea, Russian, South Korea, Taiwan, Tajikistan, Turkmenistan; ***India***: Gujarat, Maharashtra; ***Gujarat***: Chhota Udaipur, Dahod & Panchmahal.

Ecology: This taxon is uncommon, growing under the tree canopies or open grassy meadows along with *Ophioglossum costatum, O. nudicaule* and *O. parvifolium*.

IUCN category: Least Concern (LC)

Specimen examined: INDIA, Gujarat, Panchmahal Dt., Jambughoda, Dhanpuri, 22°21.4760'N 73°42.8810'E, 123m, 18.8.2014, *R.N. Kachhiyapatel & K.S. Rajput* 27 (BSJO 40926); Panchmahal Dt., Jambughoda, Lafni, 22°19.5430'N 73°41.0150'E, 116m, 4.8.2017, *R.N. Kachhiyapatel & K.S. Rajput* 236 (BSJO 40925; BARO!).

LYGODIACEAE M.Roem. Handb. Allg. Bot. 3:520. 1840

***Type*:** *Lygodium* Sw.

Monophyletic, 1 genus and *ca*. 40 species worldwide, 9 species in India

Lygodium Sw., Schrader, J. Bot. (Schrader) 1800(2):7, 106. 1801

Type: *Lygodium scandens* (L.) Sw. (=*Ophioglossum scandens* L.)

Etymology: The genus *Lygodium* is derived from the Greek words *lygodes* 'flexible, twining or pliant', referring to the climbing rachis.

Common name: Climbing Fern; commonly known as climbing maidenhair fern, small-leaf climbing fern or snake fern

Monophyletic, *ca*. 40 species in worldwide, 9 species in India

Lygodium flexuosum (Linn.) Sw., Schrad. Journ. Bot., 1800(2):7, 106. 1801; Clarke, Trans. Linn. Soc. Ser. 2 (Bot.) 1, 584. 1880; Blatter & d' Almeida, Ferns Bombay 195.

1922; Dixit. Cens. Ind. Pterid. 60. 1984; Chandra & Kaur, Nomen. Guide 7. 1987; Manickam & Irudayaraj, Pterid. FI. Western Ghats 62. Pl.8. 1992; Chandra, Ferns India 26. 2000; Manickam & Irudayaraj. Pterid. Fl. Nilgiris 77. 2003; Leti *et al*. Fl. Photogr. Cambodge 555. 2013; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:107. 2017. *Ophioglossum flexuosum* L., Sp. Pl. 1063. 1753; Singh & Panighrahi, Proc. Indian Acad. Sci. (Pl. Sci.) 93(2):124-125. ***Figure*: 35, 36**

Lectotype: South India, Herb. Hermann 1:32, no.375, BM; designated by: Alston & Holttum, Reinwardtia 5:15. 1959.

Plants terrestrial, twining, reaching up to 5 m, perennial; *rhizomes* 0.5-3 cm in dia., short creeping, densely covered with roots, apex densely scaly; *fronds* climbing, glabrous, wide spreading; *young fronds* about 1-3 m high, once or twice dichotomous, branches palmate, sometimes lobed, ovate-deltoid, apex acute, base broad, margin serrate (rarely crenate); *Stipes* 5-20 cm long, 2-5 mm in dia., glabrous, slender, base scaly, flat adaxially, round abaxially, dark brown basally, yellowish green above; *rachis* narrowly winged in scandent fronds, flattened and puberulent on upper side between wings, indefinite growth, yellowish green; *primary rachis-branches* short or indistinct, opposite, apex dormant, hairy, separate, pointed, bears three pairs of simple or forked pinnules, green; *secondary rachis-branches* 1-6 cm long, narrowly winged, 1-2 pinnate, ovate-deltoid, alternate, hairy, green; *pinnules* 2-7 cm long, pinnate, shorty stalked, simple or terminal leaflets forked, ovate-oblong to deltoid or obliquely deltoid, cordate base or auriculated and lobed, coriaceous; *basal pinnules* often large, 2-3 pinnules, subsessile, midvein prominent, veins 1-3 times forked; apical pinnules smaller, subsessile, margin serrate, midvein prominent, veins 1-2 times forked; *pinnules stalk* 2-5 mm long; *sterile pinnae* simple, sometimes palmate or auriculated, finely serrate, texture coriaceous, apex subacute, base cordate, alternate, margin serrate, green; *fertile pinnules* simple, sometimes palmate or lobed, narrower than sterile one; *strobilus* 1-4 mm long, liner, narrow finger-like projections expanded from the pinnules, arranged in two rows on each projection; *sporangia* 1-2 mm long, oblong, short stalked, annulus apical, dehiscing by a vertical slit, covered by indusium, arranged in two alternate rows; *spores* 25x35 µm, trilete, numerous, finely verrucose, yellowish green.

Phenology: Perennial; ***Sterile phase***: June-August; ***Fertile phase***: August-May

Distribution*: *World: Australia, Bangladesh, Bhutan, Burma, Cambodia, China, India, Indonesia, Japan, Laos, Malaysia, Myanmar, Nepal, New Guinea, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam; ***India***: Andaman, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand, West Bengal; ***Gujarat***: Dahod, Narmada, Navsari, Panchmahal, Dangs & Valsad.

Ecology: This taxon is found in shaded moist deciduous forest on low to high altitude ranging from 250-800 m.

IUCN category: Least Concern (LC)

Specimen examined: AUSTRALIA, Northern Territory North Coast-Island y2 (=Pobassoo Island), 1802, *R. Brown* 116 (K001057828); INDIA, Karnataka, North Kanara, Katgal, 17.4.1957, *S.K. Jain* 3894 (BSI 20203); Goa, Ordofond, 10.10.1964, *R.S. Raghvan* 103437 (BSI 49278); Maharashtra, Tilak Nagar, 17.9.2013, *A. Benniamin* 195219 (BSI 134078); Maharashtra, Koyna to Mahabaleshwar, 23.9.2013, *A. Benniamin* 195293 (BSI 134082); Gujarat, Navsari Dt., Vansada, 20°45.75000'N 73°28.75000'E, 156m, 6.10.2014, *R.N. Kachhiyapatel & K.S. Rajput* 90, 91 (BSJO 40933; BSI 140136; BARO!).

SALVINIACEAE Martinov, Tekhno-Bot. Slovar; 559. 1820

Type: *Salvinia* Seg.

Monophyletic, 2 genera and an estimated 21 species worldwide, 3 species and 3 subspecies in India

Azolla Lam., Encycl. 1(1):343. 1783

Type: *Azolla filiculoides* Lam.

Etymology: The genus *Azolla* is derived from the Greek words *azo* 'to dry' and *ollyo* 'to kill', term used for the plants referring to death from drought.

Common name: Water lens, Bayroot

Monophyletic, *ca*. 9 species worldwide, 3 subspecies in India

Azolla pinnata R. Brown **subsp. asiatica** R. M. K. Saunders & K. Fowler, Bot. J. Linn. Soc. 109:349. 1992. *Azolla pinnata* R. Br., Prodr. Fl. Nov. Holl. 167. 1810; Dixit, Cens. Indian Pterid. 174, 1984; Manickam & Irudayaraj, Pterid. FI. Western Ghats 345, PI. 261. 1992. *Azolla imbricata* (Roxb. Ex Griff.) Nakai, Bot. Mag. (Tokyo) 39:185. 1925. *Azolla pinnata* var. *imbricata* (Roxb. ex Griff.) Bonap., Notes Pteridol. 7:130. 1918.

Figure: 37, 38

Isotype: Australia, Richmond, Hawkesbury, *R. Brown* 134 (BM)

Plants aquatic, floating perennial fern, 5-18 x 1-10 mm, ovate or triangular, greenish yellow when young, reddish brown at maturity; *roots* 5-17 mm long, fibrous, unbranched, young roots covered by cone-shaped root cap, root hairs numerous; *stems* 2-12 x 0.5-1 mm, horizontal, creeping, slender, branched, pinnate, zig-zag, roots arising abaxially; *fronds* 2-12 x 1-10 mm, alternate, imbricate arranged 2 rows, lamina divided into dorsal and ventral lobe; *lateral branches* alternate, axillary, falsely, dichotomous, abaxially attached roots, downward growing fibrous roots; *leaves* 1-5 mm, alternate, sessile, nearly rectangular, margin entire, membranaceous, green centred whitish or transparent margin, dimorphic, floating dorsal and submerged ventral leaves; *dorsal lobes* floating, sessile, green, oblong, margin entire, whitish or transparent, densely papillose adaxially, habours mucilage cavies of blue-green algae abaxially; *ventral lobes* submersed, overlapping, ovate-oblong, margin entire, membranaceous, glabrous, yellowish white or transparent; *sporocarps* heterosporous, in pairs, arising at base of lateral branches, globose to sub globous, red, multicellular hair on sporocarp wall; *megasporocarp* smaller than the microsporocarp, 0.3-0.5 mm in dia., narrowly ovate, apex beaked, enclosing a single megasporangium; megasporangium in 2 tiers of floats and a terminal flagellated crown; *microsporocarps* larger than megasporocarp, 0.6-1.2 mm in dia., globose, apex with a short beak, reddish brown, microsporangia numerous; *spores* 10-20 micro, small, round, yellow.

Phenology: Perennial; ***Sterile phase***: February-November; ***Fertile phase***: November-January

Distribution**: **World: Afghanistan, Bangladesh, Bhutan, China, India, Japan, Malaysia, Myanmar, Nepal, New Guinea, Pakistan, Philippines, Singapore, South Korea, Sri Lanka, Sumatra, Taiwan, Thailand, Vietnam; ***India***: Throughout; ***Gujarat***: Ahmedabad, Amreli, Anand, Aravalli, Banaskantha, Bharuch, Bhavnagar, Botad, Chhota Udaipur, Dahod, Devbhumi Dwarka, Gandhinagar, Gir Somnath, Junadagh, Junagadh, Kheda, Kachchh, Mahisagar, Mehsana, Morbi, Narmada, Navsari, Panchmahal, Patan, Porbandar, Rajkot, Sabarkantha, Surat, Surendranagar, Tapi, Dangs, Vadodara & Valsad (common throughout the state).

Ecology: A floating fern on the water of river, marshes, stagnant streams etc.

IUCN category: Least Concern (LC)

BOLD ID: MIPDG036-18

Specimen examined: AUSTRALIA, 1829, *C. Fraser* 139 (K001092618); INDIA, Gujarat, Palanpur Dt., Dattiwara Dam site, 23.12.1977, *V. Singh* 5358 (BSJO 15614, 15615); Gujarat, Sabarkantha Dt., Vijaynagar forest, 26.4.2006, *P.J. Parmar* 22953 (BSJO 31467); Rajasthan, Bhilwara Dt., Koshithal - Kothari river, 23.9.1978, *A.N. Singh* 6530 (BSJO 8654); Valsad Dt., Kaprada, Mandva, 20°21.28833'N 73°11.84000'E, 174m, 1.12.2014, *R.N. Kachhiyapatel & K.S. Rajput* 81 (BSJO 40973).

Salvinia Seg., Pl. Veron. 3:52. 1754.

Type: *Salvinia natans* (L.) All. (=*Marsilea natans* L.).

Etymology: Genus *Salvinia* is named in honour of Professor Antonia Maria Salvini (1653-1729), a Greek scholar who helped Micheli with his botanical work.

Common name: Floating fern; Water spangles; Watermoss

Monophyletic, *ca*. 12 species worldwide, 3 species in India

Salvinia molesta Mitchell, Brit. Fern Gaz. 10:251. 1972; Dixit, Cens. Ind. Pterid. 174. 1984; Madhusoodanan, Proc. Int. Symp. Syst. Pterid. 61. fig.6. 1988; Manickam & Irudayaraj, Pterid. FI. Western Ghats 344. PI. 260. 1992; Rajgopal & Bhat, Ind. Fern J. 15:25. 1998. ***Figure*****:** 39, 40

Type: Africa, Rhodesia, Lake Kariba, Ruziruhuru river inlet, D.S. *Mitchell* 1330, GH (GH00135350).

Plants 5-30 cm, aquatic herb, free floating; *stem* 1-3 mm in dia., spongy, horizontal, branched, slender, free floating, hairy, *hairs on stem and leaves* multicellular, septate, pointed, yellowish brown; *roots* absent, root-like organs function by highly dismembered submersed leaves like a cluster of roots, densely covered by sepatate hairs; *leaves* in three groups at a node, two floating on water surface, third leaf submerged; *two floating leaves* 2-4 x 1.5-2.5 cm, opposite, herbaceous, green when young and maturity, dark brown during drying, lattened on water surface or folded upward, short stalked, obovate to oblong or orbicular, margin entire, apex round-emarginate, base cordate, midrib distinct, adaxial surface multicellular papillae or densely hairy, in groups of four, common stalk erect, multicellular, tips of four groped hairs jointed, whitish yellow, abaxial surfaces densely covered with uniseriate, septate, brownish hairs; *third leaf ca*. 20 cm long, submerged, root-like, functioning as a root, pendent, brownish yellow, highly branched, the branches covered with septate, multicellular, uniseriate hairs; *sporocarps* 1-3 mm in dia., heterosporous, arising on submerged leaves, arranged in two rows, chain like, globose- ovoid, minutely apiculated, shortly stalked, densely hairy; *megasporocarp* smaller than microsporocarp, basally arranged, contains megasprocarp; megaspores 200 µm, 32 spores per sporangia; *microsporocarp* numerous, containing microsporangia arranged in long stalked, microspores 200 µm, globose, tetrahedral.

Phenology: Annual; ***Sterile phase***: June-August; ***Fertile phase***: August-May

Distribution**: **World: Australia, India, Nepal, Sri Lanka, Taiwan; ***India***: Throughout; ***Gujarat***: Tapi, Dangs & Vadodara.

Ecology: This taxon of found on floating in still or stagnant fresh water or margins of slowly flowing streams and rivers.

IUCN category: Least Concern (LC)

Specimen examined: NEW PAPUA GUINEA, E. Sepik Prov Krosameri Rive (out of Blackwater River), 4°33'S 143°18'E, 19.8.1980, *T.M. Reeve* 3085 (K000557787); INDIA, Gujarat, Tapi Dt., Songadh, Ghuntvel, Khogal, 21°00.6616'N 73°34.8366'E, 145m, 8.2.2015, *R.N. Kachhiyapatel & K.S. Rajput* 155 (BSJO 40934; BSI 140131).

MARSILEACEAE Mirb., Hist. Nat. Veg. 5:126. 1802 (as '*Marsileae*')

Type*: *Marsilea L.

Monophyletic, 3 genera and *ca*. 61 species worldwide, 1 extant genus and 3 species in India

Marsilea L., Sp. Pl. 2:1099. 1753

Lectotype: *Marsilea quadrifolia* L. designated by: Christensen, Ind. Fil., LVII. 1905

Etymology: Genus *Marsilea* is named in honour of Luigi Ferdinando Marsigli (1656-1730), an Italian soldier, naturalist and mycologist at Bologna.

Common name: Water Clover; Four-leaf Clover; Pepperwort

Monophyletic, *ca*. 55 species worldwide and 3 species in India

Marsilea minuta L., Mant. Pl. 2:308. 1771; Gupta, *Marsilea* Monogr. 2:23, fig. 7. 1962; Dixit, Cens. Ind. Pterid. 85. 1984; Manickam & Irudayaraj, Pterid. FI. Western Ghats 342. PI. 259. 1992; Khullar, Illus. Fern Fl. West Himalaya, 335-337. 1994; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:116. 2017. *M. crenulata* Desv., Mem. Soc. Linn. Paris 6(2):179. 1827. *M. brachycarpa* A.Braun, Monatsber. Konigl. Preuss. Akad. Wiss. Berlin 1863:420. 1864. *M. poonensis* Kolh., Kew Bull. 1957:293, t.1. 1957. *M. maheshwarii* Gopal, Amer. Fern J. 58:71. 1968. *M. kedarmalii* Bhardwaja, Gena & D'Souza, Indian Fern J. 11(1&2):50. 1994. ***Figure*:** 41, 42

Lectotype: 'Habitat in India orientali', herb. Linn. No. 1254.6 (LINN); designated by Launert, Senckenbergiana Biol. 49:291. 1968.

Plants aquatic or terrestrial, amphibious herb, 5-20 cm, diffuse or dense; *rhizomes* short-long creeping, branched, apex hairy, greenish yellow, aquatic or subterranean, internodes *ca*. 10 cm long x 2-4 mm dia. in aquatic form, internodes much more shorter in terrestrial form; *roots* 0.2-0.8 mm in dia., adventitious, fibrous, branched, arising at the nodes, rarely from internodes, yellowish brown; *stipes* 0.2-15 cm long, length variable, upright or decumbent, distant on rhizome, sometimes base conate, slender, glabrous, rarely hairy, greenish yellow, bearing two pairs of cuneate-flabellate pinnae at the apex; *pinnae* 1-2.5 cm long x 0.5-1.7 cm broad, four, qudrifoliate, obcuneate, glabrous, herbaceous, lateral margin slightly concave, straight or convex, entire, terminal margin entire, crenate or denticulate; veins anastomosing regularly; *sporocarp peduncles* 2-10 mm, short, sporocarps joined by a common peduncle at stipe base, glabrous, greenish yellow; *sporocarps* 4-11 x 2-6 mm, terminally attached to peduncle, solitary or many, adnate to short distance, greenish yellow when young, blackish brown during dry, bean shaped, elliptical in lateral view, bilaterally compressed, lateral sides convex, apex round, base trunctate, 2 horns, distinct, superior one slightly larger, persistent, hard, densely hairy when young, sparsely during maturation, hairs uniseriate multicellular; *sori* 8-16 per sporocarp, flank inside of the sporocarps, arranged in two rows, adaxially attached to gelatinous mass; *sporangia* hyline, inside soral cavity, heterosporangiate; *megaspores* 166 micro, ellipsoids, whitish yellow, globose; *microspores* 166 micro., white, tetrahedral, globose.

Phenology: Perennial; ***Sterile phase***: February-August; ***Fertile phase***: September-January

Distribution**: **World: Afghanistan, Australia, Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Japan, Laos, Madagascar, Malaysia, Myanmar, Nepal, New Guinea, Pakistan, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam; ***India***: Andaman, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Delhi, Gujarat, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand West Bengal; ***Gujarat***: Ahmedabad, Amreli, Anand, Aravalli, Banaskantha, Bharuch, Bhavnagar, Botad, Chhota Udaipur, Dahod, Devbhumi Dwarka, Gandhinagar, Gir Somnath, Junadagh, Junagadh, Kheda, Kachchh, Mahisagar, Mehsana, Morbi, Narmada, Navsari, Panchmahal, Patan, Porbandar, Rajkot, Sabarkantha, Surat, Surendranagar, Tapi, Dangs, Vadodara & Valsad (common throughout in wetlands, rivers, ponds and ditches).

Ecology: This species is commonly forming diffuse colonies on mud or floating vegetation on ponds, riverine area and seasonal lakes or edges of marshes and clay substratum.

IUCN category: Least Concern (LC)

BOLD ID: MIPDG009-15

Specimen examined: BANGLADESH, Sylhet, Cachar, 6.1874, *R.L. Keenan* 310 (K001092644); INDIA, Gujarat, Dangs Dt., Waghai, 11.6.1958, *S.K. Jain* 38592 (BSI 29851); Gujarat, Jamnagar Dt., Patiya, 400 ft., 16.9.2002, *P.M. Padhye* 18573 (BSJO 26849); Narmada Dt., Khuta Amba, 21°42.2266’N 73°28.7600’E, 119m, 16.11.2014, *R.N. Kachhiyapatel & K.S. Rajput* 118 (BSJO 40936); Rajasthan, Banswara Dt., Lodha tank, 26.9.1961, *K.C. Kanodia* 75325 (BSI 79385); Banswara Dt., Kushalgarh, 20.10.1976, *V. Shing*, 3753 (BSJO 10435); Maharashtra, Panhala lake, 19.9.2013, *A. Benniamin* 195256 (BSI 134130).

PTERIDACEAE E.D.M. Kirchn., Schul-Bot. 109. 1831

Type*: *Pteris L.

Monophyletic 5 subfamilies, 53 genera, *ca*. 1211 species worldwide and 20 genera, 159 species, 13 subspecies in India

Ceratopteris Brongn., Bull. Sci. Soc. Philom. Paris 1821:186. 1822

Lectotype: *Ceratopteris thalictroides* (L.) Brongn. (=*Acrostichum thalictroides* L.), designated by: Brongn., Dict. Class. Hist. Nat. 3:350. 1823.

Etymology: The genus *Ceratopteris* is derived from the Greek words *cerato* ‘a horn’ and *pteris* ‘fern’, to the reference of antler like fertile leaf.

Common name: Antler ferns; Water ferns; Floating ferns

Monophyletic, *ca*. 6 species worldwide and 2 species and 2 subspecies in India

Key to the subspecies of Ceratopteris thalictroides

1 Plants ca. 50 cm in height, sterile fronds ca. 30 cm long, pinnatifid...**C. thalictroides subsp. thalictroides**

1 Plants ca. 60 cm in height, sterile fronds ca. 35 cm long, 2-pinnatifid...**C. thalictroides subsp. gaudichaudii**

Ceratopteris thalictroides (L.) Brongn. subsp. thalictroides; Bull. Soc. Philom. 1821:186. 1821; Blatter & d’Almeida, Ferns Bombay, 96. 1922; Dixit, Cens. Indian Pterid. 84. 1984; Chandra & Kaur, Nomen Guide Bedd. 9. 1987; Manickam & Irudayaraj, Pterid. Fl. West Ghats. 91. t. 67. 1992; Khullar, Illus. Fern West Himal. 1:332-334. 1994; Chandra, Ferns India 24. 2000; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:235, 236. 2017. *Acrostichum thalictroides* L., Sp. Pl. 2:1070. 1753.

***Figure*:** 43, 44

Lectotype: Sri Lanka, ‘Habitat *in* Zeylonae aquosis’, Herb. Hermann 3:42, No. 377, BM (000594684); designated by: Pichi Sermolli, Webbia 12:650. 1957.

Plants aquatic herb, sometimes terrestrial, 4-50 cm long, herbaceous, green; *rhizomes* 5-50 mm, erect, short, sparsely scally, yellowish brown; *roots* long fibrous roots, numerous, free-floating or in mud; *fronds* dimorphic, clustered, erect, sometimes pubescent, herbaceous, fleshy, green-yellowish green; *sterile fronds*: 5-30 cm long, 1 per plant, sometimes 2-3 per plant, pinnatifid, thin, membranaceous; *stipes* 2-10 cm long, green, semi-cylindrical, ridged, fleshy, thick, succulent, sparsely scaly; *rachis* glabrous, rarely sparsely scally, green; *lamina* 3-20 cm long, erect or procumbent, uni-bipinnate, ovate-lanceolate, sometimes narrowly triangular, apex acuminate, base broad, narrowly triangular lanceolate, vegetative buds present on senescent lamina; *pinnae* 2-10 x 1-3.5 cm, 4-9 pairs, ovate-deltoid, alternate, short stalked basally, sessile above, apex acuminate, base broad, basal pairs unipinnate, margin incised or variously lobed; *pinnules* 1-2 pairs, alternate, sessile, ovate, narrowly winged, apex obtuse to sub obtuse, base rounded-truncate, margin entire; *veins* reticulate forming number of areolae, conspicuous; *fertile fronds*: 5-45 cm long, 1-5 per plant; *stipes* 2-18 cm long, green, semi-cylindrical, ridged, succulent, base sparsely scaly; *lamina* 3-27 cm long, erect, rarely procumbent, bi-tripinnate, ovate-lanceolate or ovate triangular, apex acuminate, dissected, base round, dissected; *pinnae* 2-10 cm, 3-10 pairs, alternate, ovate-deltoid, short stalked; *ultimate segments* 1-5 cm long, linear or needle like, alternate, margin reflexed abaxially towards costa, abaxial surface covering two rows of sporangia, apex acute; *sori* in 1-2 rows; *sporangia* covered by reflexed margin, globose-subglobose, short stalked, transverse dehiscence, brown; *spores* 45 µm, 32 per sporangium, trilete, tetrahedral.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: July-October

Distribution: ***World***: Australia, New Guinea, Bangladesh, China, India, Indonesia, Japan, Madagascar, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam; ***India***: Andaman & Nicobar, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Nagaland, Odisha, Punjab, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand, West Bengal; ***Gujarat***: Banaskantha, Junagadh, Narmada, Panchmahal & Porbandar.

Ecology: This taxon growing in slow flowing rivers or streams, ditches and seasonally wet and marshy areas.

IUCN category: Least Concern (LC)

BOLD ID: MIPDG007-15

Specimen examined: PHILIPPINES, Luzon Laguimanoc, Tayabas Province, 13°55’N 121°49’E, 3.1905, *E.D. Merrill* 4012 (K000506222); INDIA, Gujarat, Narmada Dt., Khunta Amba, 21°43.0800’N 73°28.2133’E, 151m, 16.11.2014, *R.N. Kachhiyapatel & K.S. Rajput* 119 (BSJO 40937; BLAT!; BARO!).

Ceratopteris thalictroides (L.) Brogn. subsp. gaudichaudii (Brongn.) Fraser-Jenk. & Pariyar, Ferns Fern-Allies Nepal 1:257. 2015; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:236. 2017. ***Figure*: 89 (I)**

Type: Pacific Islands, Guam, Agana river, C. Gaudichaud-Beaupre 83, P, G, FI.

Plants aquatic herb, 10-60 cm long, herbaceous, green; *rhizomes* 6-60 mm, erect, sparsely scally, yellowish brown; *roots* long fibrous, numerous; *fronds* dimorphic, clustered, erect, herbaceous, green-yellowish green; *sterile fronds*: 7-35 cm long, 1-2 per plant, 2-pinnatifid, thin, membranaceous; *stipes* 5-20 cm long, green, semi-cylindrical, ridged, thick, succulent, sparsely scaly; *rachis* glabrous, rarely sparsely scally, green; *lamina* 5-39 cm long, erect, bipinnate, ovate-lanceolate, apex acuminate, base broad, narrowly triangular lanceolate, vegetative buds present on senescent lamina; *pinnae* 5-20 x 1.2-4.7 cm, 5-10 pairs, ovate-deltoid, alternate, short stalked basally, sessile above, apex acuminate, base broad, margin incised or variously lobed; *pinnules* 1-3 pairs, alternate, sessile, ovate, apex obtuse, base rounded-truncate, margin entire; *veins* reticulate forming number of areolae; *fertile fronds*: 10-58 cm long, 1-6 per plant; *stipes* 5-20 cm long, green, ridged, succulent, base sparsely scaly; *lamina* 5-32 cm long, erect, bi-tripinnate, ovate-lanceolate or ovate triangular, apex acuminate, dissected, base round, dissected; *pinnae* 5-20 cm, 3-12 pairs, alternate, ovate-deltoid, short stalked; *ultimate segments* 1-5 cm long, linear, alternate, reflexed margin abaxially towards costa, abaxial surface covering two rows of sporangia, apex acute; *sori* in 1-2 rows; *sporangia* covered by reflexed margin, globose-subglobose, short stalked, transverse dehiscence, orange to brown; *spores* 45-55 µm, 34 per sporangium, trilete, tetrahedral.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: July-October

Distribution: ***World***: Bhutan, China, India, Japan, Korea, Myanmar, Nepal, Taiwan; ***India***: Arunachal Pradesh, Assam, Bihar, Gujarat, Himachal Pradesh, Jammu & Kashmir, Kerala, Manipur, Sikkim, Uttarakhand, West Bengal; ***Gujarat***: Porbandar.

Ecology: This taxon growing in shaded streams, ditches and seasonally wet and marshy areas of the forest.

IUCN category: Data Deficient (DD)

Specimen examined: GUAM, Insulis Marianis, Locis Paludosis, *C. Gaudichaud* (P00301488); INDIA, Gujarat, Porbandar Dt., Shermalki Nes, 21°45.7800'N 69°43.3100'E, 196m, 22.11.2015, *R.N. Kachhiyapatel & K.S. Rajput* 166-A (BARO!).

Actiniopteris Link, Fil. Spec. 79. 1841

Lectotype: *Actiniopteris radiata* (Sw.) Link (=*Asplenium radiatum* Sw.), designated by: Pichi Sermolli, Webbia 17:6-7. 1962.

Etymology: The genus *Actiniopteris* is derived from the Greek words *aktin* 'ray' and *pteris* 'a fern' referring to the lamina looking like radial shaped.

Common name: Ray Fern

Monophyletic, 6 species worldwide and 1 species in India

Actiniopteris radiata (Sw.) Link, Fil. Sp. 80. 1841; Blatter & d'Almeida, Ferns Bombay 122. Pl. 10. 1922; Manickam, Fern FI. Palni Hills 27. 1984; Dixit, Cens. Indian Pterid. 68. 1984; Manickam & Irudayaraj, Pterid. Fl. W. Ghats 81. pl.58. 1992; Khullar, Illus. Fern West Himal. 1:247-248. 1994; Chandra, Ferns India 28. 2000; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:198. 2017. *Asplenium radiatum* Sw., Schrader, J. Bot. 1800(2):50. 1801. *Actiniopteris australis* (L.f.) Link var. *radiata* (Sw.) C. Chr., Dansk. Bot. Ark. 7:125. 1932. ***Figure*:** 45, 46

Lectotype: India, Kerala, Coromandel, Tranquebar, *J. Konig* misit J. Banks, 1776, Herb. L.J. Montin, S-Pa; designated by: Pichi-Sermolli, Webbia 17(1):11. 1962.

Plants 5-35 cm long, lithophytic herb, annual, erect; *rhizomes* 5-30 mm long x 5-10 mm broad, erect, rarely short creeping, thick, hard, scaly, dark, bears densely fibrous roots, covered with persistent stipe bases; *rhizome scales* 2-5 cm long x 1-3 mm broad, bicolorous, central dark brownish black band, pale yellow edges, lanceolate, apex acuminate, base broad, margin entire; *fronds* 5-32 cm long, tufted, erect, spirally arranged, erect, sterile fronds smaller than fertile fronds; *stipes* 4-28 cm x 0.5-2 mm thick, numerous, erect, compact, dark blackish brown at the base, pale yellow above, abaxial side concave grooved, adaxial surface round, scaly throughout; *stipes scales* concolorous, ovate to lanceolate, light yellow to brown; *lamina* 1-5 cm long x 2-8 cm broad, palmately compound, flabellate, semi-circular, divided into two equal halves by central deep notch, 3-5 times divided dichotomously, adaxial side of lamina base sparsely concolorous scales, abaxial side hairy, green; *ultimate segments* 0.5-2.5 cm long x 0.5-1.5 mm broad, 32-36, linear, narrow, apex divided into two acute teeth, margin entire, texture coriaceous, adaxial surface glossy, dried lamina rolls to the side of costules, fertile lamina bears intra-marginal reflexed line, bearing sporangia; *veins* dichotomous, free, running parallel to the edge of the lobe; *sori* 5-15 mm long x 0.2-0.4 mm broad, linear, elongated, numerous, protected by continuous reflexed margin flap abaxially, false indusiate; *sporangia* numerous, spherical, stalked, annulus 14-18 celled, horizontally dehiscent; *spores* 30 x 45 micro, trilete, tetrahedral, verrucate, yellowish-brown.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: August-December

Distribution: ***World***: Africa, Bhutan, India, Madagascar, Mauritius, Myanmar, Nepal, Pakistan, Saudi Arabia, South Africa, Sri Lanka, Yemen; ***India***: Andhra Pradesh, Bihar, Chhattisgarh, Delhi, Goa, Gujarat, Haryana, Karnataka, Kerala, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttarakhand; ***Gujarat***: Banaskantha, Dahod, Junagadh, Kachchh, Narmada, Panchmahal, Sabarkantha & Surendranagar.

Ecology: This species commonly found in shaded rocky cliffs of dry forest areas.

IUCN category: Least Concern (LC)

BOLD ID: MIPDG001-15

Specimen examined: INDIA, Karnataka, Mysore, Hassan Dist. Nagpuri (Hole Narsipur), 12°46'N 76°14'E, 16.6.1969, *C.J. Saldanha* 14113 (K000539314); Gujarat, Kachchh Dt., Bhuj, 16.6.1956, *G.S. Puri* (BSI 19845); Kachchh Dt., Bhuj, Sudasna hills, 29.1.1957, S.K Jain 11426 (BSI 19852); Palanpur Dt., Jessore R.F., 2.6.2002, *S.L. Meena* 17837 (BSJO 25802); Mehsana Dt., Kheralu, Toran Mata R.F., 30.6.2002, *P.J. Parmar* 12520 (BSJO 25069, 25070); Palanpur Dt., Kangara, Ambaji, 10.10.2002, *S.L. Meena* 18041 (BSJO 25863, 25864); Mehsana Dt., Taranga hills, 24.6.2004, *P.J. Parmar* 19223 (BSJO 29107, 29108); Panchmahal Dt., Pavagadh, 22°28.6100'N 73°31.3033'E, 234m, 29.7.2014, *R.N. Kachhiyapatel & K.S. Rajput* 7 (BSJO 40940; BARO!).

Anogramma Link, Fil. Sp. 137. 1841

Lectotype: *Anogramma leptophylla* (L.) Link (=*Polypodium leptophyllum* L.), designated by: Christensen, Index Fil. XXXVII. 1906.

***Etymology*:** The genus *Anogramma* is derived from the Greek words *ano* 'above' and *gramma* 'line or thread' for the reference to the position of the sori in lines

Common name: Jersey fern

Polyphyletic, *ca*. 5 species worldwide and 2 species in India

Anogramma reichsteinii Fraser-Jenk., New Sp. Syndr. Indian Pteridol. 35. 1997; Fraser-Jenkins *et al*. Ferns Fern-allies Nepal 1:254-255. 2015; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:234. 2017; Kachhiyapatel *et al.* Indian Fern J. 34:75. 2017. ***Figure*:** 47, 48

Type: India, Uttarakhand, Nainital Dt., *C.R. Fraser-Jenkins & Y.P.S. Pangtey* 24331 (FN 309), 11/9/1996, BM.

Plants 2-5 cm long, small annual herb, terrestrial, short lived, new plants can grows from perennial gametophytes; *rhizomes* 0.8-2.5 mm x 1-2 mm in diameter, erect, short, minute, distinguishable; *scales* very few, narrow, pale yellow; *fronds* 1-5 cm long, tufted, herbaceous, delicate, annual, fertile fronds taller and more pinnate than sterile ones, sterile fronds basally arranged, short and fan-shaped; *stipes* 0.6-3 cm long, pale-green when young, reddish brown at maturity, glossy, erect, slender, rounded, nearly glabrous, rarely scaly at the base; *lamina* 0.3-2 cm long, pinnatifid to pinnate, occasionally bipinnatifid, pale green to dark green, glabrous, oblong to triangular in outline; *pinnae* 1-2 pairs, distant, short stalked, narrowly ovate, base cuneate, fan-shaped pinnae margin crenate or lobed; *veins* free, simple or forked, reaching near to, but just within the margin; *sori* 1-2 mm long, elongated, simple, clustered, oblong, running for a short distance along the veins, exindusiate, bearing both young and mature sporangia; *sporangia* 250-350 μm, stalked, transversely dehiscent, sporangia capsule oblong, annulus 20-26, dark brown; *spores* 42-55 μm in diameter, tetrahedral, globose, trilete, reticulate.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: July-August

Distribution*: *World: India, Nepal; ***India***: Gujarat, Himachal Pradesh, Maharashtra, Uttarakhand; ***Gujarat***: Dangs.

Ecology: This taxon is not common in forest, growing on terrestrial moist and humid area of forest cliffs.

IUCN category: Data Deficient (DD)

BOLD ID: MIPDG068-21

Specimen examined: INDIA, Maharashtra, Panhala fort, 600m, 20.9.2013, *A. Benniamin* 195260 (BSI 134106, 164107) in error for *A. leptophylla*; Gujarat, Dang Dt., Mahardar hills, 20°44’57.24"N 73°56’5.82"E; 20°45’13.14"N 73°56’22.20"E, *ca*. 800-900 m., 28.08.2016, *R.N. Kachhiyapatel & K.S. Rajput* 193 & 194 (BSJO 40941, 40942; BARO 123450070028).

Pteris L., Sp. Pl. 2:1073. 1753

Lectotype: *Pteris longifolia* L., (=*P. vittata* subsp. *longifolia* (L.) Fraser-Jenk. & Pariyar) designated by: J. Smith, Hist. Fil., 295. 1875.

Etymology: The genus *Pteris* is derived from the Greek words ‘pteron’ wing or feather resembling for the closely spaced pinnae, which give the leaves a likeness to feathers.

Common name: Brake; Dish fern; Table fern, Chinese brake; Ladder brake

Monophyletic, *ca*. 250 species worldwide, 50 species, 11 subspecies and 1 hybrid in India

Pteris vittata L., Sp. PI. 2: 1074. 1753; Blatter & d' Almeida, Ferns Bombay 83. 1922; Verma & Khullar, Fern Gaz. 12:85. 1980; Dixit, Cens. Ind. Pterid. 73. 1984; Manickam & Irudayaraj, Asp. PI. Sci. 13. 29. 1991; Manickam & Irudayaraj, Pterid. FI. Western Ghats 68. 1992; Khullar, Ill. Fern Fl. West Him. 1:279, t.101. 1994; Chandra, Ferns India 46. 2000; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:307. 2017.

subsp. vittata L. Sp. 2:1074. 1753, ex Hieron., Hedwigia 64:290. 1914. *Polypodium trapezoides* Burm.f., Fl. Indica t.66, f.2. 1768. *Pteris obliqua* Forssk., Fl. Aegypt.-Arab. 185. 1775. *Pteris lanceolata* Desf., Fl. Atlant., 2(9):401. 1799. ***Figure*:** 49, 50

Lectotype: China, Canton, Guangdong, *P. Osbeck*, Herb. Linn. No. 1246.3, LINN; designated by: Tryon, Contrib. Gray Herb. 194:191. 1964.

Plants 10-80 cm long, terrestrial to lithophytic herb, perennial, *rhizomes* 2-8 cm long, erect to sub-erect, densely scaly, dark brown, bearing numerous fibrous roots, persistent stipe base; *rhizome scales* 2-7 mm long, ovate-lanceolate, concolorous, margin entire, apex acuminate, base broad, yellow, thin, membranaceous; *fronds* 8-72 cm long, clustered, oblong-obovate, herbaceous to sub-coriaceous; *stipes* 3-12 cm long, 2-4 mm in dia., erect to procumbent, light brown to straw-coloured, stipe base densely scaly, sparsely above, adaxially grooved, abaxially rounded; *stipe scales* same as rhizome scales; *lamina* 5-60 cm long, oblong-obovate, simply pinnate, imperipinnate, terminal pinnae larger, lower pairs of pinnae gradually reduced, wide above to middle, pale green; *rachis* 2-5 mm in dia., adaxially grooved, abaxially rounded, sparsely scaly, yellowish brown; *pinnae* 5-12 cm long, 6-12 mm broad, *ca*. 26 pairs, opposite or sub-opposite, rarely alternate, simple, linear, short stalked, oblique, thin, herbaceous, apex acuminate, base sub-cordate, sterile pinnae margin entire or slightly toothed, fertile pinnae margin reflexed, decumbent, short auricled on both acroscopic and basiscopic sides; *costae* 1-2.5 mm, conspicuous, yellowish brown; *veins* conspicuous, 1-3 times anastomosing, free, arising from the costae, reaching up to margin of pinnae; *sori* 0.5-1.5 mm broad, continuous, marginal, except at base and apex, false induciate; *indusia* membranaceous, whitish yellow, margin irregularly serrate; *sporangia* clustered, stalked, sporangia capsule globose, annulus 18-26, dark brown; *spores* 45-55 µm, yellow, trilete, tetrahedral, proximally tuberculate to rugulose, reticulate distally.

Phenology: Perennial; ***Sterile phase***: February-July; ***Fertile phase***: August-January

Distribution**: **World: Africa, Australia, Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Japan, Madagascar, Malaysia, Myanmar, Nepal, New Guinea, Pakistan, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam; ***India***: Andaman & Nicobar, Andhra Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Orissa, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand, West Bengal; ***Gujarat***: Banaskantha, Dahod, Gir Somnath, Junagadh, Panchmahal, Sabarkantha, Dangs & Valsad.

Ecology: This species is epipetric, frequently found on forest and road side cuts, old mossy walls, rock outcrops and dry and moist clefts of forest.

IUCN category: Least Concern (LC)

Specimen examined: MALAYSIA, Kelantan Kuala Aring, 4°56’N 102°21’E, 6.9.1895, *R.H. Yapp* 159 (K000444310); INDIA, Rajasthan, Pali Dt., near Ranakpur Temple, 18.2.1975, *B.V. Shetty* 1612 (BSJO 6234, 6235); Maharashtra, Chandgad, 17.9.2013, *A. Benniamin* 195206 (BSI 133984); Gujarat, Dangs Dt., Dhulda, 20°57.45833’N 73°39.17167’E, 193m, 3.1.2015, *R.N. Kachhiyapatel & K.S. Rajput* 137 (BSJO 40943, BSI 140158; CNH!).

Adiantum L., Sp. Pl. 2:1094. 1753

Lectotype: *Adiantum capillus-veneris* L., designated by: J. Smith, Hist. Fil. 274. 1875.

Etymology: The genus *Adiantum* is derived from the Greek word *adiantos* ‘unwetted’ referring for the glabrous leaves, which shed raindrops.

Common name: Huruhuru tapairu; Maidenhair fern; Makawe tapairu

Monophyletic, *ca*. 225 species worldwide, 12 species, 6 subspecies, 8 exotic species and 1 hybrid in India

Key to the species of Adiantum

1 Fronds 2-3 pinnate, deltoid-triangular...**A. capillus-veneris**

1 Fronds pinnate, ovate-lanceolate

  2 Frond densely hairy, pinnae suboblong…………………………………….**A. incisum**

  2 Fronds glabrous, pinnae lunate…………………...**A. philippense subsp. philippense**

Adiantum capillus-veneris L., Sp. PI. 2:1096. 1753; Blatter & d’Almeida, Ferns Bombay 69. 1922; Dixit, Census Indian Pterid. 74. 1984; Chandra & Kaur, Nom. Guide Bedd. Ferns S. India & Ferns Brit. India 1. 1987; Vasudeva *et al*. Indian Fern J. 8:164. 1991; Manickam & Irudayaraj, Pterid. FI. Western Ghats 103. PI. 79. 1992; Vasudeva & Bir Indian Fern J. 10:56-57. 1993; Khullar, Ill. Fern Fl. West Him. 1:289-290, t.103.

1994; Fraser-Jenkins, New Sp. Syndr. Indian Pterid. 31. 1997; Rajagopal & Bhat, Indian Fern J. 15:10. 1998; Chandra, Ferns lndia 66. 2000. 1:133. 2003; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:199. 2017. ***Figure*: **51, 52

Lectotype: France, Montpellier, *P. Magnol*, LINN (LINN-HL1252-9); designated by; Pichi Sermolli, Webbia 12:678. 1957.

Plants 10-50 cm, terrestrial herb, epilithic, perennial; *rhizome* 5-12 mm long, 1-5 mm in dia., short creeping, sometimes branched, horizontal, slender, densely scaly, bearing branched fibrous roots; *rhizome scales* 1-2 mm long, linear-lanceolate, acuminate apex, rounded base, margin entire, concolorous, brown; *frond* 9-49 cm long, 1-5 per plant, ovate, 2-3 pinnate with apical pinnae, deltoid-triangular, procumbent, spreading, light green; *stipes* 4-10 cm long, 1-3 mm in dia., procumbent, adaxially grooved, abaxially rounded, distant, black, glossy, scales at the base, glabrous above; *lamina* 5-39 cm long, deltoid-triangular, spreading, tripinnate basally, bipinnate above, unipinnate apically, apex acute in outline, base broad; *rachis* 5-36 cm long, 1-3 mm in dia., flexuous, adaxially slightly grooved, abaxially rounded, black, glossy, glabrous; *pinna* 2-10 cm long, 1-3 cm broad, 3-8 pairs, ovate, alternate, pinnate basal pairs, stalked, glabrous, *pinnae* 2-3 x 1-2 cm, 2-15 per pinna, flabellate, alternate, short stalked, apex broad, base cuneate, apical margin deeply crenate-incised, lateral margin entire, concave, glabrous, light green, herbaceous, terminal margin reflexed; *veins* conspicuous, free, forked above, ultimate margin terminating into teeth; *sori* 1-3 mm x 0.5-1.5 mm, 3-9 per pinnae, linear, elliptic or curved, marginal, pseudoinduciate or reflexed pinnae margin, membranous, whitish yellow at young, brown when mature, persistent, *sporangium* 200-300 µm, globose, stalked, annulus 14-18, brownish black; *spore* 50-80 µm, trilete, tetrahedral, nonperisporiate.

Phenology: Perennial; ***Sterile phase***: February-July; ***Fertile phase***: August-January

Distribution**: **World: Africa, Australia, Bangladesh, Bhutan, China, India, Indonesia, Japan, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam; ***India***: Andaman & Nicobar, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chandigarh, Chhattisgarh, Delhi, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Pondicherry, Punjab, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura, Uttar Pradesh, Uttarakhand, West Bengal; ***Gujarat***: Bhavnagar, Kachchh, Tapi & Dangs.

Ecology: This species naturally growing as terrestrial, lithophytic in shaded or semi-shaded area along river sides and stream.

IUCN category: Least Concern (LC)

BOLD ID: MIPDG005-15

Specimen examined: PHILIPPINES, Luzon Burgos, Province of Ilocos Norte, 18°31’N 120°39’E, 2.1917, *M. Ramos* 27136 (K000507547); INDIA, Gujarat, Valsad Dt., Dharampur, 13.6.1959, *P.S. Timir* 39040 (BSI 29611); Tapi Dt., Songadh, Ghuntvel, near Khogal village, 21°00.6400’N 73°34.7216’E, 137m, 4.1.2015, *R.N. Kachhiyapatel & K.S. Rajput* 146 (BSJO 40945, BSI 140189, 140156, BLAT!, CNH!, BARO!); Rajasthan, Alwar Dt., Sariska Tiger Reserve, 12.4.1984, *P.J. Parmar*, 9733 (BSJO 14167); Pali Dt., near Ranakpur Temple, 18.2.1975, *B.V. Shetty* 1610 (BSJO 6230); Udaipur Dt., Charhhiya R.F., 8.7.1995, *R.P. Pandey* 12163 (BSJO 18997, 18998).

Adiantum incisum Forsskal, FI. Aeg., 187. 1775; Verma & Khullar, Fern Gaz. 12:85. 1980; Dixit, Census Indian Pterid. 75. 1984; Vasudeva *et al*. Indian Fern J. 8:175. 1991; Manickam & Irudayaraj, Pterid. FI. W. Ghats 97. pl.72. 1992; Vasudeva & Bir Indian Fern J. 10:56. 1993; Khullar, Ill. Fern Fl. West Him. 1:291-296, t.105. 1994; Chandra, Ferns India, 70. 2000; Chandra, Ferns India 70. 2000; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:205. 2017. ***Figure*:** 53, 54

Type: Yemen, Al Hadiyah, *P. Forsskal* 813, C (C10001580).

Plants 10-60 cm long, terrestrial, epilithic, herbaceous, annual, green; *rhizome* 1-5 cm long, 0.5-3 cm wide, erect, rarely sub-erect, unbranched, dark brown, densely scaly, sometimes covered with persistent stipe base, basally bearing fibrous roots; *rhizome scales* 1-3 mm long, 0.5-1 mm wide, linear lanceolate, yellowish-brown, concolourous, apex acuminate, base broad, rounded, margin entire; *fronds* 9-55 cm long, 1-6 per plants, pinnate, ovate-lanceolate, spirally arranged on rhizome, spreading, rarely procumbent, sometime apex proliferated; *stipes* 2-8 cm long, 1-2.5 mm in dia., tufted, spreading, rarely procumbent, proximate, base scaly, densely hairy above, rounded, reddish brown or brownish black; *stipe base scales* same as rhizome scales, slightly narrow; *stipe hairs* uniseriate, multicellular, 2-4 celled, yellowish brown; *lamina* 7-47 cm long, 1-4 cm broad, ovate-lanceolate, simple pinnate, apex acuminate, sometimes proliferating, base broad, upper surface glabrous, rarely scantly hairy, lower surface hairy, bearing 15-25 pairs of pinnae; *rachis* 7-45 cm long, 1-2.5 mm in dia., straight, densely hairy, rounded, reddish brown or brownish black, terminating with apical pinnae, sometimes apical portion proliferating, hairs same as stipe hairs; *pinnae stalk* 2-10 mm long slender, hairy;

pinnae 0.5-1 cm long, 1-2 cm broad, 15-25 pairs, suboblong, basal pairs oblique, above pairs alternate, subsessile, apical pinnae short, sessile, widely spaced, membranaceous, pale to light green, dimidiate, hairy upper and lower surface, base cuneate, lower margin concave, rarely straight, entire, hairy, basally lateral margin parallel to rachis, entire, upper margin deeply incised, 2-5 times, primary closely lobe with wide sinus; *pinnae hairs* yellowish brown, uniseriate, pluricellular; *veins* forked free, reaching the margin; *sori* 1-5 mm long, 0.5-1 mm broad, 2-6 per pinnae, linear-oblong, sometimes slightly curved, born in reflexed margin of pinnae, margin hairy, induciate, indusia light brown, hairy, margin almost straight, membranaceous; *sporangium* 200-300 µm, spherical, stalked, annulus 15-19, brownish black; *spore* 40-70 µm, trilete, tetrahedral, nonperisporiate, light brown.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: July-January

Distribution: ***World***: Africa, Bangladesh, Bhutan, China, India, Madagascar, Mauritius, Myanmar, Nepal, Pakistan, Sri Lanka; ***India***: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chandigarh, Chhattisgarh, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand, West Bengal; ***Gujarat***: Banaskantha, Chhota Udaipur, Dahod, Junagadh, Kachchh, Narmada, Panchmahal, Porbandar, Sabarkantha, Tapi, Dangs & Valsad.

Ecology: This taxon generally growing as terrestrial in rock crevices, forest slopes, cliffs, road side cuts.

IUCN category: Least Concern (LC)

Specimen examined: TANZANIA, Lushoto, T3 Usambara, 5.1915, *A. Peter* 10315 (K000570767); INDIA, Rajasthan, Pali Dt., Dhorisar Mahadev forest hills, 500m, 20.8.1975, *B.V. Shetty* 6668 (BSJO 16210); Alwar Dt., Sariska Tiger Reserve, Kankwari forest block, 23.10.2003, *P.J. Parmar* 2721 (BSJO 14165); Banswara, Mahi river, 27.9.1961, *K.C. Kanidia* 75357 (BSI 47889); Jalor Dt., Sunda Hills, Rajpura, 11.9.1978, *B.L. Vyas* 5900, (BSJO 16209); Jalor Dt., Sareh Mandir, 21.9.1978, *B.V. Shetty* 1817 (BSJO 16211); Sikar Dt., Baleshwar F. B. Dariba, 19.9.1992, *P.J Parmar* 10525 (BSJO 18213, 18214); Maharashtra, Panhala, 19.9.2013, *A. Benniamin* 195249 (BSI 134096) determined by *CRFJ* 2017; Panchgani, 24.9.2013, *A. Benniamin* 195323 (BSI 134097) determined by *CRFJ* 2017; Gujarat, Sabarkantha Dt., Vijay Nagar, 23°54.3300'N

73°14.3200E, 361m, 31.8.2014, *R.N. Kachhiyapatel & K.S. Rajput* 59 (BSJO 40946; BSI 140096; BLAT!; BARO!).

Adiantum philippense subsp. philippense, Sp. Pl. 2:1094. 1753; Dixit, Census Indian Pterid. 75. 1984; Vasudeva & Bir, Indian Fern J. 10:55. 1993; Fraser-Jenk., New Sp. Syndr. Indian Pterid. Ferns Nepal 35. 1997; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:208. 2017. *Adiantum lunulatum* Burm.f., Fl. Indica 235. 1768, non Houtt. 1783.

***Figure*:** 55, 56

Lectotype: Philippines, Luzon, designated by: Pichi Sermolli, Webbia 12:665. 1957; ***Epitype:*** India, West Bengal, Sidrapong, Darjeeling, 2000 ft., *S.C. Verma*, 8. 1956, PAN (260); designated by: Verma & Fraser-Jenkins 2008.

Plants 6-66 cm long, terrestrial, epilithic, herbaceous, annual, green; *rhizome* 1-6 cm long, 4-40 mm wide, erect-sub-erect, sometimes short creeping, unbrnched, brownish black, apically densely scaly, sparse basally bearing numerous fibrous roots, sometimes covered with persistent dark blackish-brown stipe base; *rhizome scales* 1-2.8 mm long, 0.5-1.2 mm wide, lustrous, narrowly linear lanceolate, brown, bicolorous, dark brown centre, yellowish marginal, sometimes concolourous, apex acuminate, base broad, rounded, margin entire; *fronds* 5-60 cm long, 1-5 per plants, clumped, spreading, arching-pendate, pinnate, ovate-lanceolate, sometime apex proliferated; *stipes* 2-9 cm long, 1-2 mm in dia., tufted, lustrous, spreading, arching-pendate, proximate, base sparsely scaly, glabrous, rounded, reddish brown or brownish black, polished, glossy; *stipe base scales* same as rhizome scales, slightly narrow, sparse; *lamina* 3-51 cm long, 1-6.5 cm broad, herbaceous, glabrous, ovate-lanceolate or oblong-lanceolate, base broad, gradually reduced at tips, simple pinnate, apex acuminate, sometimes flagelliform tips, base broad; *rachis* 3-51 cm long, glossy, glabrous, slender, rounded, bearing 14-26 pairs of alternate pinnae, sometimes apex proliferating; *pinnae stalk* 2-14 mm long, short, slender, glossy, black, glabrous, largest at lower pinnae, subsessile apically; *pinnae* 0.4-2.5 cm long, 1-3.2 cm broad, 14-26 pairs, alternate, basal pairs largest, rarely oblique, apical pinnae short, subsessile, widely spaced, membranaceous, light green-green, suborbicular to obliquely oblong-ovate or lunate, glabrous upper and lower surface, base rounded, lower margin straight, rarely concave, entire, glabrous, upper margin entire to deeply incised, sometimes incised-lobate, 2-5 times, lobes rounded, basal lobes broadly cuneate, primary closely lobe with wide sinus, herbaceous; *veins* free, forking, ending at the entire margins; slightly raised; *sori* 1-7 mm long, 0.5-2 mm broad, 3-6 per pinnae, linear or curved, marginal, born in reflexed margin of pinnae, glabrous, induciate;

indusia light brown, glabrous, herbaceous, margin almost straight, membranaceous; *sporangium* 200-300 µm, globose, stalked; *annulus* 15-18, brownish black; *spore* 46-70 µm, trilete, tetrahedral, nonperisporiate, light brown-yellow.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: August-January

Distribution**: **World: Africa, Australia, Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Madagascar, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam; ***India***: Andaman & Nicobar, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Lakshadweep, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand, West Bengal; ***Gujarat***: Banaskantha, Chhota Udaipur, Dahod, Junagadh, Kachchh, Mahisagar, Narmada, Navsari, Panchmahal, Porbandar, Sabarkantha, Tapi, Dangs & Valsad (common throughout forest areas in the state).

Ecology: A very common taxon, found in all forest areas as terrestrial in moist and dry forest. Often growing along streams, road sides, cuts, crevices, forest slopes etc. This is growing in low to high elevation ranging from 130-1000 m.

IUCN category: Least Concern (LC)

Specimen examined: PHILIPPINES, Mindoro Manila, Intramuros, 24.8.1904, *D.L. Topping* 541 (K000507315); INDIA, Gujarat, Junagadh Dt., Girnar, 21.7.1957, *G.S. Puri* 22231 (BSI 46722) Determined by *S.R. Ghosh* & *N.C. Nair* 11.11.1979; Dangs, Chandkhel, 28.8.1958, *S.K. Jain* 43246 (BSI 28850); Mehsana Dt., Taranga hills, Kheralu, 28.9.2003, *P.J. Parmar* 12937 (BSJO 27489, 27490); Sabarkantha Dt., Vijay Nagar, 23°54.3300’N 73°14.3200’E, 361m, 31.8.2014, *R.N. Kachhiyapatel & K.S. Rajput* 58 (BSJO 40947); Kerala, Kumali, 750m, 16.10.1968, *N.C. Nair* 4081A (CAL 0000062961), *determined by S.R. Ghosh* 10.12.1974, 24.7.1975.

Aleuritopteris Fee, Mem. Foug. 5 Gen. Fil. 153-154. 1852

Lectotype: *Aleuritopteris farinosa* (Forssk.) Fee (=*Pteris farinosa* Forssk.), designated by: Christensen, Index Filic. XLII. 1906.

Common name: Silver fern

Etymology: The genus *Aleuritopteris* is derived from the Greek words *aleurrites* ‘floury bread’ and *pteris* ‘fern’, a plant resemble like flurry bread fern.

Not monophyletic, *ca*. 40 species worldwide, 19 species and 11 hybrids in India

Key to the species of Aleuritopteris

1 Bicolorous scales on stipes

2 Scales strictly on the stipe base...**A. bicolor**

2 Scales throughout on stipe...**A. anceps**

1 Scales on stipes bicolorous, rachis and costa scales concolorous

3 Scales on stipes and rachis..**A. formosana**

3 Scales on stipes, rachis and costa...**A. albomarginata**

Aleuritopteris albomarginata (C.B.Clarke) Ching, Hong Kong Nat. 10(3-4):199. 1941; Fraser-Jenk. *et al*. Ferns Fern-Allies Nepal 1:241. 2015; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:218. 2017. *Cheilanthes albomarginata* C.B.Clarke, Trans. Linn. Soc. Lond., 2 Bot., 1:456, t. 52. 1880. ***Figure***: 57, 58

Lectotype: *Cheilanthes albomarginata* C.B. Clarke; India, Kashmir (Kathua), Basaoli (Basohli), 5000 ft., *C.B. Clarke* 31586, 26/9/1876, K.

Plant 25-50 cm long, terrestrial, annual; *rhizome* 1-3 x 0.5-2 cm, erect, short, dark brown, scaly; *scales* 4-7 cm long, bicolorous, black centre, pale margins, linear-lanceolate, margin entire; *fronds* 20-47 x 10-15 cm, clustered; *stipe* 5-12 cm x 1-2 mm, dark brown to blackish brown, scaly throughout, densely scaly at the base; *scales* 3-7 cm long, black centre, pale margins, lanceolate; *lamina* 15-35 x 5-10 cm, deltoid to oblong-deltoid, pinnate-bipinnatifid base, sagittate base, long acuminate pinnatifid apex, green to dark green above, glabrous above, white farina beneath, sparsely scaly beneath, scales on rachis and costae; *pinnae* 8-12 x 5-8 cm, 4-9 pairs, sessile apical pairs of pinnae, acuminate, basal pairs of pinnae subsessile, ovate to ovate-deltoid basal pair of pinnae, pinnatifid apically, bipinnatifid basally; *pinnules* 1.5-6 x 0.5- 2 cm, 5-10 pairs, sessile, acroscopic pinnules smaller than adjoining basiscopic pinnules, lanceolate, pinnatifid, second basal pair of pinnae shape same and smaller than basal most pair of pinnae pair, pinnatifid, third basal and upper pinnae pairs linear-lanceolate, pinnatifid; *sori* 2-7 mm, pseudoinduciate, marginal; *indusia* 2-6.5 mm broad, thin membranaceus, yellowish brown, marginal, broad near midvein, interrupted, margin dentate, persistent; *sporangia* 300-500 µm, numerous, jointed at base, sub-globose, 14-20 annular cells, younger yellow, mature brown; *spores* 45-60 µm in diameter, trilete, round-elliptic.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: July-January

Distribution: ***World***: Bhutan, China, India, Myanmar, Nepal, Pakistan, Philippines, Taiwan, Thailand, Vietnam; ***India***: Arunachal Pradesh, Gujarat, Himachal Pradesh, Jammu & Kashmir, Maharashtra, Manipur, Meghalaya, Nagaland, Odisha, Sikkim, Uttar Pradesh, Uttarakhand and West Bengal; ***Gujarat***: Junagadh and The Dangs

Ecology: This taxon is found in high elevation ranging from 700-1000 m as epipetric or terrestrial in forest cliffs, ledges and road side cut area in moist and shaded area.

IUCN category: Data Deficient (DD)

Specimens examined**:** INDIA, Himachal Pradesh, Dalhousie, 28.9.1874, *C.B. Clarke* 23230 (K000575948); Jammu & Kashmir, Basaohil, Kathua, 25.7.1876, *C.B. Clarke* 31586 (CAL 0000063033), in error of *C. dalhousieae*, determine by *C.B. Clarke* and *CRFJ* 3.2.2012 as *C. albomarginata*; Gujarat, The Dangs Dt., Mahardar, 20°45.2600'N 73°56.3333'E, 846m, 25.8.2017, *R.N. Kachhiyapatel, S.M. Patil & K.S. Rajput* 257 (BLAT!, CNH!, BARO!).

Aleuritopteris anceps (Blanf.) Panigrahi, Bull. Bot. Surv. India 2: 321. 1961; Fraser-Jenk., New Sp. Syndr. Indian Pterid. Ferns Nepal 68. 1997; Fraser-Jenk. & Dulawat, Sum. Indian Che. F. Dis. *Negripteris* (Pteridaceae), Afro-Arabian F. Gen. India 222. 2009; Fraser-Jenk. *et al*. Ferns Fern-Allies Nepal 1:229. 2015; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:219. 2017. *Cheilanthes anceps* Blanf., J. Simla Nat. Hist. Soc. 1:21. 1886; *Cheilanthes farinosa* var. *anceps* (Blanf.) Blanf., J. Asiat. Soc. Bengal 57(2):301-302. 1888. *Aleuritopteris farinosa* var. *anceps* (Blanf.) Ching, Hong Kong Nat. 10(3-4):201-202. 1941. ***Figure*****:** 59, 60

Lectotype**:** *Cheilanthes anceps* Blanf., India, Himachal Pradesh, Jumna Valley, 5000-5520 feet, *H.F. Blanford* 1886, CAL (7068).

Plant 30-60 cm long, terrestrial, annual; *rhizome* 1.5-3.5 x 0.5-2.5 cm, erect, short, brownish black, scaly; *scales* 3-8 cm long, bicolorous, black centre, yellowish white margins, linear-lanceolate, entire margin; *fronds* 25-55 x 15-20 cm, lustrous; *stipe* 5-15 cm x 1-2 mm, dark brown to reddish brown, scaly throughout, densely scaly at the base; *scales* 2-8 cm long, bicolorous, dark brown to black centre, lighter margins, linear-lanceolate, distal scales sometimes concolorous or tip darker; *lamina* 20-40 x 5-15 cm, oblong or ovate-deltoid, bipinnatifid base, sagittate base, pinnate middle, pinnatifid apex, long acuminate apex, green above, glabrous, white farina beneath; *pinnae* 10-15 x 6-9 cm, 4-12 pairs, distinct, sessile-subsessile apical pairs of pinnae**,** acuminate, basal pairs of pinnae subsessile, ovate-deltoid to triangular basal pair of pinnae, pinnatifid apically, bipinnatifid basally; *pinnules* 2-8 x 1-3 cm, 5-12 pairs, sessile, basiscopic pinnules much longer in basal pairs than adjacent acroscopic pairs, lanceolate, pinnatifid, second basal pair of pinnae shape same and smaller than basal most pair of pinnae pair, pinnatifid, second and upper pairs of pinnae liner to lanceolate, pinnatifid; *sori* 2.5-7 mm, pseudoinduciate, marginal; *indusia* 2-7 mm broad, thin membranous, yellowish white, marginal, interrupted, margin dentate, persistent; *sporangia* 350-550 µm, numerous, jointed at base, globose to sub-globose, 12-20 annular cells, younger yellow, mature dark brown; *spores* 42-60 µm in diameter, trilete, round-elliptic.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: July-January

Distribution*: *World: Bangladesh, China, India, Indonesia, Myanmar, Nepal, New Guinea, Pakistan, Sri Lanka, Thailand; ***India***: Assam, Chandigarh, Chhattisgarh, Gujarat, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Nagaland, Odisha, Rajasthan, Sikkim, Tamil Nadu, Uttarakhand and West Bengal; ***Gujarat***: Junagadh, Narmada, Navsari, Tapi, Dangs and Valsad, Junagadh, Dangs & Valsad.

Phenology*:** Annuals, ***Sterile phase: June-July; ***Fertile phase***: July-December.

Ecology: This species found in rock crevices and road side area of moist forest area. It is luxuriously growing at mid-high altitude ranging from 350-900 m. A population of about 50-150 individuals were found and the area of occupancy (AOO) is 500 km^2. Hence, according to IUCN categories and criteria (IUCN 2017), it is assessed as Data Deficient (DD) species.

IUCN category: Data Deficient (DD)

***Specimens examined*:** INDIA, Maharashtra, Tilak Nagar, 17.9.2013, *A. Benniamin* 195223 (BSI 134008); Gujarat, Dangs Dt., Don, 20°43.88333'N 73°51.56333'E, 889m, 12.10.2014, *R.N. Kachhiyapatel & K.S. Rajput* 112 (BSI 140105).

Aleuritopteris bicolor (Roxb.) Fraser-Jenk., Fern Gaz. 18(5):223. 2009; Fraser-Jenk. & Dulawat, Sum. Indian Cheil. F. Dis. *Negripteris* (Pteridaceae), Afro-Arabian F. Gen. India 223. 2009; Fraser-Jenk. *et al*. Ferns Fern-Allies Nepal 1 232. 2015; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:221. 2017. *Cheilanthes bicolor* (Roxb.) Griff. ex Fraser-Jenk., Pakistan Syst. 5:94. 1991; Fraser-Jenk., New Sp. Syndr. Indian Pterid. Ferns Nepal 68. 1997. *Pteris bicolor* Roxb., Griffith, Calcutta J. Nat. Hist. 4:507. 1844.

***Figure*:** 61, 62

Lectotype: India, Uttarakhand, *W. Roxburgh* 2416, BR; designated by: Morton, Contrib. U. S. Nat. Herb. 38(7):367. 1974.

Plant 20-55 cm long, terrestrial, annual; *rhizome* 1.5-4 x 0.5-3 cm, erect, short, blackish brown, scaly; *scales* 2-7 cm long, bicolorous, black centre, pale margins, linear-lanceolate, entire; *fronds* 19-50 x 10-15 cm, lustrous; *stipe* 4-12 cm x 1-2 mm, chestnut brown, base scaly, glabrous above; *scales* 1.5-6 cm long, bicolorous, brownish black centre, paler margins; *lamina* 15-45 x 5-12 cm, ovate-deltoid, bipinnatifid base, sagittate base, acuminate apex, pinnatifid apex, green above, glabrous, white farina beneath; *pinnae* 8-12 x 4-7 cm, 5-10 pairs, distinct, sessile or subsessile, acuminate apically, basal pairs of pinnae bipinnatifid, ovate-deltoid, pinnatifid apically, second basal pair of pinnae shape same and smaller than basal most pair of pinnae pair, bipinnatifid, second and upper pairs of pinnae liner to lanceolate, pinnatifid; *pinnules* 1-6 x 1-3.5 cm, 6-10 pairs, sessile, basiscopic pinnules much longer in basal pairs than adjacent acroscopic pairs, lanceolate, pinnatifid; *sori* 2-5 mm, pseudoinduciate, marginal; *indusia* 2-5 mm broad, thin membranous, yellowish white, marginal, interrupted, margin toothed, persistent; *sporangia* 300-500 μm, numerous, jointed at base, globose to sub-globose, 10-16 annular cells, younger yellow, mature dark brown; *spores* 40-50 μm in diameter, trilete, round-elliptic.

Phenology**:** Annuals, ***Sterile phase***: June-July; ***Fertile phase***: July-December.

Distribution: World: Bangladesh, Bhutan, India, Laos, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand; ***India***: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chandigarh, Chhattisgarh, Goa, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand, West Bengal; ***Gujarat***: Arvalli, Banaskantha, Bharuch, Bhavnagar, Chhota Udaipur, Dahod, Junagadh, Kachchh, Mahisagar, Narmada, Navsari, Panchmahal, Porbandar, Sabarkantha, Surat, Surendranagar, Tapi, Dangs & Valsad (common throughout in forest areas of the state).

Ecology: This taxon is growing as terrestrial or epipetric in dry or moist forest area. It is growing at road side cuts, crevices, forest floors etc. ranging from mid to high elevation.

IUCN category: Least Concern (LC)

BOLD ID: MIPDG061-21

Specimen examined**:** INDIA, Rajasthan, Pali Dt., Kan Pahar, Bijapur forest, 863m, 17.2.1975, B.V. Shetty 1605 (BSJO 6229), in error *C. farinosa*; Maharashtra, Tilak Nagar, 17.9.2013, *A. Benniamin* 195224 (BSI 134009); Panhala, 20.9.2013, *A. Benniamin* 195245 (BSI 134011); Mahabaleshwar, 24.9.2013, *A. Benniamin* 195305 (BSI 134021); Gujarat, Valsad Dt., Wilson hills, 20°30.8316'N 73°16.4433'E, 190m, 24.8.2014, *R.N. Kachhiyapatel & K.S. Rajput* 36 (BSJO 40949; BSI 140104; CNH!; BLAT!).

Aleuritopteris formosana (Hayata) Tagawa, Act. Phytotax. Geobot. 14(6):191. 1952; Fraser-Jenk. & Dulawat, Sum. Indian Cheil. F. Dis. *Negripteris* (Pteridaceae), Afro-Arabian F. Gen. India 222. 2009; Fraser-Jenk. *et al*. Ferns Fern-Allies Nepal 1:241. 2015; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:225. 2017. *Cheilanthes formosana* Hayata, Matsumura & Hayata, J. Coll. Sci. Imp. Univ. Tokyo 22:612. 1906. *Cheilanthes anceps* var. *brevifrons* Khullar, Amer. Fern J. 66:24. 1976. *Cheilanthes brevifrons* (Khullar) Khullar, Indian Fern J. 1:90. 1984. ***Figure*****:** 63, 64

Type**:** Taiwan, *Nakahara* 203, HT:T.

Plant 20-40 cm long, terrestrial, annual; *rhizome* 1.5-3.5 x 0.5-2.5 cm, erect, short, blackish brown, densely scaly; *scales* 3-6 cm long, bicolorous, black centre, light brown margins, linear-lanceolate, margin entire; *fronds* 17-44 x 7-10 cm, oblong to oblong-lanceolate, clustered; *stipe* 6-14 cm x 1-2 mm, dark brown to reddish brown, round, scaly throughout, densely scaly at the base, dimorphic scales; *scales* 3-7 cm long, bicolorous stipe base scales, black-dark brown centre, lighter margin, lanceolate, entire, concolorous above stipe midpoint, brown, rarely dark brown tip, lanceolate; *lamina* 10-30 x 5-10 cm, oblong to oblong-lanceolate, pinnate-bipinnatifid, long acuminate pinnatifid apex, dark green above, glabrous, white farina beneath, scaly beneath, on rachis and costae, scales concolorous, 0.5-3 cm long, light brown, lanceolate; *pinnae* 6-9 x 2-6 cm, 3-8 pairs, sessile-subsessile, ovate to ovate-deltoid basal most pair of pinnae, pinnatifid apically, bipinnatifid basally second basal pinnae pair oblong-lanceolate, smaller than basal most pairs of pinnae, third basal and above pinnae pair liner-lanceolate, pinnatifid; *pinnules* 0.7-5 x 0.4- 2 cm, 3-6 pairs, sessile, basiscopic pinnules larger than adjacent acroscopic pinnae, lanceolate, pinnatifid; *sori* 1.5-5.5 mm, pseudoinduciate, marginal; *indusia* 1.5-6 mm broad, membranous, yellowish brown, marginal, interrupted, margin toothed, persistent; *sporangia* 250-500 μm, numerous, globose to sub-globose, 12-18 annular cells, younger yellow, mature brown; *spores* 40-60 μm in diameter, trilete, round-elliptic.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: July-December

Distribution**:** ***World***: Bhutan, China, Guinea, India, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Taiwan, Thailand; ***India***: Andhra Pradesh, Arunachal Pradesh, Assam, Chhattisgarh, Gujarat, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Rajasthan, Sikkim, Tripura, Uttar Pradesh, Uttarakhand, West Bengal; ***Gujarat***: Navsari, Tapi, Dangs & Valsad.

Ecology: This taxon is frequently found in high elevation ranging from 700-1000 m as terrestrial or epipetric in moist forest areas along with forest cliffs, ledges.

IUCN category: Least Concern (LC)

BOLD ID: MIPDG017-15, MIPDG060-21

Specimen examined: INDIA, Gujarat, Dangs Dt., Saputara, 20°34.1300'N 73°44.9133'E, 900m, 12.10.2014, *R.N. Kachhiyapatel & K.S. Rajput* 96 (BSJO 40951; BSI 140122; BLAT!, CNH!, BARO!); Dangs Dt., Mahardar, 20°45.28167'N 73°56.34333'E, 849 m, 25.8.2017, *R.N. Kachhiyapatel, S.M. Patil & K.S. Rajput* 253 (BSI 140120; BLAT!; BARO); Dangs Dt., Don hills, 20°43.9116'N 73°51.2500'E, 883m, 25.8.2017, *R.N. Kachhiyapatel & K.S. Rajput* 267 (BALT!).

Cheilanthes Sw., Syn. Fil. 5:126. 1806

Lectotype: *Cheilanthes micropteris* Sw., designated by: Maxon, Sci. Surv. Porto Rico & Virgin Islands 6(3):428. 1926.

Etymology: The genus *Cheilanthes* is derived from the Greek words *cheilos* 'margin' and *anthus* 'a flower', in reference to marginal sporangia.

Common name: Lip fern

Monophyletic, *ca*. 100 species worldwide and 11 species and 2 subspecies in India

Cheilanthes tenuifolia (Burm. f.) Sw., Syn. Fil. 129, 332. 1806; Blatter & d'Almeida, Ferns Bombay 80. t.6. 1922; Dixit, Census Indian Pterid. 66. 1984; Chandra & Kaur, Nomen. Guide 22. 1987; Manickam & Irudayaraj„ Pterid. FI. Western Ghats 90. Pl. 66. 1992; Chandra, Ferns India 58. 2000. *Trichomanes tenuifolium* Burm. f., Fl. Indica 237. 1768. ***Figure*:** 65, 66

Type: India, *W.D. Brackenridge*, PH (PH00025406)

Plants 5-33 cm long, terrestrial herb, epilithic, perennial; *rhizome* 1-7 cm long, 1-5 cm in dia., brownish black, short creeping, horizontal, un-branched, densely scaly, bearing branched fibrous roots basally; *rhizome scales* 1-2.5 mm long, dense, linear to linear-lanceolate, apex acuminate, base broad rounded, margin entire, concolorous, brownish black; *frond* 8-26 cm long, 1-4 per plant, tufted, dimorphic, sterile frond longer than sterile frond, procumbent to sub-erect, spreading, green; *stipes* 2-10 cm long, 1-2.5 mm in dia., slender, sterile frond stipe shorter than fertile frond stipe, procumbent to sub-erect, shallowly grooved adaxially, abaxially rounded, distant, dark purplish to black, glossy, scaly at the base, glabrous above or sparsely hairy; *stipe base scales* 0.5-4 mm long, sparse, linear to linear-lanceolate, narrow, entire, brown; *lamina* 6-16 cm long, 7-18 cm broad, broadly deltoid-triangular or deltoid-pentagonal in outline, spreading, quadripinnate-tripinnate basally, bipinnate above, unipinnate apically, apex acuminate in outline, base broad, glabrous; *rachis* 6-16 cm long, 1-2 mm in dia., flexuous, above grooved, basally rounded, black, shining, glossy, glabrous; *costa and costules* 7-18 cm, same as rachis except in size; *pinna* 3-9 cm long, 1-3 cm broad, 4-12 pairs, alternate, deltoid-ovate, basal pair largest, basal pairs pinnate, apically pinnatifid, stalked, glabrous; *pinnae* 0.8-3 cm long, 0.5-2 cm broad, 2-10 per pinna, elliptic-ovate, sub-pinnatifid, alternate, short stalked, apex acuminate, base broad-cuneate, apical margin crenate-incised, lateral margin entire, glabrous, light green, herbaceous, terminal margin reflexed; *veins* 2-4 times forked, reaching up to margin, indistinct; *sori* 0.5-3 cm long, 2-6 mm broad, linear, interrupted, marginal, pseudoinduciate or reflexed pinnules margin, membranous, glabrous, persistent; *indusia* short, margin entire, glabrous; *sporangium* 200-300 µm, stalked, globose, annulus 13-17 celled, brownish black; *spore* 40-75 µm, trilete, tetrahedral, nonperisporiate, blackish brown.

Phenology: Perennial; ***Sterile phase***: June-July; ***Fertile phase***: July-May

Distribution**: **World: Australia, Bangladesh, Cambodia, China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, New Guinea, New Zealand, Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Vietnam; ***India***: Andaman & Nicobar, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, West Bengal; ***Gujarat***: Panchmahal.

Ecology: This taxon is growing as lithophytic in dry, rocky seasonal ditches.

IUCN category: Data Deficient (DD)

Specimen examined: SINGAPORE, 1°22’N 103°48E’, 27.3.1895, *P. Faurie* 15927 (K000408736); INDIA, Kerala, Oltakkal, near Tenmalai, 18.6.1960, *K.N. Subramanian* 63064 (BSI 35166); Maharashtra, Ratnagiri, near highway road, 20.9.2013, *A. Benniamin* 195241 (BSI 134023); Gujarat, Panchmahal Dt., Jambughoda, Narukot, 22°23.7066’N 73°39.5033’E, 141m, 30.7.2017, *R.N. Kachhiyapatel & K.S. Rajput* 205 (BSJO 40952; BSI 140190, 140125; CNH!; BLAT!; BARO!).

ATHYRIACEAE Alston, Taxon 5:25. 1956

Type: *Athyrium* Roth

Monophyletic, 3 genera and *ca*. 650 species worldwide, 3 genera and 3 genera, 102 species, 8 subspecies and 17 hybrids in India

Athyrium Roth, Tent. Fl. Germ. 3(1):31. 1800

Lectotype: *Athyrium filix-femina* (L.) Roth (=*Polypodium filix-femina* L.), designated by J. Smith, Hist. Fil., 327. 1875.

Etymology: The genus *Athyrium* is derived from the Greek word *athoros* 'door less' meaning door less the sporangia only unpunctually push back the outer edge of the indusium.

Common name: Lady Fern

Monophyletic, *ca*. 230 species worldwide and 50 species, 1 subspecies and 17 hybrids in India

Key to the species of Athyrium

1 Fronds linear-lanceolate, unipinnate to pinnatifid

2 Pinnae falcate-ovate...**A. falcatum**

2 Pinnae ovate-deltoid...**A. micropterum**

1 Fronds broadly lanceolate, 2-3 pinnate to pinnatifid

3 Rhizome short creeping, lamina broadly elliptic-lanceolate

4 Pinnae deltoid-lanceolate...**A. parasnathense**

4 Pinnae triangular-deltoid long pointed tip………**A. schimperi subsp. biserrulatum**

3 Rhizome not creeping, lamina lanceolate...................................**A. hohenackerianum**

Athyrium falcatum Beddome, Ferns S. India, t. 151. 1864; Beddome, Handb. Ferns Brit. India 164. 1883; Blatter & d'Almeida. Ferns Bombay 113. 1922; Vasudeva & Bir, Indian Fern J. 4:11. 1987; Vasudeva & Bir Indian Fern J. 10:129. 1993; Fraser-Jenkins, New Sp. Syndr. Indian Pteridol. 58. 1997; Fraser-Jenkins, Taxon. Rev. Indian Subcont. Pteridophytes, 601.2008; Fraser-Jenk., *et al.* Ferns Fern-Allies Nepal 1:23. 2015; Patil *et al*. Field Guide Pterid. N.W. Ghats 81. 2017. ***Figure*****:** 67, 68

Lectotype: India, Tamil Nadu, Anamallays, 5000 ft, *Beddome s.n*. (K001089325 'a'); designated by: Dwivedi *et al*. Indian Fern J. 35(1&2):50-53. 2018; ***Syntypes***: *Beddome s.n*. (K001089325 'b' & 'c'), 151 in Beddome (1863); designated by: Dwivedi *et al*. Indian Fern J. 35(1&2):50-53. 2018.

Plants 20-40 cm long, terrestrial, lithophytic, epilithic, herb, annual; *rhizomes* 1-5 cm long, erect, scaly, yellowish brown, caespitose, bearing numerous fibrous roots; *rhizome scales* 2-7 mm long, 1-2 mm broad, dense, liner-lanceolate, concolorous, yellowish brown, apex acuminate, base broad, margin entire, thin, membranaceous; *fronds* 9-35 cm long, clustered, erect to procumbent, lanceolate, broad at centre, narrowed both ends, herbaceous to sub-coriaceous, monomorphic, pale green-green; *stipes* 3-6 cm long, 1-4 mm in dia., erect to procumbent, glabrous, pale green at young, yellowish when mature, stipe base densely scaly, sparsely above, adaxially grooved, abaxially rounded; *stipe scales* same as rhizome scales; *lamina* 6-29 cm long, 3-13 cm broad, linear-lanceolate to lanceolate, unipinnate to pinnatifid, apex long acuminate, pinnatifid apex, lower pairs of pinnae gradually reduced, pinnate basally, broad middle, herbaceous, glabrous, dark green to pale green; *rachis* 5-27 cm long, 1-3 mm in dia., straminaceous, flat-round, yellowish brown; *pinnae* 3-6 cm long, 10-20 mm broad, *ca*. 25 pairs, fertile, sub-opposite to alternate, sub-sessile, oblique, thin, herbaceous, apical pairs long acuminate, pinnatifid, deltoid-triangular lower pairs, falcate-ovate above pairs, apex obtuse-acuminate, base broad, margin crenate to lobed, auriculated basally on both sides, basal auricle larger than apical one; *veins* free, distinct above and below, forked, reaching to the margin; *sori* 2.5-4 mm long, 0.5-1.5 mm broad, on ventral side of pinnae, numerous, median, crescent or hook like, sometimes J-shaped, indusiate; *indusia* 2.5-4 mm long, 0.5-1.5 mm broad, thin, membranaceus, yellow-brown, hook like or J-shaped, margin dentate, persistent; *sporangia* 200-600 µm in diameter, numerous, sub-globose, brown; *annulus* 13-18 celled, dark brownish black; *spores* 40-60 µm in diameter, monolete, plano-convex in lateral view and elliptic in polar view.

Phenology: Annual; ***Sterile phase***: July-August; ***Fertile phase***: August-November

Distribution**: **World: India, Myanmar, Nepal; ***India***: Chhattisgarh, Gujarat, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Mizoram, Odisha, Rajasthan, Tamil Nadu, Tripura, Uttarakhand; ***Gujarat***: Junagadh, Dangs & Valsad.

Ecology: This taxon is found as terrestrial in moist forest area on forest floors, cliffs, crevices.

IUCN category: Least Concern (LC)

Specimen examined: INDIA, Madhya Pradesh, Rewa Dt., Kaimur Hills, Govindgurh, 625m, 17.9.1959, K.M. Sebartine 8852 (CAL); Maharashtra, Purandhar, on the way to Vazirgad fort, near NCC camp, 20.7.1963, *S.R. Rolla* 88631 (BSI 63517); Maharashtra, Nasik Dt., Trambak hills, 26.7.1983, *P.L. Narasimhan* 163993 (BSI 107627); Gujarat, Dangs Dt., Saputara, 20°34.2250’N 73°44.8283’E, 939m, 12.10.2014, *R.N. Kachhiyapatel & K.S. Rajput* 99 (BSJO 40954); Valsad Dt., Vavar, 20°20.1683’N 73°23.1700’E, 561m, 12.10.2014, *R.N. Kachhiyapatel & K.S. Rajput* 114 (BSJO 40953; BSI 140074).

Athyrium hohenackerianum (Kunze) T. Moore, Index Fil. 49. 1857; Beddome, Ferns S. India t.151. 1864; Blatter & d’Almeida, Ferns Bombay 111. 1922; Manickam &

Irudayaraj, Pterid. FI. Western Ghats 233. PI. 179. 1992; Vasudeva & Bir Indian Fern J. 10:130. 1993; Fraser-Jenkins, Taxon. Rev. Indian Subcont.Pteridophytes, 601. 2008; Patil *et al*. Field Guide Pterid. N.W. Ghats, 80. 2017. *Asplenium hohenackerianum* Kunze, Bot. Zeitung 1849:771. 1849. *Allantodia hohenackeriana* Kunze, Farnkrauter 2:63, t.126. 1850. ***Figure*:** 69, 70

Type: India, Karnataka, *R.F. Hohenacker* 211, K (K001089324), E (E00417595)

Plants 10-41 cm long, terrestrial herb, lithophytic, epilithic, annual; *rhizomes* 1-4 cm long, sub-erect, densely scaly, yellowish brown, bearing numerous fibrous roots; *rhizome scales* 2-6 mm long, 0.5-2 mm broad, liner-lanceolate, concolorous, apex acuminate, base broad, margin entire, yellowish brown to golden, thin, membranaceous; *fronds* 9-37 cm long, spreading, erect to procumbent, elliptic-lanceolate, narrowed both ends, herbaceous, monomorphic, green; *stipes* 3-7 cm long, 1-3.8 mm in dia., erect-procumbent, herbaceous, densely scaly, greenish yellow, adaxially grooved, abaxially rounded; *stipe scales* same as rhizome scales; *lamina* 6-30 cm long, 3-15 cm broad, herbaceous, elliptic-lanceolate to lanceolate, bipinnate to sub-bipinnate, apex long acuminate, pinnatifid apex, lower pairs of pinnae gradually reduced, oblique, pinnate basally, broad middle, glabrous, pale green; *rachis* 6-28 cm long, sparsely scaly, rounded, yellowish brown; *pinnae* 3-7 cm long, 10-30 mm broad, *ca*. 25 pairs, numerous, fertile, alternate to sub-opposite, sub-sessile, oblique basal pairs, thin, herbaceous, apical pairs long acuminate, pinnate, ovate lanceolate, apex acuminate, base broad, margin serrate; *venation* free, distinct above and below, reaching to the margin; *sori* 1.5-6 mm long, 0.5-3 mm broad, numerous, copious, on ventral side of pinnae, median, curved or hook like, sometimes J-shaped, indusiate; *indusia* 1.5-6 mm long, 0.5-3 mm broad, yellow-brown, curved or hook like, sometimes J-shaped, margin dentate, persistent, thin, membranaceus; *sporangia* 200-500 μm in diameter, numerous, sub-globose, brown; *annulus* 10-17 celled, dark brownish black; *spores* 40-65 μm in diameter, monolete, plano-convex to concavo-convex in lateral view and elliptic in polar view, perisporiate.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: July-November

Distribution**: **World: India, Sri Lanka; ***India***: Andhra Pradesh, Chhattisgarh, Goa, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu; ***Gujarat***: Banaskantha, Dahod, Junagadh, Narmada, Navsari, Porbandar, Sabarkantha, Tapi, Dangs & Valsad (common throughout in forest areas of Junagadh, central and south Gujarat).

Ecology: This taxon is growing as terrestrial, epilithic and epipetric in moist and shaded places of forest.

IUCN category: Least Concern (LC)

Specimen examined: SRI LANKA, Matale East, 1865, *G.H.K. Thwaites* 3867 (K001089323); INDIA, Chhattisgarh, Bastar, 550m, 27.8.1970, N.C. Nair 40307 (CAL 2604) in error of *A. filix-faemina*, determine by *CRFJ* 2012; Goa, Panda, on the way, far long to Panda on the main road, Malala-Panda, 15.1.1962, *S.R. Rolla* 84782 (BSI 83646); Ordofond-Butpal, 4th mile, 25.8.1963, *K.C. Kanodia* 89521 (BSI 83648); Maharashtra, Raigad Dt., Matheran, on the way to Panoroma point, 8.9.2004, *S.K. Das* 189937 (BSI 134233); Chandgad, 17.9.2013, *A. Benniamin* 195205 (BSI 133951); Gujarat, Dang Dt., Ghadir, 28.8.1958, *S.K. Jain*, 43176 (BSI 29844); Dang Dt., Subir-Moramvihar, 30.8.1958, *S.K. Jain*, 43412 (BSI 29846); Dang Dt., Waghai-Chikaloa, 31.8.1958, *S.K. Jain* 43466 (BSI 46723) determined by *S.K. Mudaliar* 14.3.1968; Dang Dt., Bhavansgarh, 22.11.1959, *B.M. Wadhwa* 60651 (BSI 29848); Valsad Dt., Chavshala, 20°19.17333'N 73°19.30333'E, 296m, 28.11.2014, *R.N. Kachhiyapatel & K.S. Rajput* 121-B (BSJO 40956; BARO!).

Athyrium micropterum Fraser-Jenk., New Sp. Syndr. Indian Pteridol. 58. 1997; Fraser-Jenkins, Taxon. Rev. Indian Subcont. Pteridophytes 601. 2008; Fraser-Jenk. *et al.*, Ferns Fern-Allies Nepal 1:23. 2015. *Asplenium macrocarpon* var. *atkinsonii* C.B. Clarke ex Baker, Hooker & Baker, Syn. Fil. ed. 2:489. 1874. *Athyrium macrocarpon* var. *atkinsonii* (C.B. Clarke ex Baker) Tardieu, Asplen. Tonkin 84. 1932. ***Figure:*** 71, 72

Type: India, Uttarakhand, Nainital, 'Pangtey's Gorge', ca. ½ km East of Pangote, Kilbury (Kilabari), behind China Peak, North of Nainital, *C.R. Fraser-Jenkins* 24436 (FN 414), 22.9.1996, BM; ***Isotypes***: H, E (from NMW), KATH.

Plants 16-42 cm long, terrestrial herb, lithophytic, epilithic, delicate, annual; *rhizomes* 1-3 cm long, erect to sub-erect, short, densely scaly, yellowish brown; *rhizome scales* 1-6 mm long, 0.5-2.5 mm broad, liner or linear-lanceolate, concolorous, apex long acuminate, base broad, margin entire, yellowish brown, thin, membranaceous; *fronds* 15-39 cm long, spreading, 2-6 per rhizome, procumbent, lanceolate to elliptic-lanceolate, narrowed both ends, herbaceous, monomorphic, green to pale green; *stipes* 3-10 cm long, 1-4 mm in dia., shorter than lamina, procumbent, densely scaly base, sparsely above, adaxially grooved, abaxially rounded, herbaceous, greenish yellow; *stipe scales* same as rhizome scales; *lamina* 12-29 cm long, 3-10 cm broad, herbaceous, lanceolate to elliptic-lanceolate, pinnate to pinnatisect, apex acute-acuminate, pinnatifid apex, lower pairs of pinnae gradually reduced, pinnate basally, broad at middle, glabrous, green to pale green; *rachis* 10-26 cm long, glabrous, rounded, yellowish brown; *pinnae* 1-5 cm long, 1-4 cm broad, ca. 22 pairs, numerous, fertile, alternate, sub-sessile, oblique basal pairs, thin, herbaceous, apical pairs long acuminate, pinnate basally, ovate to ovate-deltoid, apex acuminate, base broad, margin deeply incised to crenate; *venation* forked, distinct above, indistinct below, reaching to the margin; *sori* 2-4.5 mm long, 0.4-2 mm broad, numerous, on ventral side of pinnae, along the veins, median to sub-median, linear, sometimes hook like, indusiate; *indusia* 2-4.5 mm long, 0.4-2 mm broad, yellowish brown, linear or hook like, margin wavy or dentate, persistent, thin, membranaceus; *sporangia* 200-510 μm in diameter, numerous, sub-globose, stalked, brown; *annulus* 10-18 celled, dark brownish black; *spores* 40-60 μm in diameter, monolete, plano-convex in lateral view, elliptic in polar view, perisporiate.

Phenology: Annual; *Sterile phase*: July-August; *Fertile phase*: August-November

Distribution**: **World: Bhutan, China, India, Nepal; ***India***: Arunachal Pradesh, Himachal Pradesh, Nagaland, Sikkim, Uttarakhand, West Bengal; ***Gujarat***: The Dangs, Narmada, Tapi and Valsad

Ecology: This taxon is growing at high elevation ranging from 700-1000 m as terrestrial and epilithic.

Specimen examined: INDIA, Maharashtra, Satara Dt., Mahabaleshwar, 1200m, 13.10.1968, *M.R. Almeida* 711 (BLAT); Karnataka, North Kanara, 25.11.1950, *Famandez* 1880 (BLAT); Andhra Pradesh, East Godavari Dt., Valamum, 550m, 23.12.1993, *Mohanan* 170337 (MH); Gujarat, The Dangs Dt., Mahardar hills, 20°45.3950'N 73°56.3983'E, 868m, 25.8.2017, *R.N. Kachhiyapatel & K.S. Rajput* 249 (BSJO 40957; BARO!).

Athyrium parasnathense (C.B. Clarke) Ching ex Mehra & Bir, Res. Bull. Panjab Univ., Sci. 15:141. 1964; Frazer-Jenkins, Taxon. Rev. Indian Subcont. Pteridophytes., 208-209.2008; Patil *et al*. Field Guide Pterid. N. W. Ghats, 83. 2017; Vijayakant *et al.* New Add. Fern Fl. Tamil Nadu, India 3(4):1671. 2017. *Asplenium filix-femina* var. *parasnathense* C.B. Clarke, Trans. Linn. Soc. London, 2 Bot., 1:493, t.61, f.2. 1880. *Athyrium pectinatum* var. *tenellum* Bedd., Suppl. [Handb.] Ferns Brit. India 36. 1892.

***Figure*:** 73, 74

Type: India, Jharkhand, Chota Nagpore, Parasnath Hill, 1219 m, *C.B. Clarke* 24756, 17/11/1874, K (K001089341)

Plants 15-55 cm in long, terrestrial herb, lithophytic, epilithic, annual fern; *rhizomes* 2-5 cm long, short creeping to sub-erect, densely scaly apex, caespitose, brownish yellow, bearing numerous fibrous roots; *rhizome scales* 2-5.5 mm long, 0.5-2.2 mm broad, liner-lanceolate, concolorous, yellow, apex acuminate, base broad, margin entire, thin, membranaceous; *fronds* 13-50 cm long, 3-16 cm broad, spreading, erect to procumbent, 2-6 per rhizome, elliptic-lanceolate to broadly lanceolate, narrowed both ends, herbaceous, green, monomorphic; *stipes* 3-10 cm long, 1-4.2 mm in dia., erect-procumbent, herbaceous, densely scaly, pale green to greenish yellow, adaxially grooved, abaxially rounded, densely scaly stipe base, sparse above; *stipe scales* same as like rhizome scales, narrower; *lamina* 10-40 cm long, 3-16 cm broad, herbaceous, elliptic-lanceolate to lanceolate, bipinnate-bipinnatifid, apex long acuminate, pinnatifid apex, lower pairs of pinnae gradually reduced, oblique, pinnate basally, broad middle, glabrous, glossy, pale green; *rachis* 7-37 cm long, glabrous or sparsely scaly basally, rounded, yellowish brown; *pinnae* 3-8 cm long, 10-36 mm broad, *ca*. 27 pairs, numerous, fertile, alternate to sub-opposite, sessile to sub-sessile, oblique basal pairs, thin, herbaceous, apical pairs long acuminate, pinnate, deltoid-lanceolate, apex acuminate, base broad, margin crenate or deeply lobed; *pinnules* 1-2 cm long, pinnatifid, margin acutely toothed; *venation* forked, slightly distinct both sides, reaching to the margin; *sori* 1-5 mm long, 0.5-3 mm broad, numerous, copious, in two rows, on ventral side of pinnae, median, curved or hook like, rarely linear, indusiate; *indusia* 1-5 mm long, 0.5-3 mm broad, sub-median, yellowish brown, curved or hook like, rarely linear, margin crenate to dentate, persistent, thin, membranaceus; *sporangia* 200-600 μm in diameter, numerous, sub-globose, brown; *annulus* 12-18 celled, dark brownish black; *spores* 45-65 μm in diameter, monolete, bilateral, planoconvex to concavo-convex in lateral view and elliptic in polar view, perisporiate.

Phenology: Annual; ***Sterile phase***: July-August; ***Fertile phase***: August-November.

Distribution*: *World: Endemic to India; ***India***: Bihar, Chhattisgarh, Gujarat, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Sikkim, Tamil Nadu, Uttarakhand; ***Gujarat***: Banaskantha, Dahod, Junagadh, Narmada, Navsari, Porbandar, Sabarkantha, Tapi, Dangs & Valsad.

Ecology: This species found in moist forest at mid to high elevation ranging from 600-1000 m as lithophytic, epilithic or epipetric.

IUCN category: Least Concern (LC)

Specimen examined: INDIA, Maharashtra, Pratap ghat, 12.9.1967, *B.M. Wadhwa* 104936 (BSI 78156) determined by *CRFJ* March, 2013; Satara Dt., Patan, 800m, 20.8.2013, *S.M. Patil & M.M. Dongare* 1067 (SUK); Gujarat, Dangs Dt., Don hills, 20°43.9116'N 73°51.2500'E, 883m, 25.8.2017, *R.N. Kachhiyapatel & K.S. Rajput* 265 (BSJO 40959; BSI 140075; BLAT!); Junagadh dt., Girnar hills, Ambaji-Sitavan, 21°32.08500'N 70°31.43667'E, 651m, 24.9.2017, *R.N. Kachhiyapatel & K.S. Rajput* 283 (BLAT!).

Athyrium schimperi Moug. ex Fee subsp**. biserrulatum** (Christ) Fras.-Jenk., New Sp. Syndr. Indian Pterid. & Ferns Nepal 60. 1997. *Athyrium schimperi* Moug. ex Fee, Mem. Fam. Foug. 5 Gen. Fil. 186-187. 1852; Beddome, Handb. Ferns Brit. India Suppl. 36. 1892; Dixit, Census Indian Pterid. 129. 1984; Khullar, Ill. Fern Fl. West Him. 2:73, t.26. 2000; Chandra, Ferns India 134. 2000. *Athyrium biserrulatum* Christ, Bull. Acad. Int. Geogr. Bot. Mans. 17:135. 1907; Ching, Act. Bot. Austro-Sinica 1:20. 1983.

Figure: 75, 76

Type: China, Yunnan, Environs de Yunnan sen, Vallon humide, *Pere F. Ducloux* 84, 5.12.1905, P.

Plants 20-60 cm in long, terrestrial fern, lithophytic, epilithic, herbaceous, annual fern; *rhizomes* 2-6 cm long, short creeping, rarely sub-erect, apex densely scaly, caespitose, yellowish brown; *rhizome scales* 3-7 mm long, 0.5-2 mm broad, numerous, linear to liner-lanceolate, concolorous, pale yellow, acuminate apex, broad base, entire margin, membranaceous; *fronds* 18-54 cm long, 5-19 cm broad, long spreading, procumbent, 2-4 per rhizome, elliptic-broadly lanceolate, narrowed both ends, herbaceous, green, monomorphic; *stipes* 4-8 cm long, 1-5 mm in dia., distant on rhizome, procumbent, herbaceous, stramineous, densely scaly basally, sparse above, yellow to yellowish green, adaxially grooved, abaxially rounded; *stipe scales* same as like rhizome scales; *lamina* 14-46 cm long, 5-19 cm broad, 2-pinnate, herbaceous, elliptic-broadly lanceolate, apex long acuminate, pinnate to pinnatifid apex, lower pairs of pinnae gradually reduced, 2-pinnate basally, broad middle, glabrous, glossy, rarely scaly, pale green; *rachis* 14-40 cm long, rounded, straimeneous, glabrous, rarely scaly, herbaceous, yellowish green; *pinnae* 2-8 cm long, 5-25 mm broad, ca. 22 pairs, fertile, thin, herbaceous, alternate, sub-sessile, dimorphic, basal 2-3 pairs much reduced in size, triangular-deltoid, apex acute-acuminate, base broad, margin crenate to toothed, middle pairs of pinnae larger, ovate, apex long acuminate, base broad, margin toothed, pinnate-pinnatifid; *pinnules* 3-12 mm long, 1-4 mm broad, ca. 10 pairs, sessile, opposite-sub-opposite sometimes alternate, oblong or linear-lanceolate, margin toothed sometimes crenate, upper pairs pinnatifid; *veins* forked, distinct on both sides; *sori* 1-2.5 mm long, 0.2-0.8 mm broad, 2-5 pairs, numerous, arranged in two rows, on ventral side of pinnae, sub-median, linear, rarely curved, indusiate; *indusia* 1-2.5 mm long, 0.2-0.8 mm broad, yellow, linear, rarely curved, margin crenate to dentate, persistent, thin, membranaceus; *sporangia* 200-600 µm in diameter, numerous, sub-globose, dark brown; *annulus* 12-17 celled, dark brownish black; *spores* 40-65 µm in diameter, monolete, bilateral, plano-convex lateral view and elliptic in polar, dark brown, perinate.

Phenology: Annual; *Sterile phase*: July-August; *Fertile phase*: August-November

Distribution**: **World: Africa, Bhutan, China, India, Myanmar, Nepal, Pakistan; ***India***: Arunachal Pradesh, Gujarat, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Meghalaya, Nagaland, Rajasthan, Sikkim, Uttarakhand, West Bengal; ***Gujarat***: Dangs

Ecology: This taxon is luxuriously growing as terrestrial in the riverine areas and high altitude ranging from 400-1000m.

IUCN category: This species found along the stream sided area with high moisture as lithophytic.

Specimen examined: INDIA, Gujarat, The Dangs Dt., Baripada, 20°39.2616'N 73°40.9533'E, 380m, 5.10.2014, *R.N. Kachhiyapatel & K.S. Rajput* 81 (BSJO 40960; BSI 140076; BLAT!; BARO!); The Dangs Dt., Baripada, 20°39.30000'N 73°40.95833'E, 374m, 5.10.2014, *R.N. Kachhiyapatel & K.S. Rajput* 82 (BSI 140077; CNH!; BLAT!; BARO!); The Dangs Dt., Baripada, 20°39.26167'N 73°40.95333'E, 380m, 26.8.2017, *R.N. Kachhiyapatel & K.S. Rajput* 269-A (BSI 140078; BLAT!).

THELYPTERIDACEAE Ching ex Pic. Serm., Webbia 24:709. 1970

Type*: *Thelypteris Schmidel.

Monophyletic, 2 subfamilies, 30 genera and *ca*. 1034 species worldwide and 1 genera, 81 species, 2 subspecies in India

Thelypteris Schmidel, Icon. Pl., ed. 2, 3:45-48, pl.11, 13. 1763

Type: *Thelypteris palustris* Schott (=*Acrostichum thelypteris* L.)

Etymology: The genus *Thelypteris* is derived from the Greek words *thelys* 'female' and *pteris* 'fern', a name used by Theophrastus.

Vernacular Name: Maiden fern, Female fern

Monophyletic, 2 species (*i.e.* genus *Thelypteris* only) worldwide, 79 species 4 subspecies and 16 hybrids in India (PPG-I, 2016 segregated most of the genera, while Fraser-Jenkins *et al* 2017, 2018 clumped all genera in single genus *i.e*. *Thelypteris*)

Key to the species of Thelypteris

1 Fronds membranaceous, apically pinnatifid, veins free except lowest pairs, sori arranged on two opposite rows..**T. dentata**

1 Fronds tufted, imperipinnate or proliferating tip, veins free except lowest 5-6 pairs, sori zig-zag fashion...**T. prolifera**

Thelypteris dentata (Forssk.) E.P. St. John, Amer. Fern J. 26(2):44. 1936. *Christella dentata* (Forssk.) Brownsey & Jermy, Brit. Fern Gaz. 10(6):338. 1973; Khullar *et al*. Nova Hedw. 36:626. 1983; Dixit, Census Indian Pterid. 104. 1984; Manickam & Irudayaraj, Pterid. FI. Western Ghats 198. PI. 149. 1992; Chandra, Ferns India, 289. 2000; Khullar, Ill. Fern Fl. West Him. 2:179-181. 2000; Fraser-Jenkins, Taxon. Revis. Indian Sub-continental Pterid. 192. 2008; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:428. 2017. ***Figure*****:** 77, 78

Type: Yemen, 1763, *P. Forsskal* 809, C

Plant 10-120 cm long, terrestrial, epilithic, perennial herb; *rhizomes* 2-8 cm long, 0.5-4 cm in diameter, short creeping, sometimes sub-erect, densely scaly apex, brown or reddish brown, bearing numerous dark brown fibrous roots; *rhizome scales* 1-6 mm long, 2-8 mm broad, linear-lanceolate, yellow to pale brown, apex long acuminate, base broad, margin entire, thin membranaceous; *frond* 8-112 cm long, 2-24 cm broad, 2-12 per rhizome, monomorphic, bipinnate, clustered, spreading, procumbent, sometimes erect, elliptic-lanceolate, narrow at both ends, broad centre; *stipe* 3-15 cm long, 5-15 mm in dia., procumbent to sub-erect, tufted, glossy, base densely scaly, sparsely above, hairy, adaxially grooved, abaxially rounded, yellowish green to brownish yellow; *stipe scales* same as rhizome scales, narrower; *lamina* 5-98 cm long, 2-24 cm broad, procumbent to sub-erect, elliptic-lanceolate, narrow at both ends, apex pinnatifid, long acuminate, bipinnate central to basal part; *rachis* 6-25 cm long, 2-15 mm in dia., procumbent, tufted basally, herbaceous apically, glossy, hairy, rounded, apically green, basally yellowish green; *pinnae* 2-12 cm long, 8-22 mm broad, *ca*. 20 pairs, fertile, alternate, sub-sessile, thin herbaceous, linear-lanceolate, apex acuminate, truncate base, margin undulate, sinus reaching up to ¼ to the costa, basally short auriculated, acroscopic auricale larger; *costa* 2-10 cm long, 1-3 mm broad, jointed to pinnae lobes, greenish yellow; *lobes* 2-10 mm long, 2-5 mm broad, *ca*. 20, jointed, oblique, entire, oblong, rounded apex, base flat, attached to costa, thin, firm; *costules* 2-7 mm long, 0.5-1 mm broad, green; *vein* 2-4 mm long, 6-8 pairs, free except lowest pairs, simple, free, sometimes acicular hairs present on vein and veinlets, lowest veins of adjuscent lobes meets and forming an excurrent veinlet running to the sinus; *veinlets* running parallel to the sinus; *sori* 0.5-1 mm in dia., median on veins, arranged on two opposite rows, indusiate, circular; *indusium* densely hirsute; *indusia* 0.5-1 mm in dia., reniform, membranaceous, thin, sometimes hirsute, whitish yellow; *sporangia* 200-600 µm in diameter, numerous, sub-globose, brown; *annulus* 14-17 celled, yellowish green to blackish brown; *sporangial stalk* elongated, multicellular; *spores* 35-60 µm in diameter, monolete, bilateral, plano-convex in lateral view and elliptic in polar view, yellow to dark brown.

Phenology: Perennial; ***Sterile phase***: June-August; ***Fertile phase***: September-May

Distribution**: **World: Afghanistan, Africa, Australia, Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Japan, Madagascar, Myanmar, Nepal, Pakistan, Philippines, Singapore, South Korea, Sri Lanka, Taiwan, Thailand, Vietnam; ***India***: Andaman & Nicobar, Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Goa, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand, West Bengal; ***Gujarat***: Navsari, Tapi & Dangs.

Ecology: This taxon luxuriously growing along the streams and moist banks.

IUCN category: Data Deficient (DD)

Specimen examined: CONGO, Kouilou Region, 29.11.1990, *I.F. La Croix* 4974 (K000501462); INDIA, Maharashtra, Khandala, along railway line upto 2nd tunnel, 2.8.1966, *B.M. Wadhwa* 109973 (BSI 58560); Lingmala falls, 24.9.2013, *A. Benniamin* 195314 (BSI 134120, 134121); Gujarat, Navsari Dt., Vansada, 20°45.77833'N 73°29.19167'E, 125m , 1.12.2014, *R.N. Kachhiyapatel & K.S. Rajput* 126 (BSJO 9062; BARO!); Dangs Dt., Kudkas, 20°47.5250'N 73°31.0321'E, 136m, 8.2.2015, *R.N. Kachhiyapatel & K.S. Rajput* 158 (BSJO 40961; BSI 140087; CNH!).

Thelypteris prolifera (Retz.) C.F. Reed, Phytologia 17(4):306. 1968. *Ampelopteris prolifera* (Retz.) Copel., Gen. Fil. 144. 1974; Holttum, Fl. Malaya 2:298. 1954; Vasudeva & Bir, Indian Fern J. 4:10. 1987. *Goniopteris prolifera* (Retz.) C. Presl, Tent. Pterid. 183. 1836; Beddome, Ferns S. India t.172. 1864; Beddome, Handb. Ferns Brit. India 296. fig. 153. 1883; Blatter & d'Almeida, Ferns Bombay 164. 1922; Khullar, An Illu. Fern Fl. West Himalaya 170-172, Pl.64. 2000; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 1:480. 2017. ***Figure*: 79, 80**

Type: India, *J.G. Koenig*, GOET.

Plant 8-130 cm long, terrestrial, epilithic, stoloniferous, perennial herb; *rhizomes* 2-10 cm long, 0.5-3 cm in diameter, creeping, scaly, brownish black, bearing numerous dark brown fibrous roots; *rhizome scales* 1-5 mm long, 1-7 mm broad, calthrate, concolorous, ovate-lanceolate, brownish yellow, apex acuminate, base broad, margin entire, thin, membranaceous; *frond* 6-120 cm long, 2-28 cm broad, 2-10 per rhizome, simple pinnate, imperipinnate, linear-lanceolate, clustered, spreading, procumbent to sub-erect, dimorphic, proliferating apices, sometimes apical portion with terminating pinnae, some pinnae bearing, axillary buds forming secondary fronds; *stipe* 2-18 cm long, 5-12 mm in dia., procumbent, tufted, shining, stipe sparsely scaly, hairy, adaxially grooved, abaxially rounded, yellowish green to brownish yellow, dark brown base; *stipe scales* same as rhizome scales, sparse, deciduous; *lamina* 5-102 cm long, 2-28 cm broad, procumbent to sub-erect, linear-lanceolate, apex proliferating or ends with terminal pinnae, sometimes axillary buds present, simple pinnate, sub-coriaceous; *rachis* 5-100 cm long, 5-12 mm in dia., sometimes bearing vegetative buds axillary, procumbent or sub-erect, tufted, shining, hairy, adaxially grooved, rounded abaxially, yellowish brown; *pinnae* 3-11.5 cm long, 5-13 mm broad, *ca*. 24 pairs, dimorphic, sterile and fertile, alternate, short stalked, sub-coriaceous, linear-lanceolate, apex acute, truncate base, oblique, margin crenate, margin cut down *ca*. 1/8 to the costa forming sinus, sparsely hairy at both sides, terminal pinnae larger, sometimes auriculated; *costa* 2-10 cm long, 1-2 mm broad, distinct, jointed to pinnae lobes, greenish yellow; *lobes* 1-6 mm long, 1-4 mm broad, *ca*. 30, jointed, slightly oblique, oblong, rounded apex, entire apex, base flat, base attached to costa, thin, sub-coriaceous; *costules* 1-6 mm long, 0.5-1 mm broad, *ca*. 10-30 pairs, alternate, distinct, grooved like, green; *vein* 2-5 mm long, 6-9 pairs, distinct on both sides, free except lowest 5-6 pairs, simple, free, lowest 5-6 adjacent lobe veins oppositely arranged united and forming intermediate excurrent veinlet running to the short sinus; *veinlets* free, short; *sori* 0.5-1 mm in dia., ventral side of pinnae, terminal on veinlets, zig-zag fashion, exindusiate, circular; *indusia* absent; *paraphysis* numerous, capitate, multicellular, orange; *sporangia* 200-550 μm in diameter, numerous, sub-globose, brown, protected by paraphysis; *sporangia stalk* short stalked, multicellular; *annulus* of 12-16 cells, vertical; *spores* 35-55 μm in diameter, monolete, bilateral, plano-convex in lateral view and round-elliptic in polar view, yellow.

Phenology: Perennial; ***Sterile phase***: June-August; ***Fertile phase***: September-June

Distribution**: **World: Africa, Australia, Bangladesh, Bhutan, China, India, Indonesia, Laos, Madagascar, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam; ***India***: Andhra Pradesh, Arunachal Pradesh, Assam, Bihar, Chhattisgarh, Goa, Gujarat, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Odisha, Sikkim, Tamil Nadu, Tripura, Uttar Pradesh, Uttarakhand, West Bengal; ***Gujarat***: Narmada, Navsari, Tapi & Dangs.

Ecology: This taxon luxuriously growing as terrestrial, lithophytic or epipetric along the rivers, streams, ditches and wet banks.

IUCN category: Data Deficient (DD)

BOLD ID: MIPDG010-15, MIPDG011-15; MIPDG012-15

Specimen examined: SRI LANKA, Trinconmale, 4.2.1976, *R. Wight* 65 (K000951404); Gujarat, Narmada Dt., Panjara Ghats, 21°39.91333'N 73°33.77000'E, 144m, 21.1.2015, *R.N. Kachhiyapatel & K.S. Rajput* 149 (BSJO 90464; BLAT!); Dangs Dt., Mahal, Mahal Campsite Road, 20°55.4466'N 73°39.7600'E. 195m, 8.2.2015, *R.N. Kachhiyapatel & K.S. Rajput* 156 (BSJO 40963; CNH!).

HYPODEMATIACEAE Ching, Acta Phytotax. Sin. 13(1):96. 1975

Type: *Hypodematium* Kunze.

Monophyletic, 2 genera and *ca*. 22 species worldwide and 3 subspecies and 2 hybrids in India

Hypodematium Kunze., Flora 16(2):690. 1833

Type: *Hypodematium onustum* Kunze.

Etymology: The genus *Hypodematium* is derived from the Greek word *hypodema* 'a sandal or a shoe' refereeing as the shape of the sandal or shoe like indusium of the species.

Common name: Wood Fern

Monophyletic, *ca*. 20 species worldwide and 3 subspecies and 2 hybrids in India

Hypodematium crenatum (Forssk.) Kuhn, von Decken, Reis., Ill. Bot. Ost.-Africa, 3(3):37, t.a. 1879, **subsp. crenatum**; Holltum, Ferns Malay 501. 1968; Verma & Khullar, Fern Gaz. 12:86. 1980; Dixit, Census Indian Pterid. 137. 1984; Vasudeva & Bir, Indian Fern J. 4:11. 1987; Vasudeva & Bir, Indian Fern J. 10:135. 1993; Chandra, Ferns India 160. 2000; Khullar, Ill. Fern Fl. West Him. 2:161, t.61. 2000; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 2:292. 2018. ***Figure*:** 81, 82

Type: Yemen, ad Mont. Bolghose, *P. Forsskal*, C.

Plant 10-74 cm long, rupestral, perennial herb; *rhizomes* 2-10 cm long, 1-4 cm broad, short creeping, densely scaly throughout, tufted, caespitose, yellowish brown;

rhizome scales 2-10 mm long, 0.4-1.5 mm broad, numerous, linear to liner-lanceolate, concolorous, non-caltherate, golden yellow-reddish orange, long acuminate apex, base broad, entire margin, glossy, thin membranaceous; *fronds* 8-64 cm long, 5-24 cm broad, spreading, procumbent, 2-6 per rhizome, ovate-deltoid or pentagonal-ovate, tripinnate-pinnatifid, herbaceous, green, monomorphic; *stipes* 3-24 cm long, 1-3 mm in dia., procumbent, sometimes swollen base, tuft, stramineous, densely scaly basally, glabrous above, grooved, yellow or yellowish orange; *stipe scales* same as rhizome scales, confined to swollen base; *lamina* 5-40 cm long, 5-36 cm broad, tripinnate-pinnatifid, herbaceous, ovate-deltoid or pentagonal-ovate, apex acuminate, unipinnate to pinnatifid apex, base cuneate, sometimes cordate, basal half tipinnatifid, lowest pairs of pinnae broadest, hairy on both surface, shining, green to pale green; *hairs* 200-700 µm long, numerous, multicellular, slender, straight and needle-like, thin, white, deciduous, present on rachises, pinnae, costa, pinnules, costules, ultimate segments, veins and indusia; *rachis* 4-25 cm long, grooved, straimeneous, hairy, tuft, yellowish green; *pinnae* 2.5-18 cm long, 2-14 cm broad, 5-20 pairs, unipinnate basal pairs, upper pairs pinnatifid, basal most pair opposite-subopposite, alternate above, stalked, ovate-deltoid basal most pairs, upper mid half pairs ovate, apex acuminate, base broad, apical pairs confluent, green, hairy, texture herbaceous; *costa and costules* same as rachis, hairy; *pinnules* 0.5-7 cm long, 0.3-4 cm broad, *ca*. 2-13 pairs, hairy, alternate, basal pairs stalked, sessile above pairs, crowded often over lapping, pinnate to pinnatifid, acroscopic one smaller than basiscopic one, basal pairs ovate-lanceolate, oblong above, apex acuminate, base cuneate, margin pinnate-pinnatifid, green; *ultimate segments* 5-12 mm long, 1-5 mm broad, *ca*. 2-9 pairs, hairy, numerous, alternate, subsessile, stalk winged, oblong, pinnate-pinnatifid, apex obtuse, base obtuse-rounded, margin deeply crenate, green; *veins* 3-4 times forked, distinct on both surface, reaching up to the margin; *sori* 0.5-1.2 mm long, 0.3-1 mm broad, 2-5 pairs, arranged on middle of the veins, alternate rows, on ventral side of pinnae, sub-median, rounded, indusiate; *indusia* 0.5-1.2 mm long, 0.3-1 mm broad, creamish white, reniform, covered with dense stiff hairs, margin entire, persistent, thin, membranaceous; *sporangia* 200-550 µm in diameter, numerous, sub-globose, brown-dark brown; *annulus* 12-18 celled, dark brownish black central part, pale yellow marginal; *spores* 42-55 µm in diameter, monolete, bilateral, reniform to ellipsoid, dark brown, perinate, wrinkled.

Phenology: Perennial; ***Sterile phase***: June-September; ***Fertile phase***: October-December

Distribution**: **World: Afghanistan, Africa, Bhutan, China, India, Japan, Madagascar, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Taiwan; ***India***: Assam, Darjeeling, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Meghalaya, Rajasthan, Sikkim, Tamil Nadu, Uttarakhand; ***Gujarat***: Junagadh.

Ecology: This species growing as lithophytic at elevation ranging from 650-700 m in dry to semi-moist places of hill slope.

IUCN category: Data Deficient (DD)

BOLD ID: MIPDG013-15

Specimens examined: CAPE VERDE, St Vincent, Mount Venede von, 6.1841, *Vogel* 90 (K001134439); INDIA, Gujarat, Junagadh Dt., Girnar hills, 21°32.05833’N 70°31.46833’E, 668m, 26.12.2014, *R.N. Kachhiyapatel & K.S. Rajput* 129 (BSJO 40967; CNH!; BARO!); Junagadh Dt., Girnar hills, 21°32.08833’N 70°31.43333’E, 646m, 23.11.2015, *R.N. Kachhiyapatel & K.S. Rajput* 167 (BSI 140191, 140192, 140095; CNH!; BLAT!; BARO!).

TECTARIACEAE Panigrahi, J. Orissa Bot. Soc. 8:41. 1986

Type*: *Tectaria Cav.

Monophyletic, 7 genera and *ca*. 250 species worldwide and 2 genera 25 species, 1 hybrid, 2 exotic species in India

Tectaria Cav., Anales Hist. Nat. 1(2):115. 1799

Type: *Tectaria trifoliata* (L.) Cav.

Etymology: The genus *Tectaria* is derived from the Latin ‘*tectum*’ ‘roof’ and ‘*-aria*’ a substantive suffix, referring to the roof like indusium of some species.

Common name: Halberd fern

Monophyletic, *ca*. 200 species worldwide and 23 species and 1 hybrid and 2 exotic species in India

Tectaria coadunata (J.Sm.) C. Chr., Contrib. U.S. Natl. Herb., 26(6):331. 1931; Dixit, Census Indian Pterid. 142. 1984; Kuo, Taiwania 30:29. 1985; Manickam & Irudayaraj, Pterid. FI. Western Ghats, 260 Pi. 200. 1992; Fraser-Jenkins, New Sp. Syndr. Indian Pterid 288. 1997; Irudayaraj & Bir, Indian Fern J. 14:114. 1997; Chandra, Ferns India, 222. 2000; Khullar, Ill. Fern Fl. West Him. 2:433, t.154. 2000; Fraser-Jenkins *et al*. Annot. Checklist Indian Pterid. 2:365. 2017. *Aspidium coadunatum* Wallich ex Hook. & Grev., Icon. Fil. 2. t.202. 1831, non Kaulf. 1824; Beddome, Ferns S. India 28. t.81. 1863. *Sagenia coadunata* J. Smith, Hook. Journ. Bot. 4:184. 1841. ***Figure*:** 83, 84

Lectotype: Nepal, Kathmandu Dis.; designated by: Holttum, Kew Bull. 43(3):487. 1988 as on the sheet of *Aspidium coadunatum* Wall. ex Hook. & Grev., *N. Wallich* 377.1, 1820, K (K001080705); ***Isolectotypes***: BM, E, CAL

Plant 15-100 cm long, lithophyte, rarely epilithic, annual herb; *rhizomes* 2-20 cm long, 3-8 cm broad, creeping, rarely sub-erect, densely scaly throughout, tufted, caespitose, brown or reddish brown; *rhizome scales* 2-15 mm long, 1-5 mm broad, dense, ovate-lanceolate to lanceolate, concolorous, reddish brown, apex acuminate, base rounded, margin entire sometimes small projections, thin, membranaceous; *fronds* 12-92 cm long, 1-5 per rhizome, clustered, procumbent, young fronds erect, cordate to deltate, broad at base, herbaceous, monomorphic, pale green-green; *stipes* 5-35 cm long, 1-8 mm in dia., procumbent, sparsely hairy, glossy, pale green to yellow at young, reddish yellow or straw coloured when mature, stipe base densely scaly, sparse above, adaxially grooved, abaxially rounded; *stipe scales* same as rhizome scales; *lamina* 6-57 cm long, 4-40 cm broad, cordate to deltoid, bipinnate to bipinnatifid, apex long acuminate, pinnatifid apex, lowest pairs of pinnae largest, pinnate basal pairs, herbaceous, sparsely hairy, dark green to pale green; *rachis* 5-56 cm long, 1-8 mm in dia., same as stipe; *pinnae* 2-20 cm long, 1.5-15 mm broad, *ca*. 12 pairs, fertile, thin, herbaceous, both the surface sparsely pilose, basal pinnae pairs 1-2 pairs alternate, pinnate, stalked, deltate, asymmetric, acroscopic side smaller than basiscopic one, apex long acuminate or attenuate, base rounded, apical pinnae pairs opposite, pinnatifid, falcate-ovate or lanceolate, symmetric, apex long acuminate or attenuate, margin deeply crenate, ciliated; *pinnules* 2-12 cm long, 0.5-2.8 cm broad, symmetric, basal most pinnules largest, opposite, pinnatifid, falcate-ovate or lanceolate, apex obtuse to acuminate-attenuate, margin deeply crenate, margin, ciliated; *veins* anastomosing or netted, copious, rarely forming included veinlets in areolae, distinct on both sides, reaching up to the margin, hairy; *sori* 0.5-3 mm long, 0.2-2.5 mm broad, on ventral side of pinnae, numerous, sub-marginal to median, reniform to orbicular, indusiate, cluster to two alternate rows, arranged on veinlets; *indusia* 0.5-3 mm long, 0.2-2.5 mm broad, reniform, thin, membranaceus, yellowish white, margin entire, persistent; *sporangia* 200-500 μm in diameter, numerous, sub-globose, yellowish when young, brown at maturity; *sporangial stalk* is 4-7 celled long, upper portion biseriate, lower portion uniseriate; *annulus* 10-15 celled, dark brownish black; *spores* 45-50 μm in diameter, monolete, bilateral, plano-convex-elliptic, perine irregularly folded, yellow at young, dark brown at maturity.

Phenology: Annual; ***Sterile phase***: June-August; ***Fertile phase***: September-January

Distribution**: **World: Africa, Bangladesh, Bhutan, China, India, Laos, Madagascar, Malaysia, Myanmar, Nepal, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam; ***India***: Andhra Pradesh, Arunachal Pradesh, Assam, Chhattisgarh, Goa, Gujarat, Himachal Pradesh, Jammu & Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Mizoram, Nagaland, Nagaland, Odisha, Rajasthan, Rajasthan, Sikkim, Tamil Nadu, Telangana, Tripura, Tripura, Uttar Pradesh, Uttarakhand, West Bengal; ***Gujarat***: Junagadh, Narmada & Dangs.

Ecology: This taxon frequently found at mid to high elevation ranging from 500-1000 m in moist shaded forest, ledges and rock outcrops.

IUCN category: Least Concern (LC)

BOLD ID: MIPDG002-15

Specimen examined: CHINA, Province de Kouy-Tcheou; Pin-fa, 13.2.1903, *J. Cavalerie* 872 (K001080741); INDIA, Gujarat, Dangs Dt., Malegaon, Kotamdar, 20°35.4250’N 73°45.6883’E, 755m, 28.10.2014, *R.N. Kachhiyapatel & K.S. Rajput* 116 (BSJO 9068; BSI 140094); Junagadh Dt., Girnar hills, Ambaji temple-Guru Dattatreya Paduka temple, 21°31.66167’N 70°31.77500’E, 1035m, 24.9.2017, *R.N. Kachhiyapatel & K.S. Rajput* 291 (BLAT!; BARO!).

POLYPODIACEAE J. Presl & C. Presl, Delic. Prag. 159. 1822

***Type*:** *Polypodium* L.

Monophyletic, 6 subfamilies, 65 genera and *ca*. 1652 species worldwide, 17 genera, 74 species and 4 subspecies in India

Lepisorus (J. Sm.) Ching, Bull. Fan Mem. Inst. Biol. Bot. 4(3):47, 56-58. 1933

Type: *Lepisorus nudus* (Hook.) Ching

Etymology: The genus *Lepisorus* is derived from the Greek words *lepis* ‘scale’ and ‘*sorus*’ indicating the small sori of some species.

Common name: Poly pod fern genus

Monophyletic, 80 species worldwide and 13 species in India

Lepisorus nudus (Hook.) Ching in Bull. Fan. Mem. Inst. Biol. 4:83. 1933; Dixit, Census Indian Pterid. 41. 1984; Manickam & Irudayaraj, Pterid. FI. Western Ghats 332. PI. 252. 1992; Khullar, Ill. Fern Fl. West Him. 1:101, 103, t.38. 1994; Nampy & Madhusoodanan, Fern Fl. S. Ind. 54-55. 1998; Chandra, Ferns India 381. 2000; Fraser-Jenkins, Taxon. Revis. Indian Subcont. Pterid., 39-41, 538. 2008. *Pleopeltis nuda* Hook., Exot. FI. 1:63. 1823; Sledge, Bull. Br. Mus. Nat. Hist. Bot. 2(5):135. 1960. *Pleopeltis* *linearis* sensu Beddome, Handb. Ferns Brit. India 346. 1883; Blatter & d'Almeida, Ferns Bombay 170. 1922. ***Figure*:** 85, 86

Type: China, Poo-too-san Island, 1848, *Fortune* 18, K (K000959572).

Plants 5-25 cm long, epiphytic, epilithic, herbaceous, annual, green; *rhizome* 1-10 cm long, 0.5-3 mm in diam., netted in fibrous roots, branched, long creping, densely scaly, dark brown to brownish black, persistent; *rhizome scales* 1-3 mm long, 0.5-1 mm broad, lustrous, ovate lanceolate, yellowish brown, concolorus with clear lumen, apex acute, margin slightly dentate, base broad, persistent; *fronds* 4.5-24.7 cm long, 1-15 per rhizome, spreading, erect, simple, monomorphic, linear to narrowly lanceolate; *stipes* 0.5-3 cm long, 1-4 mm in dia., distant on rhizome, tufted, erect, scaly, rounded, glabrous, green or yellowish brown, glossy, persistent; *stipe base scales* same as rhizome scales, sparse; *lamina* 4-21.3 cm long, 2-9 mm broad, coriaceous, thick, fleshy, dark green adaxially, pale green abaxially, linear to narrowly lanceolate, apex acuminate to long attenuate, base attenuate, simple, sparsely scaly on adaxial side, curled after drying period, dehiscent when dry; *midrib* 4-21.2 cm long, 0.5-1 mm broad, prominent, slightly distinct, raised on adaxial side, scaly adaxially side; *veins* indistinct, areoles irregular with forked free veinlets, free, forking, ending at the entire margins; slightly raised; *sori* 0.5-1.3 mm long, 0.4-1 mm broad, arranged in single row, 16 alternate pairs on either side of midrib, medial or slightly toward midvein, round to orbicular, distinct, persistent, medium to large, toward apical part of lamina, exindusiate, sparsely covered with paraphyses; *paraphyses* 100-400 µm long, 100-300 µm broad, peltate, caltherate, persistent, yellowish brown, lumen yellowish white; *sporangium* 200-500 µm, globose to sub-globose, stalked; *annulus* 12-20 celled, brownish black; *spore* 46-70 µm, monolete, bilateral, oblong-elliptic, plano-convex in lateral view, exine smooth or minutely rugose, light brown-yellow.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: July-September

Distribution*: *World: Africa, Bangladesh, Bhutan, China, India, Japan, Malaya, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, Vietnam; ***India***: Andhra Pradesh, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Nagaland, Sikkim, Tamil Nadu, West Bengal; ***Gujarat***: Dangs & Valsad.

Ecology: This taxon is growing as epiphytic, pendent, often with the stipe and lamina abruptly bent downward, sometimes sub-erect on tree trunks and mossy rocks of high elevation ranging from 600-1000m.

IUCN category: Data Deficient (DD)

BOLD ID: MIPDG006-15

Specimen examined: BANGLADESH, Chittong, 12.4.1802, *Francis Buchanan-Hamilton* (BM001038472); INDIA, Gujarat, Dangs Dt., Saputara hill, 20°34.17833’N 73°44.88333’E, 913m, 5.10.2014, *R.N. Kachhiyapatel & K.S. Rajput* 77 (BSI 140092; CNH!); Dangs Dt., Saputara hill, 20°34.2250’N 73°44.8283’E, 939m, 12.10.2014, *R.N. Kachhiyapatel & K.S. Rajput* 98 (BLAT!).

Microsorum Link, Hort. Berol. 2:110. 1833

Type: *Microsorum irregulare* Link.

Etymology: The genus *Microsorum* is derived from the Greek words *mikros* (small, tiny), and *soros,* indicating the small sori of some species.

Common name: Fishtail Fern; Polypod genus

Paraphyletic, 40 species worldwide and 5 species in India

Microsorum membranaceum (D. Don) Ching, Bull. Fan. Mem. Inst. Biol. 4:309. 1933; Verma & Khullar, Fern Gaz. 12:87. 1980; Dixit, Census Indian Pterid. 45. 1984; Manickam & Irudayaraj, Pterid. FI. Western Ghats 327. PI. 248. 1992; Khullar, Ill. Fern Fl. West Him. 1:121, t.45. 1994; Nampy & Madhoosudanan, Fern Fl. S. Ind. 78-79. 1998; Chandra, Ferns India 406. 2000. *Pleopeltis membranacea* Moore, Index Fil. 191. 1857; Beddome, Ferns S. India 59, t.177. 1864; Beddome, Handb. Ferns Brit. India. 355. 1880; Beddome, Handb. Ferns Brit. India 355. 1883; Blatter & d’Almeida, Ferns Bombay 172. 1922; Vasudeva & Bir, Indian Fern J. 10:197-198. 1993. *Polypodium membranaceum* D. Don, Prodr. FI. Nepal 2. 1825; Clarke, Trans. Linn. Soc. Loud.II. Bot. 1. 560. 1880. ***Figure*:** 87, 88

Type: Nepal, 1818, *Wallich N.*, BM (BM001038357)

Plants 8-60 cm long, epiphytic, epilithic, rarely terrestrial, herbaceous, annual herb, green; *rhizome* 2-10 cm long, 6-20 mm in diam., short creeping, densely scaly, slender, round, branched, tufted, attached on barks of tree and mossy rocks, green to brownish black, persistent; *rhizome scales* 1-7 mm long, 0.5-4 mm broad, ovate-lanceolate, clathrate, dark brown, concolorus, apex acute, entire-sub entire, base broad, persistent; *fronds* 7.4-58 cm long, 1-7 cm broad, 1-10 per rhizome, spreading, erect or procumbent, simple, monomorphic, lanceolate or elliptic-lanceolate; *stipes* 0.5-4 cm long, 1-5 mm in dia., narrowly winged downward, tufted, erect, sparsely scaly, abaxially grooved, adaxially rounded, yellowish green, glossy; *lamina* 6.9-54 cm long, 1-7 cm broad, membranaceous, thin, green to pale green, lanceolate or elliptic-lanceolate, apex long acuminate, base decurrent, margin entire, sometimes wavy, simple, dehiscent when dry; *midrib* 6.9-54 cm long, 0.5-2.5 mm broad, prominent, raised on adaxial side; *veins* distinct, reticulate, lateral main veins parallel, not reaching to margin, 2-5 mm apart from margin, veinlets included, veinlets forming areoles; *sori* 0.5-2.5 mm long, 0.4-2.4 mm broad, irregularly scattered on abaxial side, numerous, globose to sub-orbicular, distinct, persistent, exindusiate, sparsely with paraphyses, yellowish-orange; *paraphyses* 200-900 µm long, 20-50 µm broad, numerous, linear, filamentous, uniseriate, non-caltherate, persistent, yellow; *sporangium* 200-500 µm, numerous, globose to sub-globose, stalked, yellowish brown; *annulus* 14-22 celled, brownish black; *spore* 50-80 µm, monolete, bilateral, plano-convex in lateral view, oblong-elliptic in lateral view, minutely granulate, bright yellow.

Phenology: Annual; ***Sterile phase***: June-July; ***Fertile phase***: August-October

Distribution**: **World: Bhutan, Burma, China, India, Laos, Nepal, Philippines, Sri Lanka, Taiwan, Thailand, Vietnam ***India***: Andhra Pradesh, Arunachal Pradesh, Assam, Gujarat, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Manipur, Meghalaya, Nagaland, Sikkim, Tamil Nadu, West Bengal; ***Gujarat***: Dangs & Valsad.

Ecology: This taxon is luxuriously growing as epiphytic, pendent, sometimes sub-erect on mossy tree trunks and wet mossy rocks of high elevation ranging from 600-1000 m.

IUCN category: Data Deficient (DD)

Specimen examined: PHILIPPINES, Luzon Benguet province, Baguio, 3.1907, *A.D.E. Elmer* 8367 (K000598554); INDIA, Gujarat, Dangs Dt., Malegaon, Kotamdar, 20°35.4250'N 73°45.6883'E, 755m, 25.12.2015, *R.N. Kachhiyapatel & K.S. Rajput* 172 (BSJO 40969).

5.3 SYSTEMATIC TREATMENT OF GYMNOSPERMS

Ephedraceae Dumort., Anal. Fam. Pl. 11, 12. 1829

Type: *Ephedra* L.

Monophyletic, 1 genus, *ca*. 65 species worldwide and *ca*. 14 species in India

Ephedra L., Sp. Pl. 2:1040. 1753

Lectotype: *Ephedra distachya* L., designated by: M. L. Green, Prop. Brit. Bot. 192. 1929.

Etymology: The genus *Ephedra* is derived from the Ancient Greek word *epi* 'upon' and *hedra* 'seat', collectively known as sitting upon.

Common name: Joint Fir

Monophyletic, *ca*. 65 species worldwide, *ca*. 14 species in India

5.3.1 Key to the species of Ephedra

1 Plants 4 cm long, leaf *ca*. 2 cm long, female cones 2-6 per node, bracts 2-4 per cone...**E. foliata**

1 Plants 4-8m long, leaf *ca*. 4 cm long, female cones 4-10 per node, bracts 10-24 per cone…………………………………………………………….…….**E. karumanchiana**

Ephedra foliata Boiss. ex C.A.Mey.**,** Mem. Acad. Imp. Sci. Saint-Petersbourg, Ser. 6, Sci. Math., Seconde Pt. Sci. Nat. 6:107. 1846; Sahni, Gymnosperms of India & Adj. Countries. 1990; *E. alte* C.A.Mey., Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 5:35. 1845; *E. ciliata* Fisch. & C.A.Mey., Bull. Cl. Phys.-Math. Acad. Imp. Sci. Saint-Petersbourg 5:36. 1845; *E. foliata* var. *ciliata* (Fisch. & C.A.Mey.) Stapf, Denkschr. Kaiserl. Akad. Wiss., Wien. Math.-Naturwiss. Kl. 56(2):49. 1889.

Syntype: IRAN, April 1842, *Kotschy, K.G.T.* 866 (K: K000459001); *Determined by*: Freitag, H., & M. Maier-Stolte on 29th April 2004. ***Figure*****:** 90, 91

Plants 0.8-4m height, dioecious, terrestrial, scandent or trailing shrub; roots 1-8 cm in dia., taproot, branched, brownish black, woody; *stem* 0.5-4m long, 1-8cm in dia., slender, green when young, dark brown at maturity, woody, branched, distinct nodes and internodes; *branchlets* 1-6 mm in dia., 1-4 per node, whorls, green, ridges and furrows; *leaves* 0.1-2 cm long, 0.1-2 mm in width, 2-3 per node, scaly, densely hairy, linear, sheathing at base, sheath whitish yellow or green, apex acute; *male strobili* 1-8mm long, 1-2mm in width, 1-5 strobilus per node, whorled, short stalked, ovate, bracteates; *bract* 6-12 per strobilus, greenish yellow, margin ciliate; *male flowers* 0.5-5mm, 4-8 per strobilus; *anthers* 0.5-1.5 mm, 2-3 per flower; *female strobili* 0.4-1 cm long 1.5-3.5 mm in dia., 2-6 per node, short stalked, on nodal branches or terminal, bracteates; *bract* 2-4 pairs, opposite decussate, yellowish green, sometimes white at maturity; *ovules* 1-5 mm long, 1-2 mm in dia., 1-2 per strobilus, ovate, greenish yellow; *seeds* 1-2 per strobilus, ovate, covered with fleshy bract, persistent micropyle.

Phenology: Annual; ***Sterile phase***: June-January; ***Fertile phase***: February-May.

Distribution: World: Afghanistan, Algeria, Bahrain, Chad, Djibouti, Egypt, Ethiopia, India, Iran, Iraq, Jordan, Kuwait, Mauritania, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, Turkmenistan, United Arab Emirates & Yemen; ***India***: Gujarat, Haryana, Punjab & Rajasthan; ***Gujarat***: Kachchh & Devbhumi-Dwarka.

Ecology: This species growing luxuriously in desert regions of Gujarat specifically in Kachchh region in fully exposed areas of the sun light. The species is growing in the association with wide range of angiosperms *viz*., *Acacia jacquemontii* Benth., *Capparis* *decidua* (Forssk.) Edgew., *Prosopis chilensis* (Molina) Stuntz, *Salvadora oleoides* Decne.

IUCN category: Least Concern (LC)

Specimen examined: INDIA, Gujarat, Kachchh Dt., Navinal, 22°47.15000'N 69°37.455'E, 11m, 02.10.2014, *R.N. Kachhiyapatel & K.S. Rajput* 67 (BARO!); Kachchh Dt., Kalo Dungar, 23°55.88167'N 69°48.758'E, 387m, 03.10.2014, *R.N. Kachhiyapatel & K.S. Rajput* 68 (BARO!); Kachchh Dt., Dhinodhar, 23°27.225'N 69°20.093'E, 160m, 18.11.2017, *R.N. Kachhiyapatel & K.S. Rajput* 293 (BARO!).

Ephedra karumanchiana Patel *et al*. Phytotaxa 111-111. 2021.

Type: INDIA, Gujarat, Banaskantha Dt., Ramsan, 135-160m, 8th March 2015, *Patel et al.* 160. (CAL!); ***Isotype***: BARO!, SUK!, K!. ***Figure*: 92, 93**

Plants 4-8m height, dioecious, terrestrial, scandent shrub; roots 1-15 cm in dia., taproot, numerous, branched, brownish black, woody; *stem* 3-5m long, rarely 6m, 5-15cm in dia., rarely up to 22cm, green-brown when young, dark brown at maturity, thick, woody, branched, distinct nodes and internodes; *branchlets* 1-8 mm in dia., 2-5 per node, whorls, scabrous, green, having ridges and furrows; *leaves* 0.2-4 cm long, 0.5-3 mm in width, 2-4 per node, scaly, hairy, whorl, linear, sheathing at base, white-yellow, apex acute, green-pale green; *male strobili* 0.5-1.2 cm long, 2-3 mm in width, 3-12 strobilus per node, rarely bifurcate, whorled, short stalked, ovate-lanceolate, bracteates; *bract* 10-24 per strobilus, bi-colours, centre dark green, margin hyaline, ciliate; *male flowers* 1-3 cm, 10-15 per strobilus (mature); *anthers* 1-2 mm, 2-3 per flower; *female strobili* 0.5-1.2 cm long 2-5 mm in dia., 4-10 per node, rarely 14, short stalked, terminal, sometimes on nodal branches, bracteates; *bract* 3-4 pairs, opposite, pink when young, pink or sometimes white at maturity, mucronate, connate; *ovules* 2-7 mm long, 2-3 mm in dia., 1-2 per strobilus, rarely 3, ovate, green-black; *seeds* 1-2 per strobilus, rarely 3, covered with fleshy bract, ovate, black, persistent micropyle.

Phenology: Annual; ***Sterile phase***: June-January; ***Fertile phase***: February-May.

Distribution: World: India; ***India***: Gujarat; ***Gujarat***: Banaskantha.

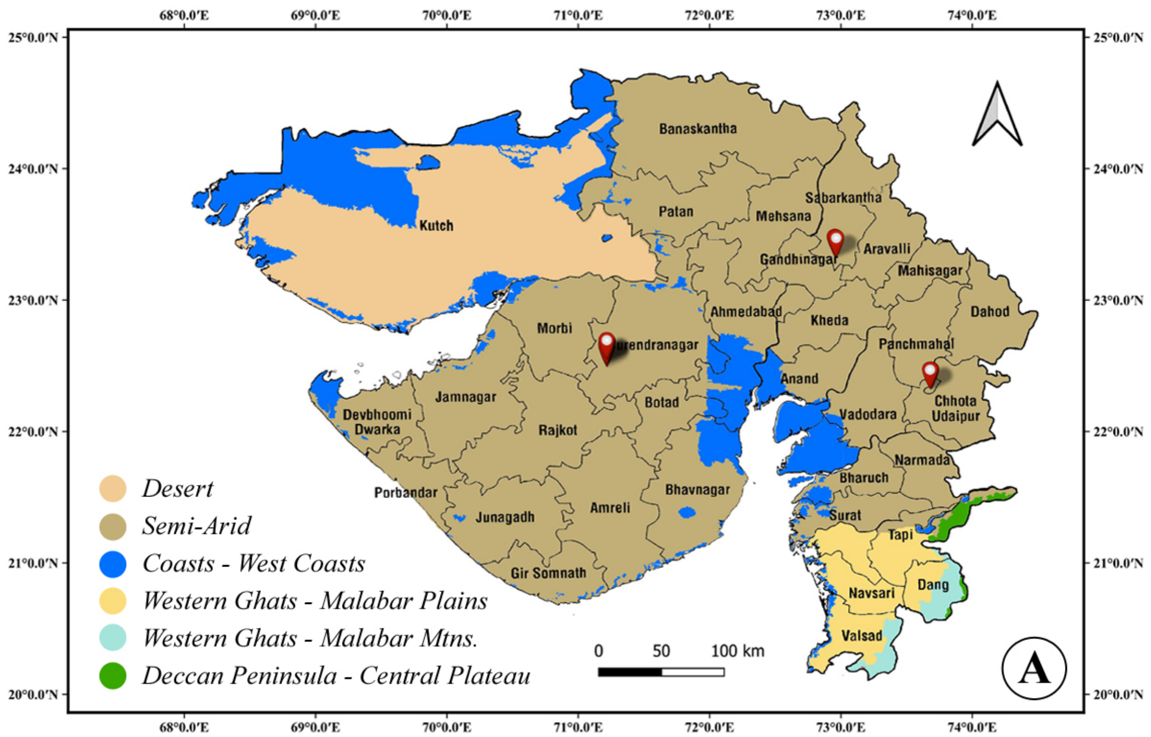
Ecology: This species growing luxuriously in drier (arid regions of Gujarat and Rajasthan in fully exposed areas of the sun light. The species is growing in the association with wide range of angiosperms *viz*., *Acacia jacquemontii* Benth., *A. leucophloea* (Roxb.) Willd., *Azadirachta indica* A. Juss., *Capparis decidua* (Forssk.) Edgew., *Clerodendrum multiflorum* G. Don, *Euphorbia caducifolia* Haines, *Prosopis* *chilensis* (Molina) Stuntz, *Salvadora oleoides* Decne., *Salvadora persica* L. & *Tecomella undulata* (Sm.) Seem. This species prefers typically dry, loose and sandy soil.

IUCN category: Data Deficient (DD)

NCBI: MH732928; MH250182; MH250181; MH250180; MH250179

Specimen examined: INDIA, Gujarat, Banaskantha Dt., Ramsan, 24°26.23167'N 72°02.57833'E, 139m, 08.03.2015, *Patel et al*. 160 (BARO!); Rajasthan; Jalore Dt., Pooran, 24°48.12387'N 72°18.83237'E, 263m, 03.11.2017, *R. N. Kachhiyapatel, S. K. Patel & K. S. Rajput* 300 (BARO!).

Distribution of *Isoetes coromandelina* subsp. *coromandelina* in different bio-geographical zones (A) and different regions (B) of Gujarat.



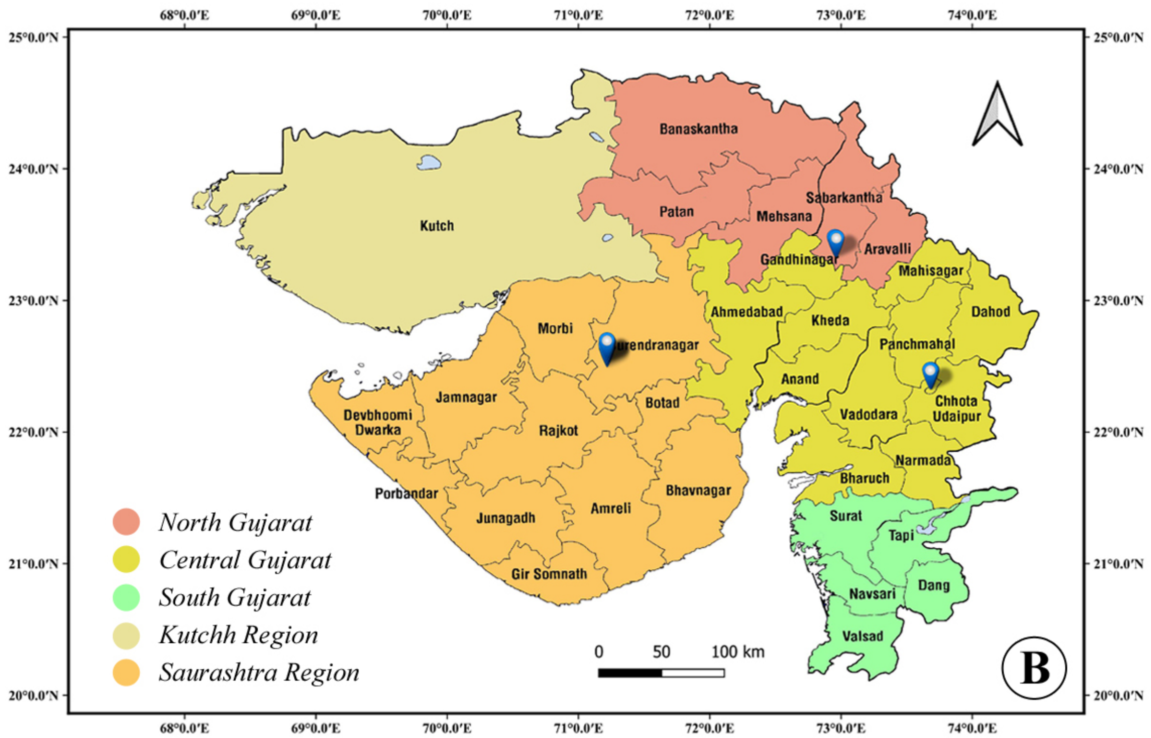


Figure: 9

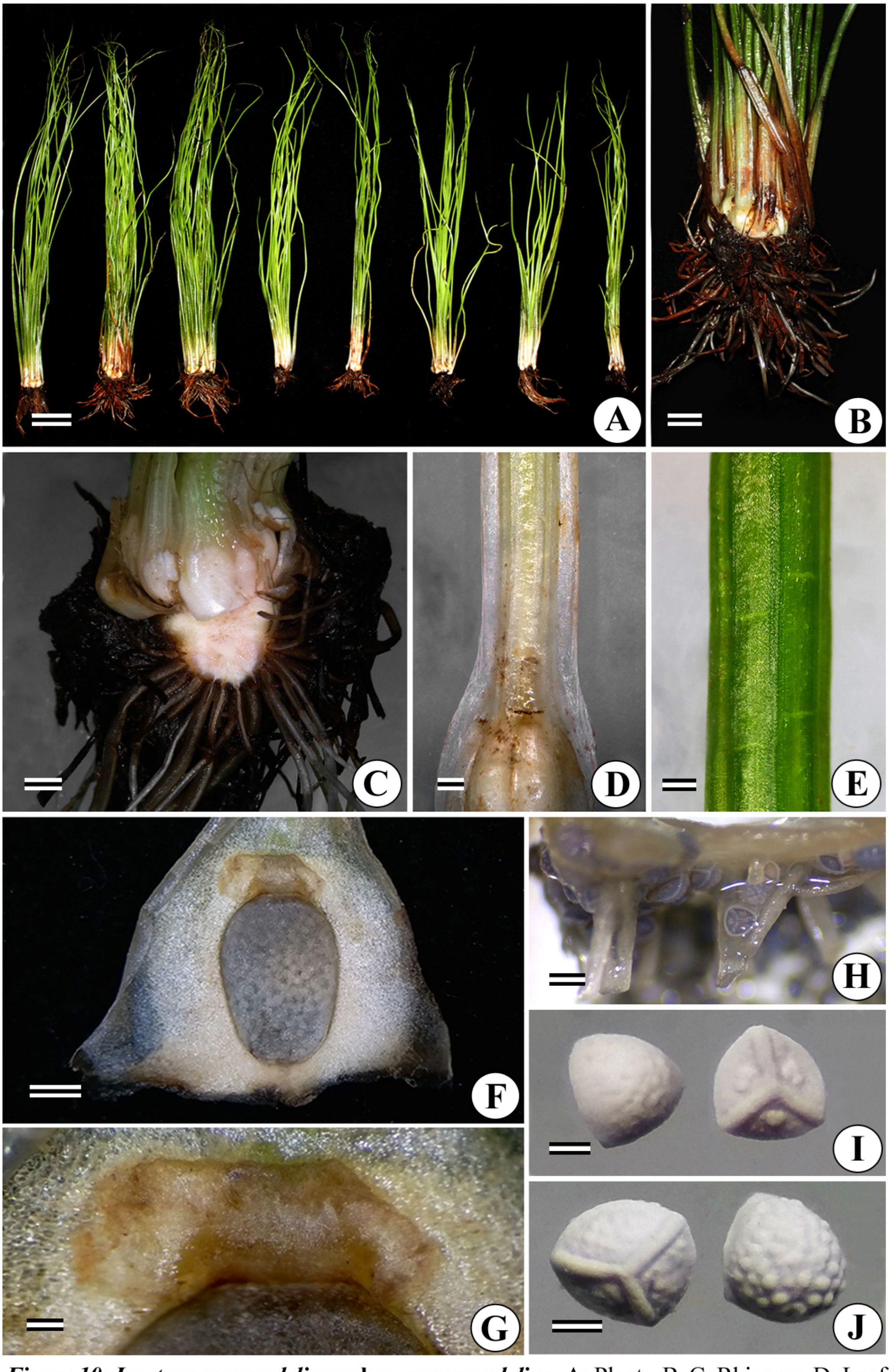
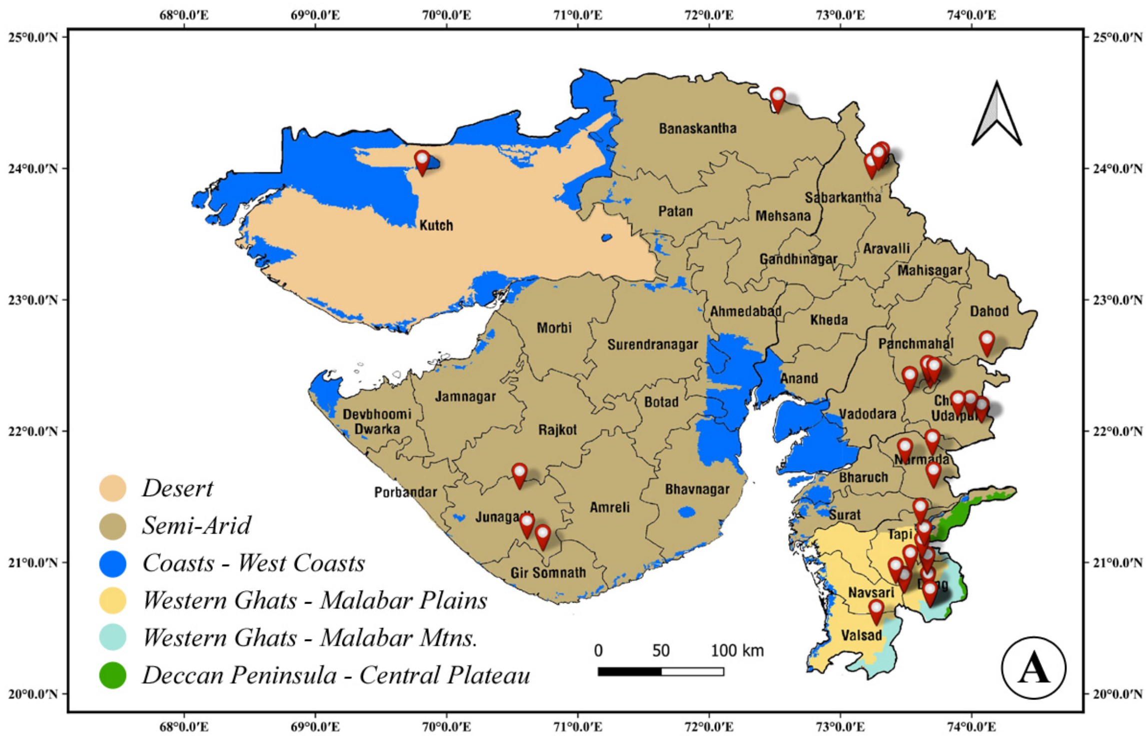


Figure 10: Isoetes coromandelina* subsp. *coromandelina. A: Plants, B, C: Rhizome, D: Leaf base, E: Leave, F: Sporangia, G: Ligule, H: Trabaculae, I, J: Small and large megaspores. ***Scale Bar:*** A: 5 cm, B: 1 cm, C: 5 mm, D, E: 2 mm, F: 3 mm, G, H: 0.5 mm, I: 100 µm, J: 200 µm.

Distribution of *Selaginella ciliaris* in different bio-geographical zones (A) and different regions (B) of Gujarat.



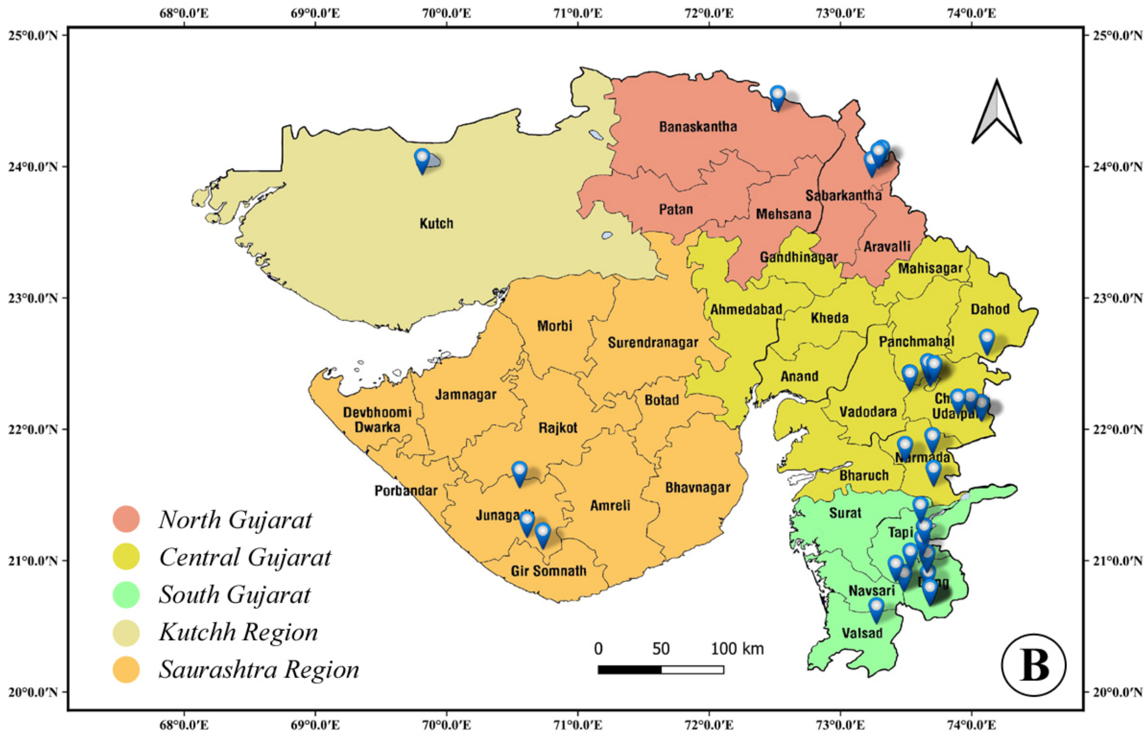


Figure: 11

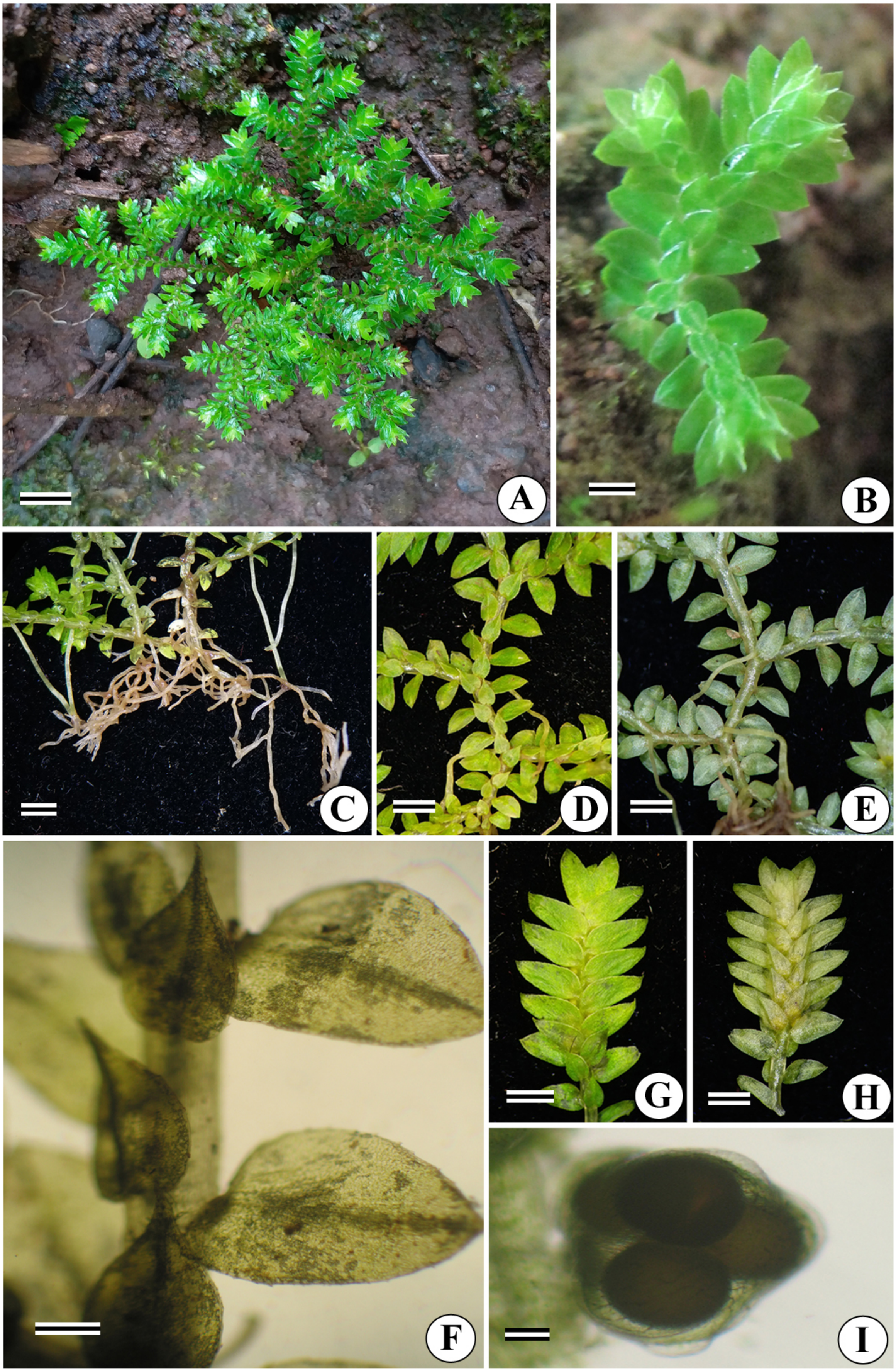
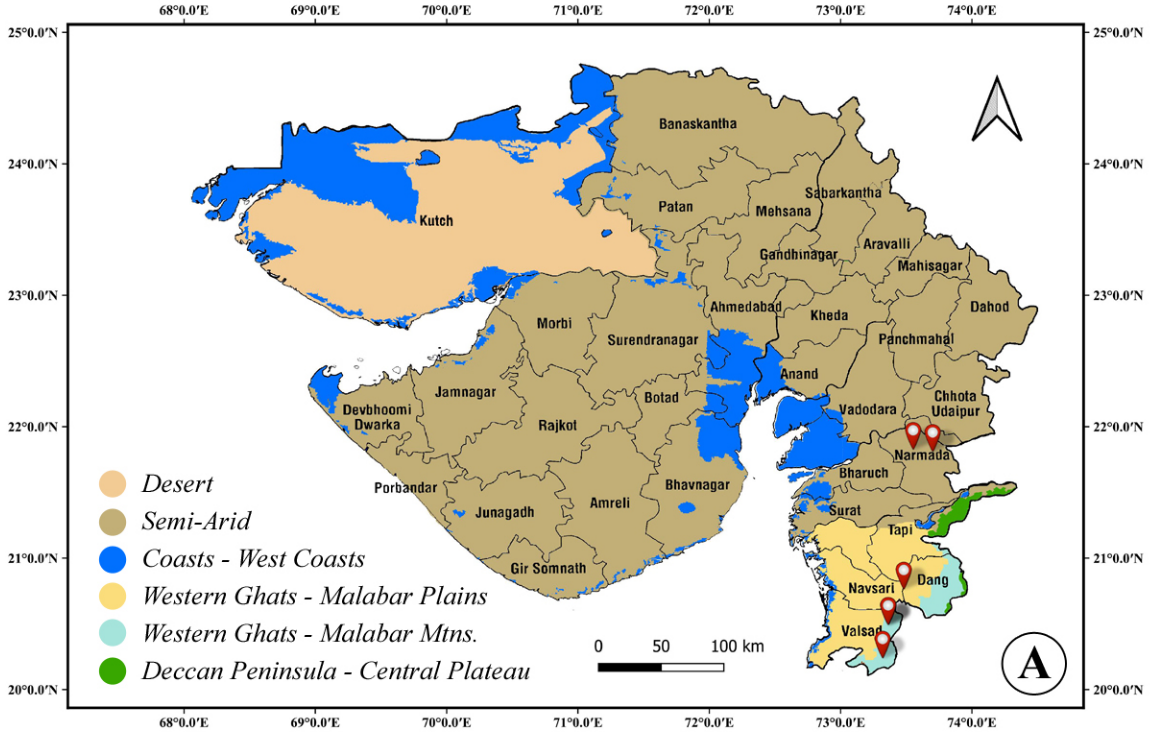


Figure 12: Selaginella ciliaris. A, B: Habit, C: Rhizophores, D, E: Adaxial and abaxial view, F: Lateral and median leaves , G, H: Strobilus, I: Sporangia. ***Scale Bar:*** A: 1 cm, B-E, G, H: 5 mm, F, I: 1 mm, D: 50 cm.

Distribution of *Selaginella delicatula* in different bio-geographical zones (A) and different regions (B) of Gujarat.



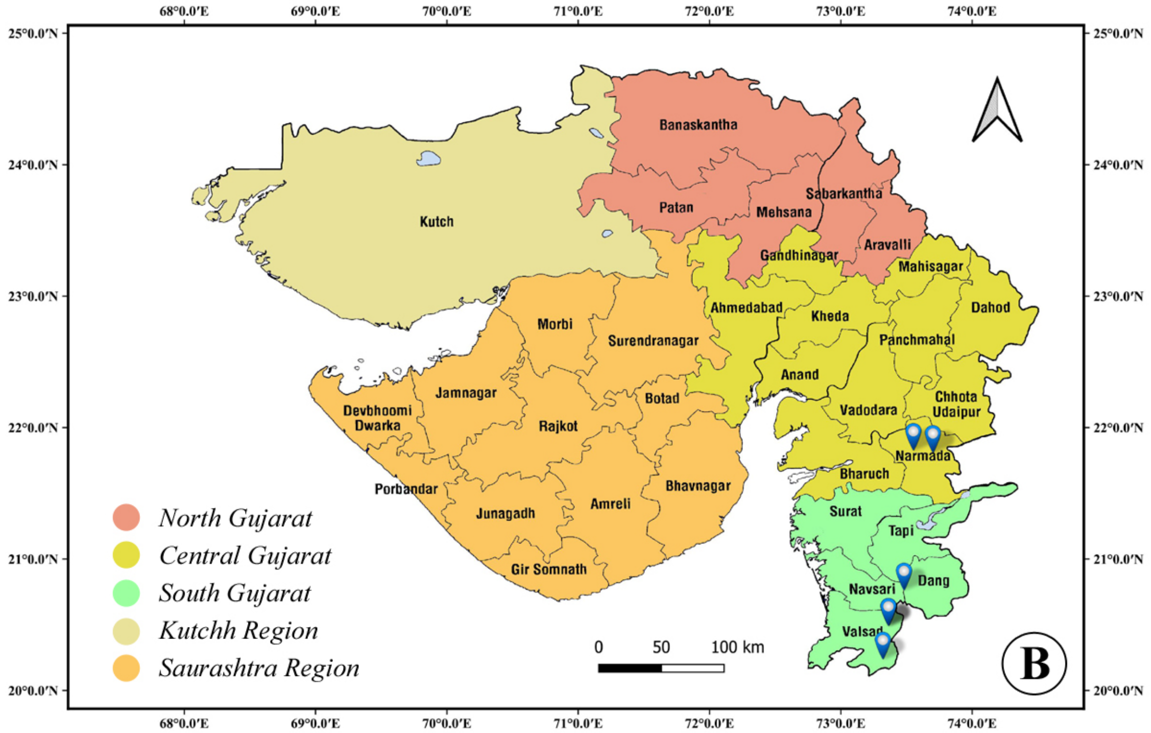


Figure: 13

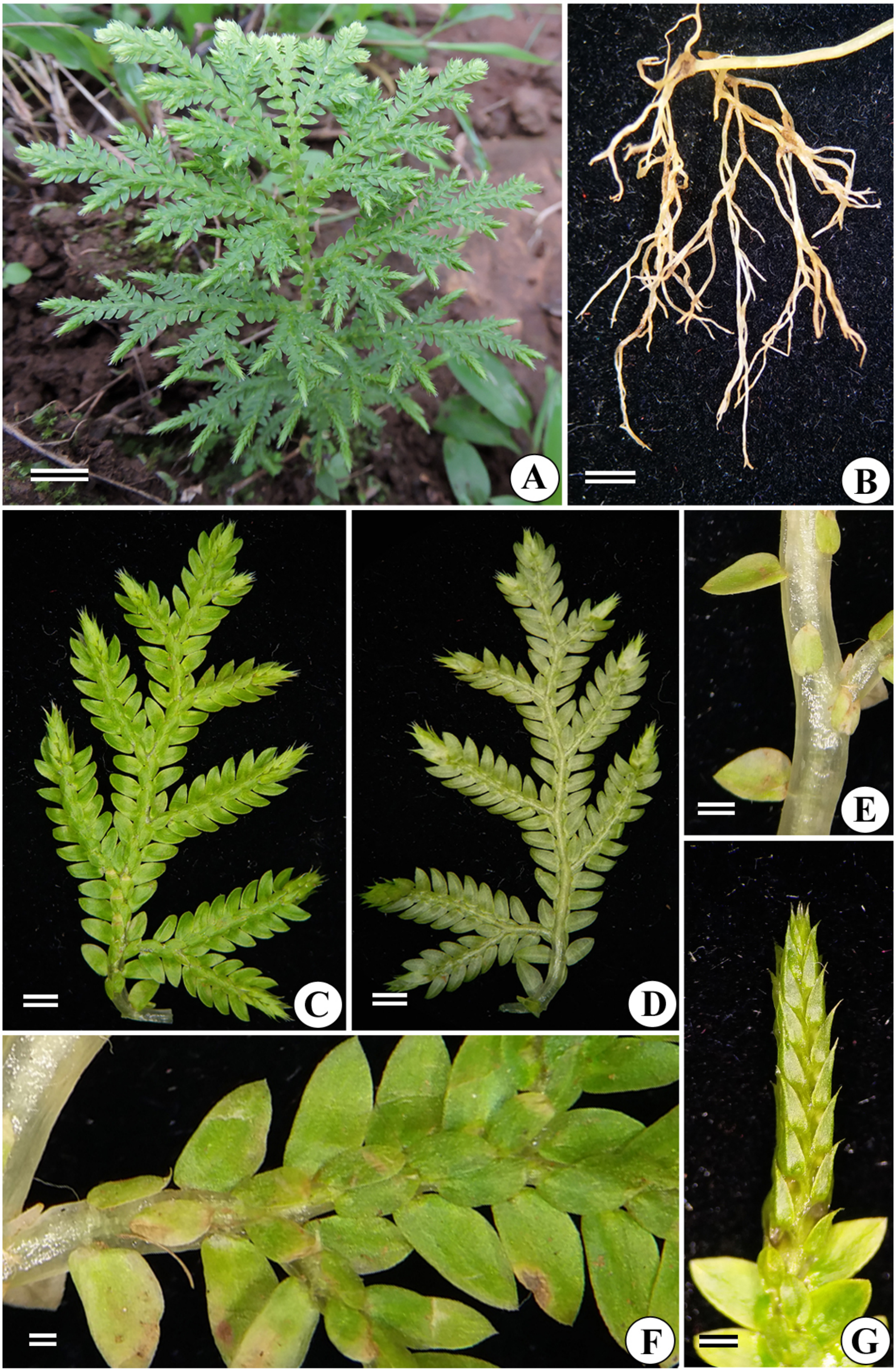
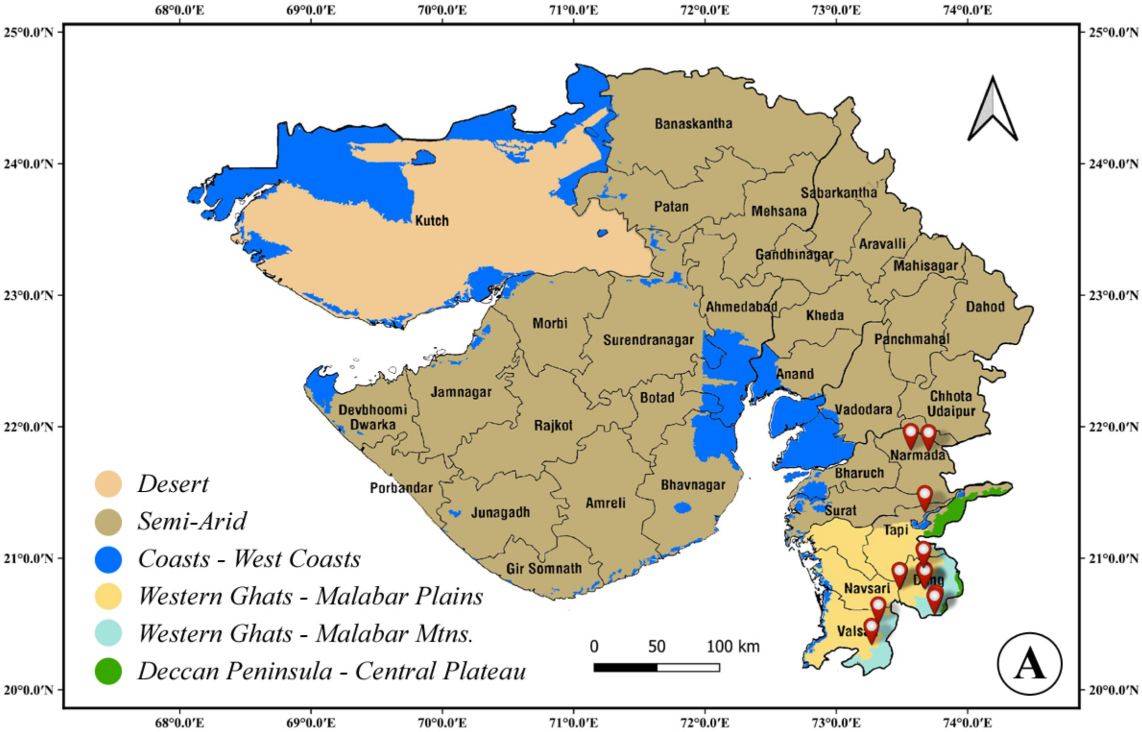


Figure 14: Selaginella delicatula. A: Habit, B: Rhizophores, C, D: Branches, E, F: Lateral, axillary and median leaves, G: Strobilus. ***Scale Bar:*** A: 3 mm, B: 1 cm, C, D: 5 mm, E-G: 1 mm.

Distribution of *Selaginella repanda* in different bio-geographical zones (A) and different regions (B) of Gujarat.



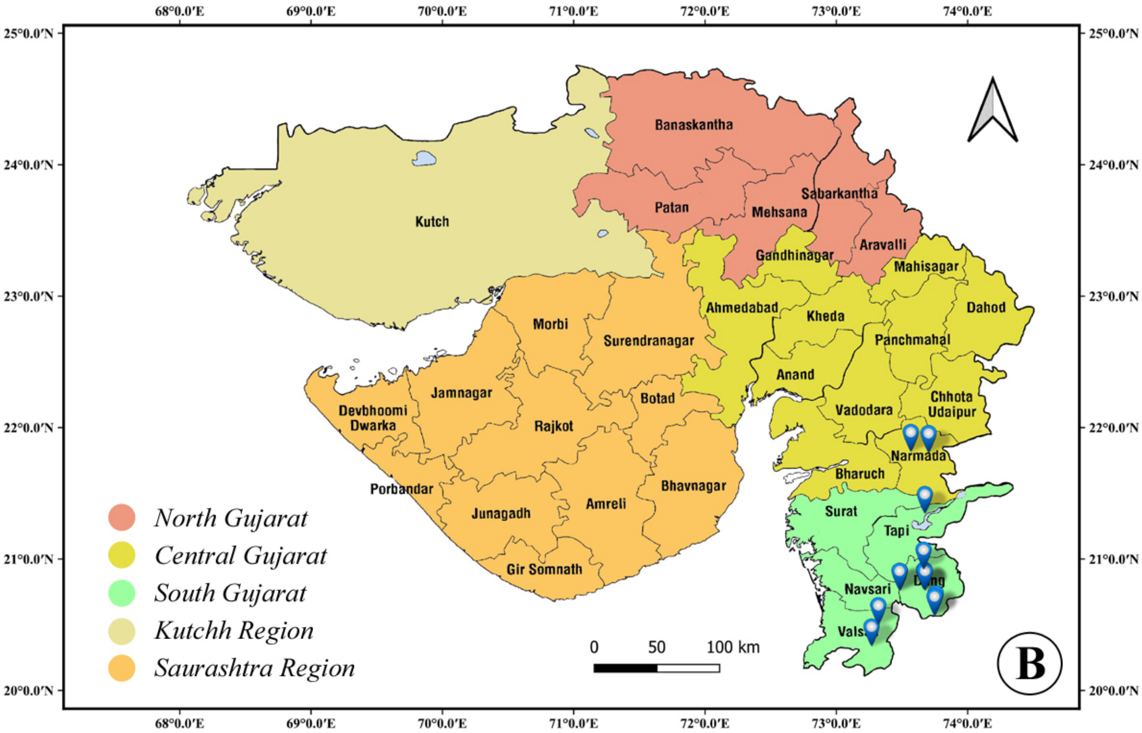


Figure: 15

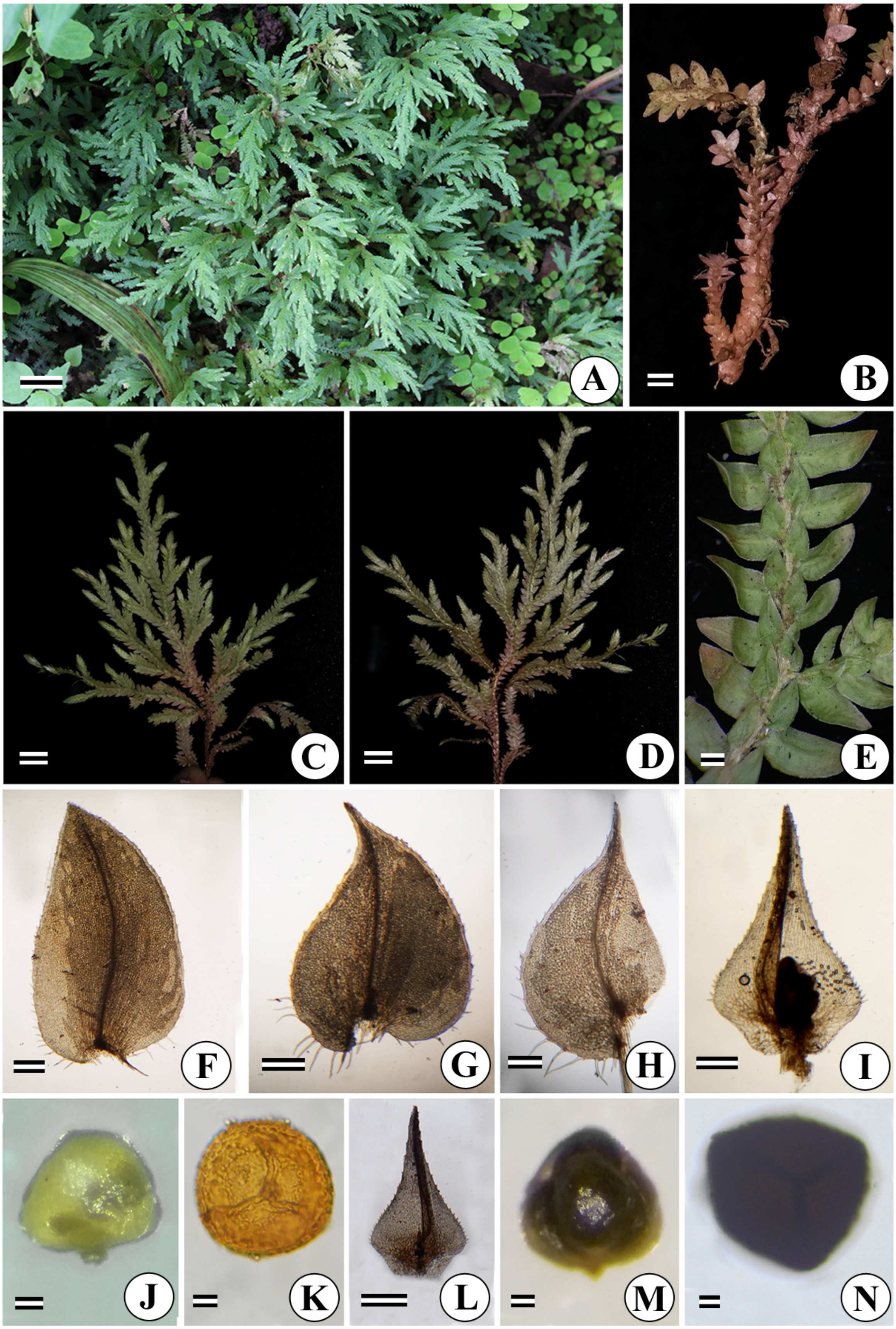
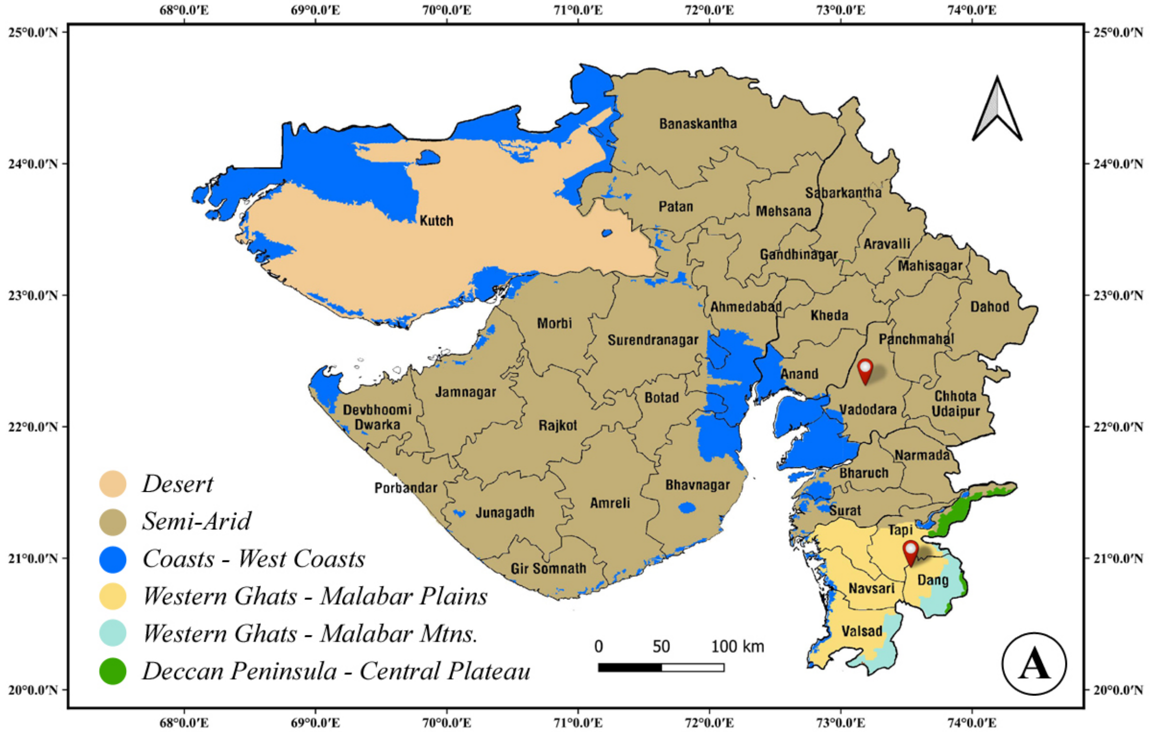


Figure 16: Selaginella repanda. A: Habit, B: Main stems base, C, D: Plant dorsal and ventral view, E: Branches, F-H: Lateral, Median & Axillary leaves, I: Microsporophyll, J: Microsporangia, K: Microspore, L: Megasporophyll, M: Megasporangia, N: Megaspore. ***Scale Bar:*** A: 5 cm, B: 2 mm, C, D: 5 mm, E: 1 mm, F-I, L: 200 µm, K: 10 µm, M, N, J: 20 µm.

Distribution of *Equisetum ramosissimum* in different bio-geographical zones (A) and different regions (B) of Gujarat.



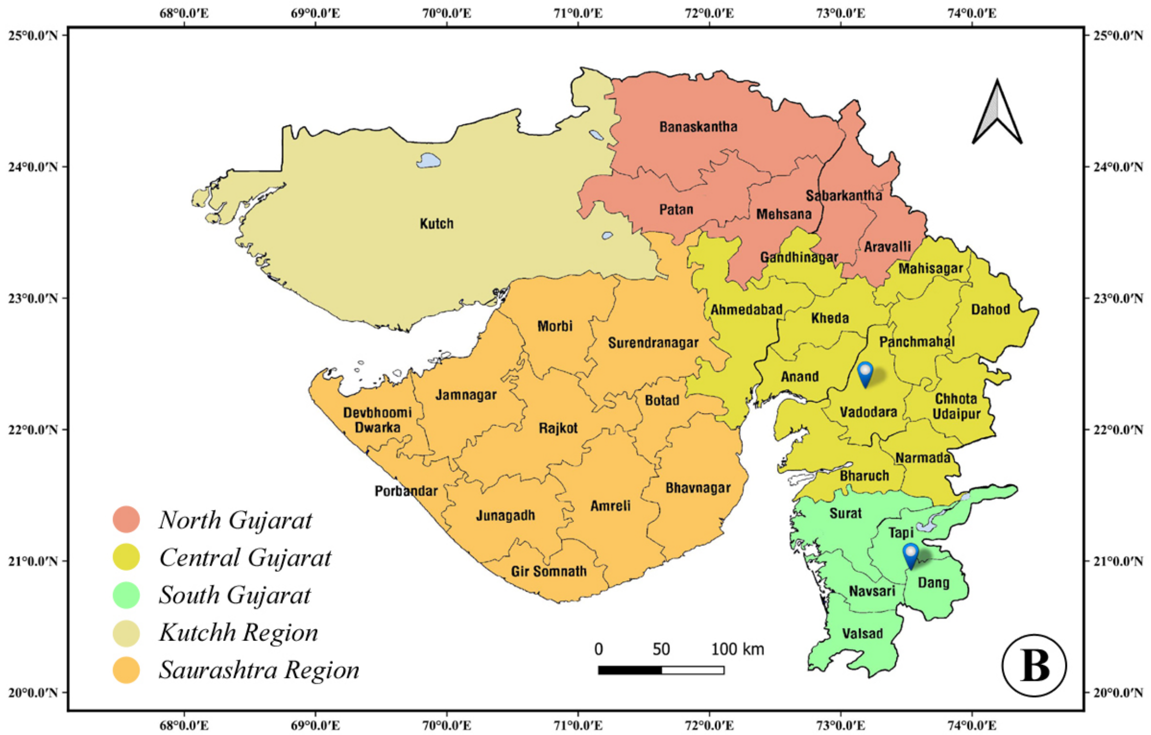


Figure: 17

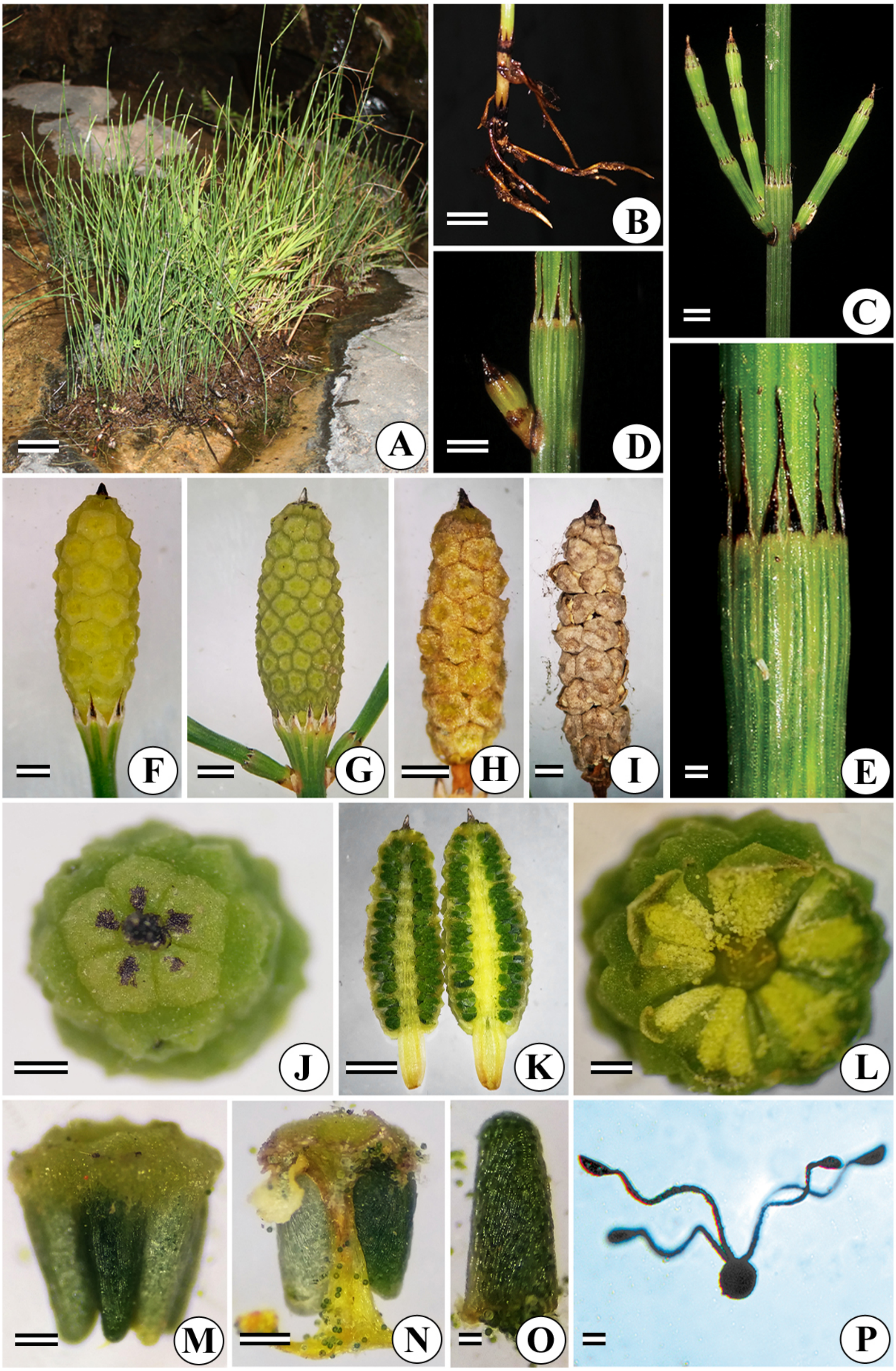
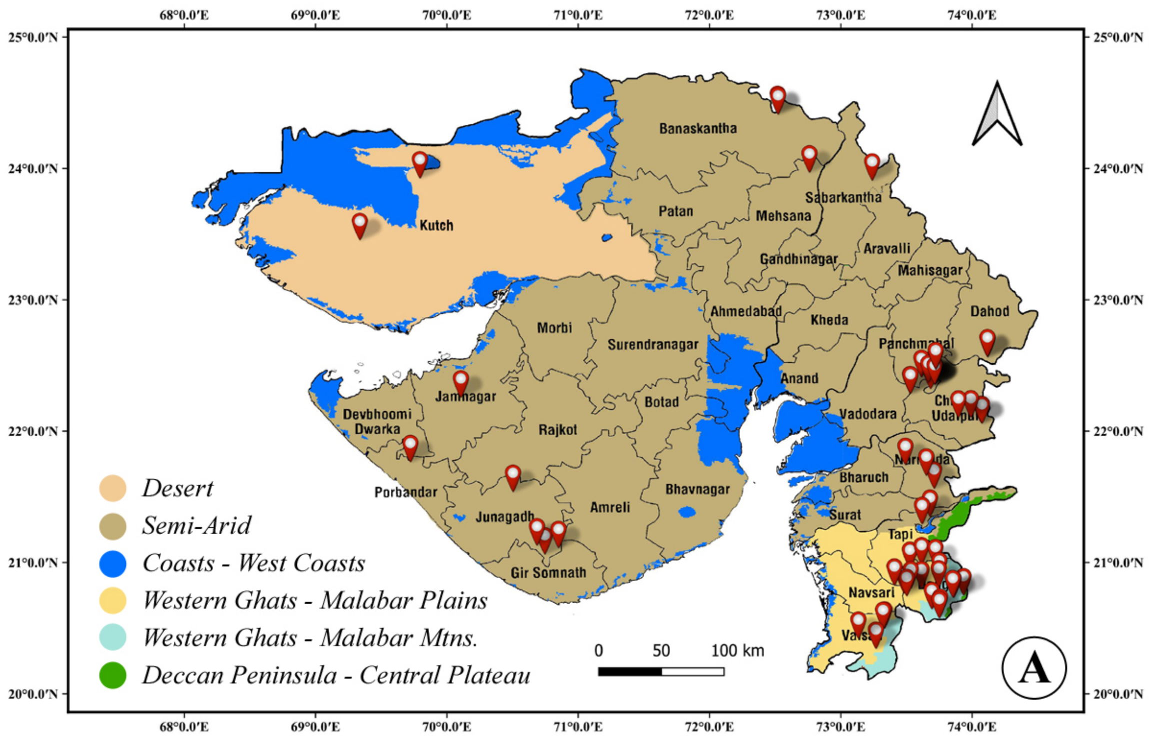


Figure 18: Equisetum rammosissmum. A: Habit, B: Rhizome, C, D: Branches, E: Leaf sheath, F-L: Strobilus, M, N: Sporangiophore, O: Sporangium, P: Spore. ***Scale Bar:*** A: 10 cm, B: 5 mm, C, D, F-I: 2 mm, J, L: 1 mm, K: 3 mm, E, M, N: 0.5 mm, O: 100 µm, P: 10µm.

Distribution of *Ophioglossum costatum* in different bio-geographical zones (A) and different regions (B) of Gujarat.



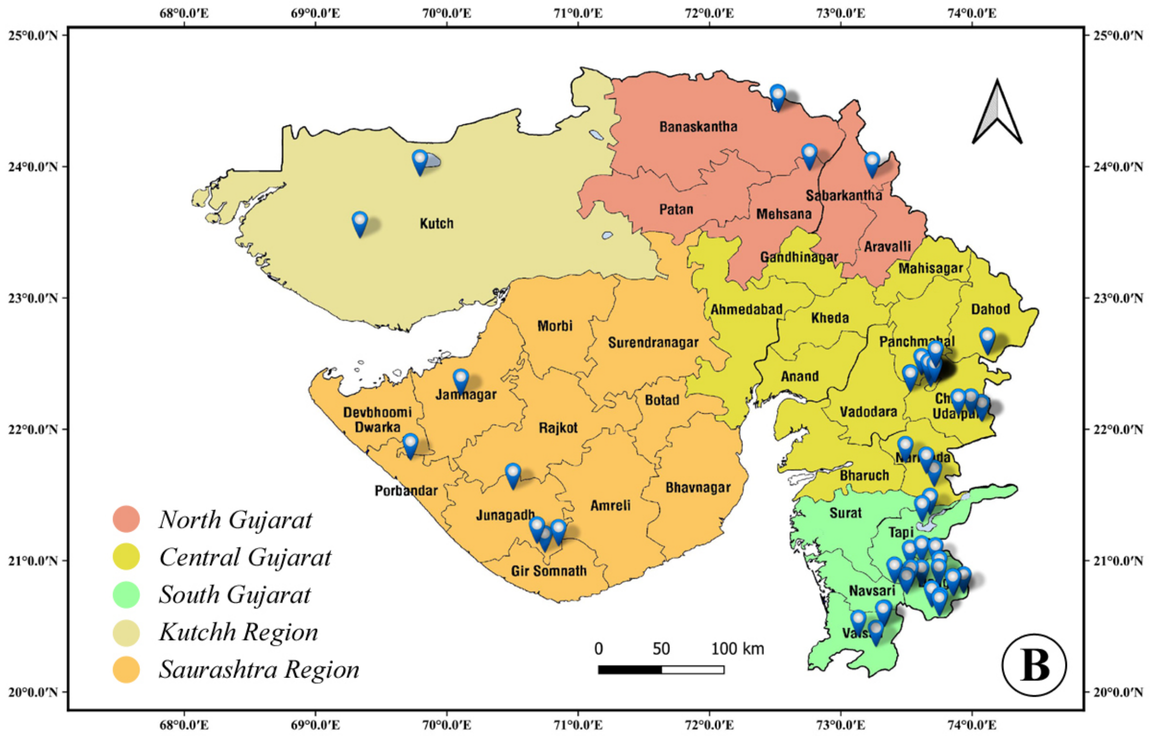


Figure: 19

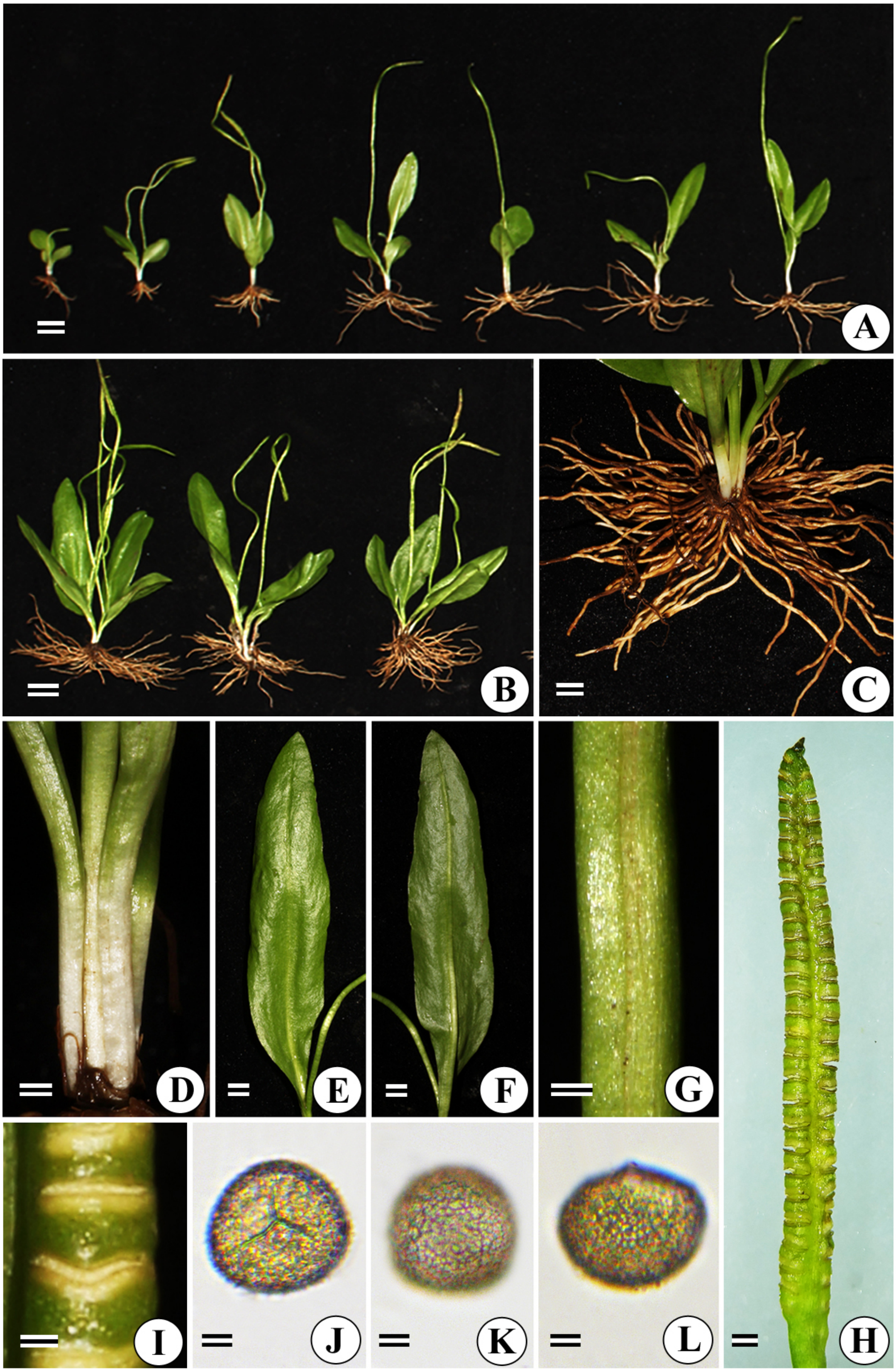
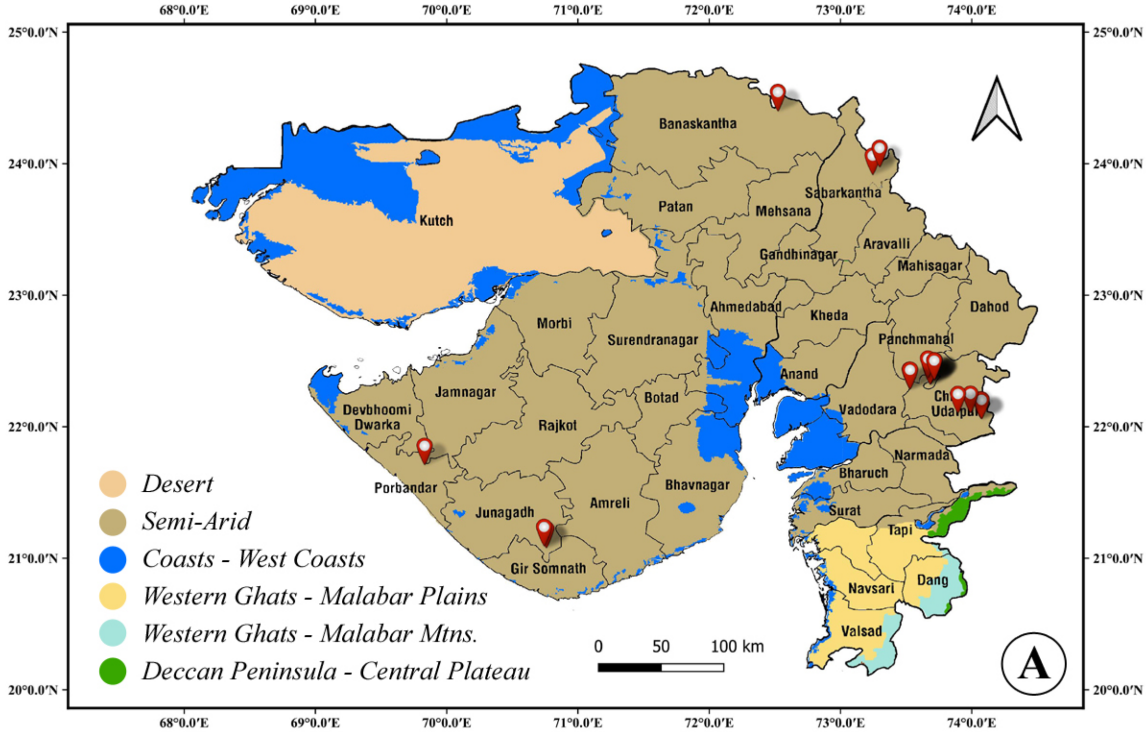


Figure 20: Ophioglossum costatum. A, B: Plants, C: Rhizomorph, D: Common stalk, E, F: Trophophylls, G: Fertile segment, H: Strobili, I: Sporangia, J-L: Spores. ***Scale Bar:*** A, B: 1 cm, C, E, F: 3 mm, D: 2 mm, G-H: 1 mm, I: 100 µm, J-L: 10 µm.

Distribution of *Ophioglossum gramineum* in different bio-geographical zones (A) and different regions (B) of Gujarat.



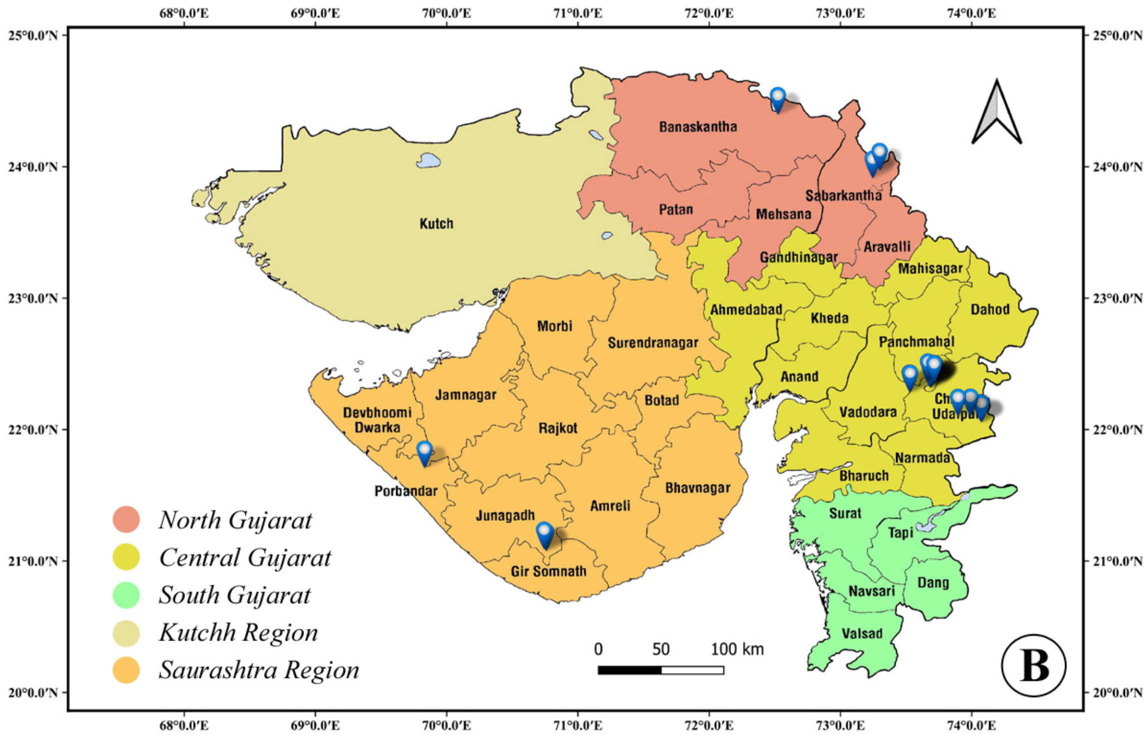


Figure: 21

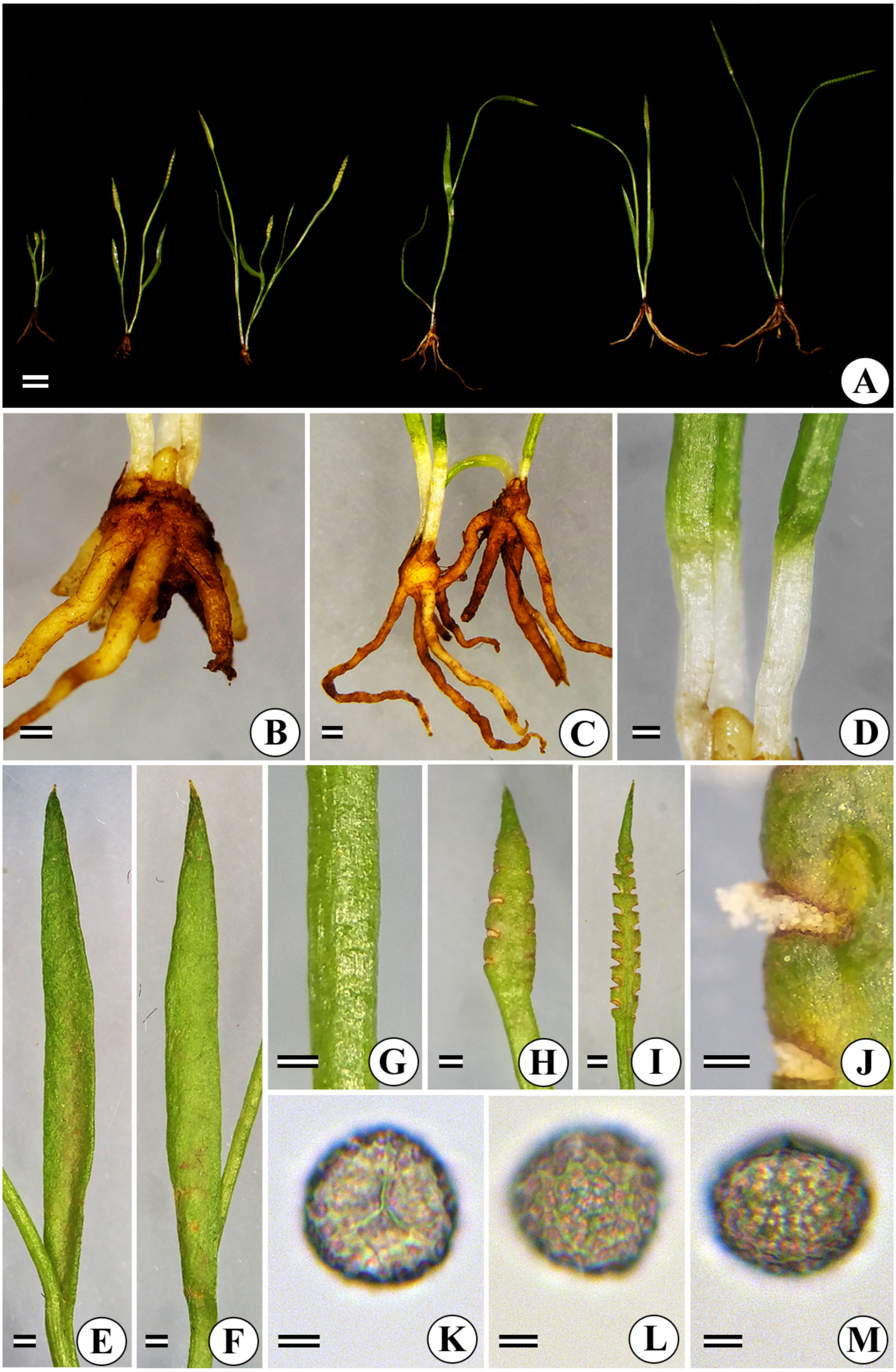


Figure 22: Ophioglossum gramineum. A: Plants, B, C: Rhizomorph, D: Common stalk, E, F: Trophophylls, G: Fertile segment, H, I: Strobili, J: Sporangia, K-M: Spores. ***Scale Bar:*** A: 1 cm, B, C, E, F, I: 1 mm, D, G, H: 0.5 mm, J: 200 µm, K-M: 10 µm.

Distribution of *Ophioglossum gujaratense* in different bio-geographical zones (A) and different regions (B) of Gujarat.

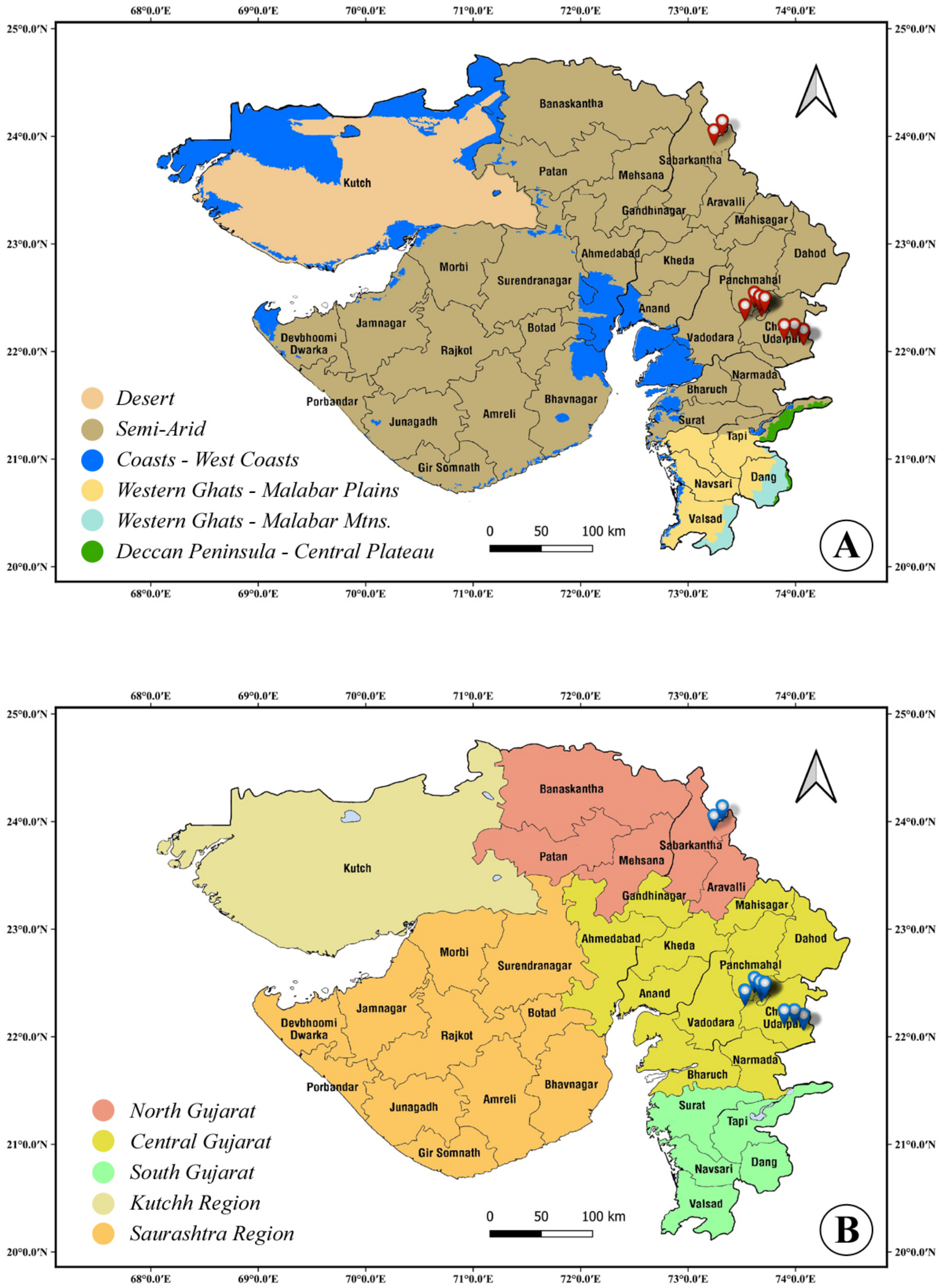


Figure: 23

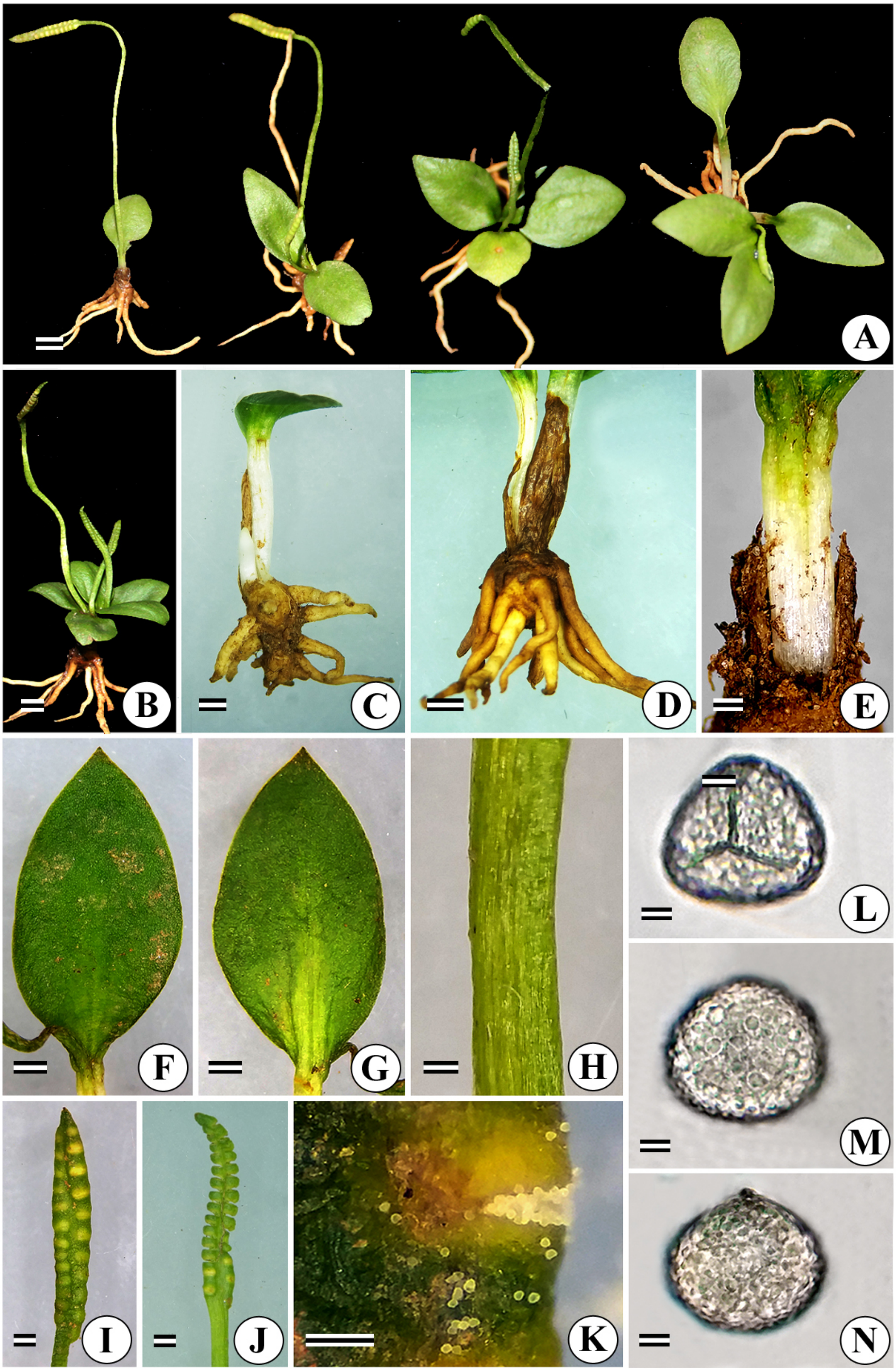
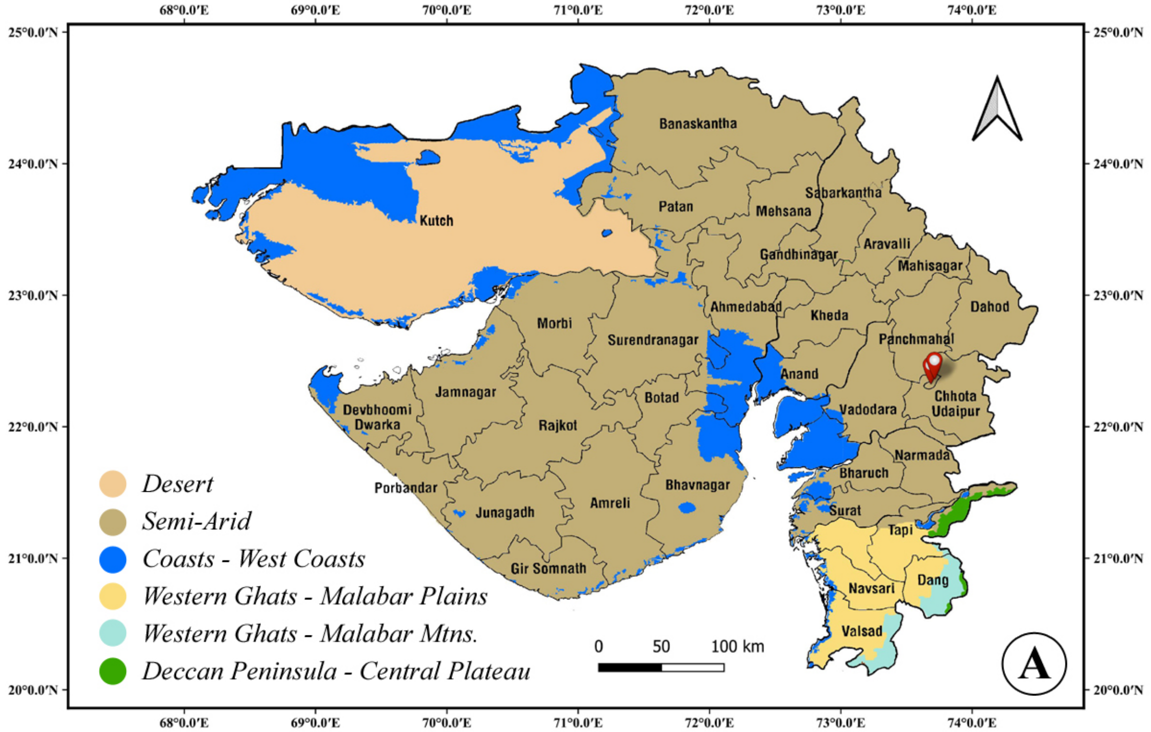


Figure 24: Ophioglossum gujaratense. A-C: Plants, D: Rhizomorph, E: Common stalk, F, G: Trophophylls, H: Fertile segment, I, J: Strobili, K: Sporangium, L-N: Spores. ***Scale Bar:*** A, B: 5 mm, C, F, G, I, J: 1 mm, D: 2 mm, E, H, K: 500 µm, L-N: 10 µm.

Distribution of *Ophioglossum jaykrishnae* in different bio-geographical zones (A) and different regions (B) of Gujarat.



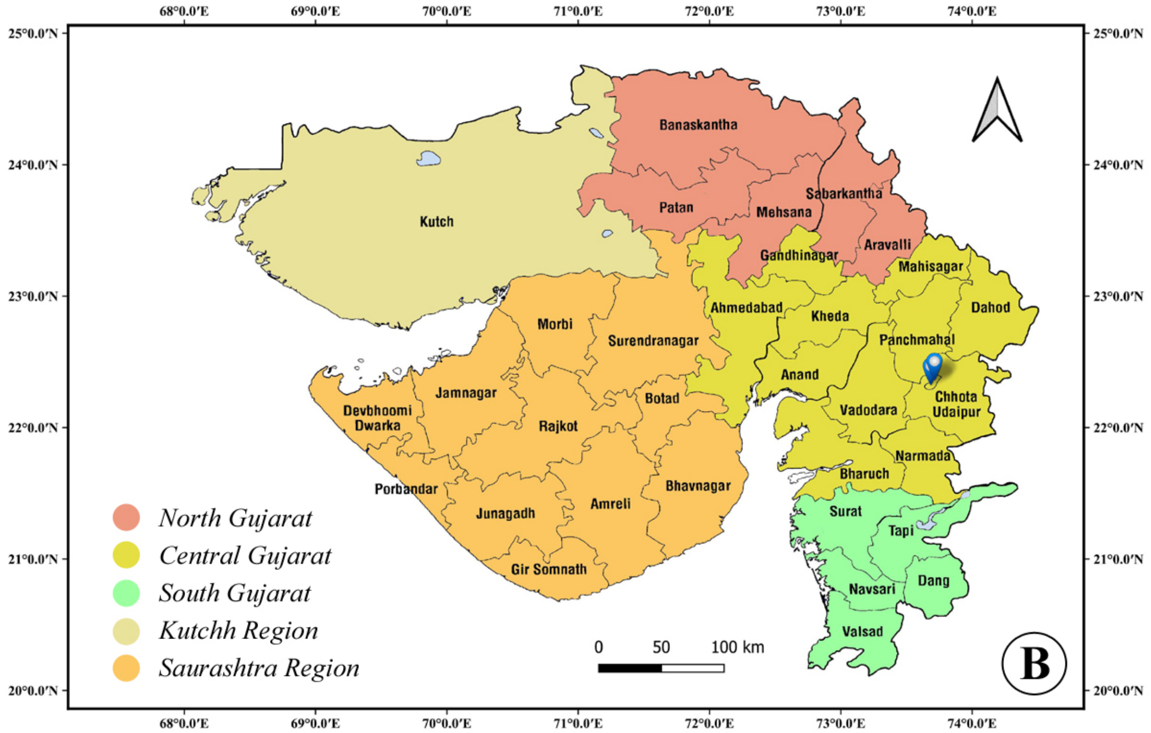


Figure: 25

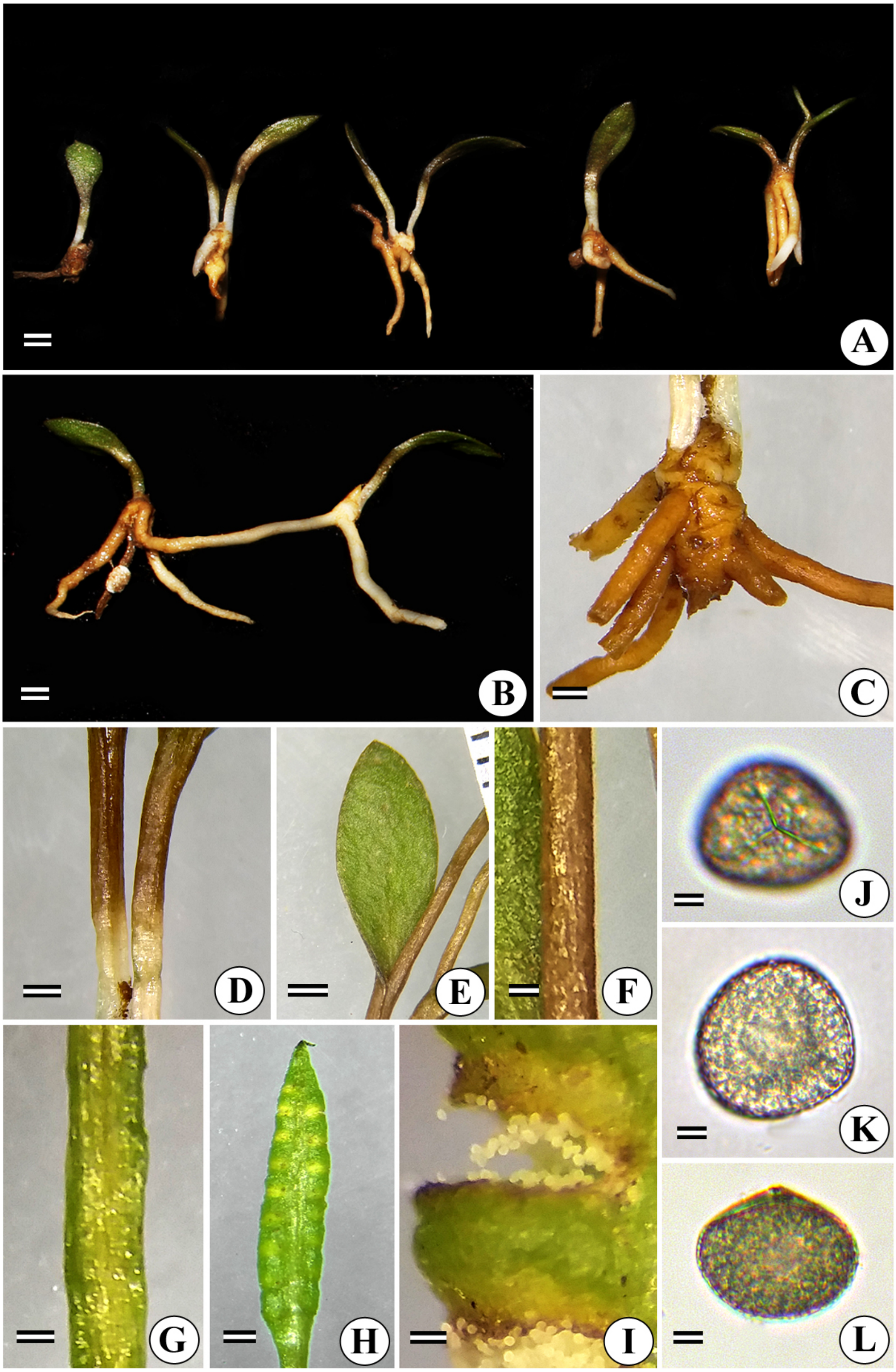
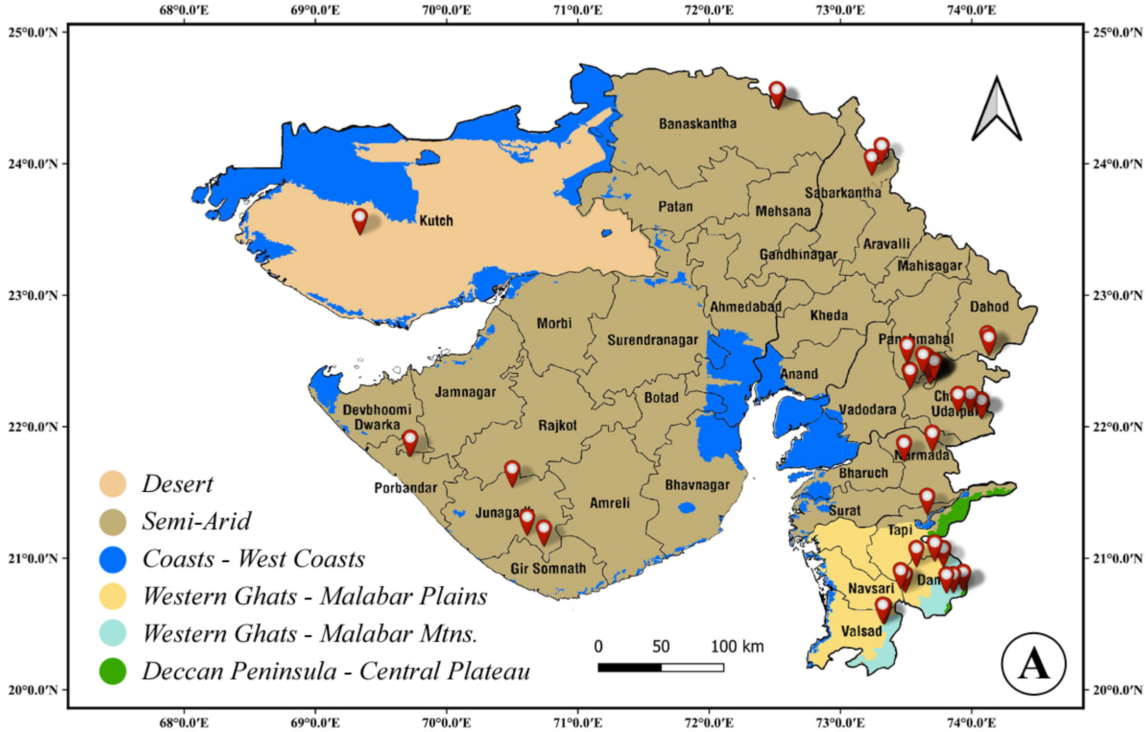


Figure 26: Ophioglossum jaykrishnae. A, B: Plants, C: Rhizomorph, D: Common stalk, E: Trophophylls, F, G: Fertile segment, H: Strobilus, I: Sporangium, J-L: Spores. ***Scale Bar:*** A, B, E: 2 mm, C, D, H: 1 mm, F, G: 500 µm, I: 200 µm, J-L: 10 µm.

Distribution of *Ophioglossum nudicaule* in different bio-geographical zones (A) and different regions (B) of Gujarat.



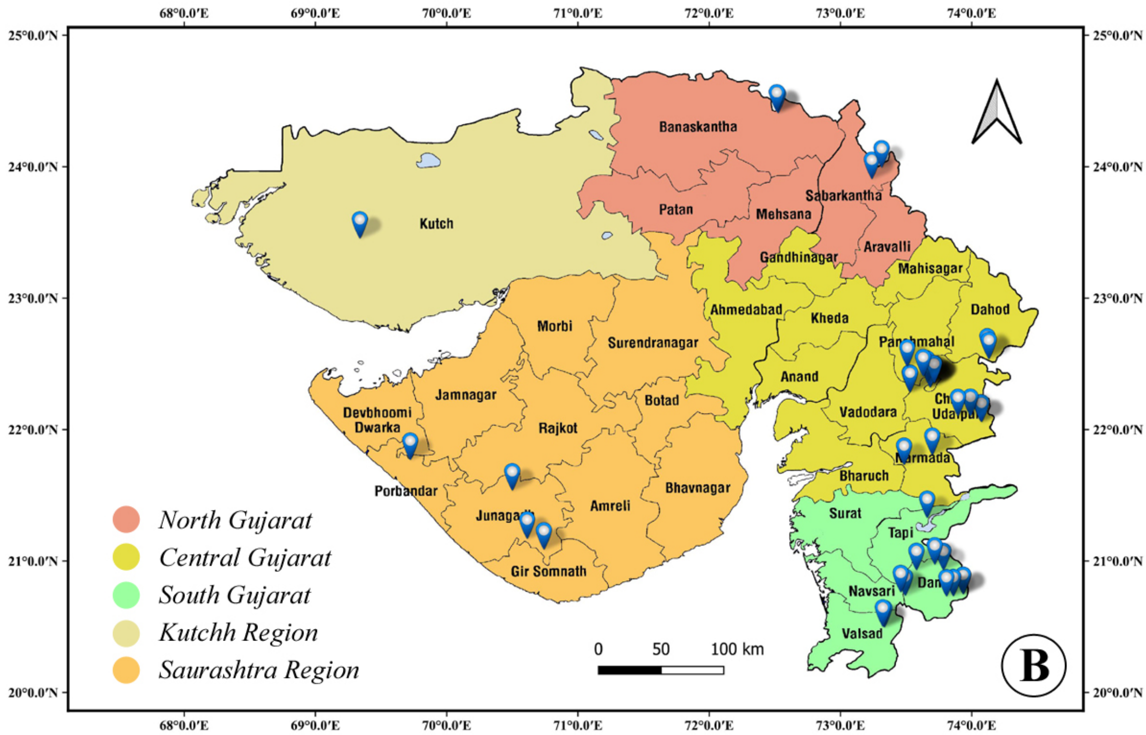


Figure: 27

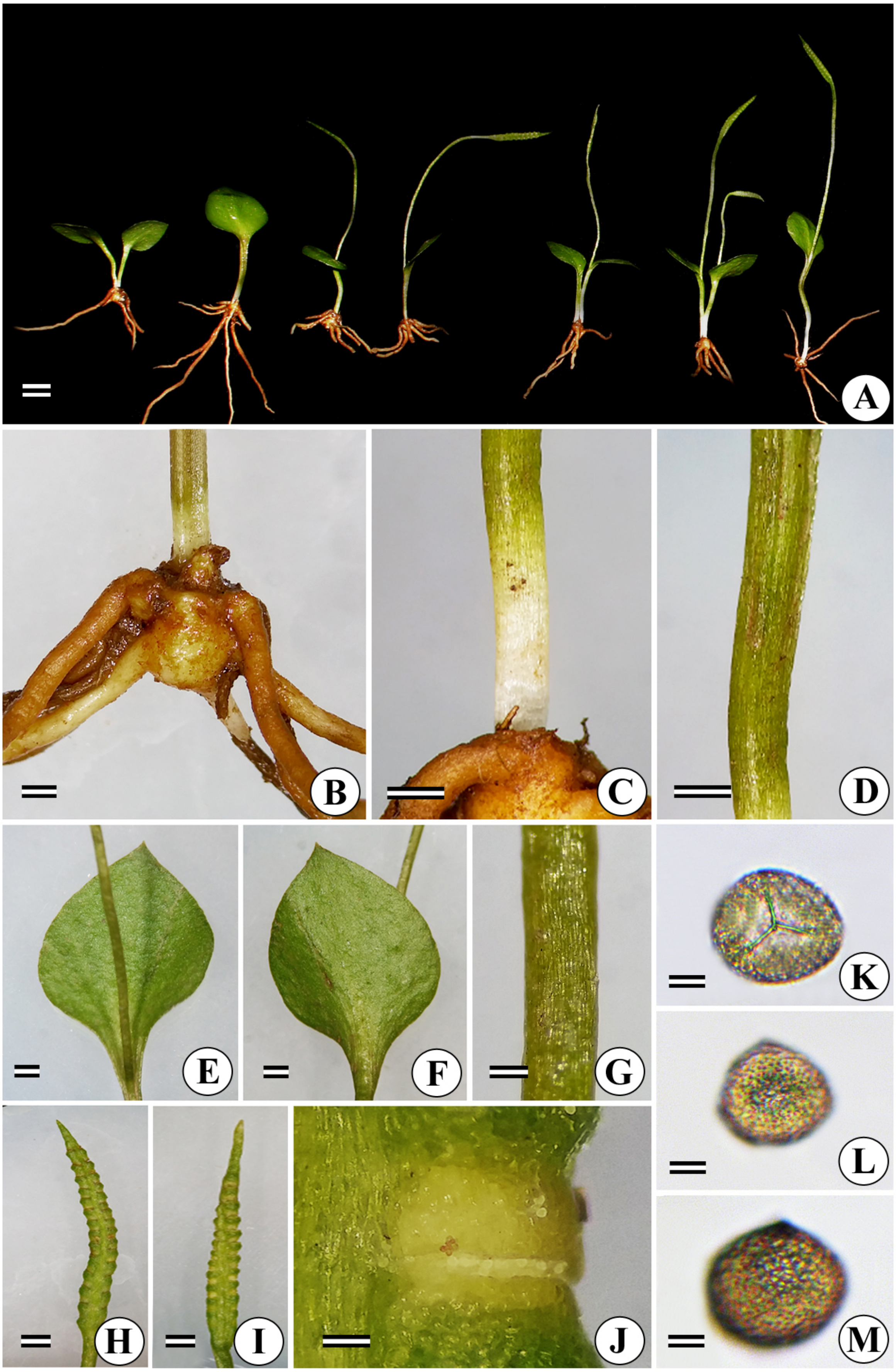
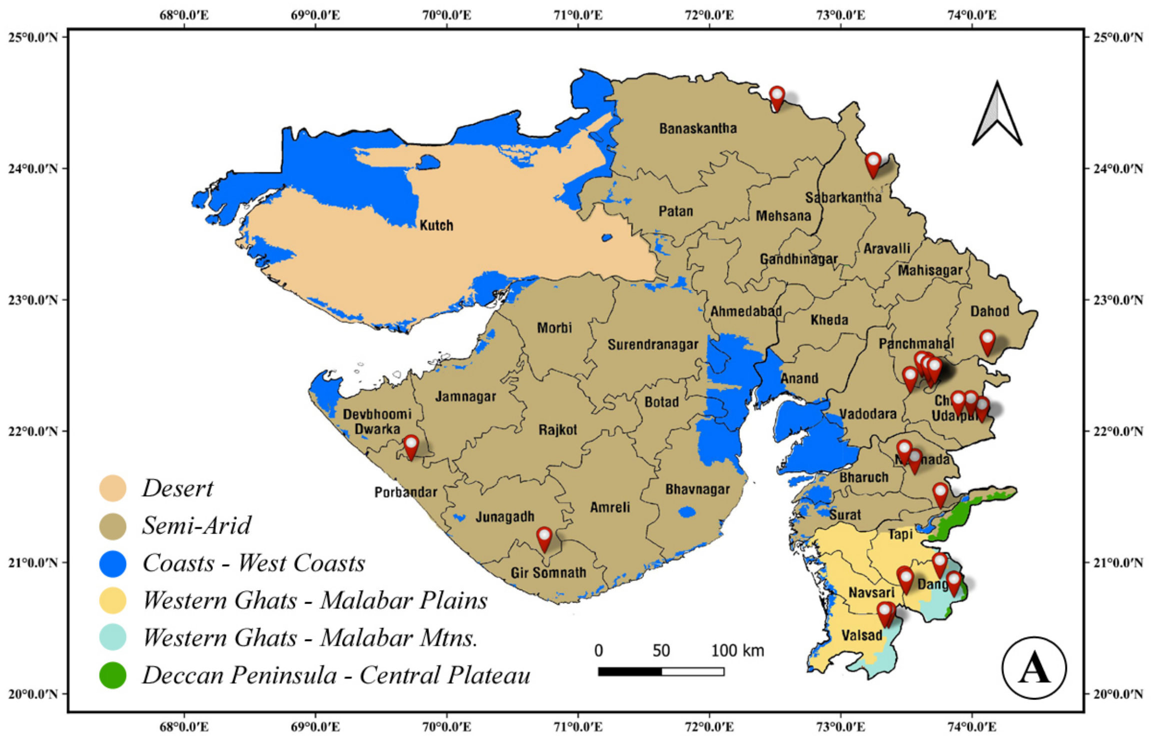


Figure 28: Ophioglossum nudicaule. A: Plants, B: Rhizomorph, C, D: Common stalk, E, F: Trophophylls, G: Fertile segment, H, I: Strobili, J: Sporangium, K-M: Spores. ***Scale Bar:*** A: 5 mm, B-D: 1 mm, E-G: 500 µm, H, I: 2 mm, J: 30 µm, K-M: 10 µm.

Distribution of *Ophioglossum parvifolium* in different bio-geographical zones (A) and different regions (B) of Gujarat.



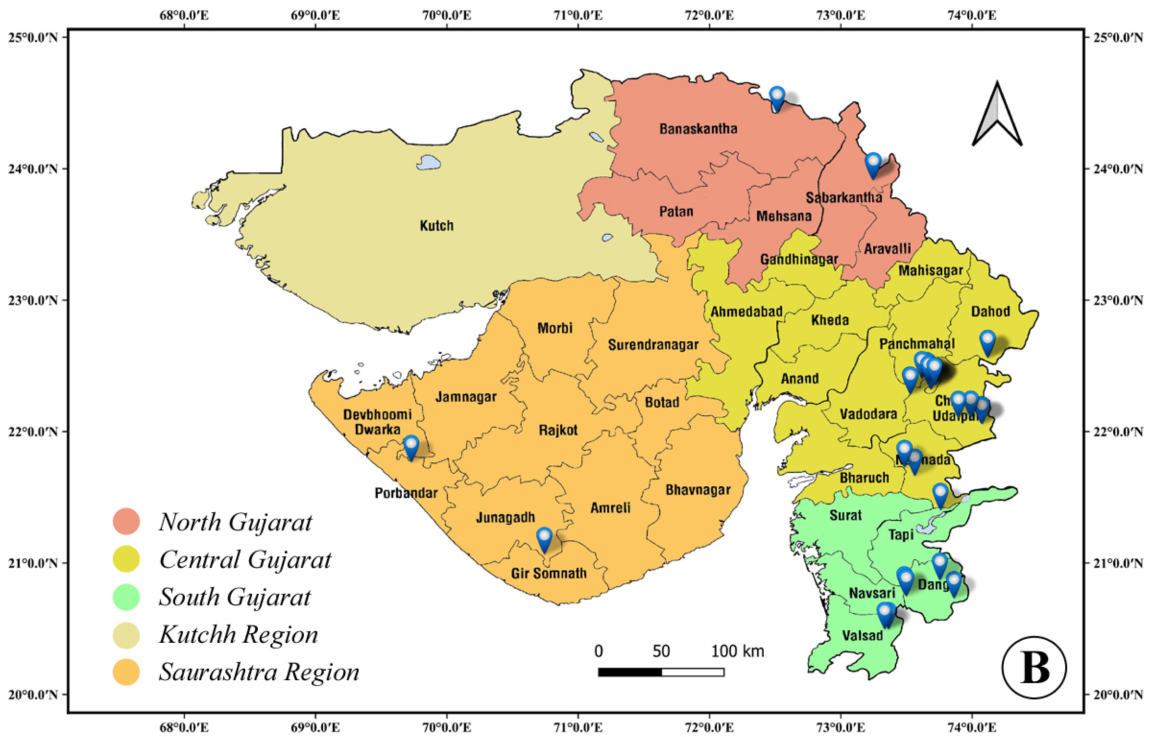


Figure: 29

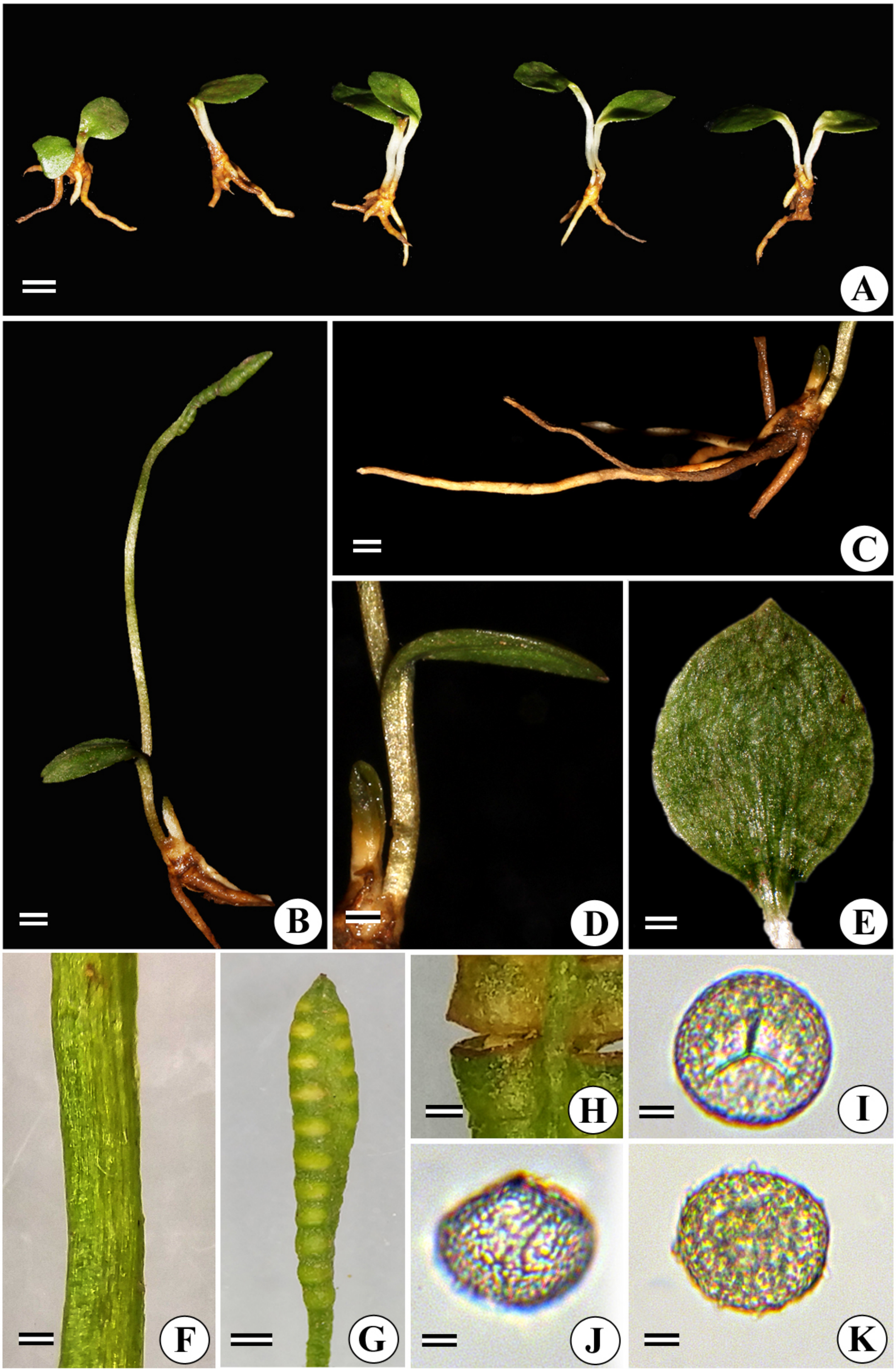
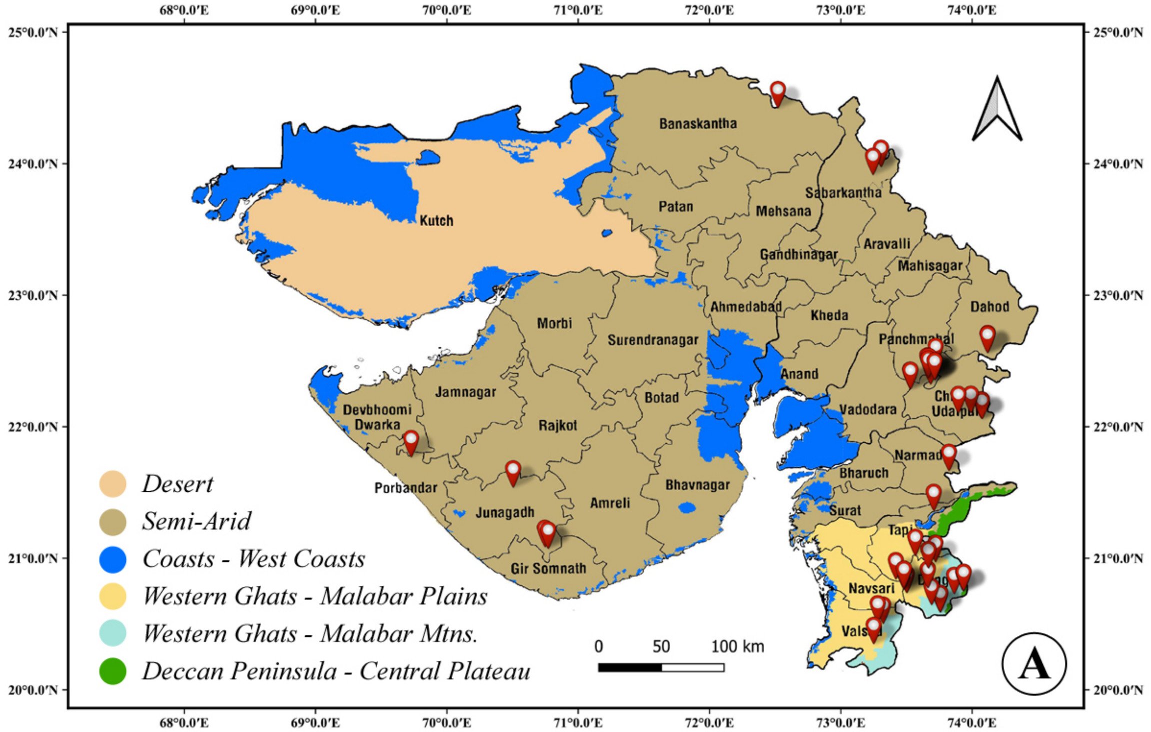


Figure 30: Ophioglossum parvifolium. A, B: Plants, C: Rhizomorph, D: Common stalk, E: Trophophyll, F: Fertile segment, G: Strobilus, H: Sporangium, I-K: Spores. ***Scale Bar:*** A: 4 mm, B, C: 2 mm, D, E: 1 mm, F: 500 µm, G, H: 200 µm, I-K: 10 µm.

Distribution of *Ophioglossum reticulatum* in different bio-geographical zones (A) and different regions (B) of Gujarat.



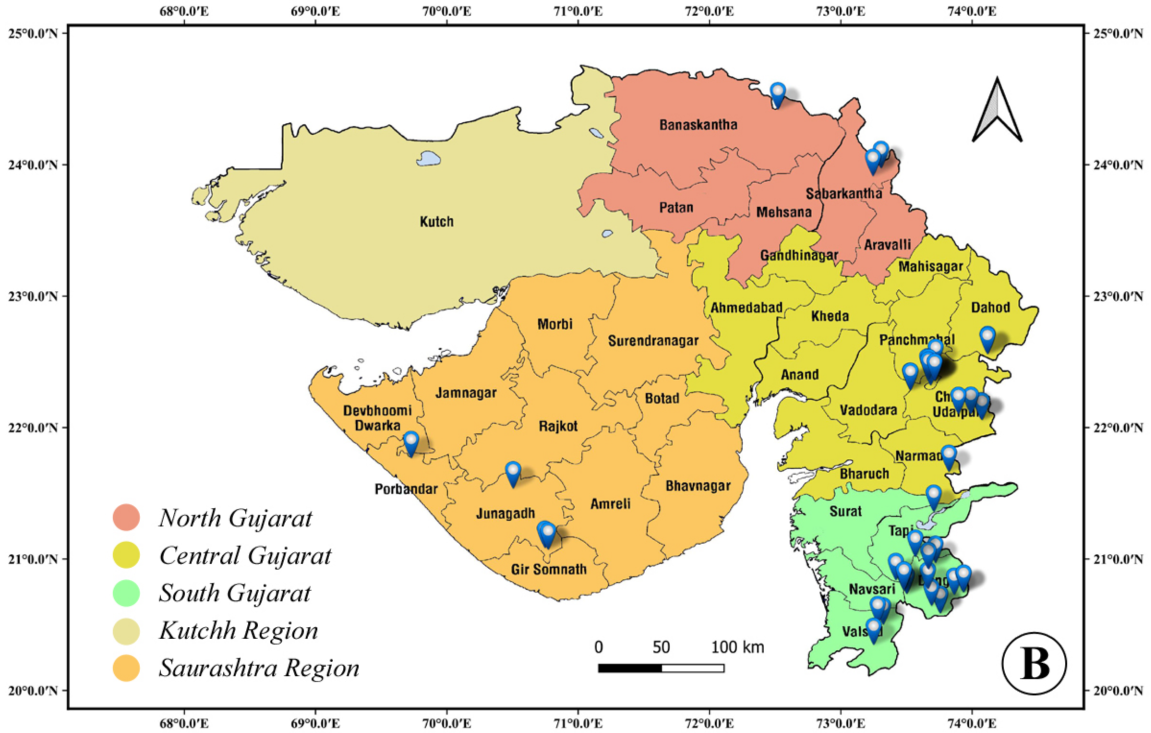


Figure: 31

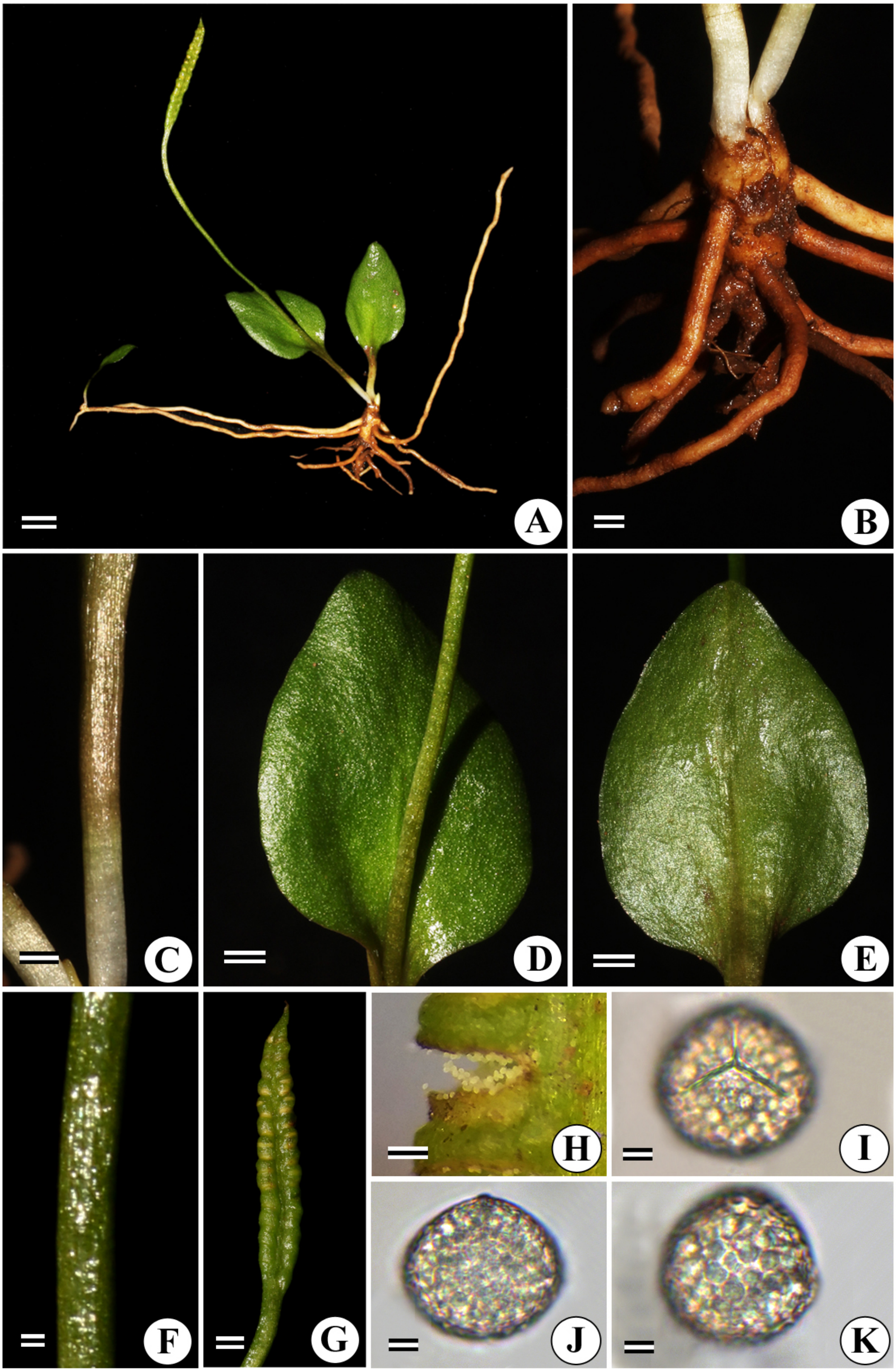
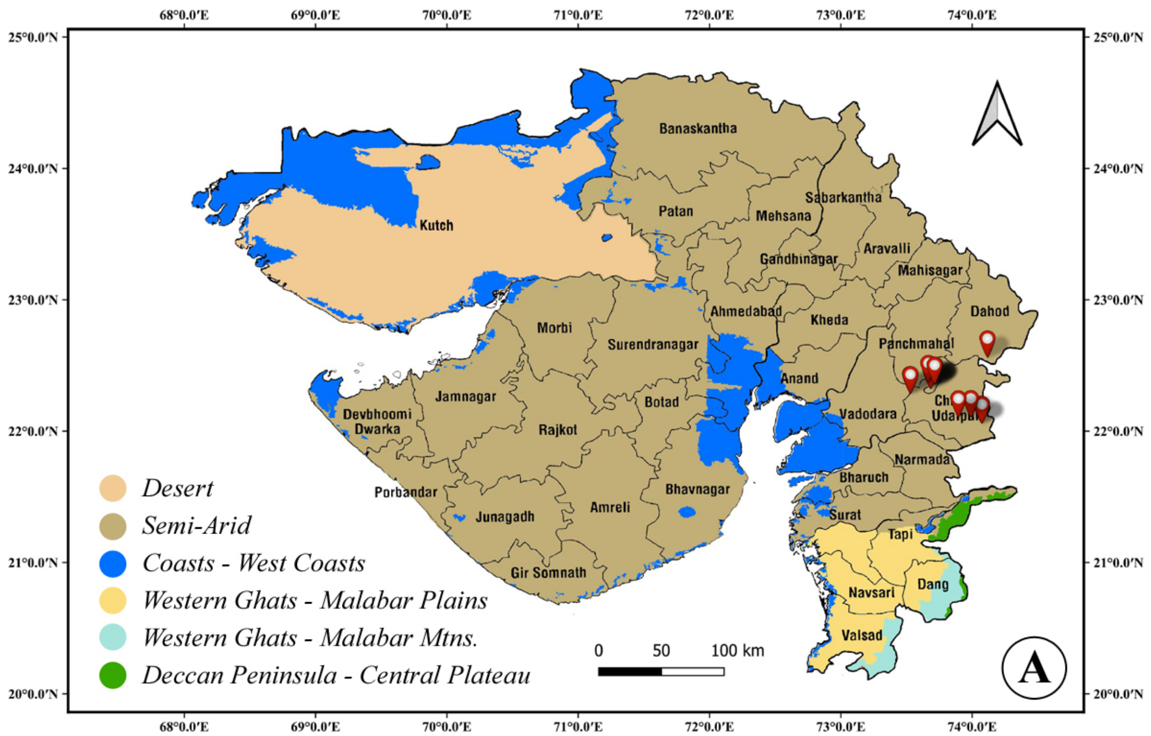


Figure 32: Ophioglossum reticulatum. A: Plant, B: Rhizomorph, C: Common stalk, D, E: Trophophylls, F: Fertile segment, G: strobilus, H: Sporangium, I-K: Spore. ***Scale Bar:*** A: 1 cm, B, C, G: 1 mm, D, E: 2 mm, F, H: 500 µm, I-K: 10 µm.

Distribution of *Ophioglossum thermale* in different bio-geographical zones (A) and different regions (B) of Gujarat.



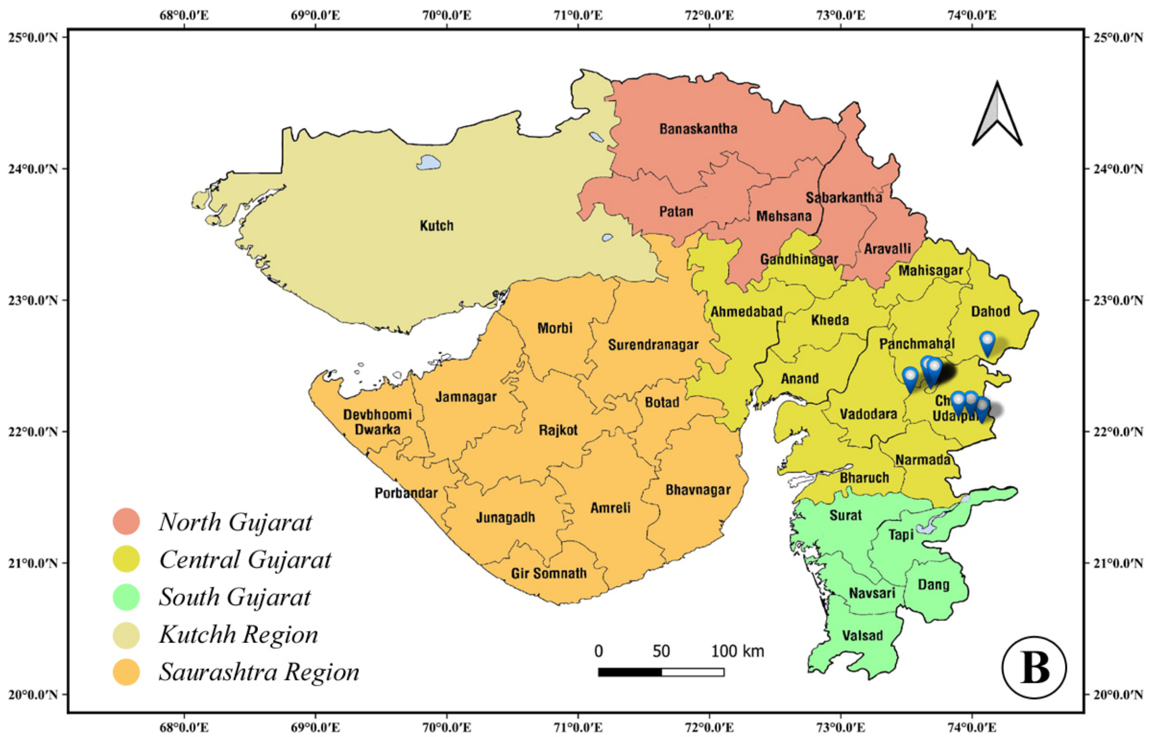


Figure: 33

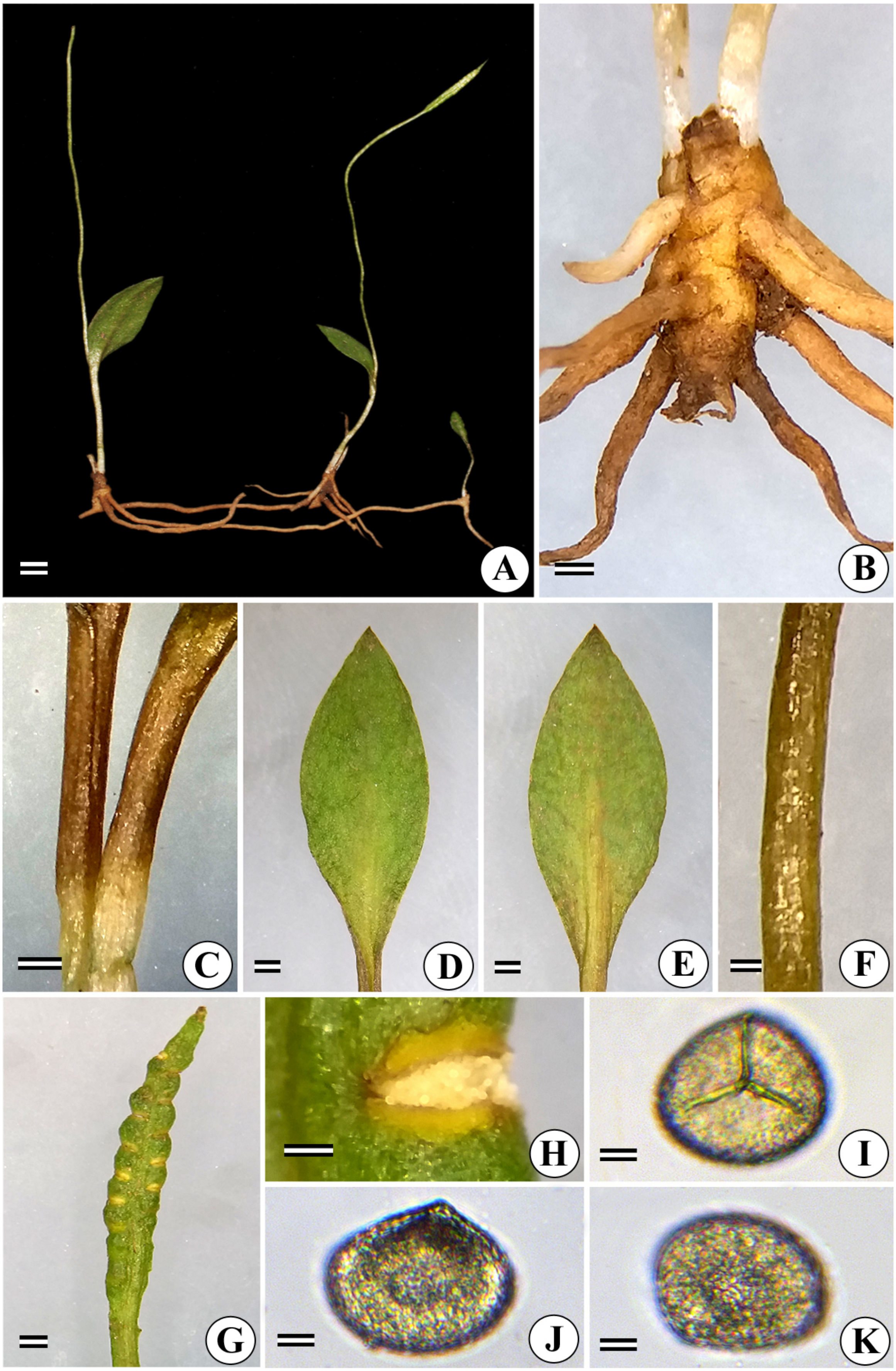
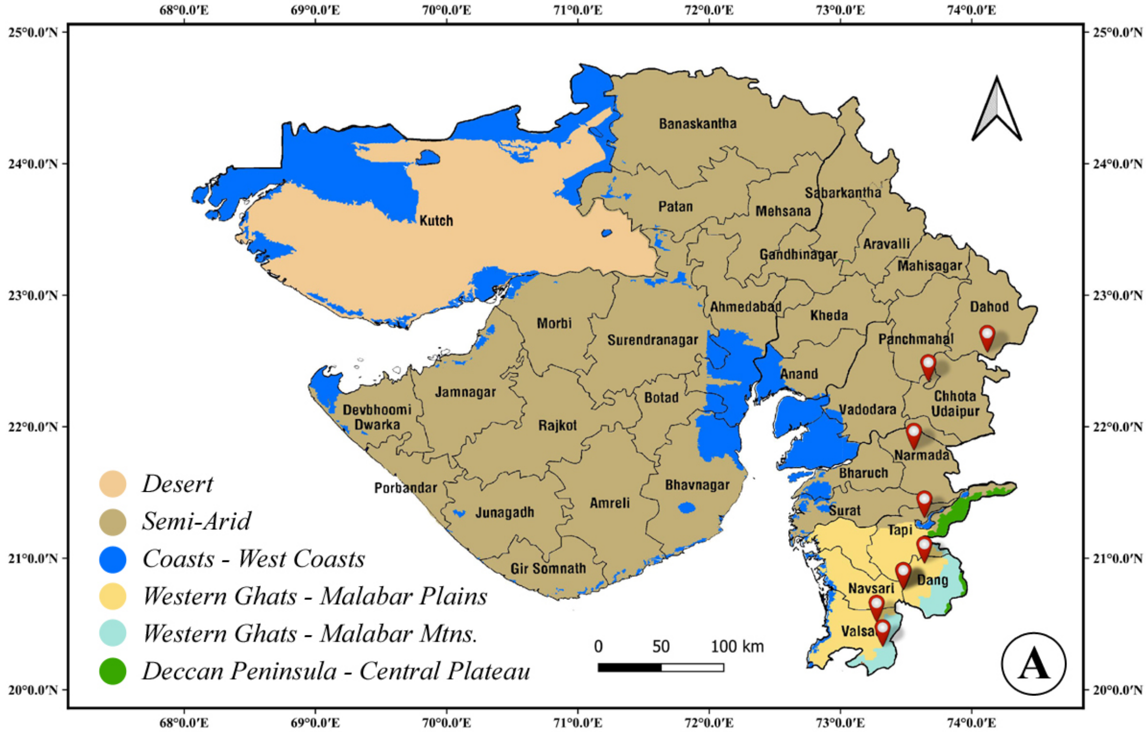


Figure 34: Ophioglossum thermale. A: Plant, B: Rhizomorph, C: Common stalk, D, E: Trophophylls, F: Fertile segment, G: Strobilus, H: Sporangium, I-K: Spores. ***Scale Bar:*** A: 5 mm, B, D, E, G: 1 mm, C: 2 mm, F, H: 500 µm, I-K: 10 µm.

Distribution of *Lygodium flexuosum* in different bio-geographical zones (A) and different regions (B) of Gujarat.



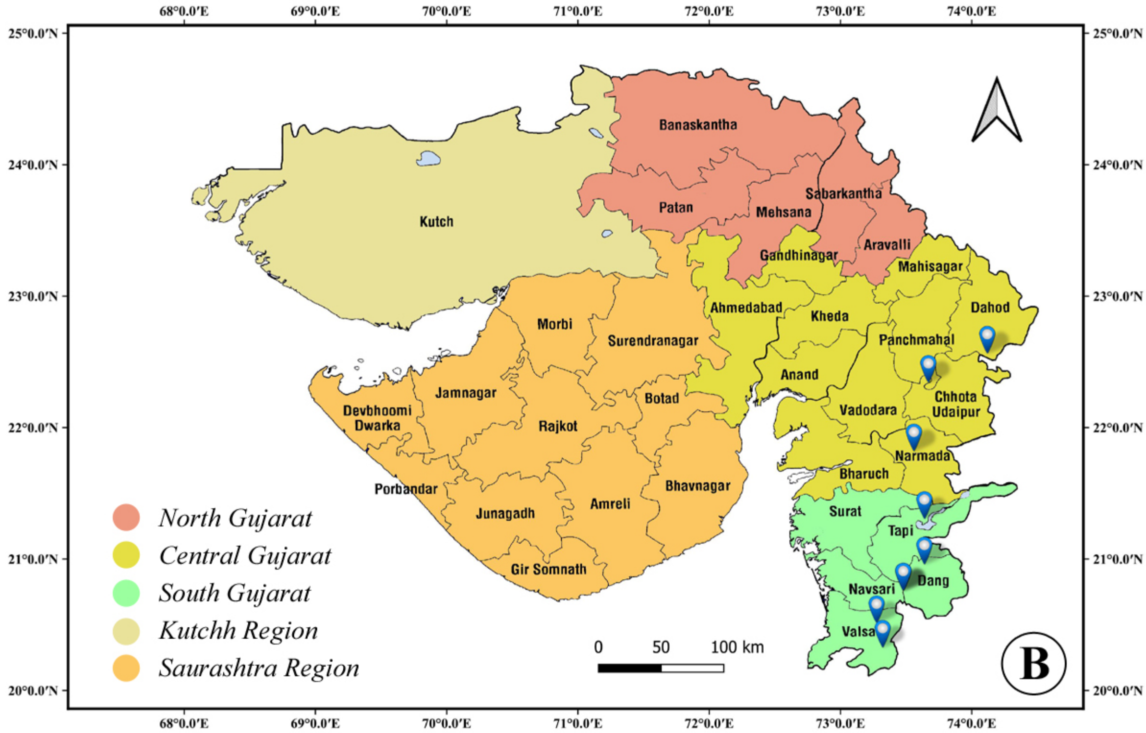


Figure: 35

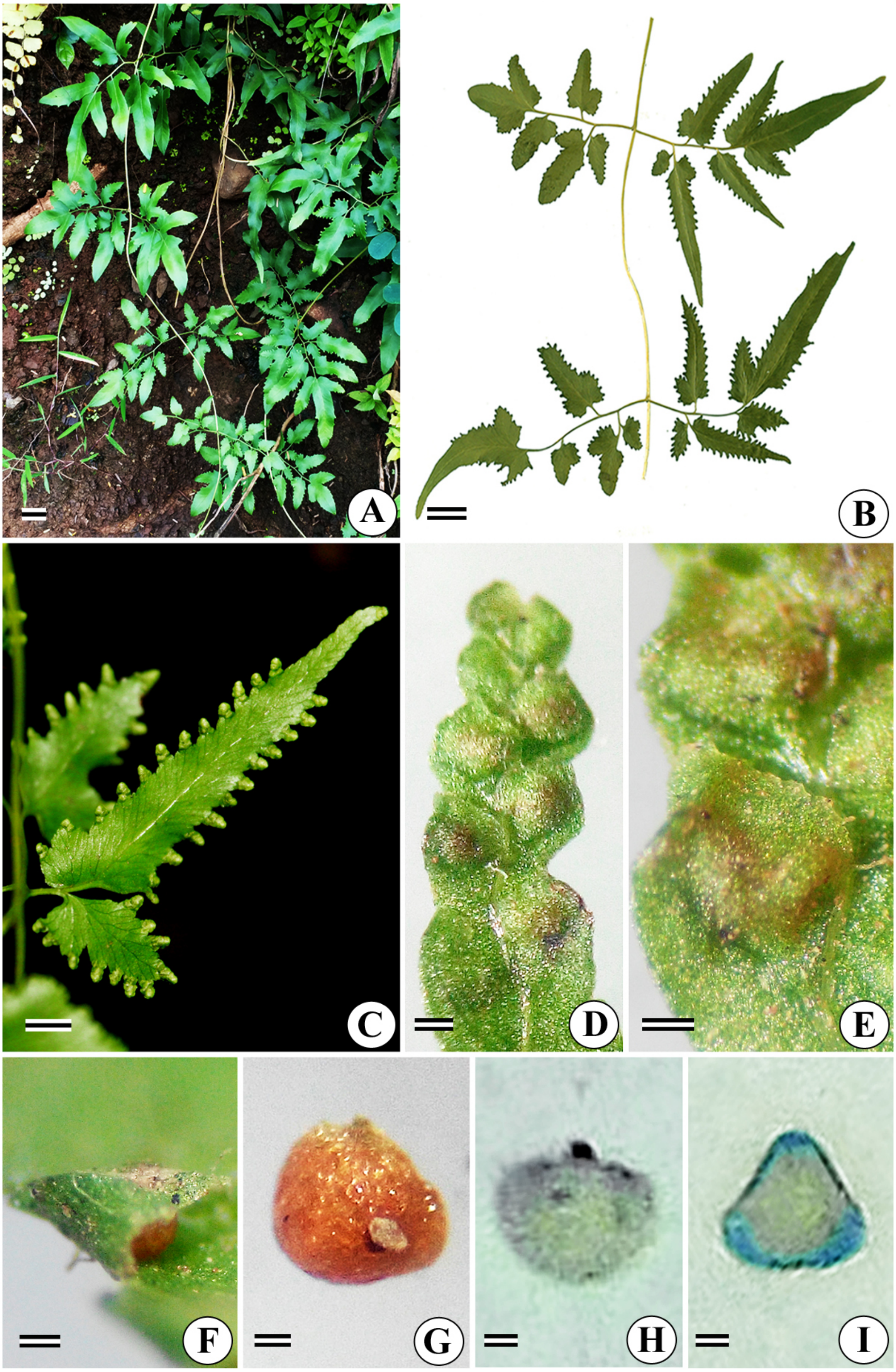
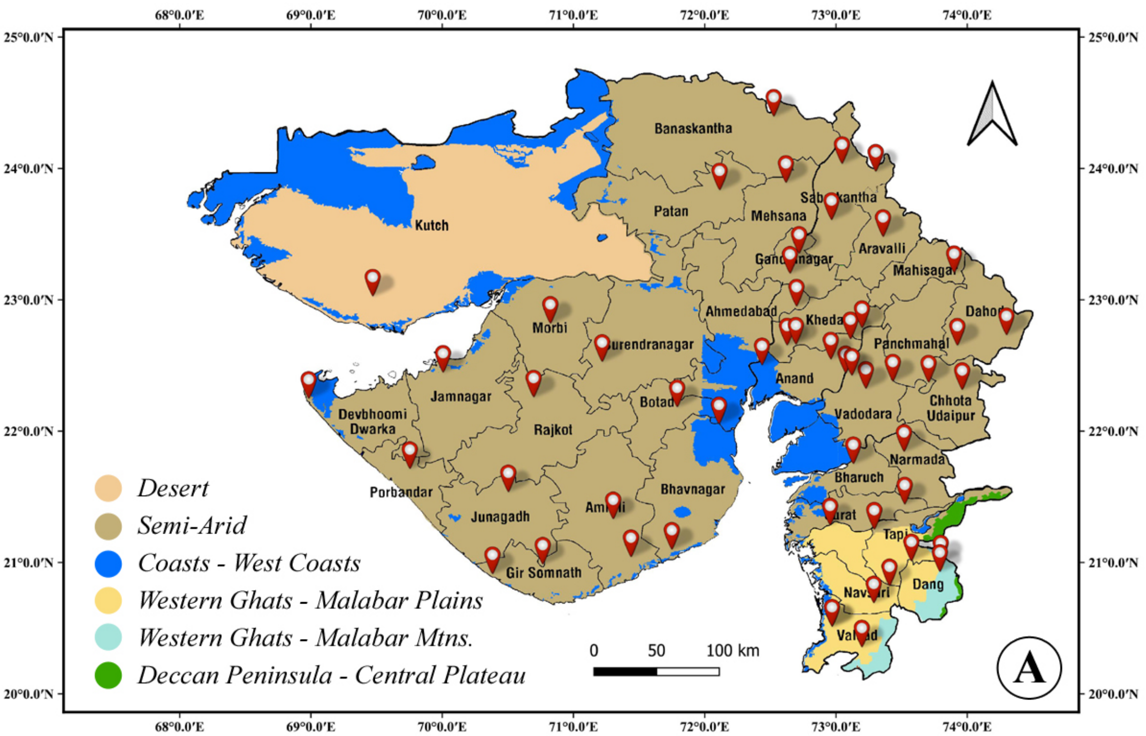


Figure 36: Lygodium flexuosum. A: Habit, B: Part of frond, C: Pinnules, D: Strobilus, E, F: Sporangia, G: Sporangium, H, I: Spores. ***Scale Bar:*** A, B: 3 cm, C: 1 cm, D: 500 µm, E, F: 300 µm, G: 100 µm, H, I: 10 µm.

Distribution of *Azolla pinnata* subsp. *asiatica* in different bio-geographical zones (A) and different regions (B) of Gujarat.



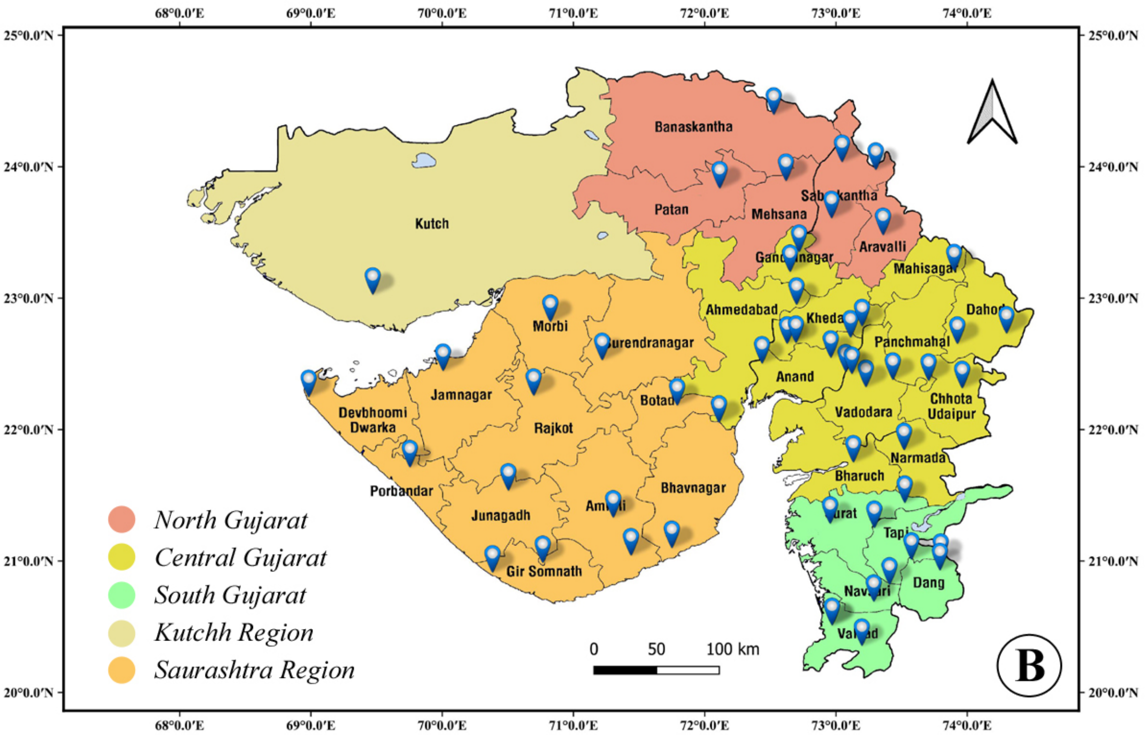


Figure: 37

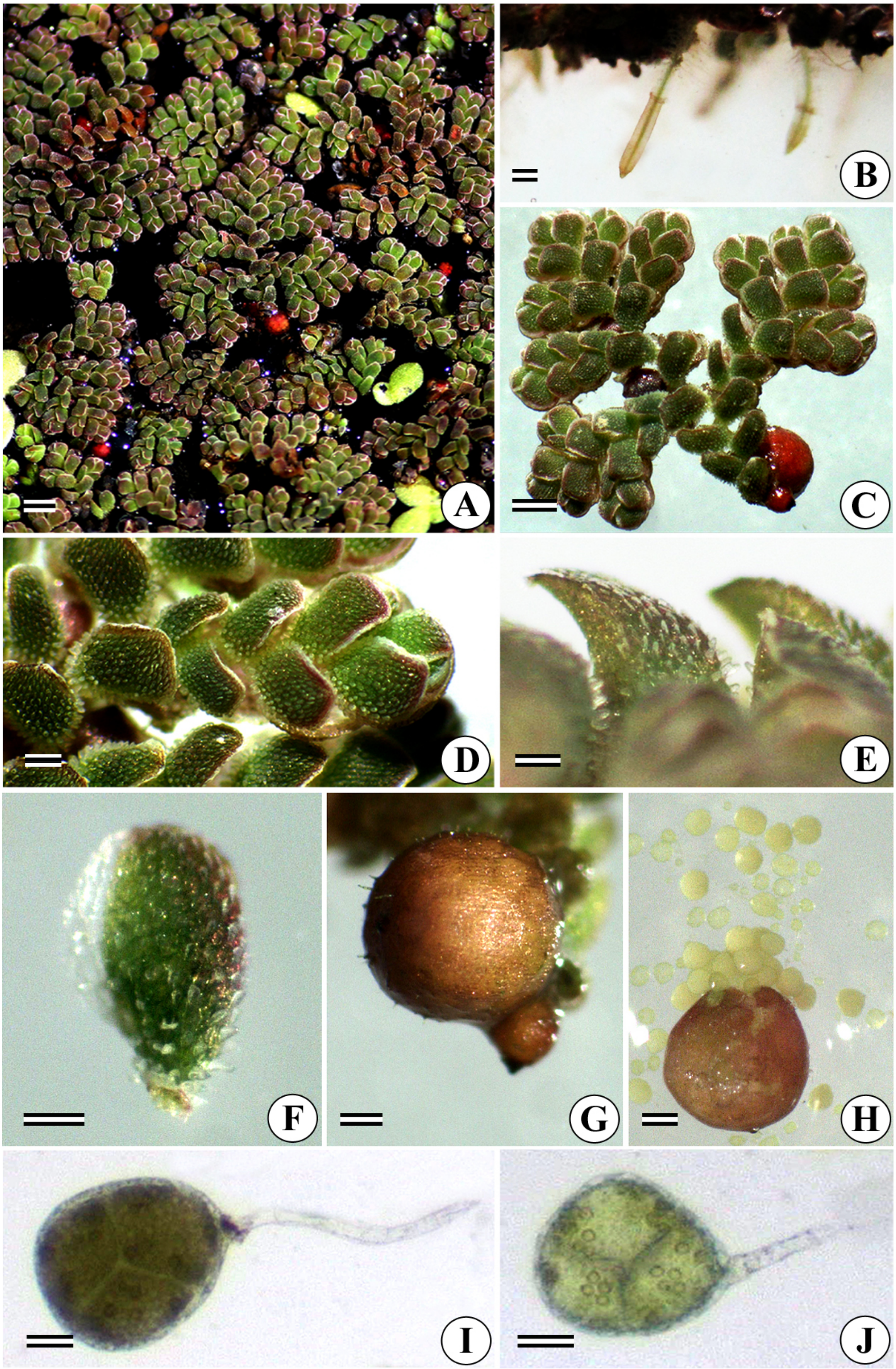
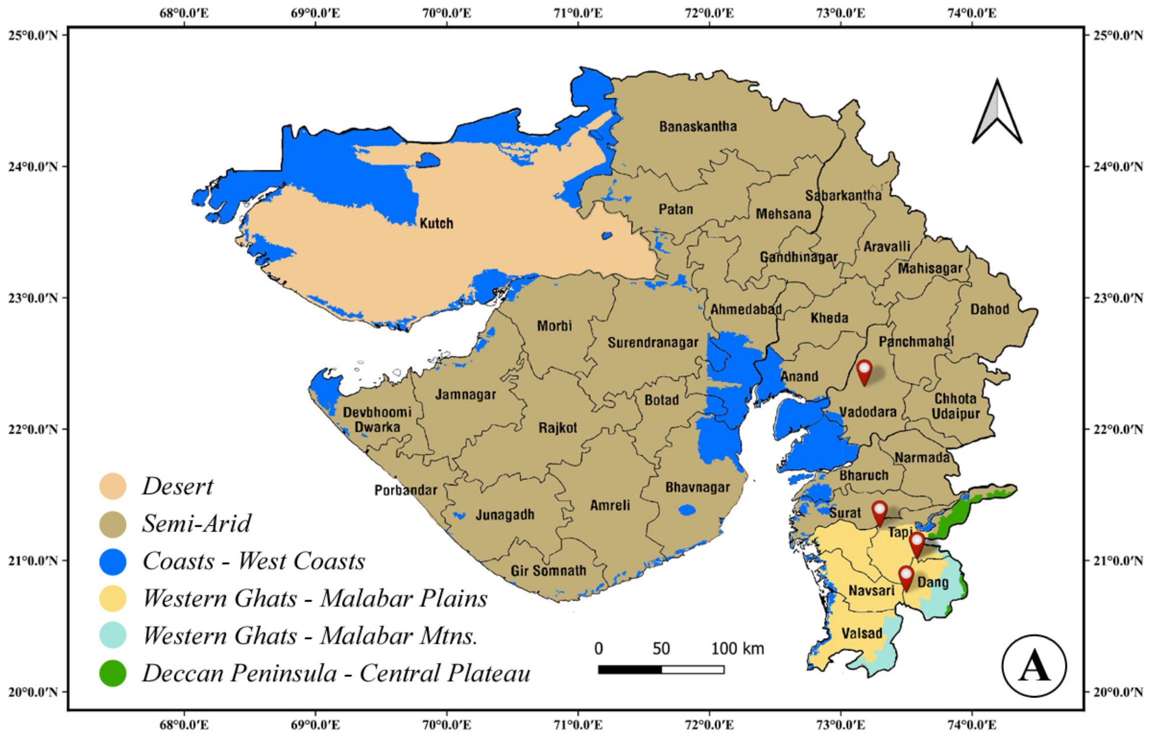


Figure 38: Azolla pinnata **subsp.** ***asiatica***. A: Habit, B: Roots, C: Plant, D: Lateral branches, E, F: Dorsal lobes, G, H: Sporocarps, I: Megaspore, J: Microspore. ***Scale Bar:*** A, C: 2 mm, B, D-F: 1 mm, G: 0.5 mm, H: 0.2 µm, I: 30 µm, J: 10 µm.

Distribution of *Salvinia molesta* in different bio-geographical zones (A) and different regions (B) of Gujarat.



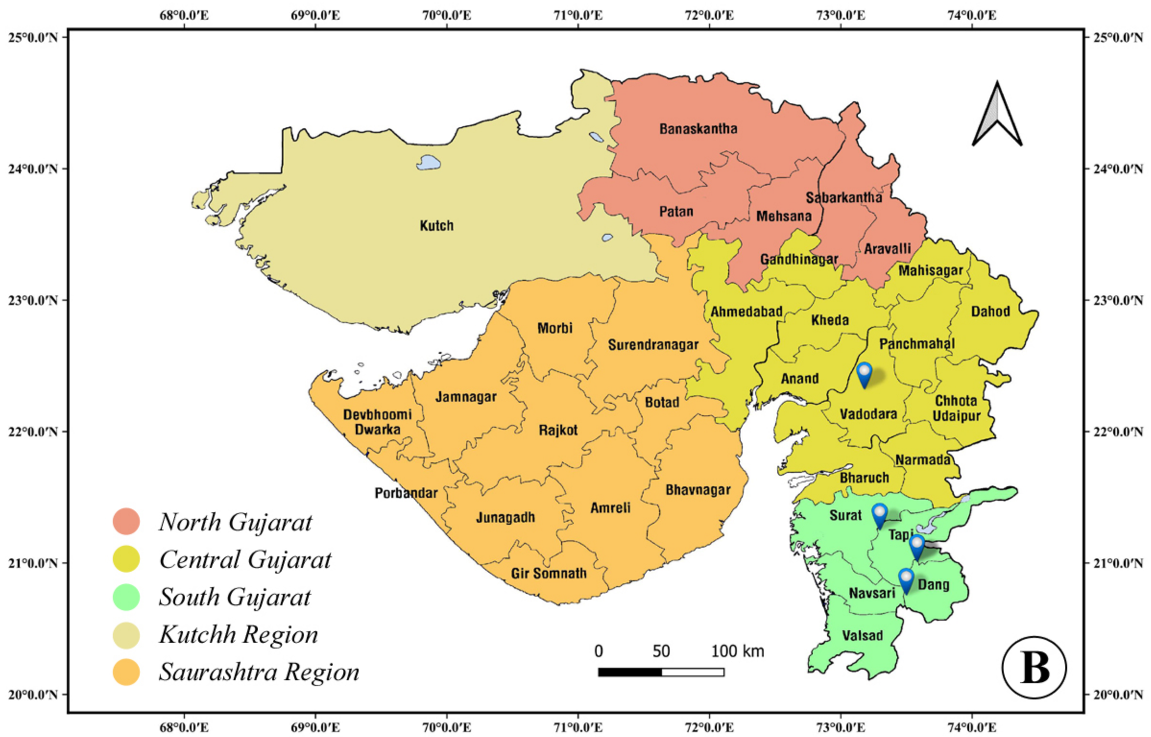


Figure: 39

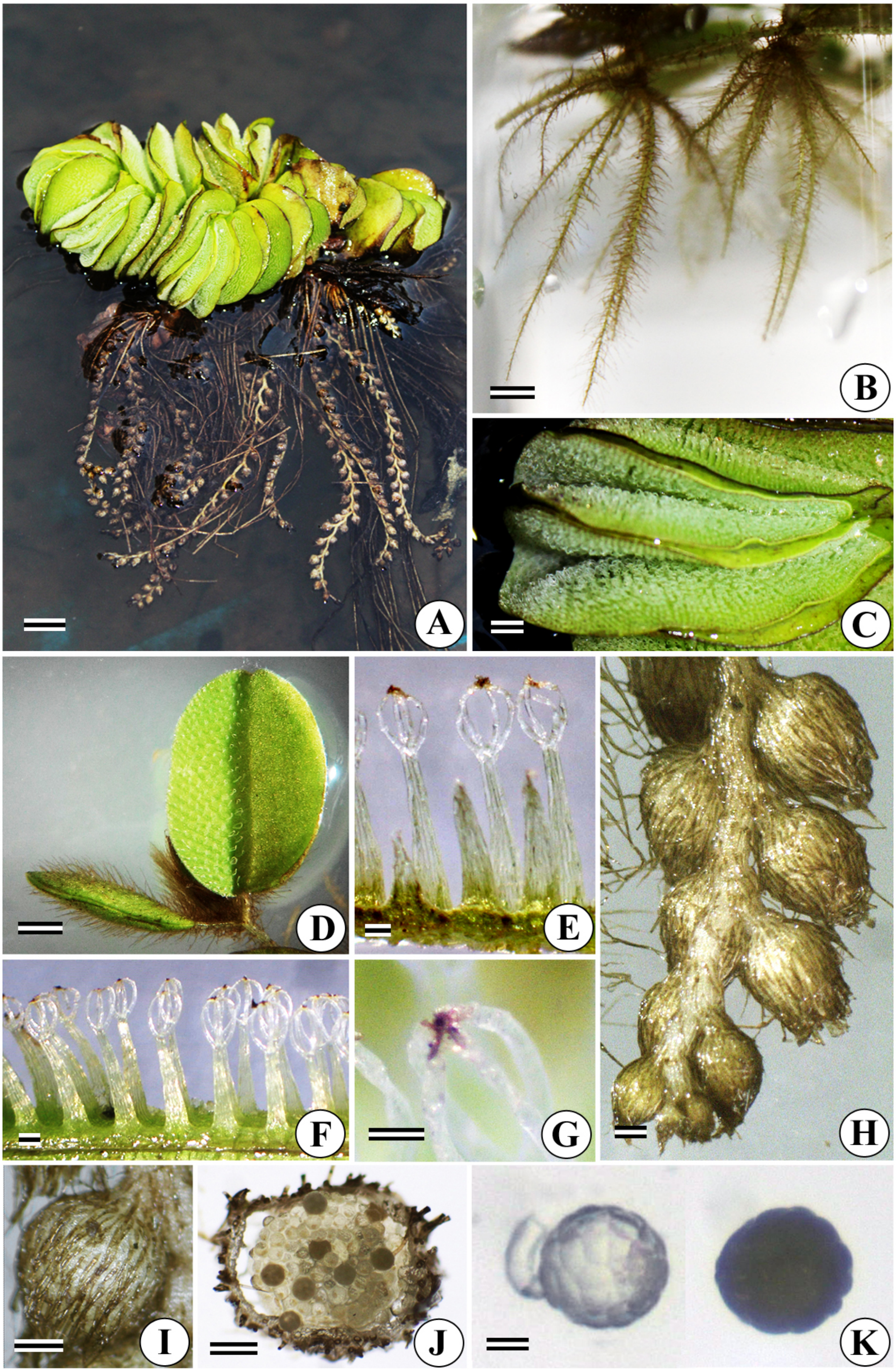
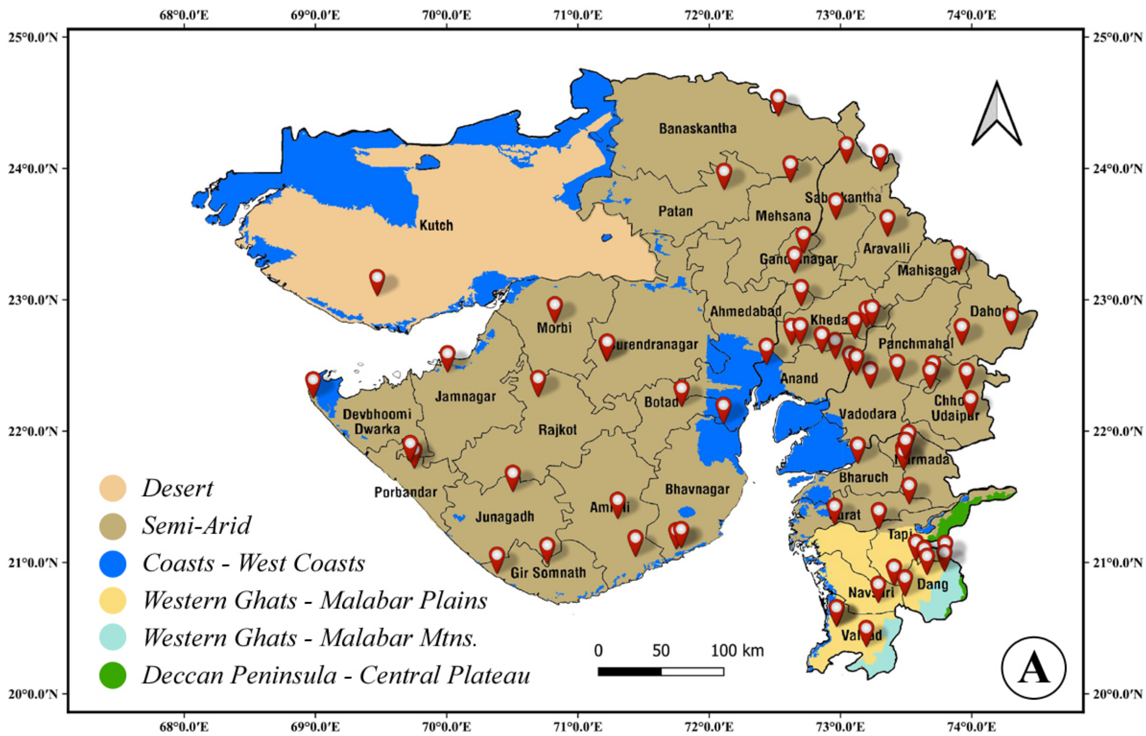


Figure 40: Salvinia molesta. A: Habit, B: Rroot-like organ, C, D: Floating leaves, E-G: hairs, H-J: Sporocarps, K: Spores. ***Scale Bar:*** A: 3 cm, B, C: 1 mm, D: 1 cm, E, F, H: 100 µm, G, J, I: 50 µm, K: 10 µm.

Distribution of *Marsilea minuta* in different bio-geographical zones (A) and different regions (B) of Gujarat.



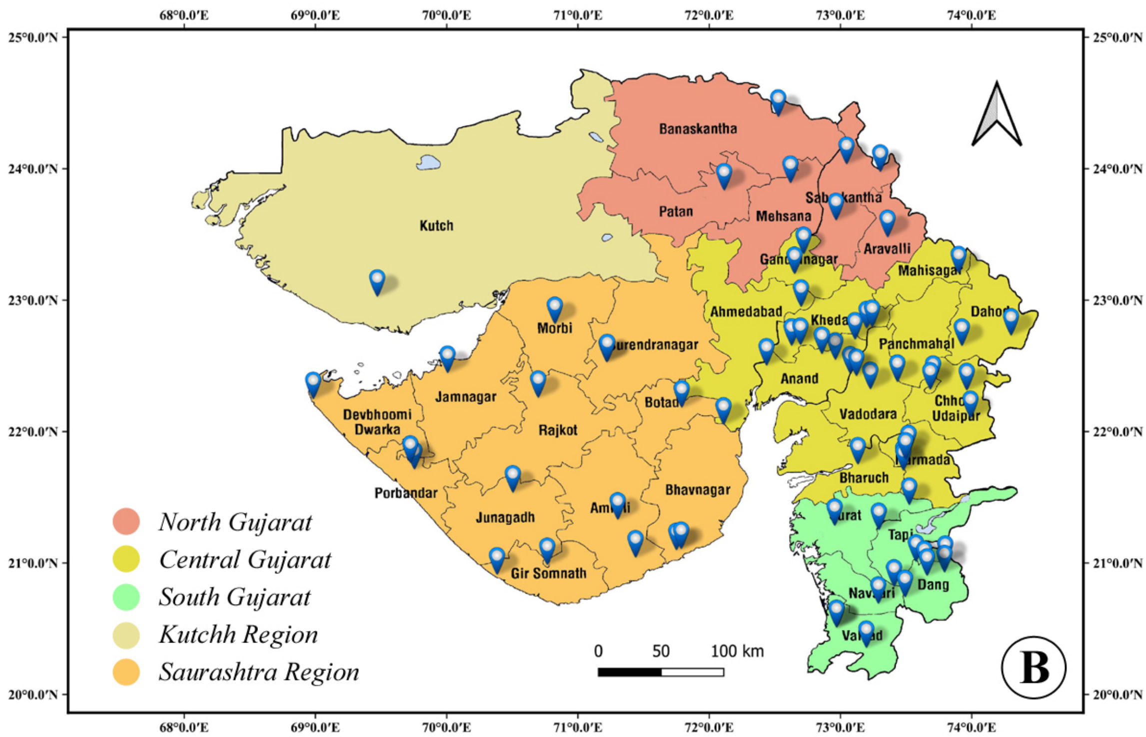


Figure: 41

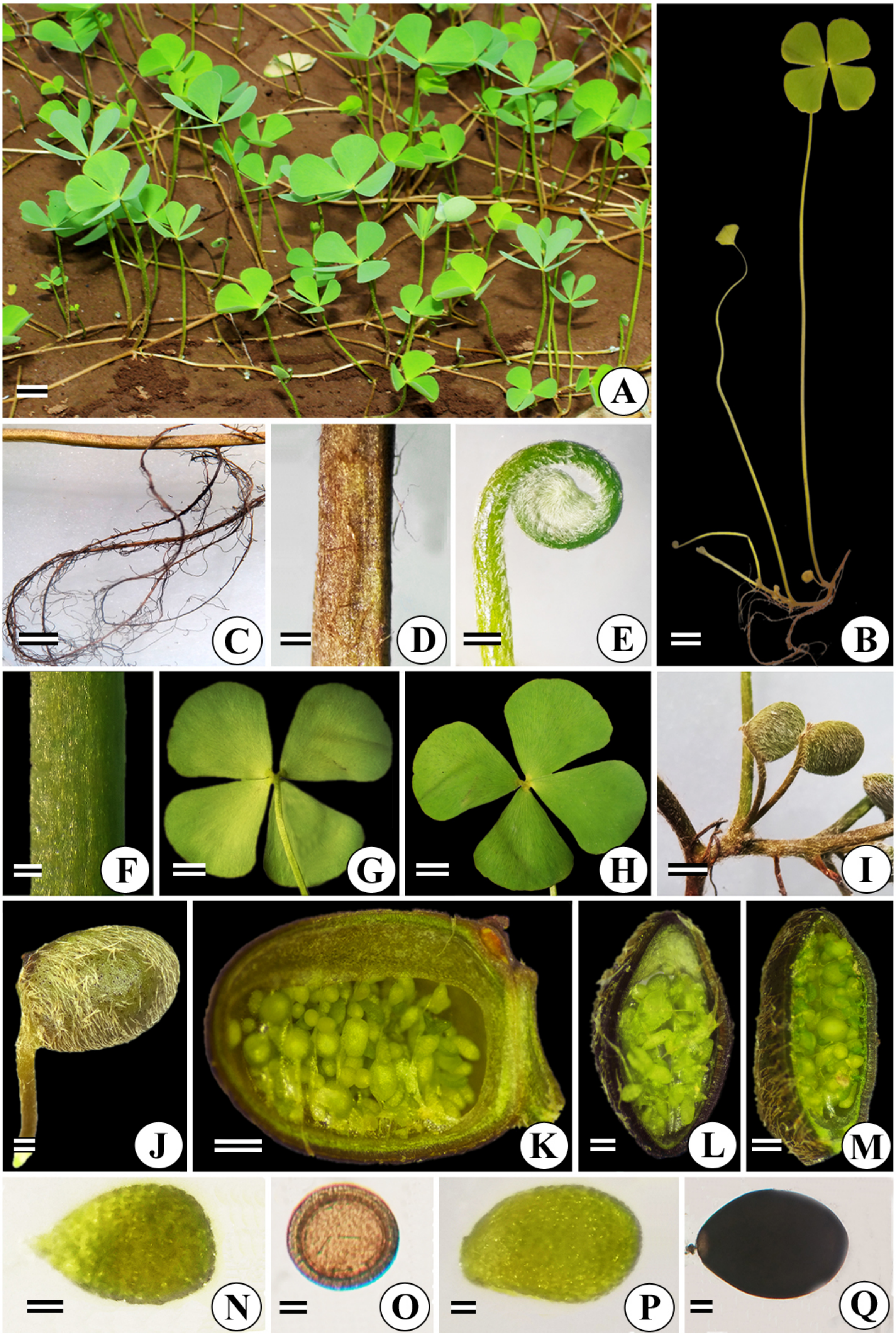
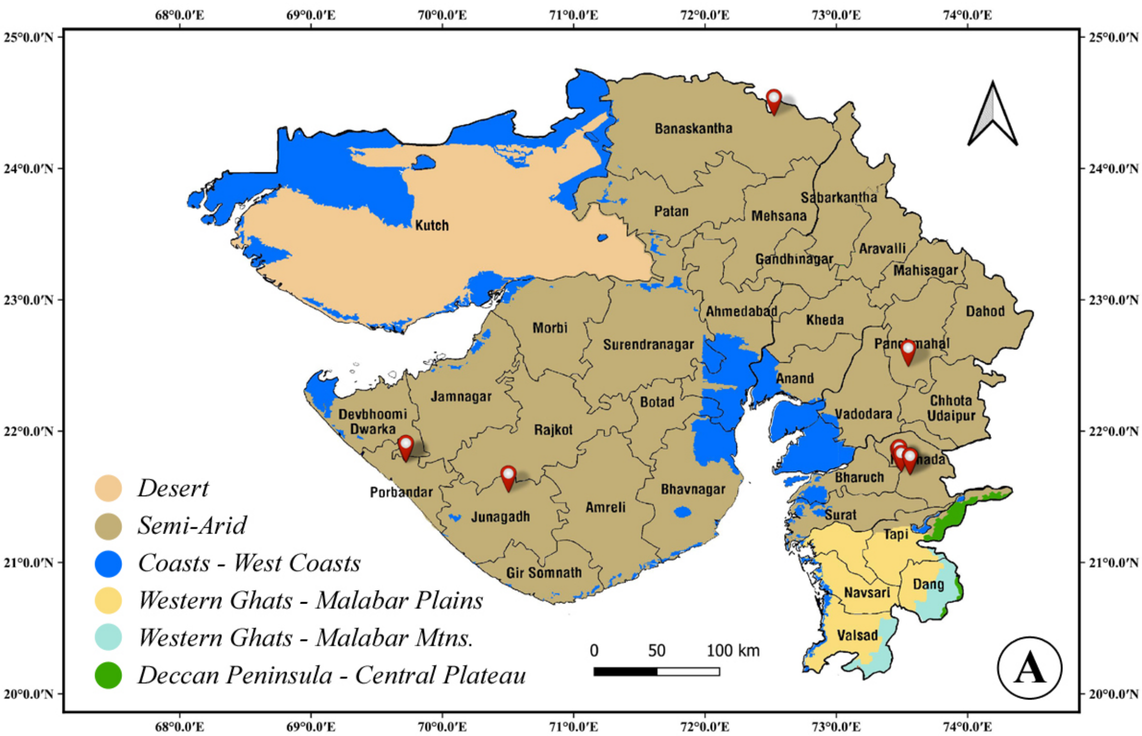


Figure 42: Marsilea minuta. A: Habit, B: Plant, C: Rhizomes & roots, D: Rhizome, E: Fiddlehead, F: Stipes, G, H: Pinnae, I-M: Sporocarps, N: Microsporangium, O: Microspore, P: Megasporangium, Q: Megaspore. ***Scale Bar:*** A, B: 2 cm, C: 1 cm, D, F, L, M: 1 mm, E, 3 mm, G-K: 5 mm, N, P: 100 µm, O, Q: 10 µm.

Distribution of *Ceratopteris thalictroides* subsp. *thalictroides* in different bio-geographical zones (A) and different regions (B) of Gujarat.



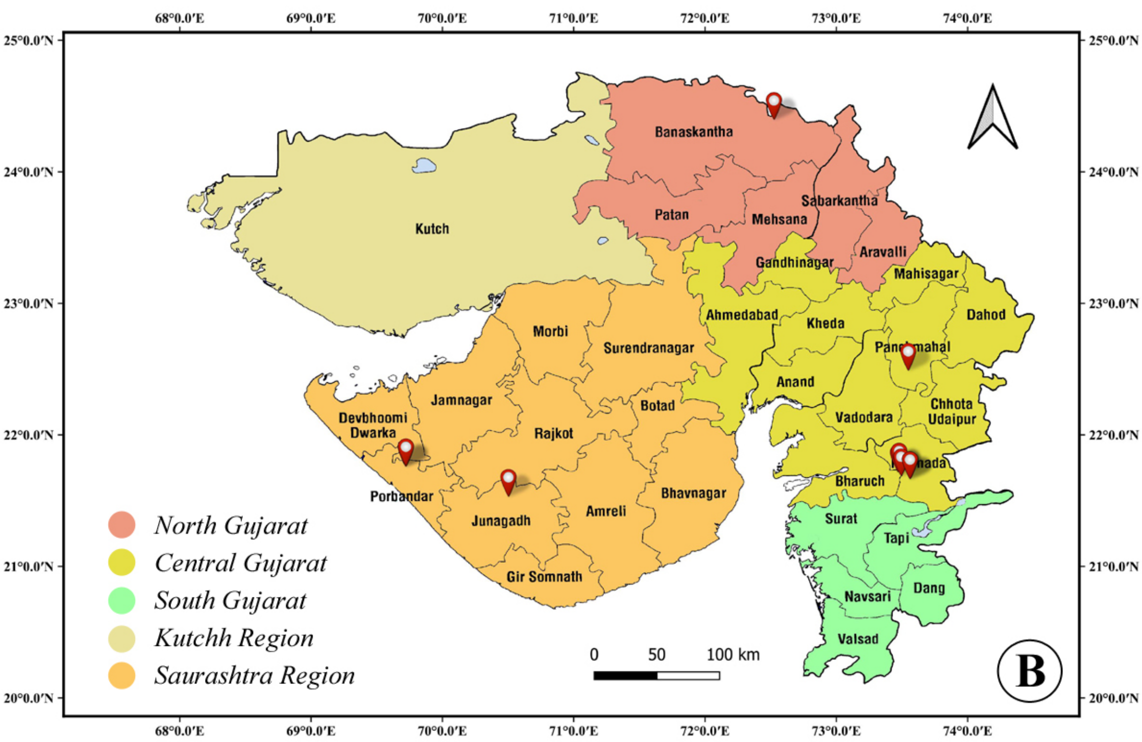


Figure: 43

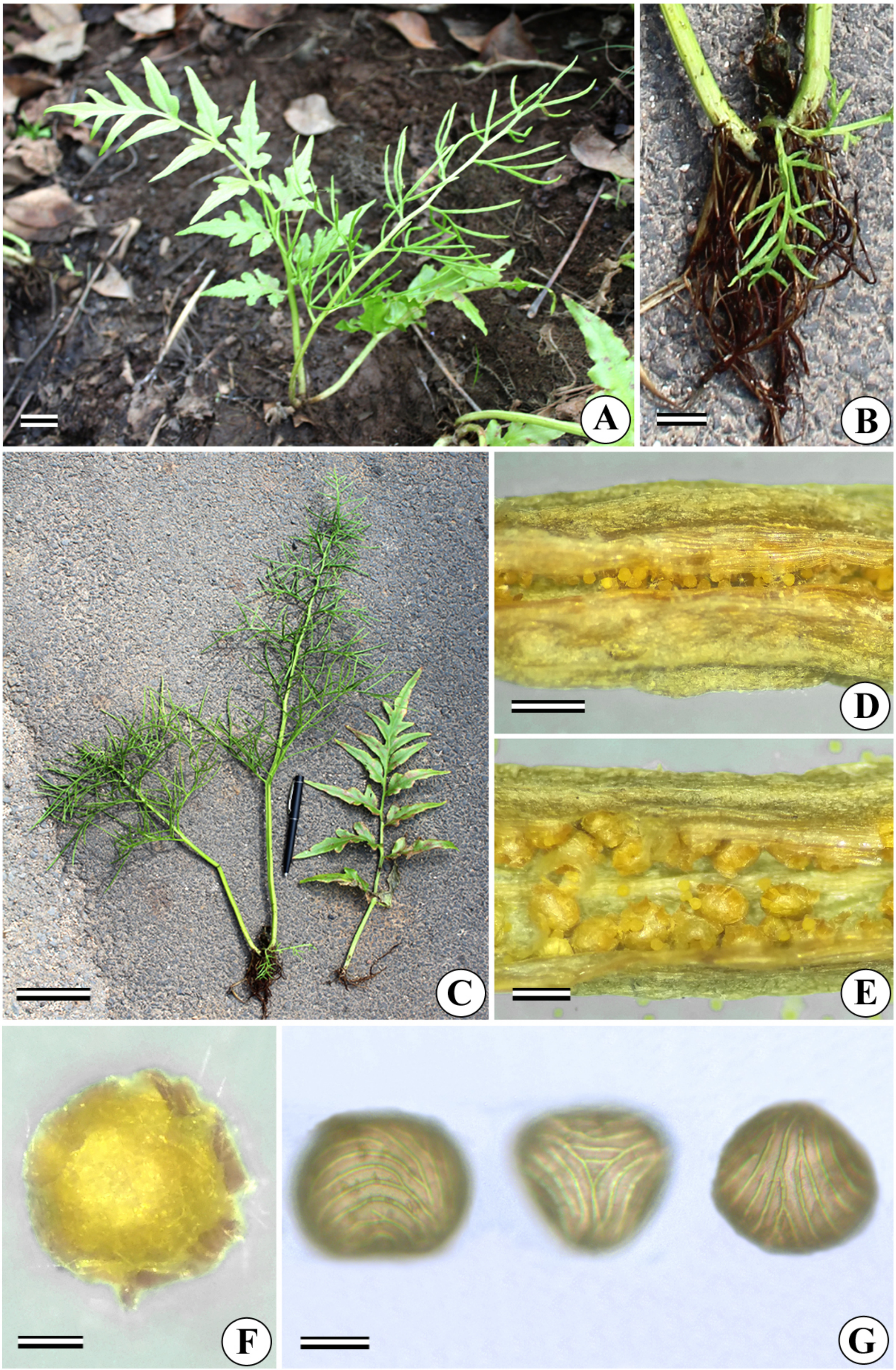
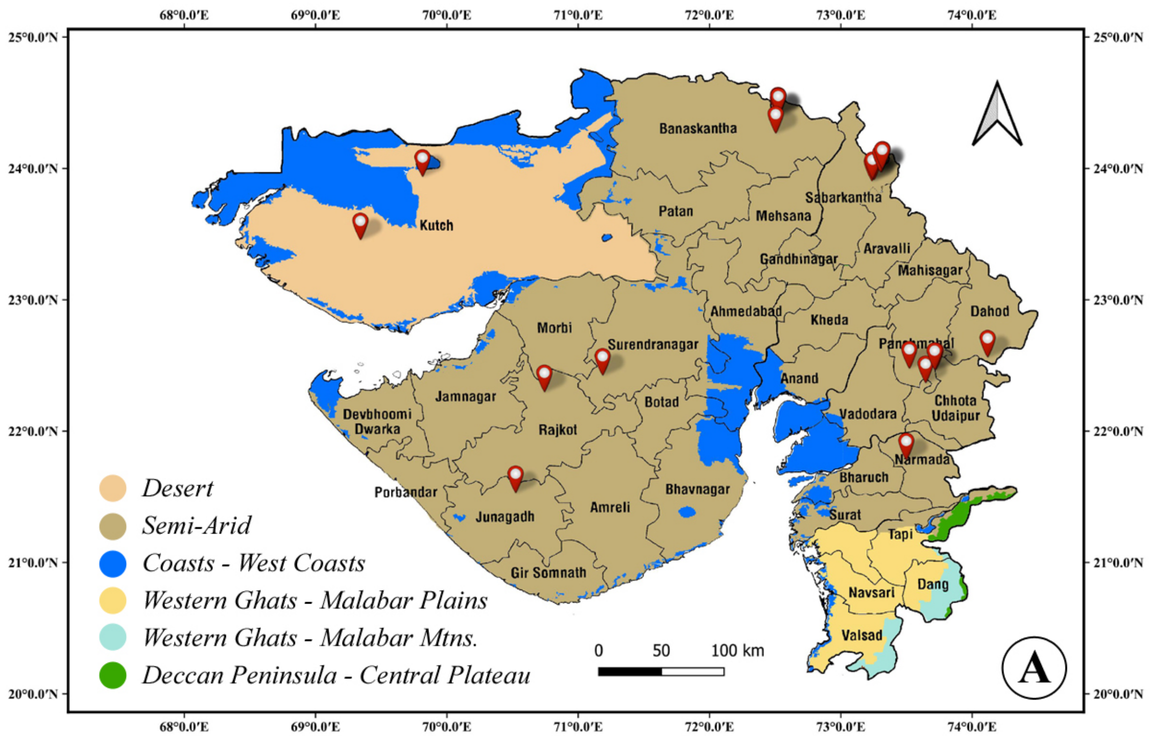


Figure 44: Ceratopteris thalictroides* subsp. *thalictroides*.** A: Habit, B: Rhizome, C: Frond, D, E: Pinnae, F: Sporangium, G: Spores. ***Scale Bar: A, B: 1 cm, C: 10 cm, D, E: 0. 5 mm, F: 100 µm, G: µm.

Distribution of *Actiniopteris radiata* in different bio-geographical zones (A) and different regions (B) of Gujarat.



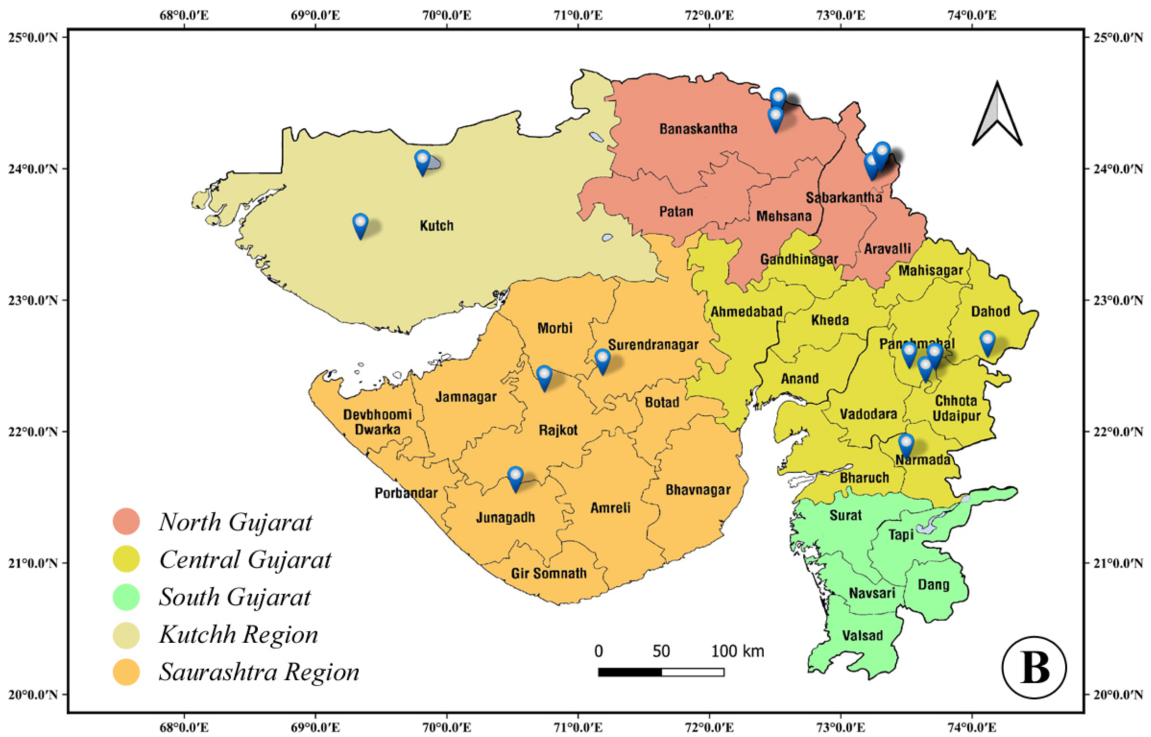


Figure: 45

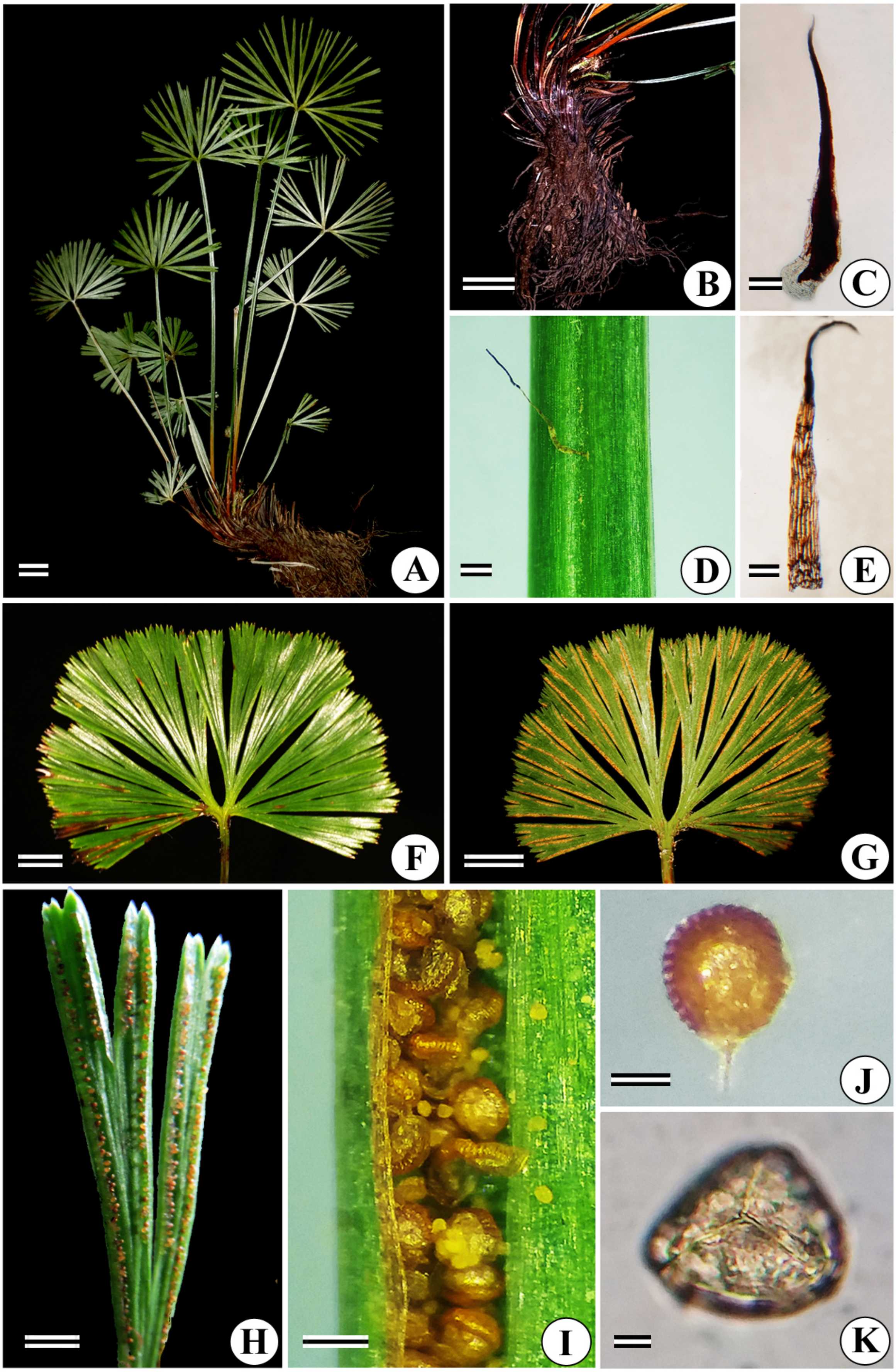


Figure 46: Actiniopteris radiata. A: Plant, B: Rhizome, C: Rhizome scale, D: Stipes, E: Stipe scale, F, G: Lamina, H: Ultimate segments, I: Sori, J: Sporangium, K: Spore. ***Scale Bar:*** A, B: 1 cm, C-E: 0.2 mm, F, G: 5 mm, H: 2 mm, I: 60 µm, J: 100 µm, K: 10 µm.

Distribution of *Anogramma reichsteinii* in different bio-geographical zones (A) and different regions (B) of Gujarat.

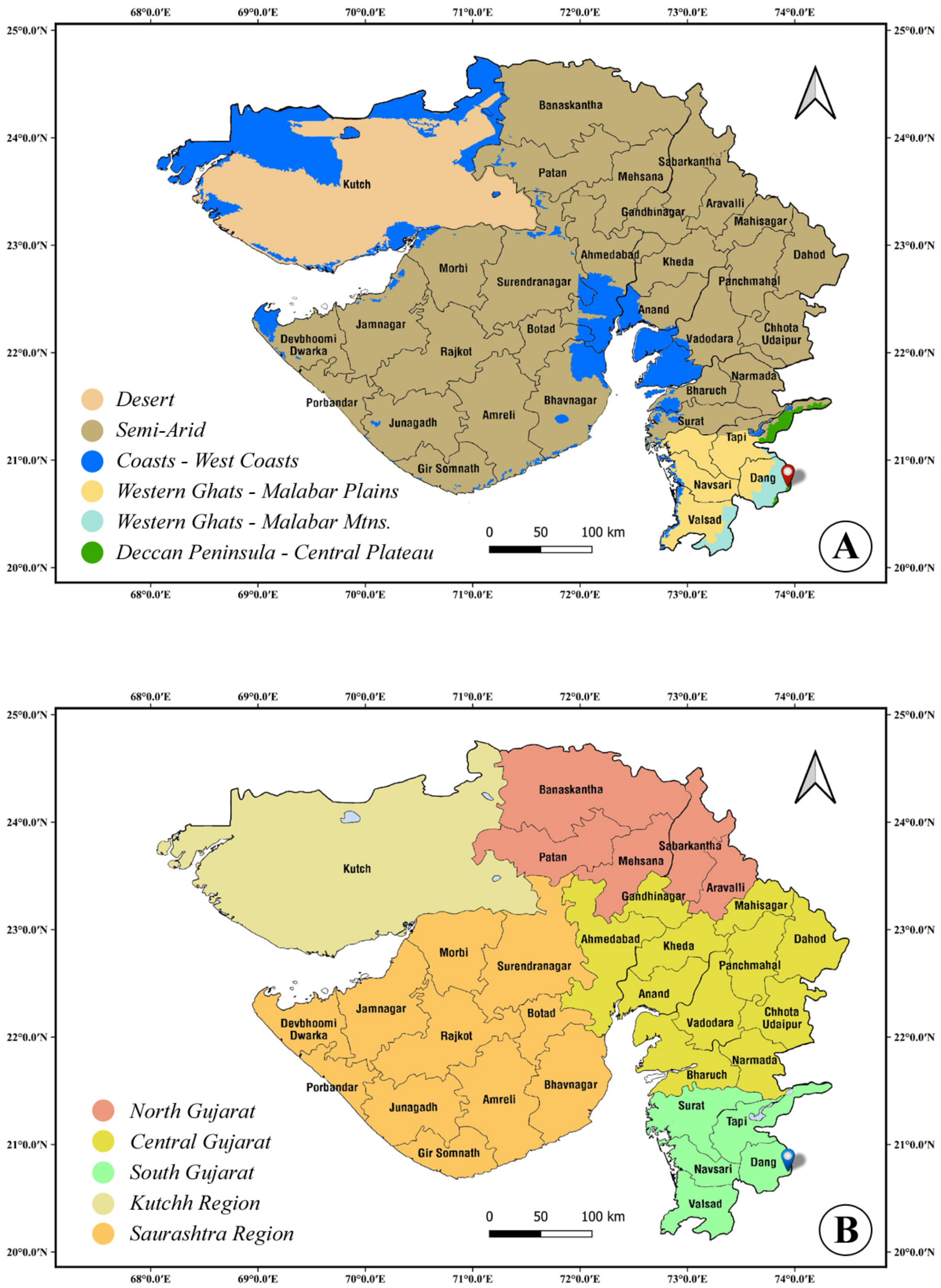


Figure: 47

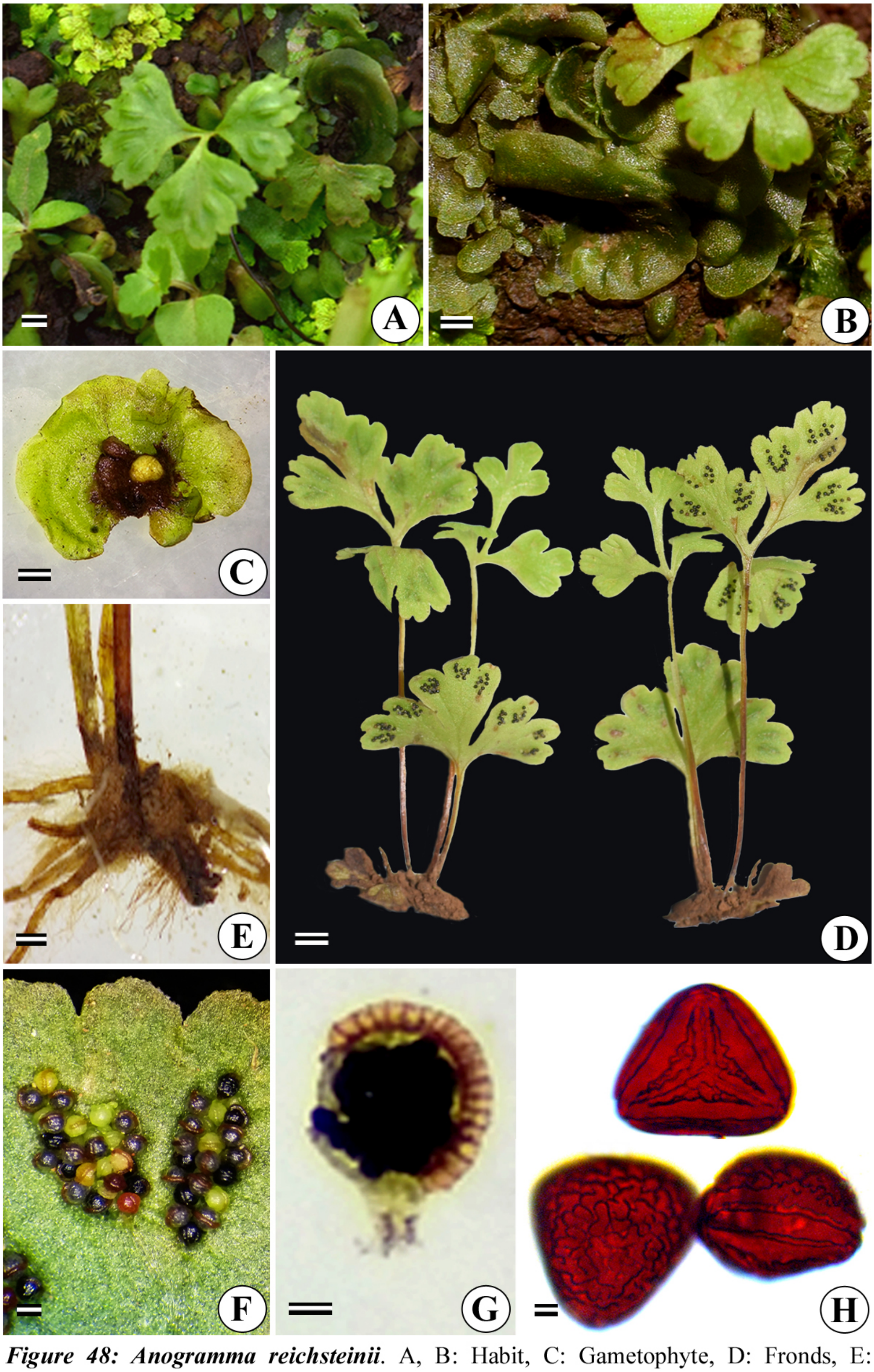
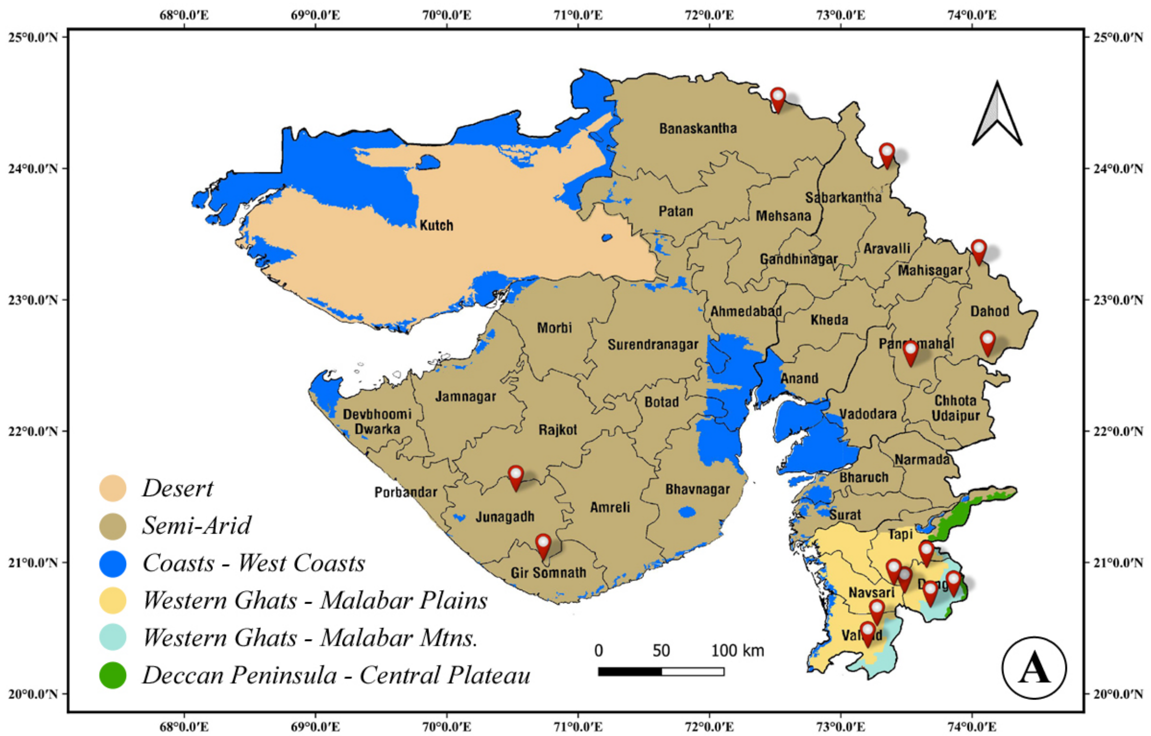


Figure 48: Anogramma reichsteinii. A, B: Habit, C: Gametophyte, D: Fronds, E: Rhizomes, F: Sori, G: Sporangium, H: Spores. ***Scale Bar:*** A-C, E: 1 mm, D: 0.5 cm, F: 200 µm, G: 100 µm, H: 5 µm.

Distribution of *Pteris vittata* subsp. *vittata* in different bio-geographical zones (A) and different regions (B) of Gujarat.



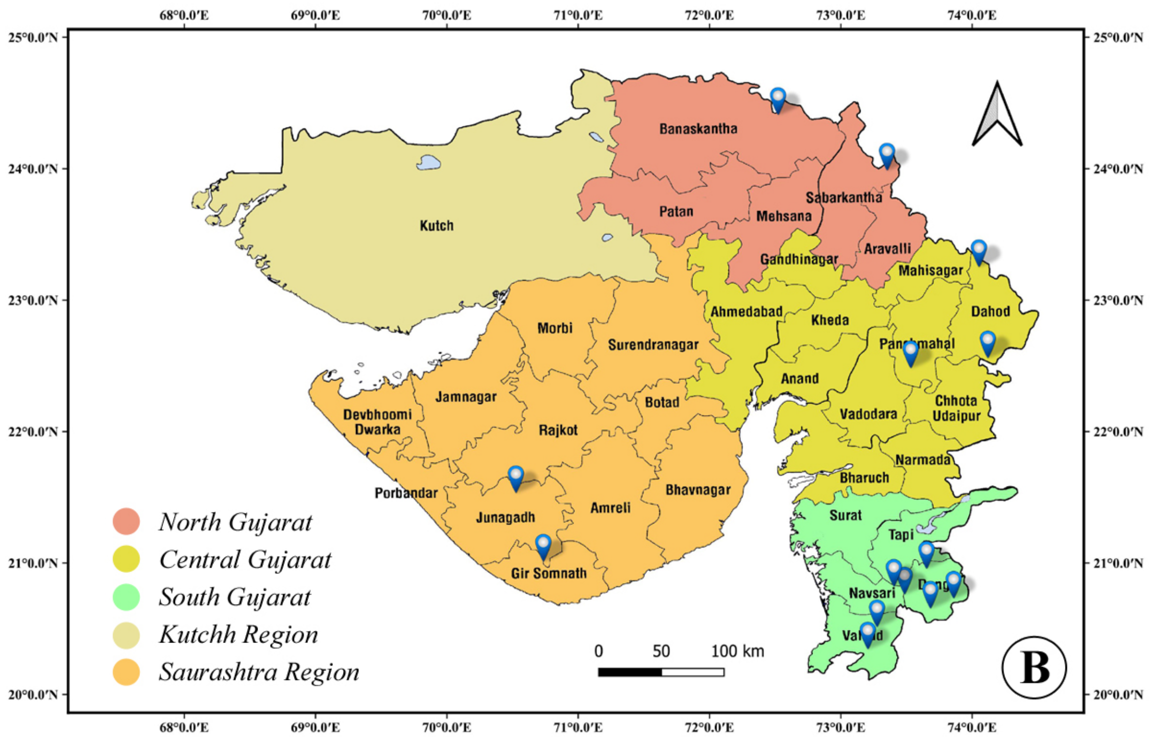


Figure: 49

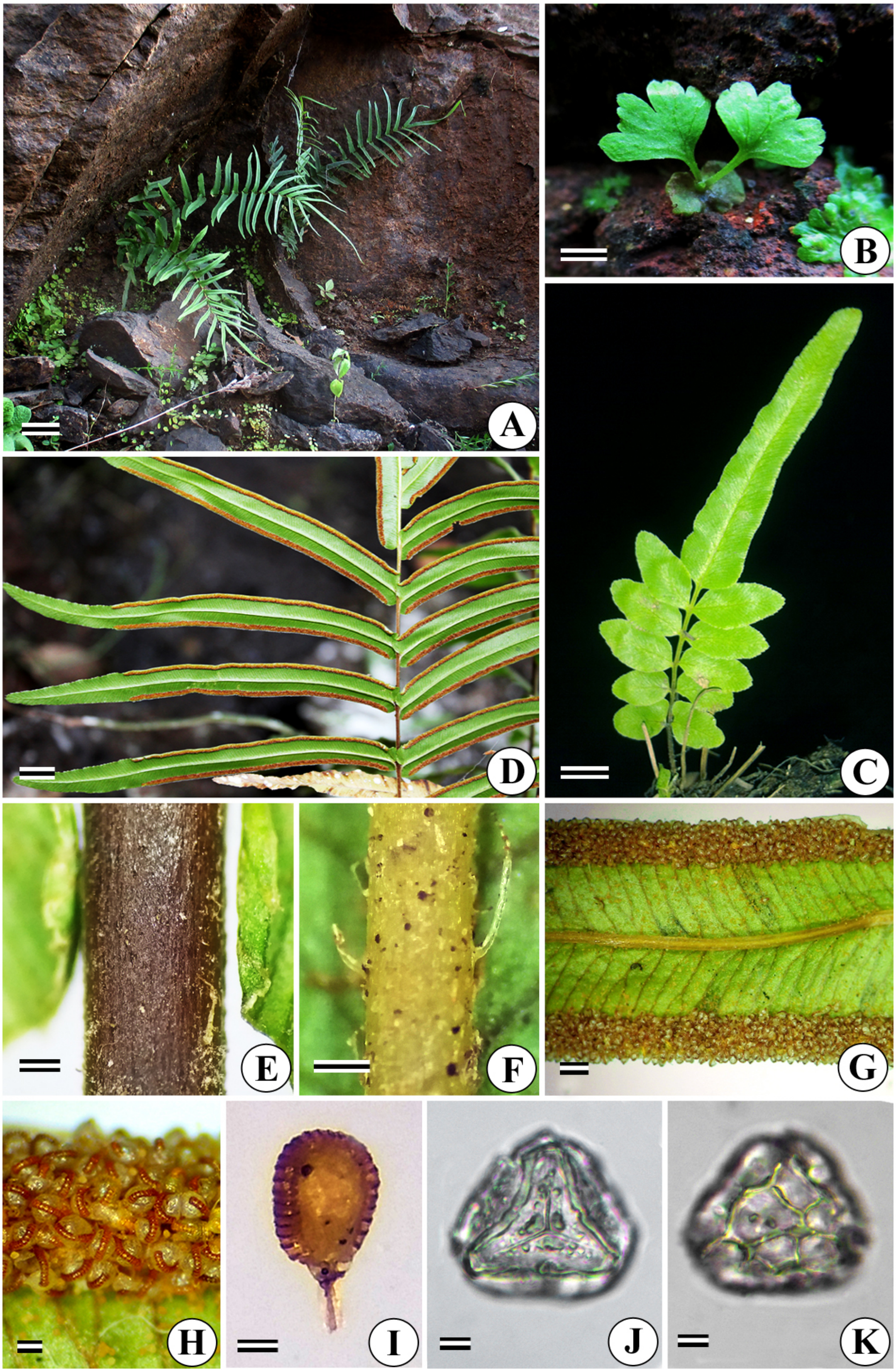
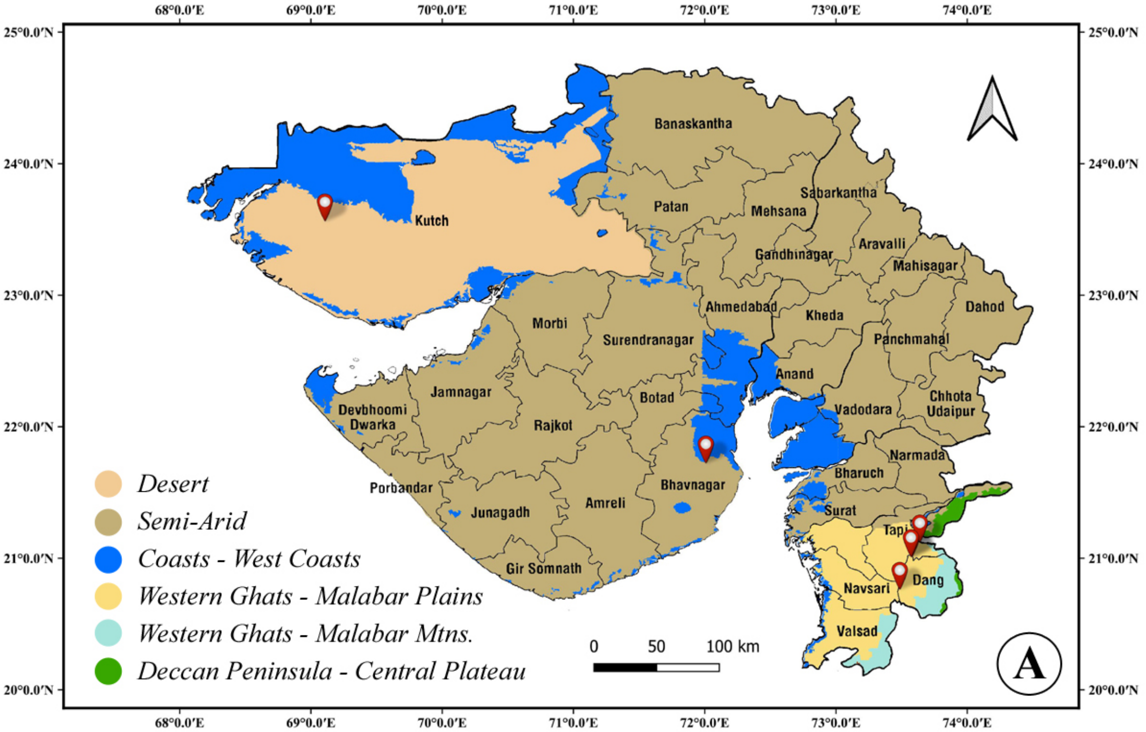


Figure 50: Pteris vittata* subsp. *vittata. A: Habit, B: Young plant, C: Frond, D: Rachis & pinnae, E: Rachis, F: Costae, G: Pinnae, H: Sori, I: Sporangium, J, K: Spores. ***Scale Bar:*** A: 10 cm, B, F: 500 µm, C, D: 1 cm, E: 1 mm, G: 2 mm, H: 200 µm, J, K: 10 µm.

Distribution of *Adiantum capillus-veneris* in different bio-geographical zones (A) and different regions (B) of Gujarat.



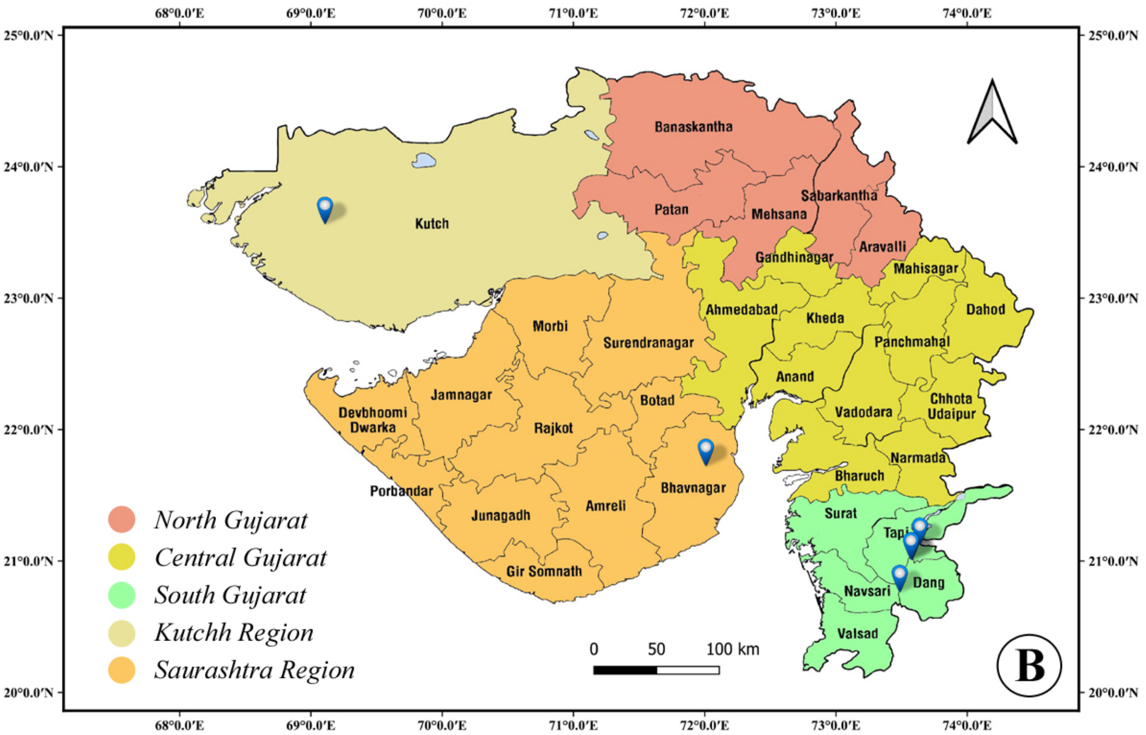


Figure: 51

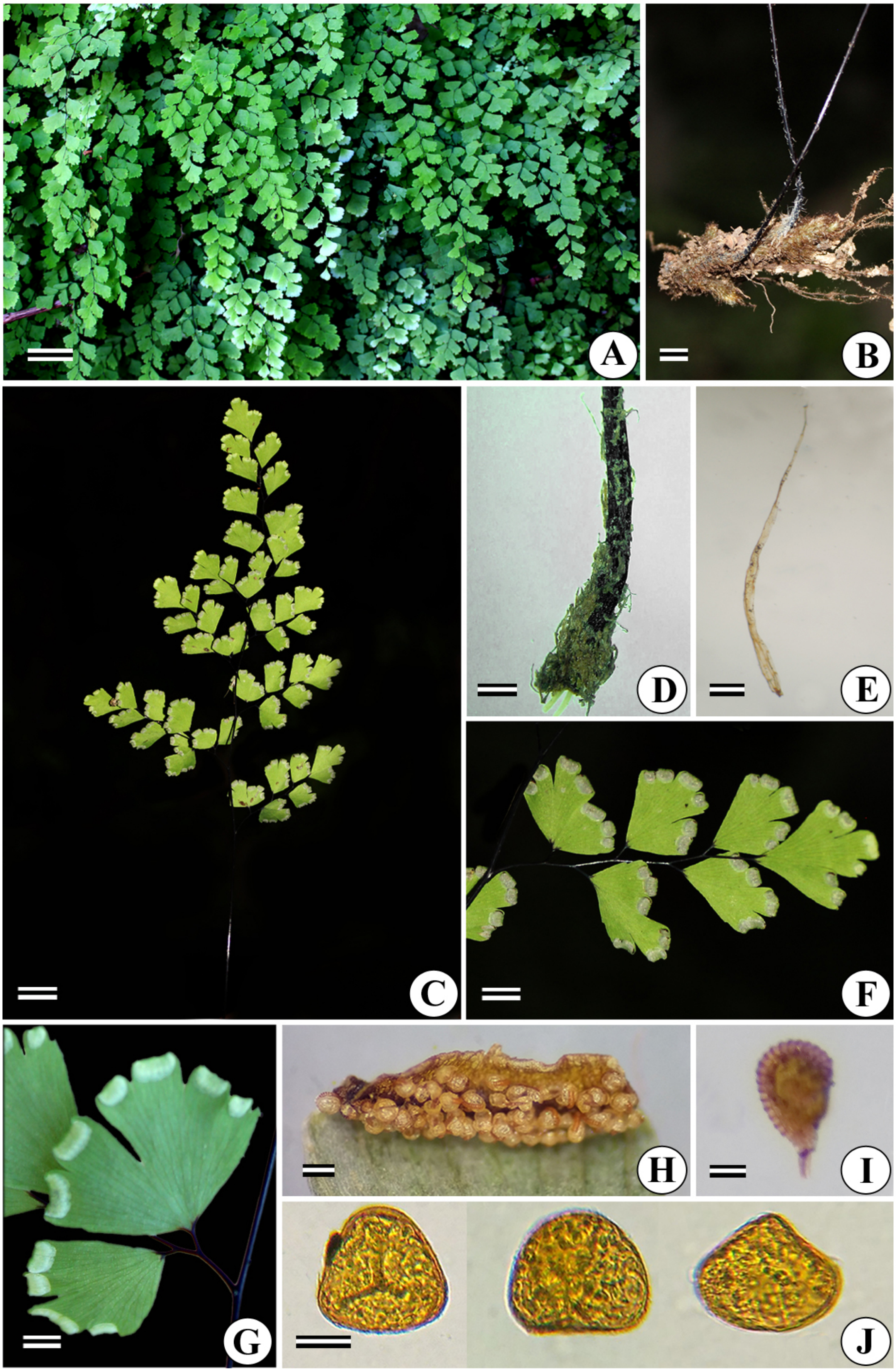
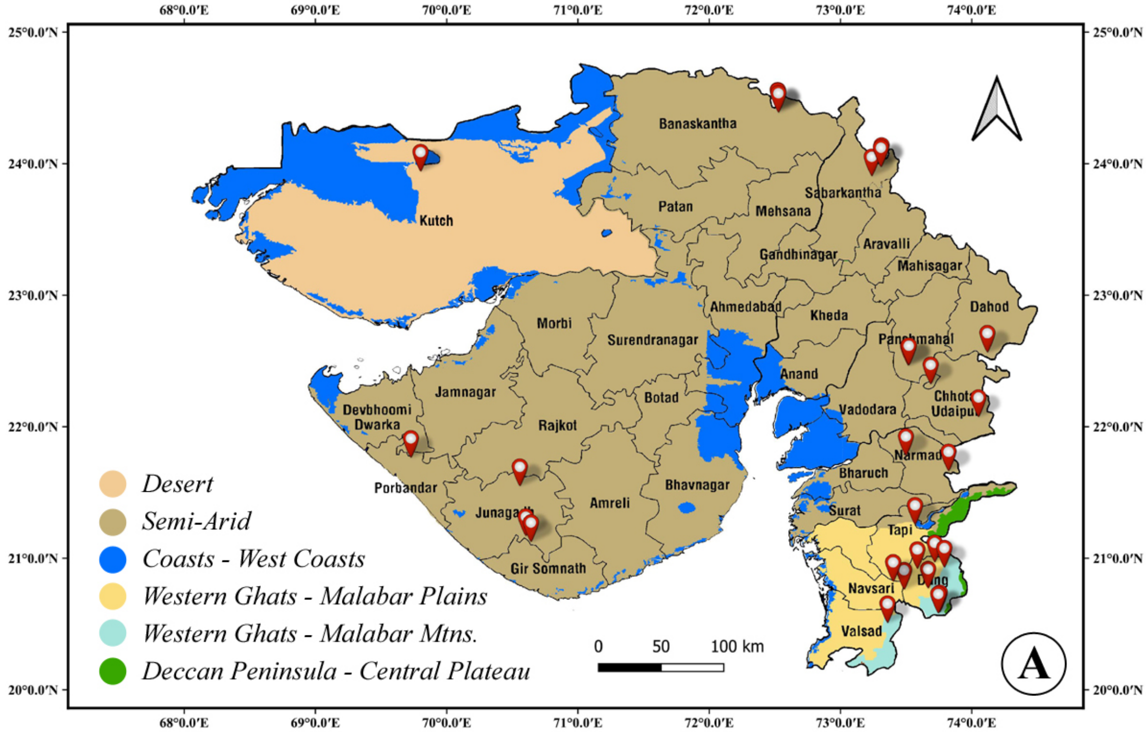


Figure 52: Adiantum capillus-veneris. A: Habit, B: Rhizome, C: Frond, D: Stipe base, E: Stipe base scale, F: Pinna, G: Pinnae, H: Sori, I: Sporangium, J: Spores. ***Scale Bar:*** A: 15 cm, B, D, G: 2 mm, C: 15 cm, E: 1 mm, F: 5 mm, H: 200 µm, I: 100 µm, J: 20 µm.

Distribution of *Adiantum incisum* in different bio-geographical zones (A) and different regions (B) of Gujarat.



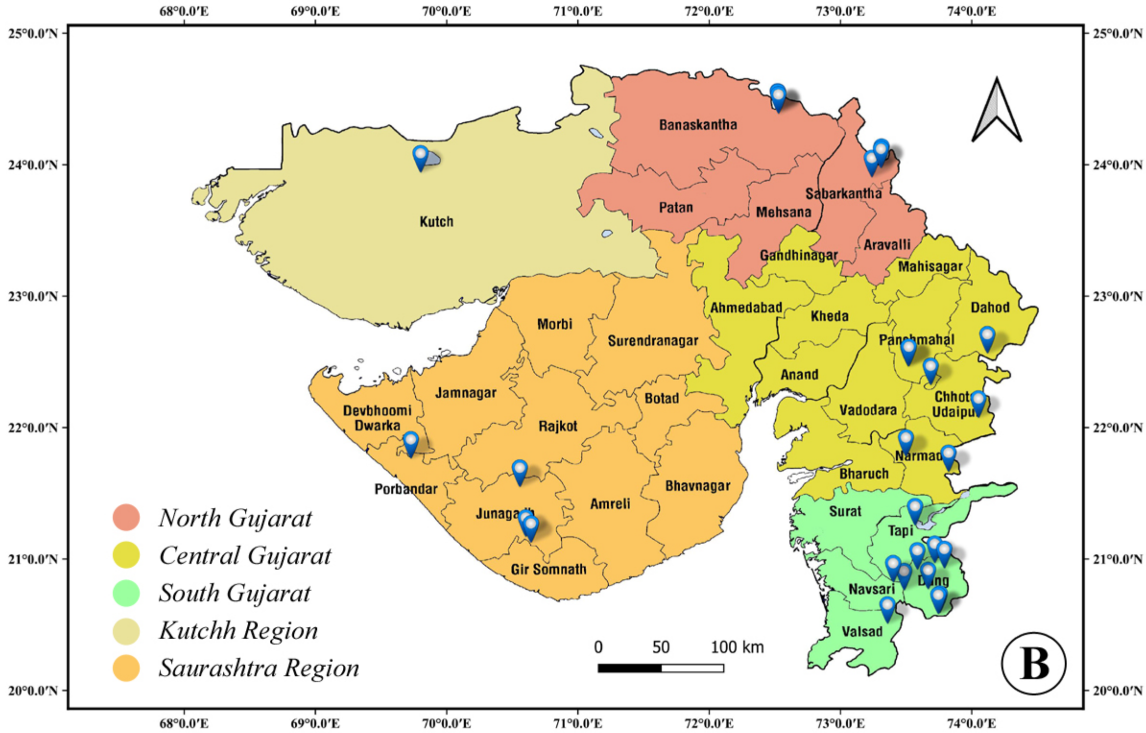


Figure: 53

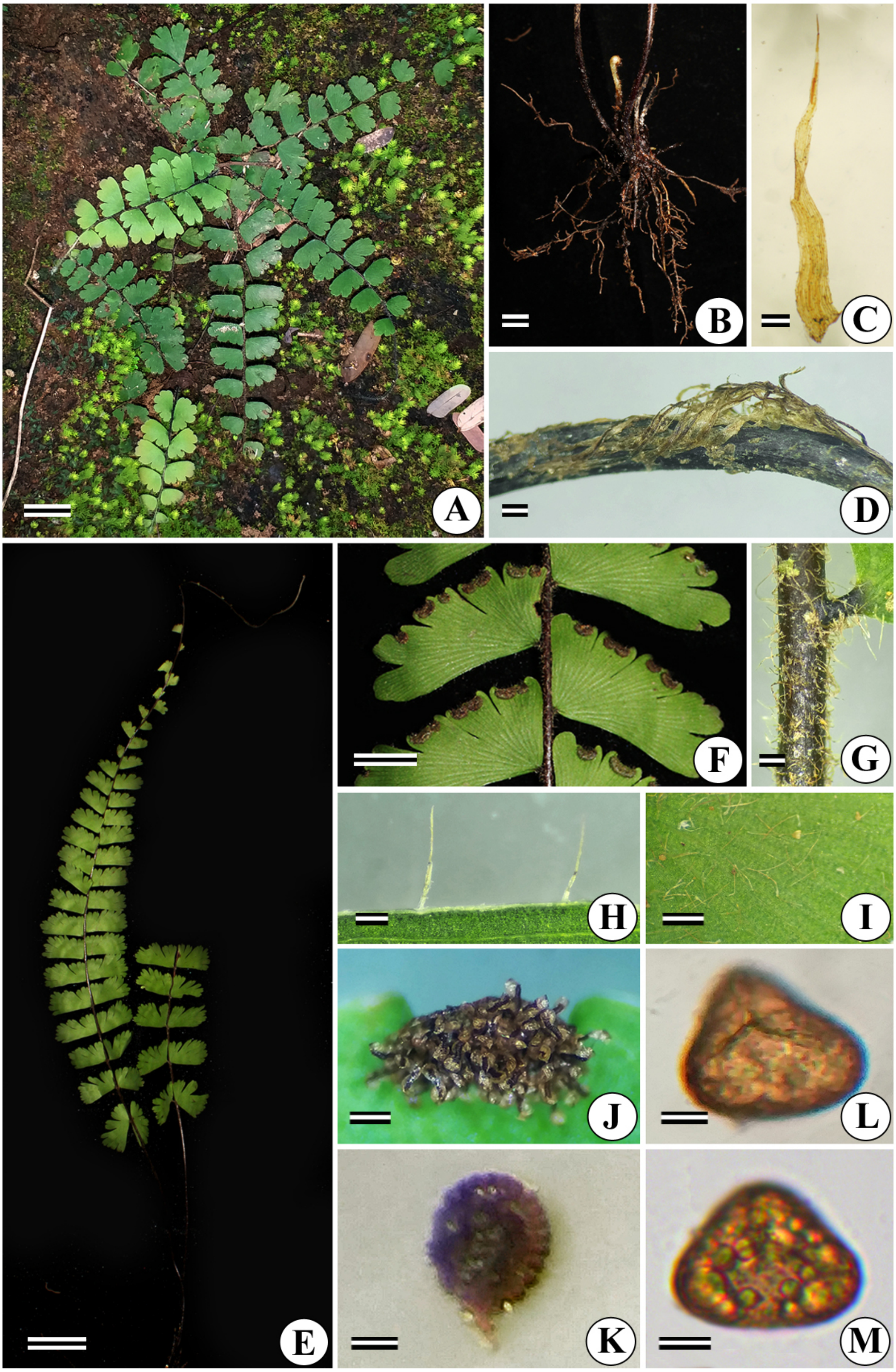
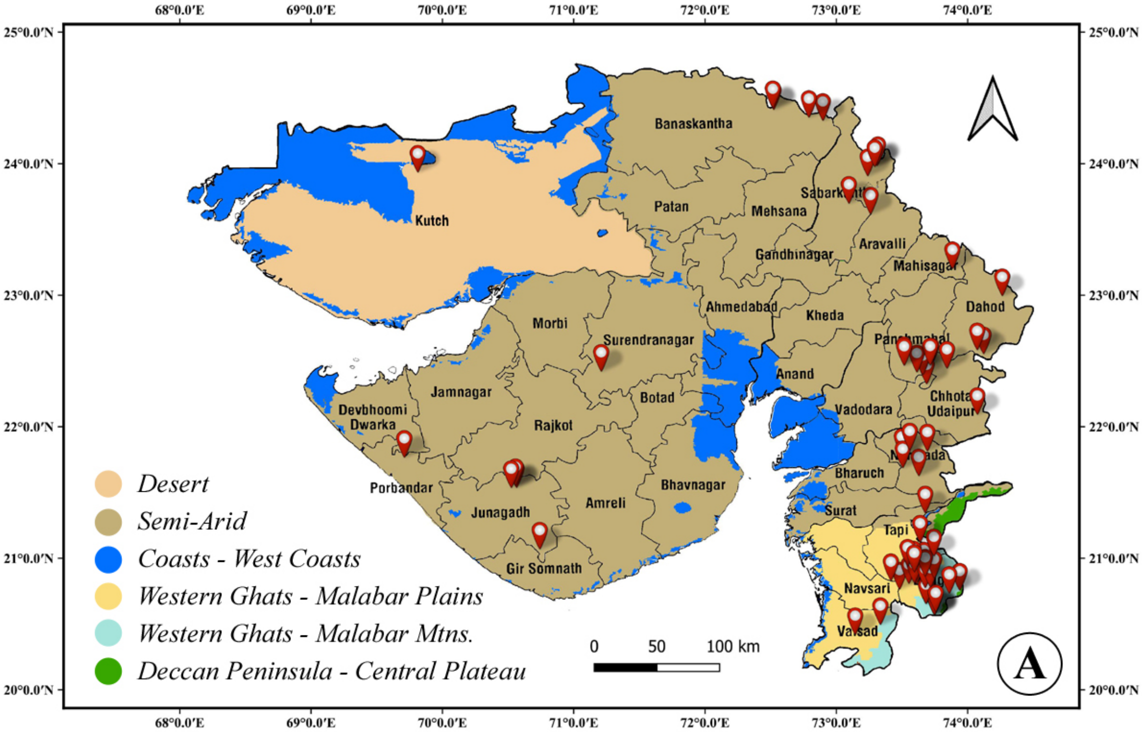


Figure 54: Adiantum incisum. A: Habit, B: Rhizome, C: Scale, D: Stipe, E: Frond, F: Pinnae, G: Rachis, H, I: Hairs, J: Sori, K: Sporangium, L, M: Spores. ***Scale Bar:*** A, E: 3 cm, B: 3 mm, C, H, I, J: 250 µm, D, G: 0.5 mm, F: 1 cm, K: 100 µm, L, M: 200 µm.

Distribution of *Adiantum philippense* subsp. *philippense* in different bio-geographical zones (A) and different regions (B) of Gujarat.



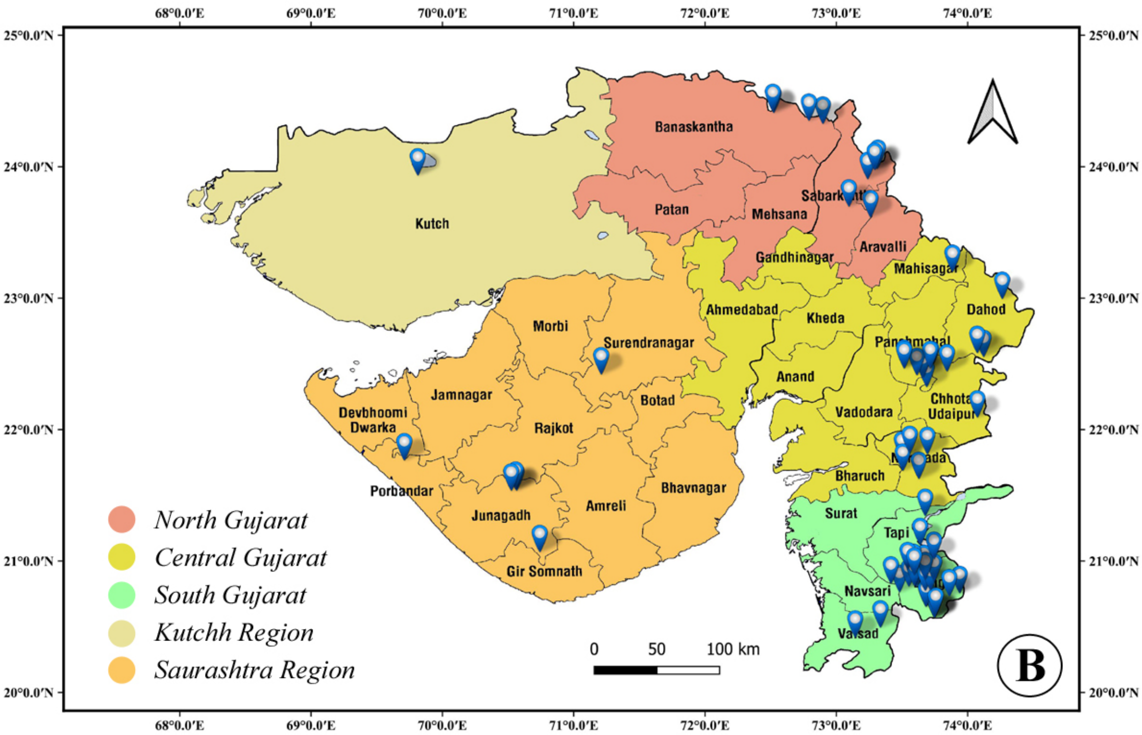


Figure: 55

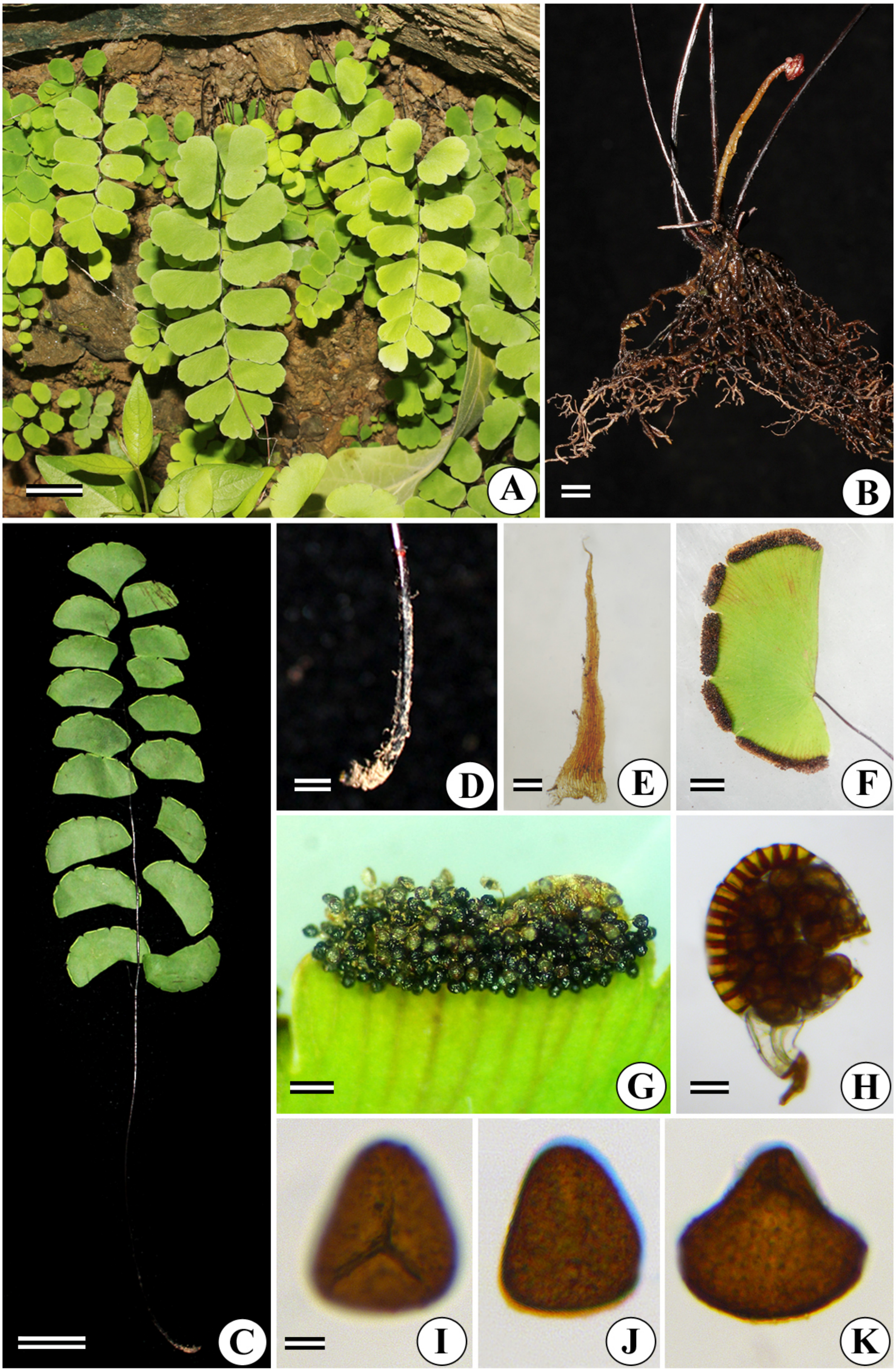


Figure 56: Adiantum philippense* subsp. *philippense*.** A: Habit, B: Rhizome, C: Frond, D: Stipe base, E: Stipe base scale, F: Pinnae, G: Sori, H: Sporangium, I-K: Spores. ***Scale Bar: A, C: 3 cm, B, D: 3 mm, E: 0.2 mm, F: 5 mm, G: 0.5 mm, H: 50 µm, I-K: 20 µm.

Distribution of *Aleuritopteris albomarginata* in different bio-geographical zones (A) and different regions (B) of Gujarat.

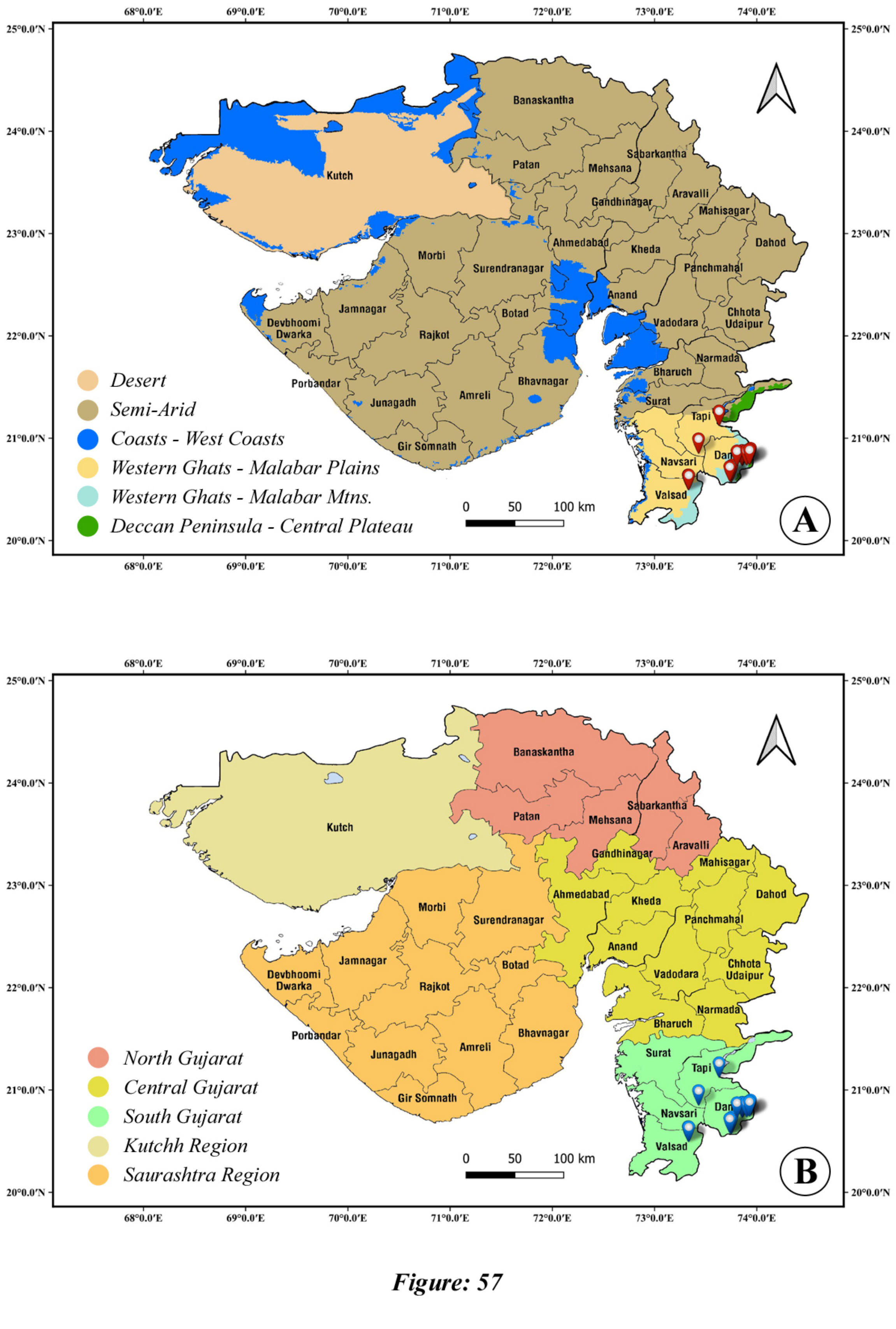


Figure: 57

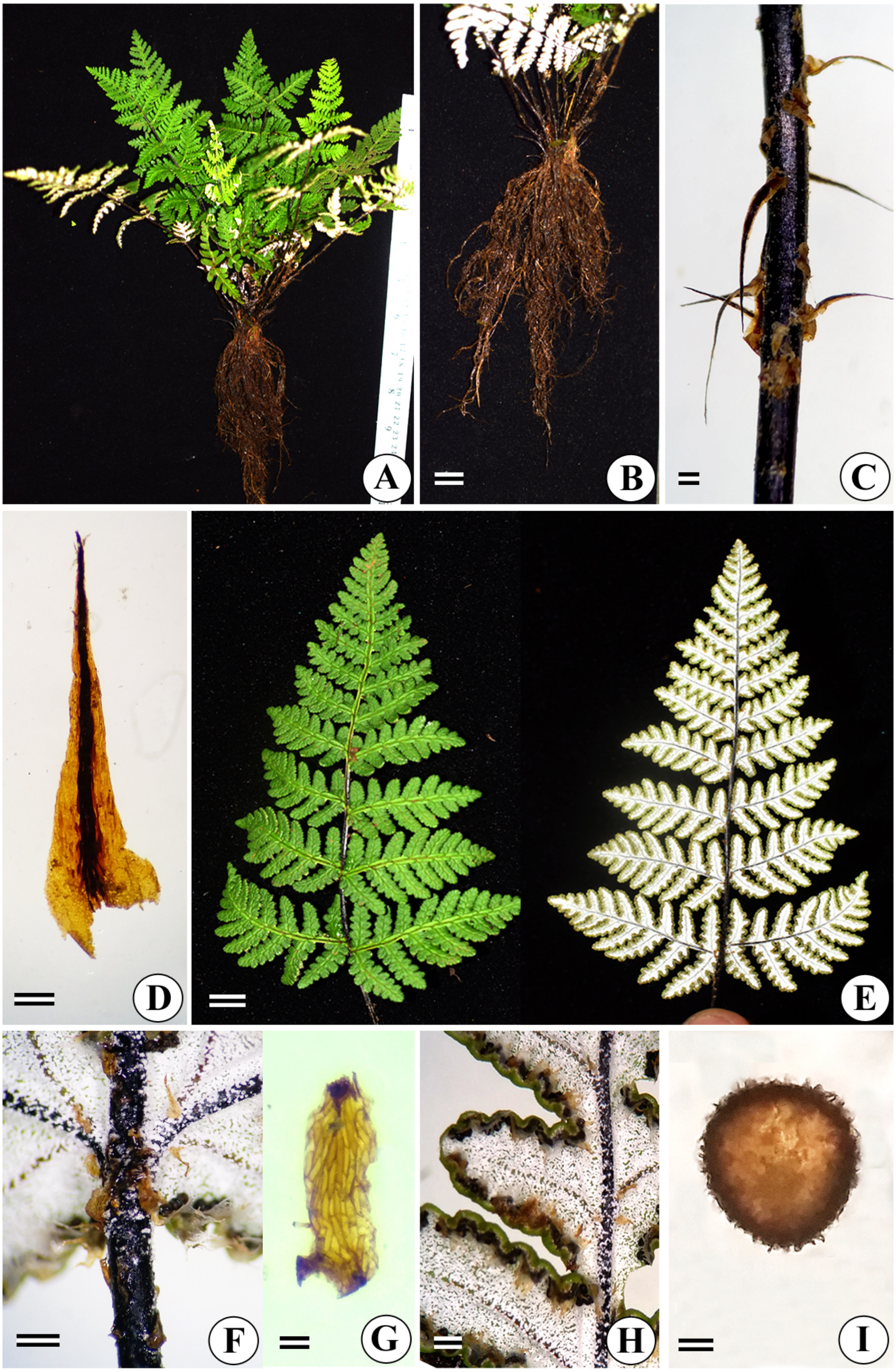
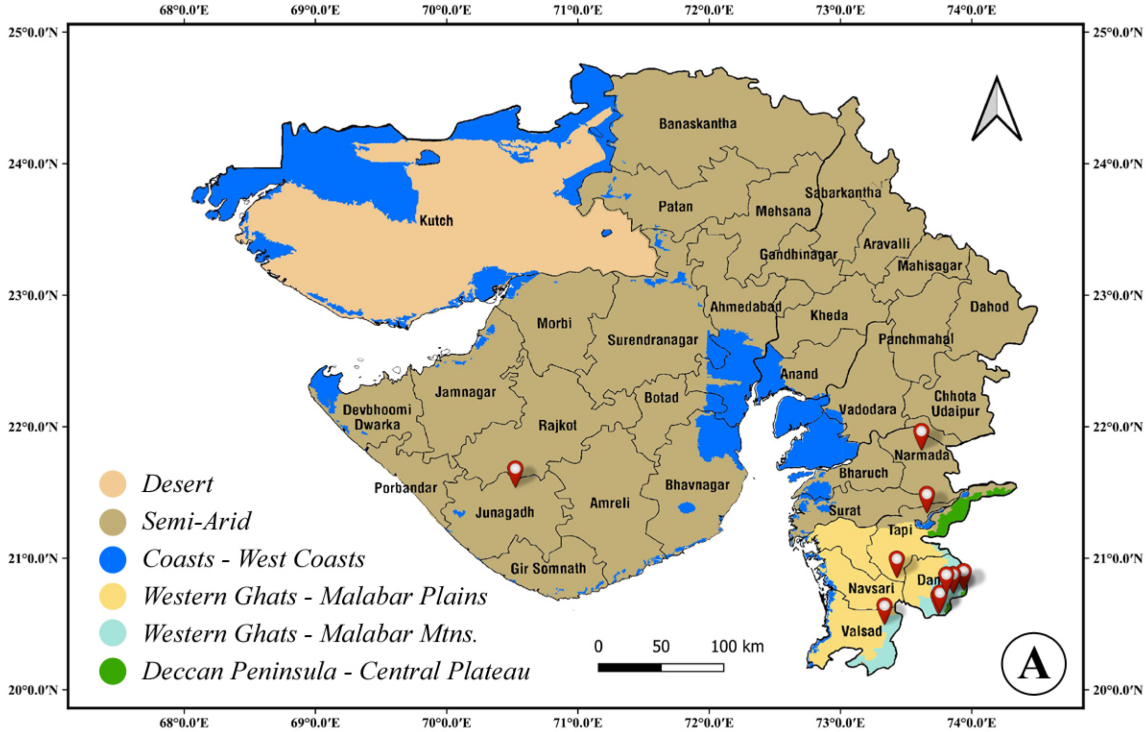


Figure 58: Aleuritopteris albomarginata. A: Habit, B: Rhizome, C: Stipe, D: Stipe scale, E: Fronds, F: Rachis, G: Rachis scale, H: Costa, I: Spore. ***Scale Bar:*** B: 5 mm, C: 0.5 mm, D, G: 50 µm, E: 1 cm, F: 1 mm, H: 2 mm, I: 10 µm.

Distribution of *Aleuritopteris anceps* in different bio-geographical zones (A) and different regions (B) of Gujarat.



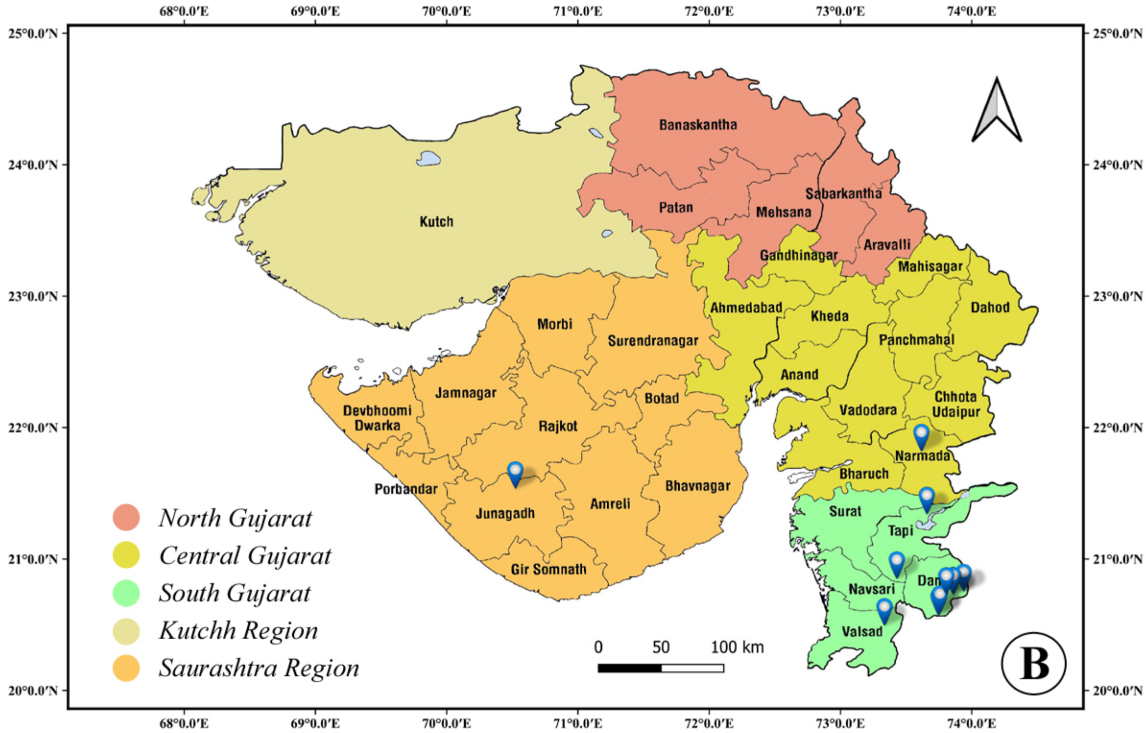


Figure: 59

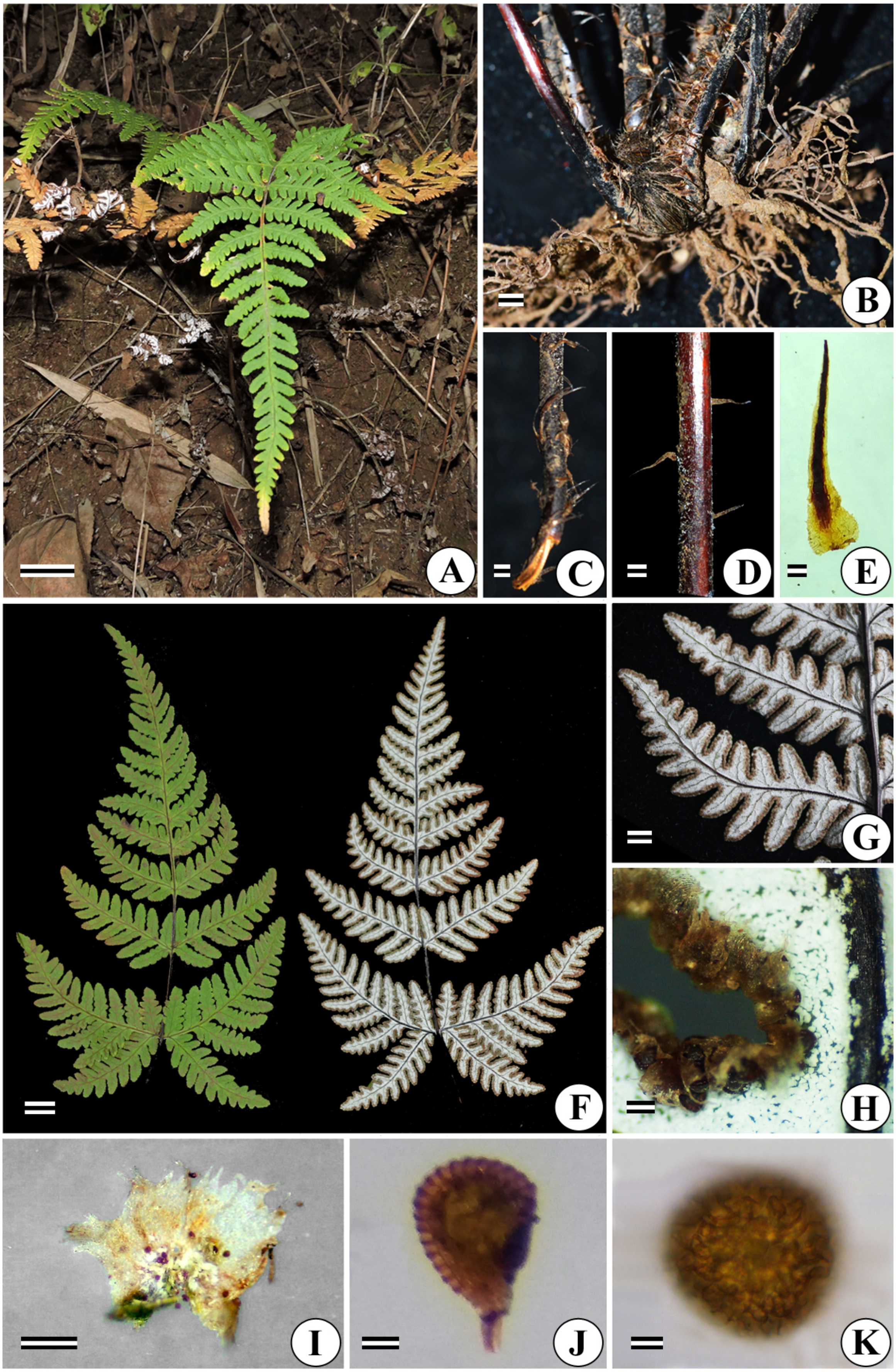
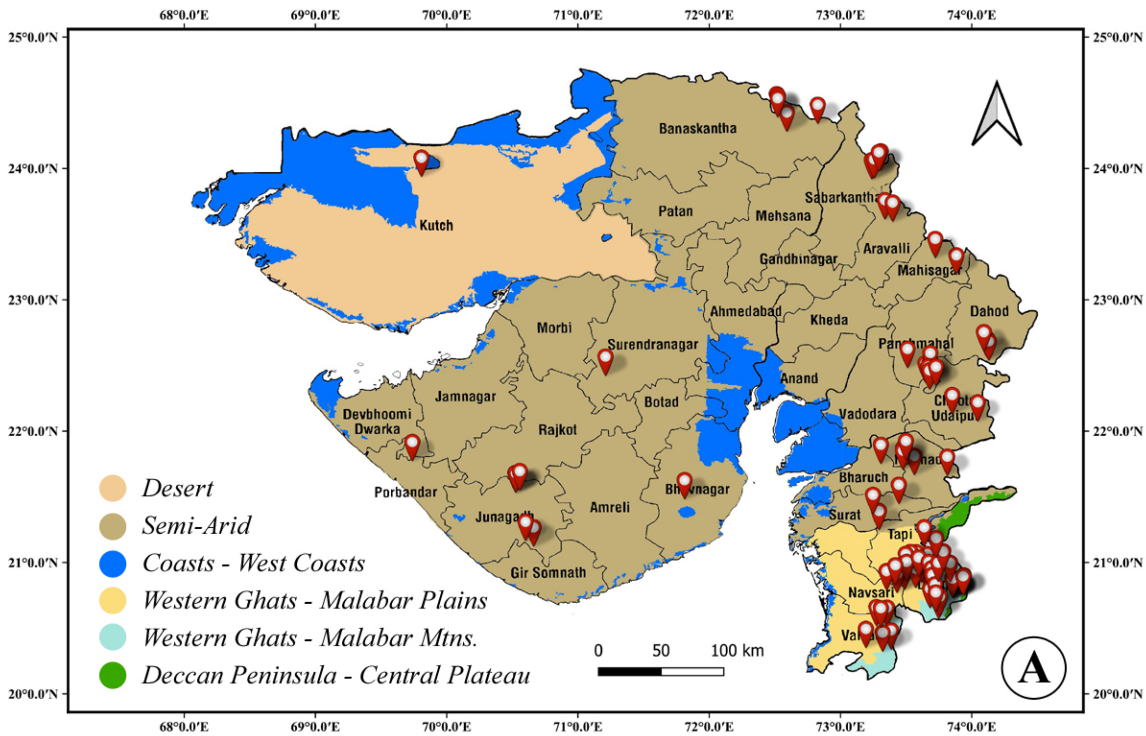


Figure 60: Aleuritopteris anceps. A: Habit, B: Rhizome, C, D: Stipe, E: Stipe scale, F: Fronds, G: Pinnae, H: Sori, I: Indusium, J: Sporangium, K: Spore. ***Scale Bar:*** A: 3 cm, B, H: 1 mm, C, D: 0.5 mm, E: 100 µm, F: 1 cm, G: 2 mm, I: 300 µm, J: 50 µm, K: 10 µm.

Distribution of *Aleuritopteris bicolor* in different bio-geographical zones (A) and different regions (B) of Gujarat.



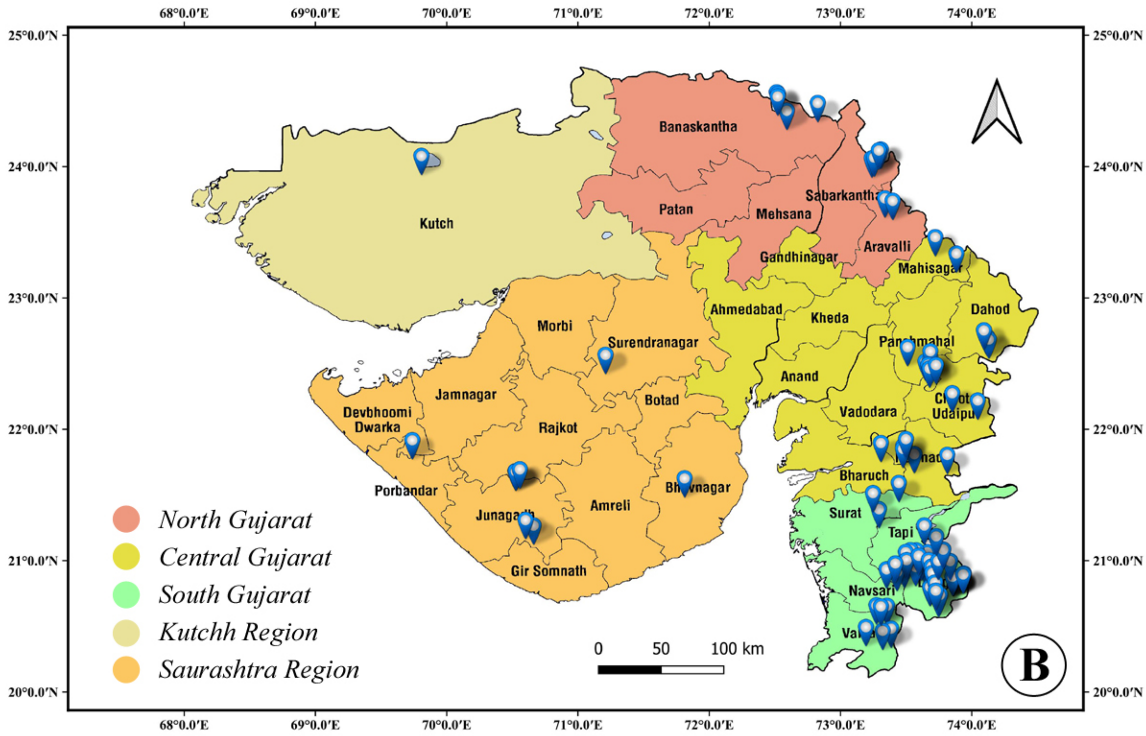


Figure: 61

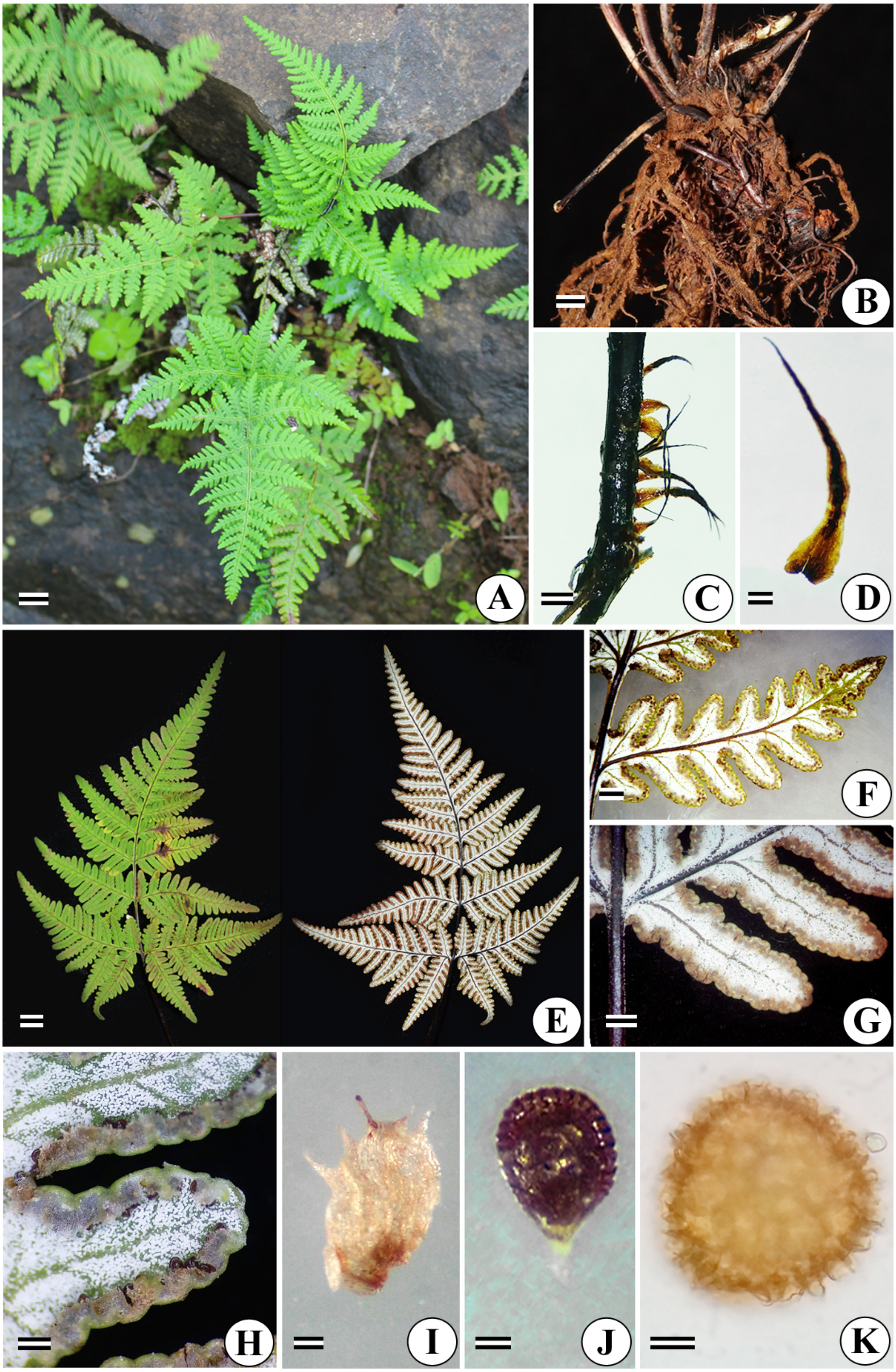
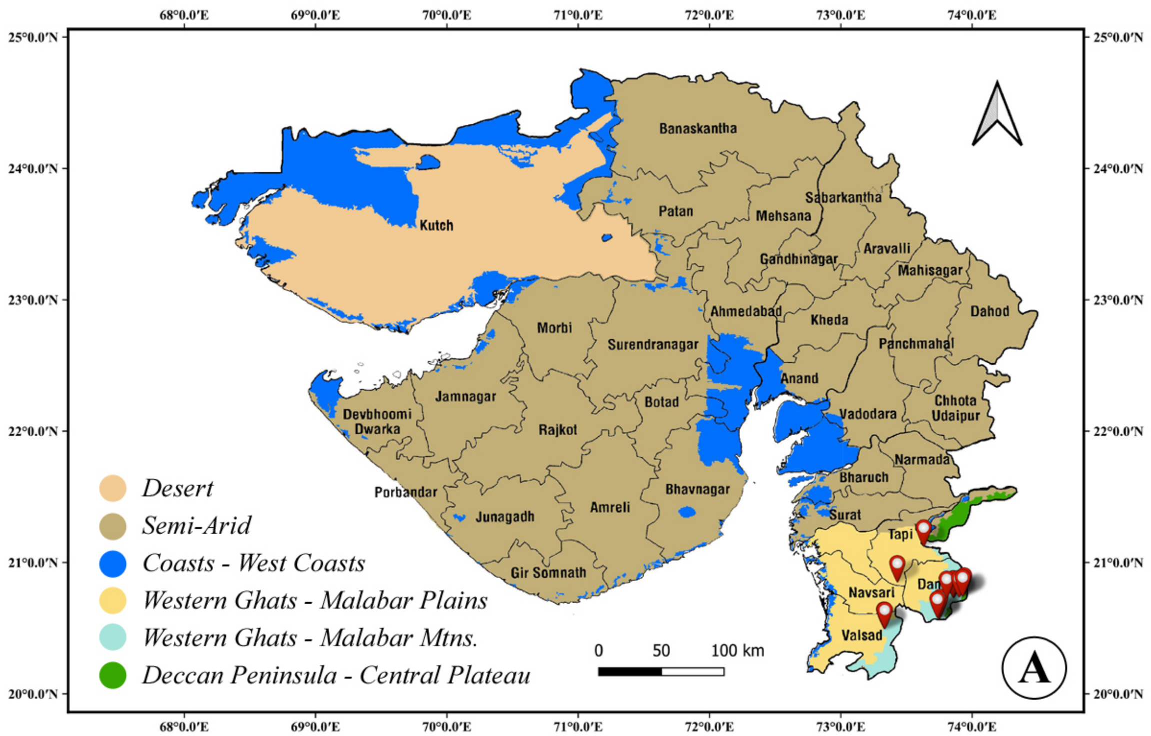


Figure 62: Aleuritopteris bicolor. A: Habit, B: Rhizome, C: Stipe base, D: Stipe base scale, E: Frond, F: Pinnae, G, H: Pinnule, I: Indusium, J: Sporangium, K: Spore. ***Scale Bar:*** A, E: 1 cm, B, G, F: 2 mm, C, I: 1 mm, D: 200 µm, H; 3 mm, J: 100 µm, K: 20 µm.

Distribution of *Aleuritopteris formosana* in different bio-geographical zones (A) and different regions (B) of Gujarat.



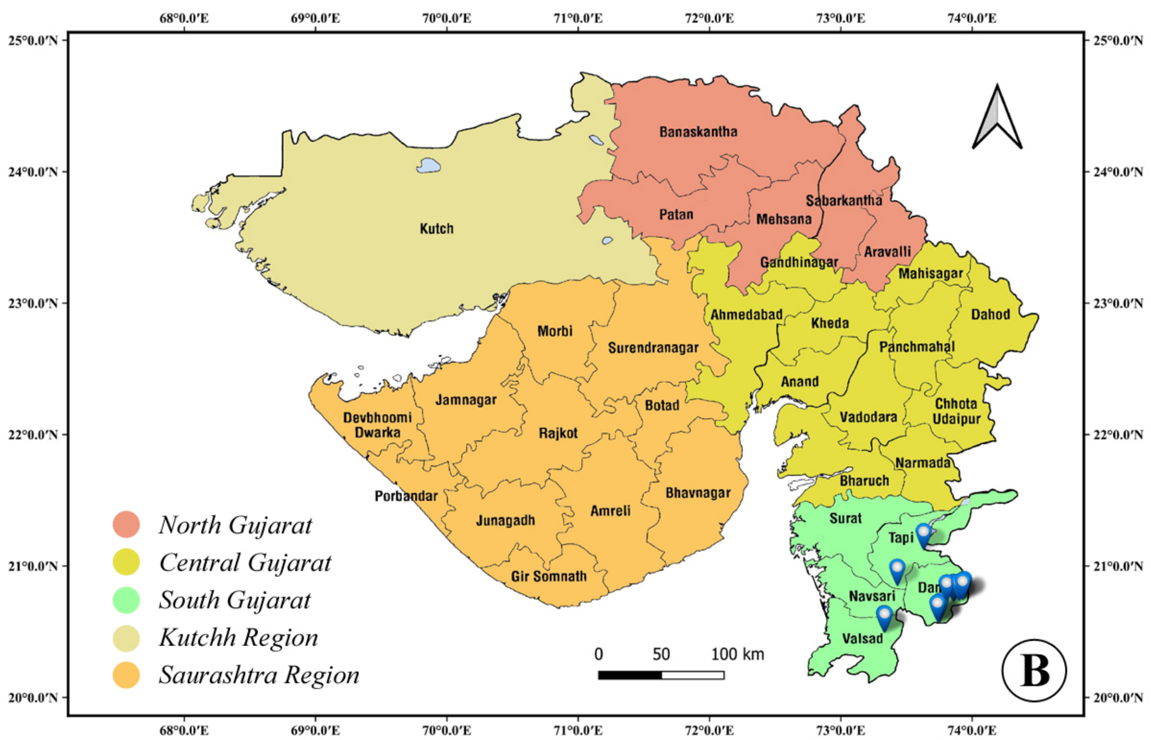


Figure: 63

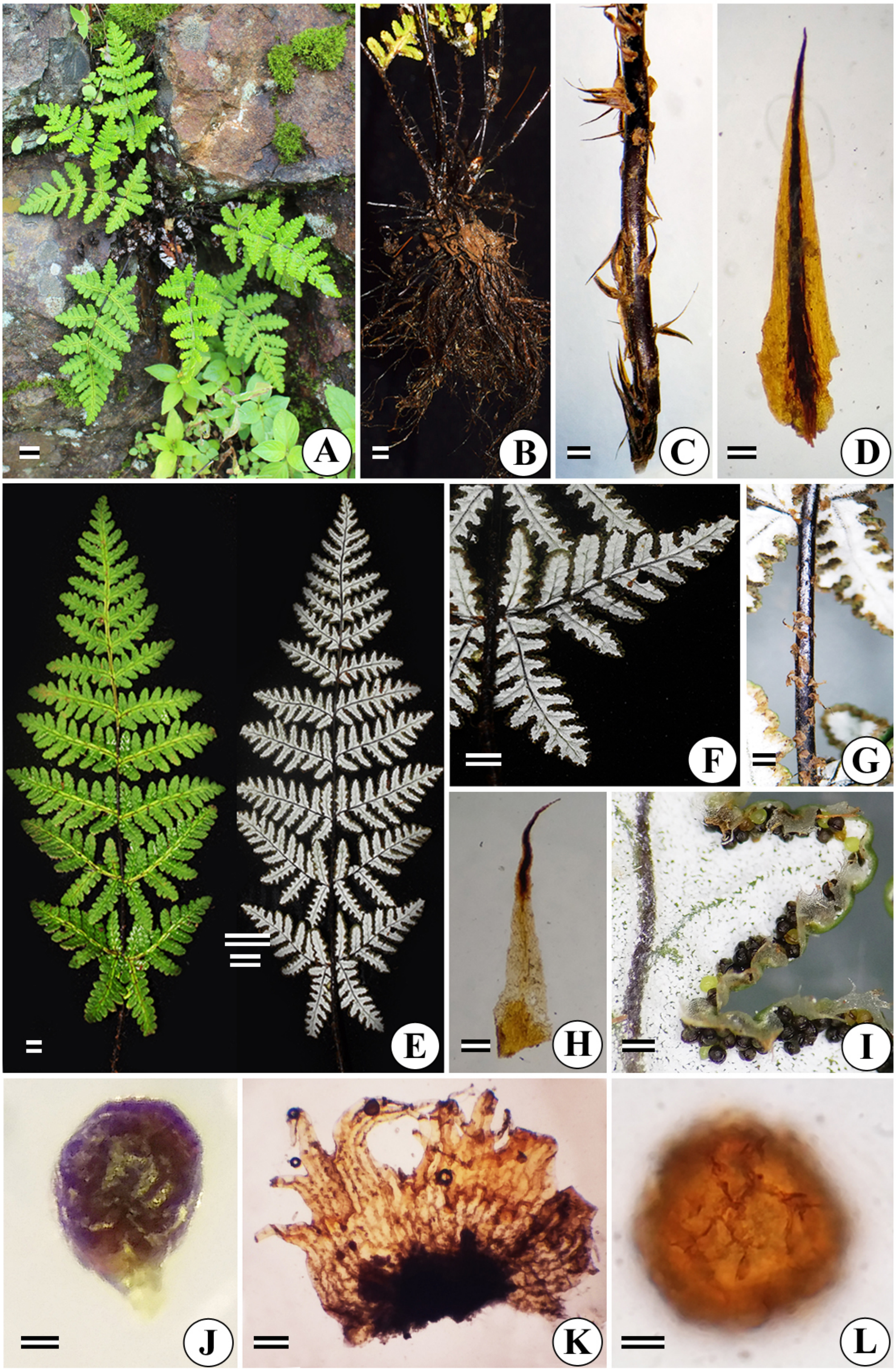
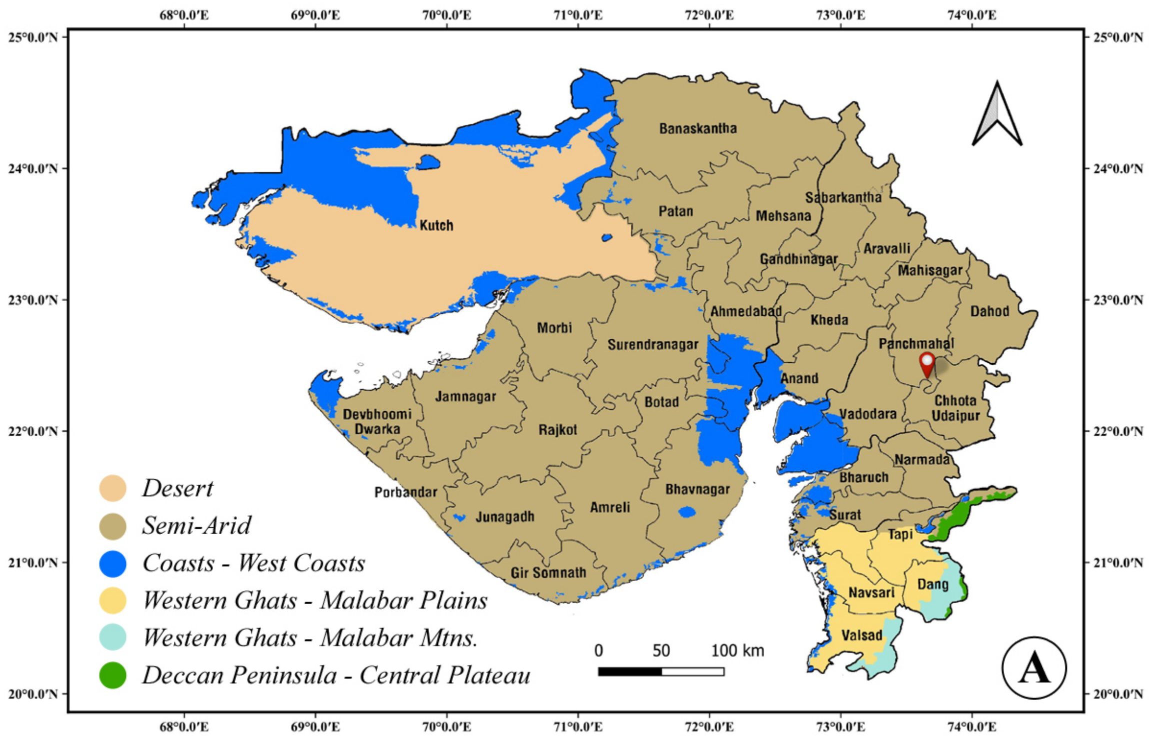


Figure 64: Aleuritopteris formosana. A: Habit, B: Rhizome, C: Stipe, D: Stipe base scale, E: Fronds, F: Pinnae, G: Rachis, H: Rachis scale, I: Sori, J: Sporangium, K: indusium, L: Spore. ***Scale Bar:*** A: 1 cm, B, E, F: 3 mm, C, G: 1mm, D, H, J, K: 100 µm, I: 0.5 mm, L: 10 µm.

Distribution of *Cheilanthes tenuifolia* in different bio-geographical zones (A) and different regions (B) of Gujarat.



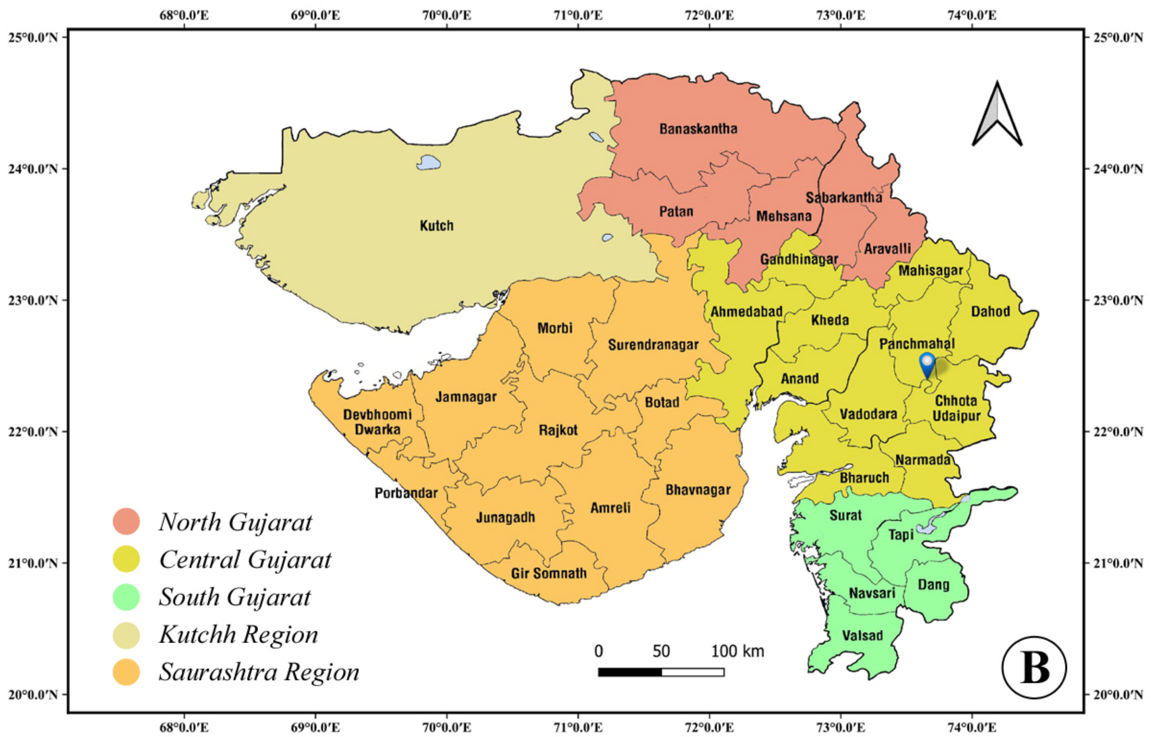


Figure: 65

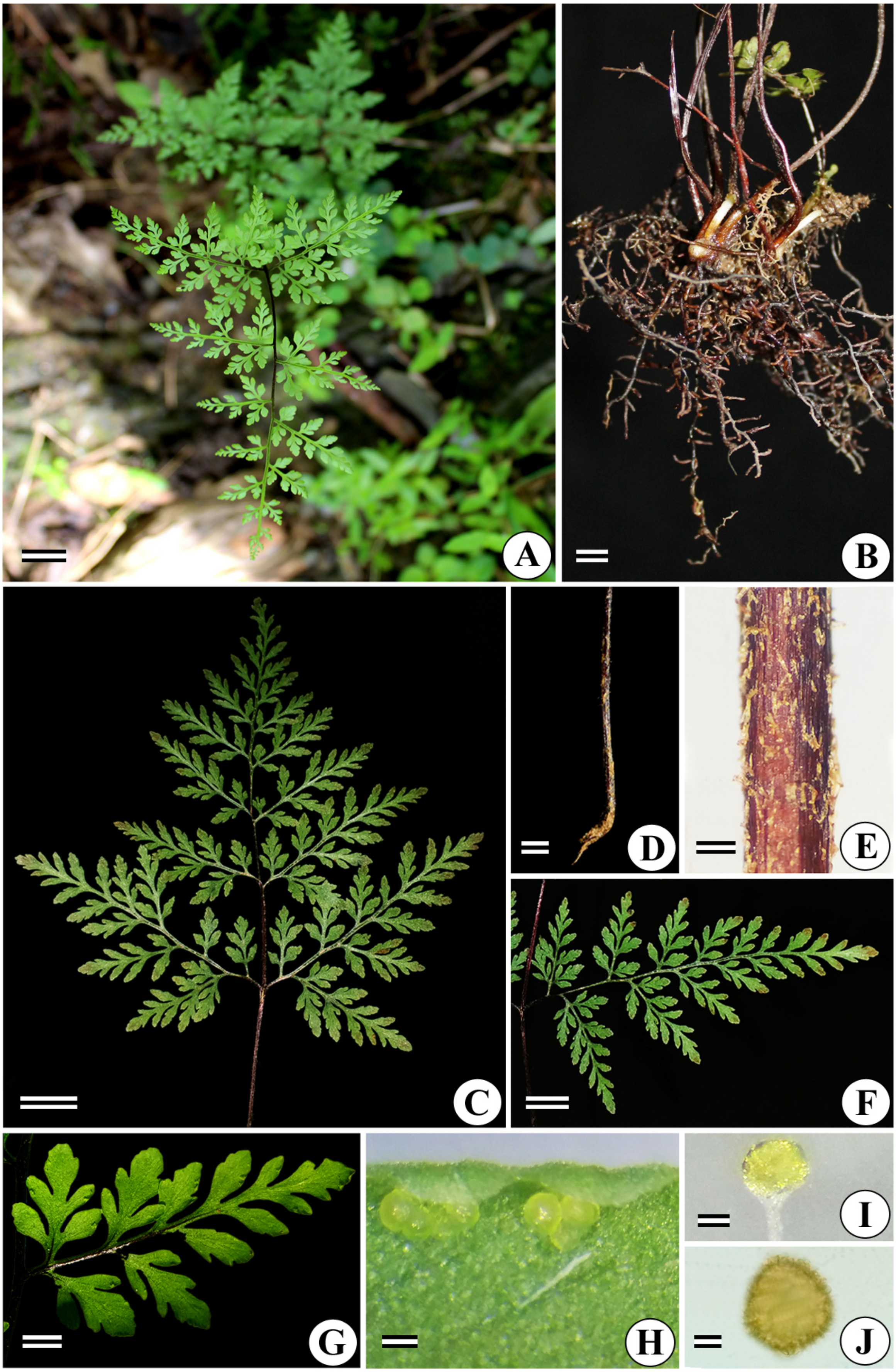
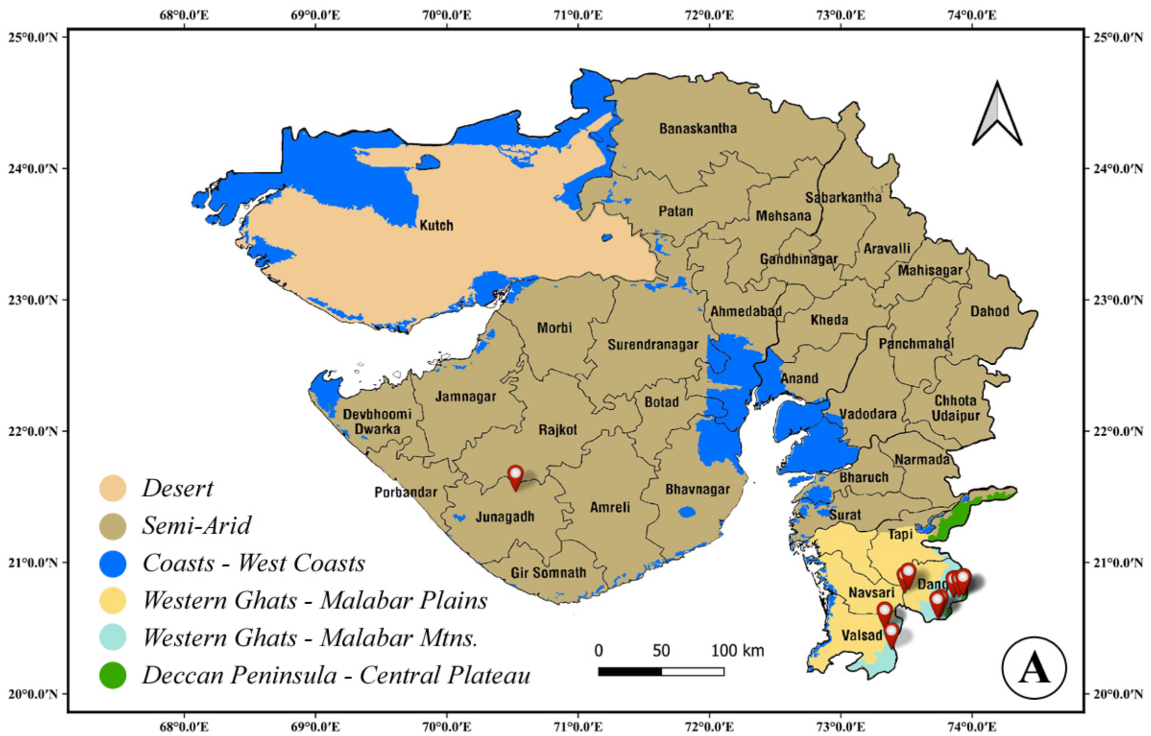


Figure 66: Cheilanthes tenuifolia. A: Habit, B: Rhizome, C: Fronds, D, E: Stipe, F: Pinna, G: Pinnae, H: Sori, I: Sporangium, J: Spore. ***Scale Bar:*** A, C: 2 cm, B: 5 mm, D: 3 mm, E: 0.5 mm, F: 1 cm, G: 0.5 cm, H: 100 µm, I: 50 µm, J: 10 µm.

Distribution of *Athyrium falcatum* in different bio-geographical zones (A) and different regions (B) of Gujarat.



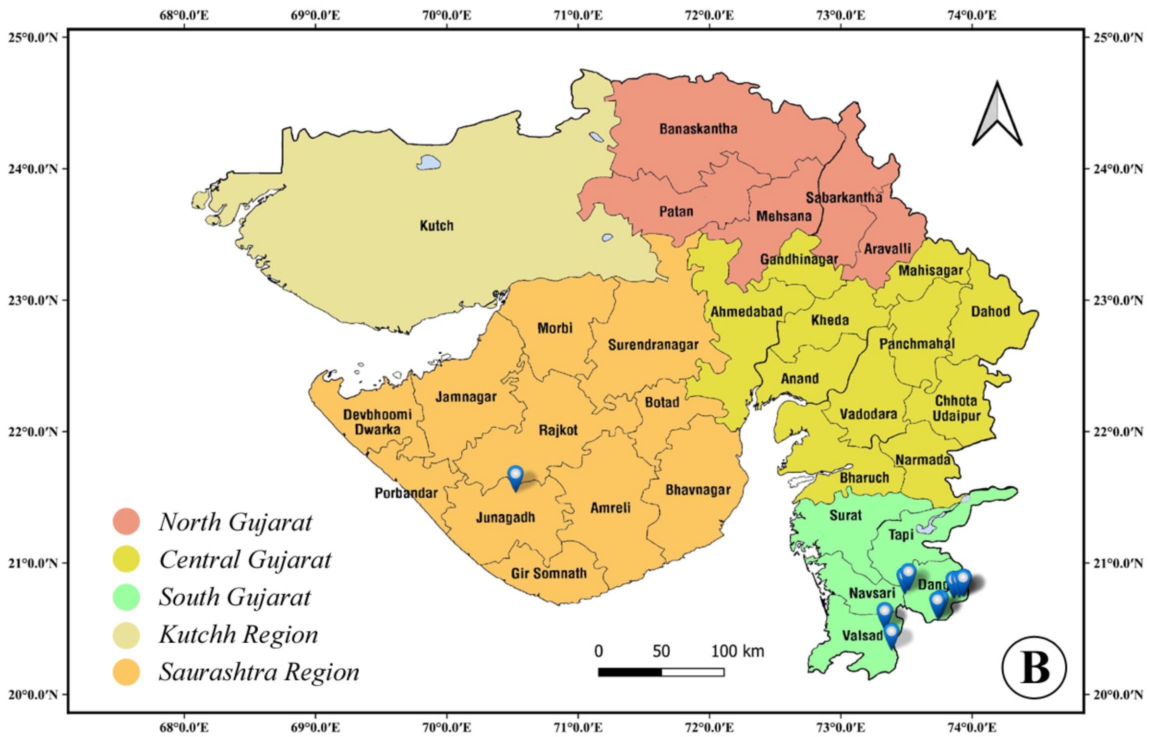


Figure: 67

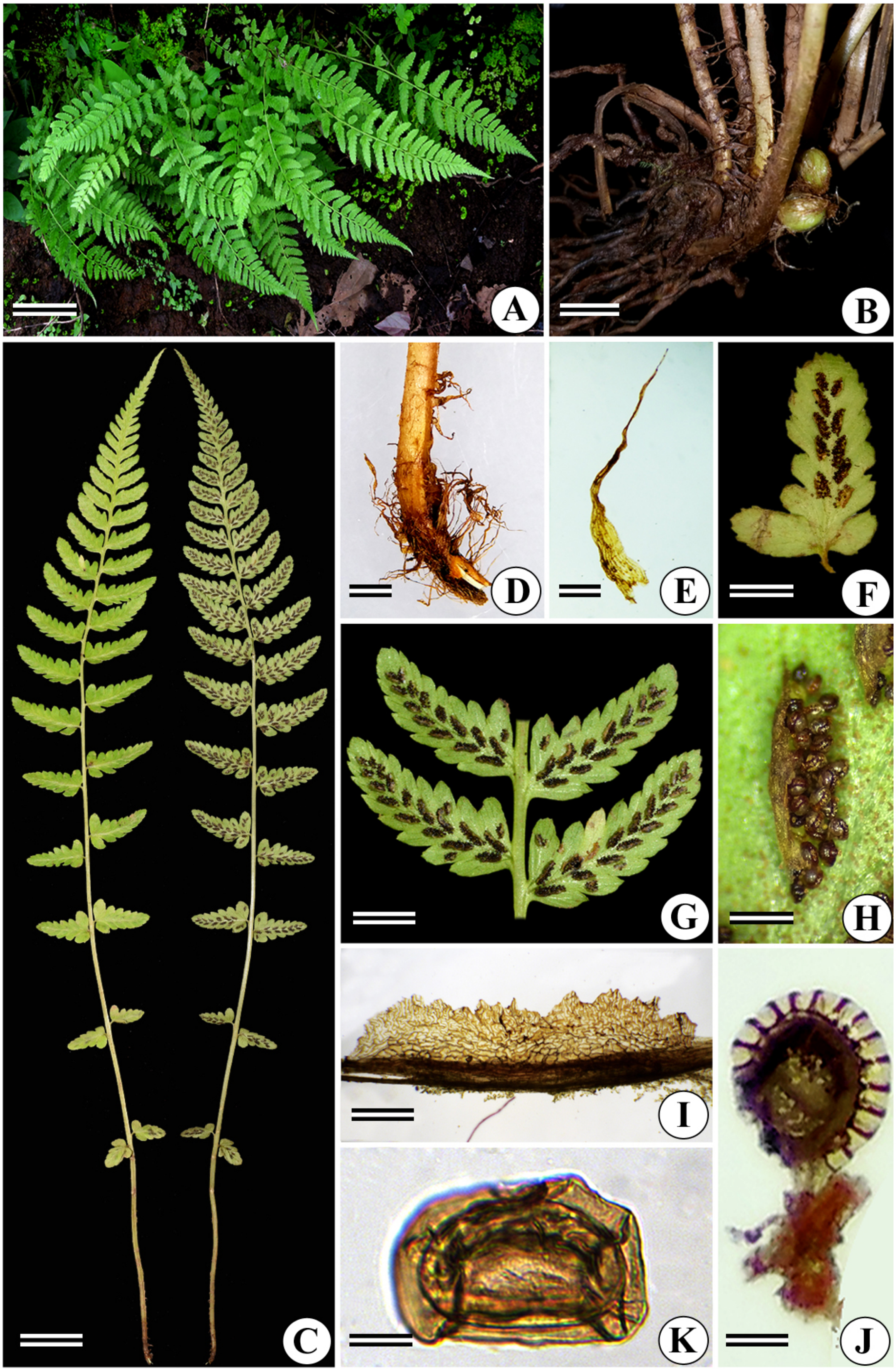
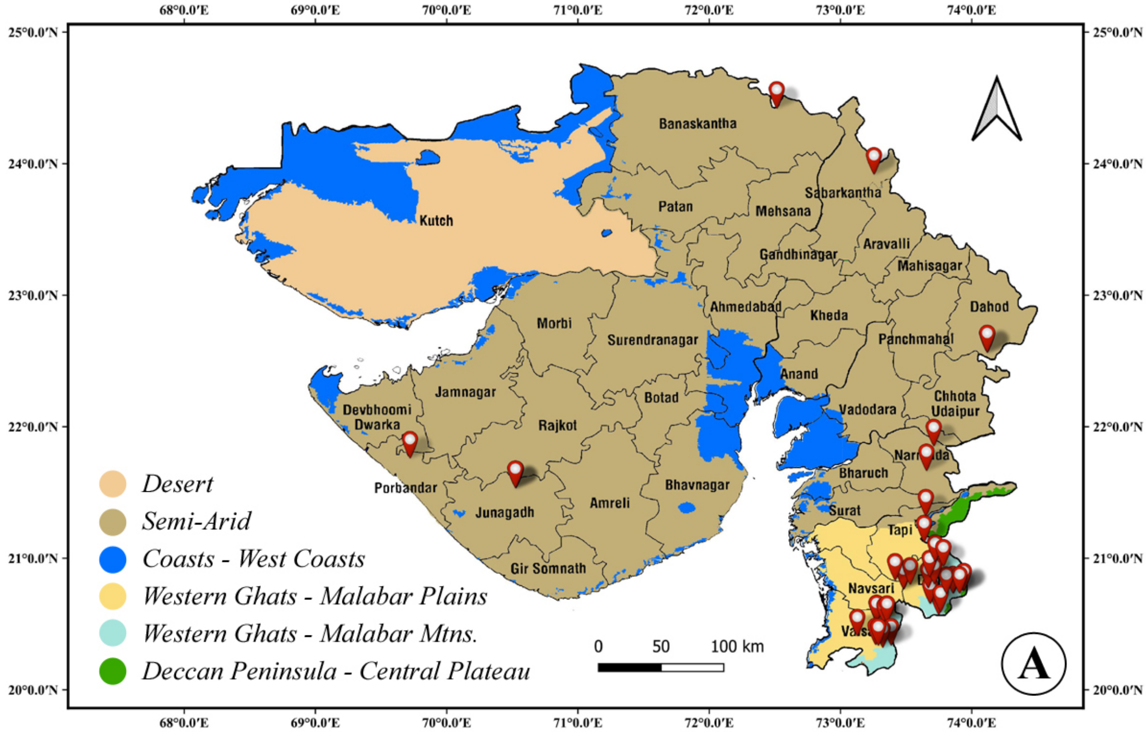


Figure 68: Athyrium falcatum. A: Habit, B: Rhizome, C: Fronds, D: Stipe, E: Scale, F, G: Pinnae, H: Sori, I: Indusium, J: Sporangium, K: Spore. ***Scale Bar:*** A: 15 mm, B: 5 mm, C: 20 mm, D: 3 mm, E: 2 mm, F, G: 10 mm, H: 500 µm, I: 300 µm, J: 100 µm, K: 10 µm.

Distribution of *Athyrium hohenackerianum* in different bio-geographical zones (A) and different regions (B) of Gujarat.



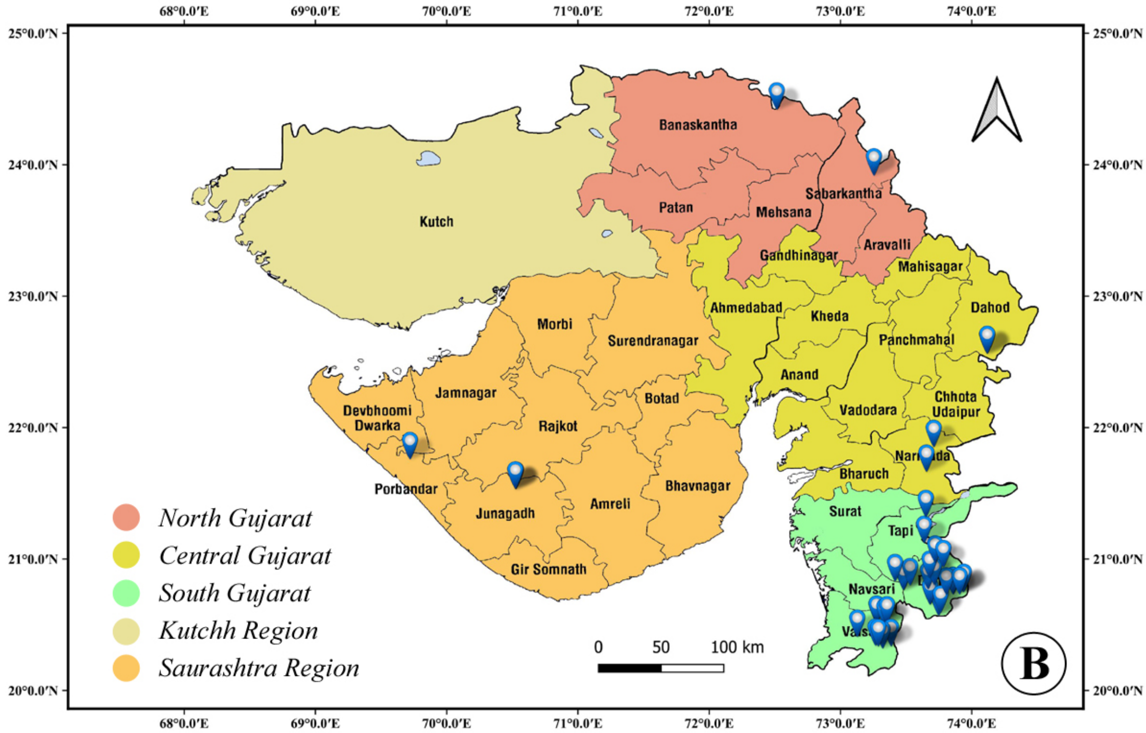


Figure: 69

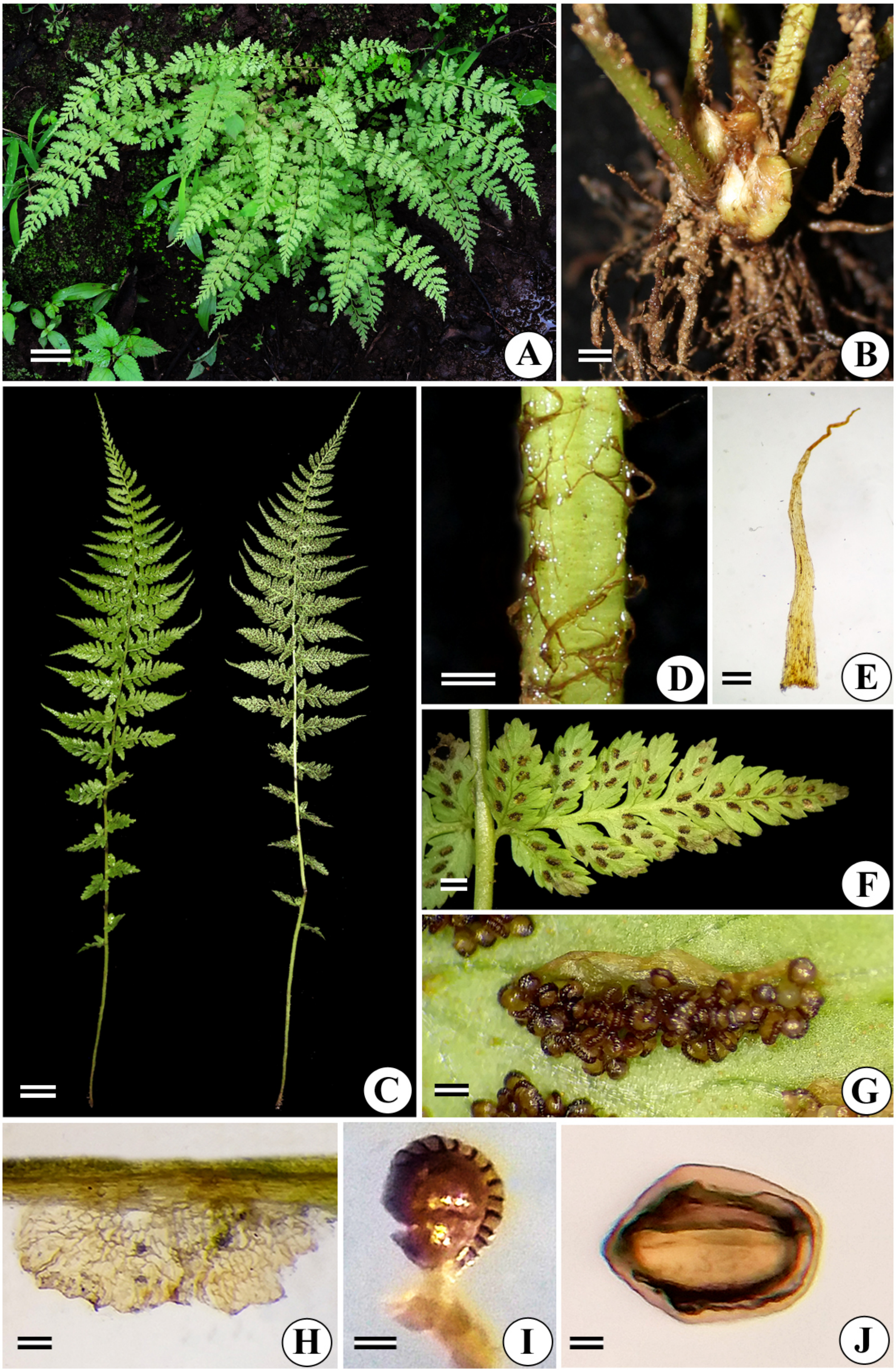
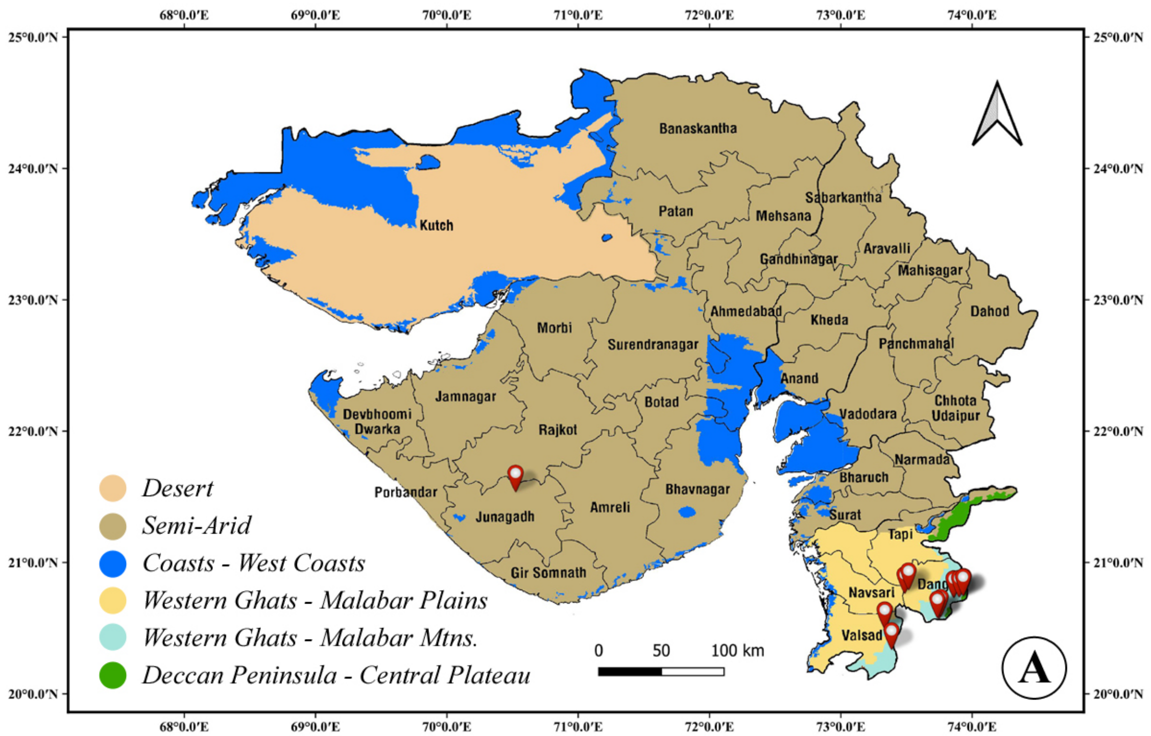


Figure 70: Athyrium hohenackerianum. A: Habit, B: Rhizome, C: Fronds, D: Stipe, E: Scale, F: Pinnae, G: Sori, H: Indusium, I: Sporangium, J: Spore. ***Scale Bar:*** A, C: 3 cm, B, F: 1 mm, D: 0.5 mm, E, H, I: 100 µm, G: 250 µm, J: 10 µm.

Distribution of *Athyrium micropterum* in different bio-geographical zones (A) and different regions (B) of Gujarat.



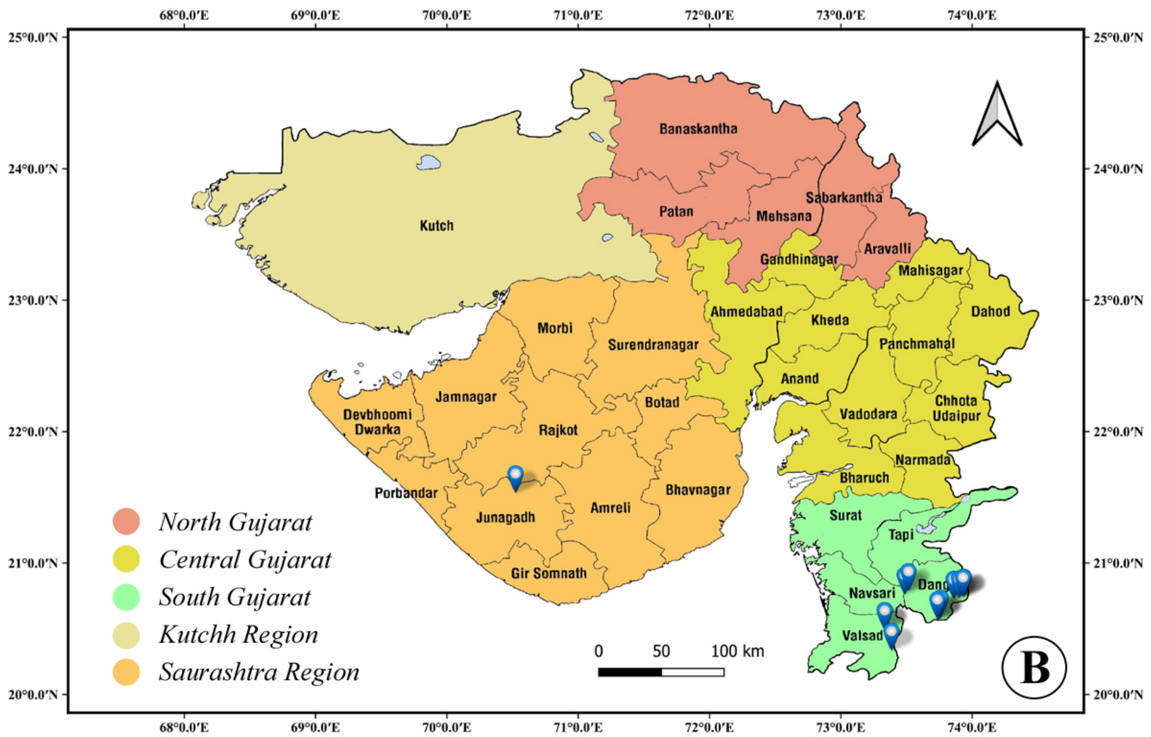


Figure: 71

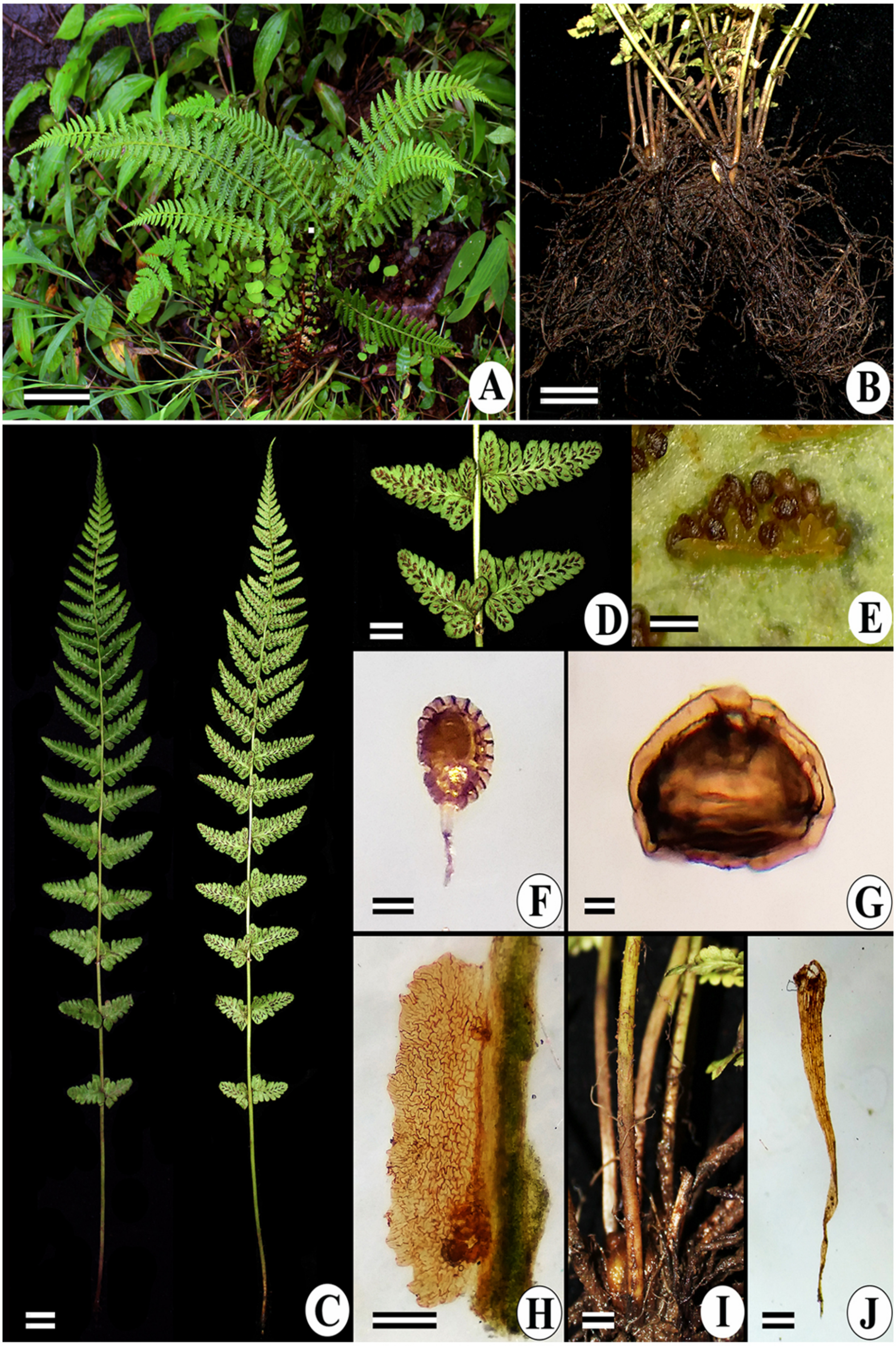
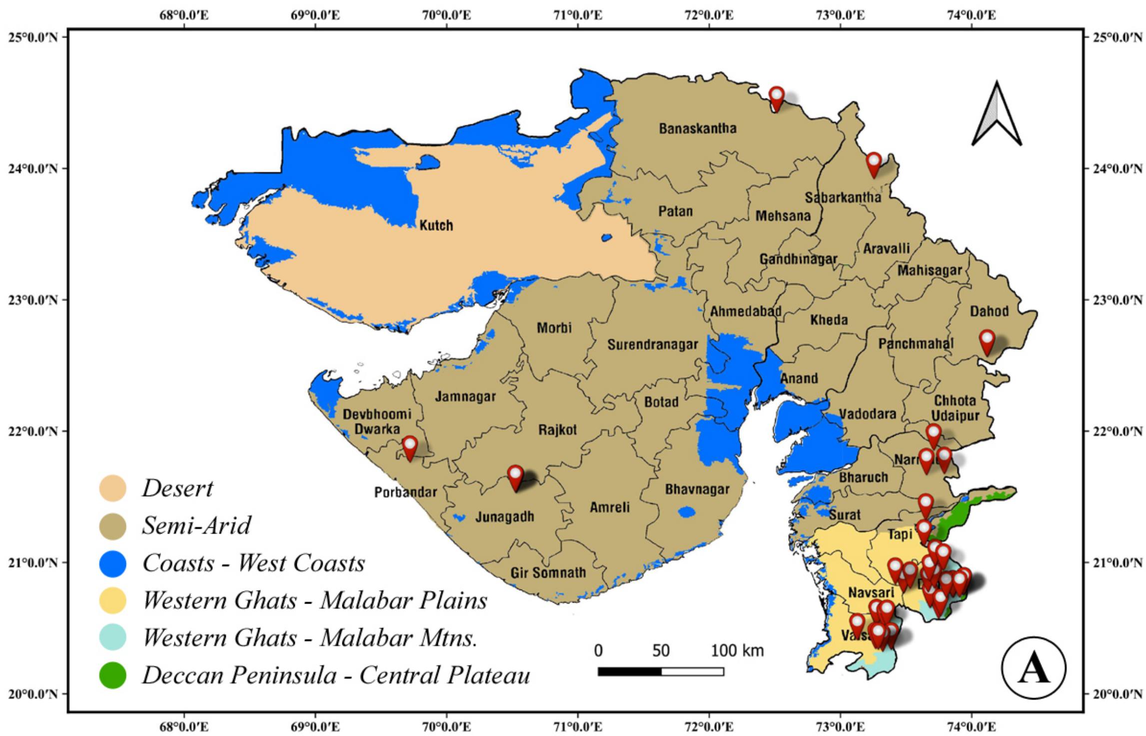


Figure 72: Athyrium micropterum. A: Habit, B: Rhizome, C: Frond, D: Pinnae, E: Sorus, F: Sporangium, G: Spore, H: Indusium, I: Stipe, J: Scale. ***Scale Bar:*** A, C: 2 cm, B, D: 1 cm, E, H, J: 500 µm, F: 100 µm, G: 10 µm,, I: 5 mm.

Distribution of *Athyrium parasnathense* in different bio-geographical zones (A) and different regions (B) of Gujarat.



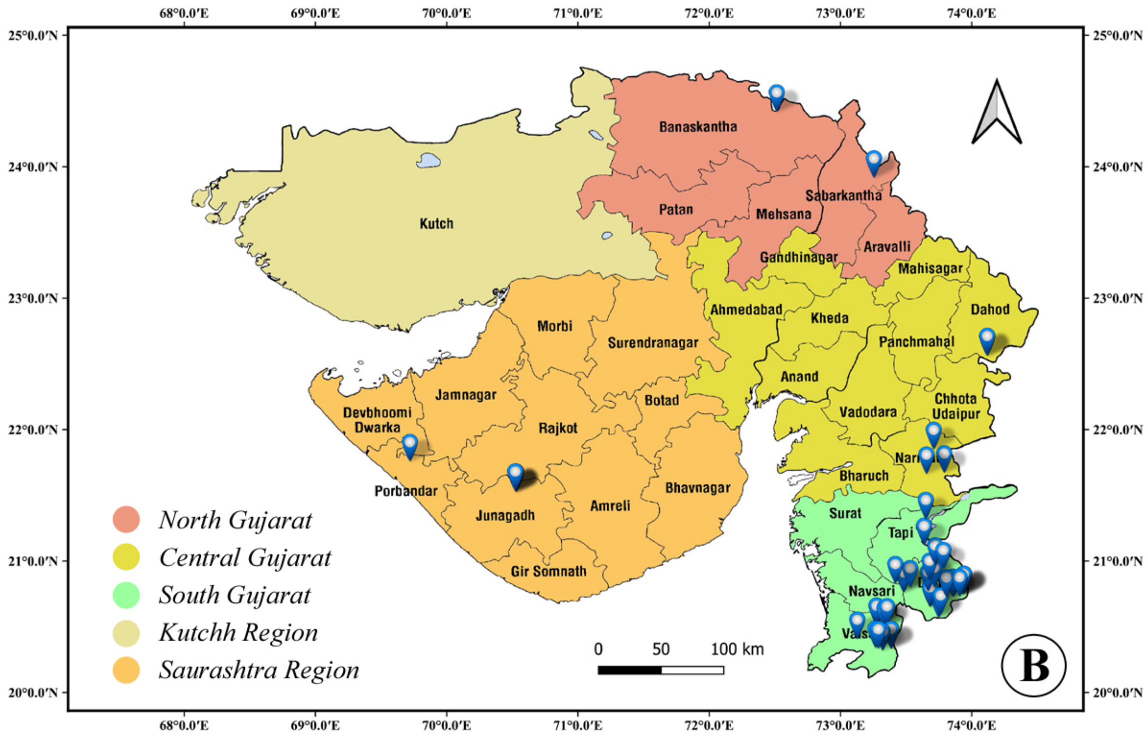


Figure: 73

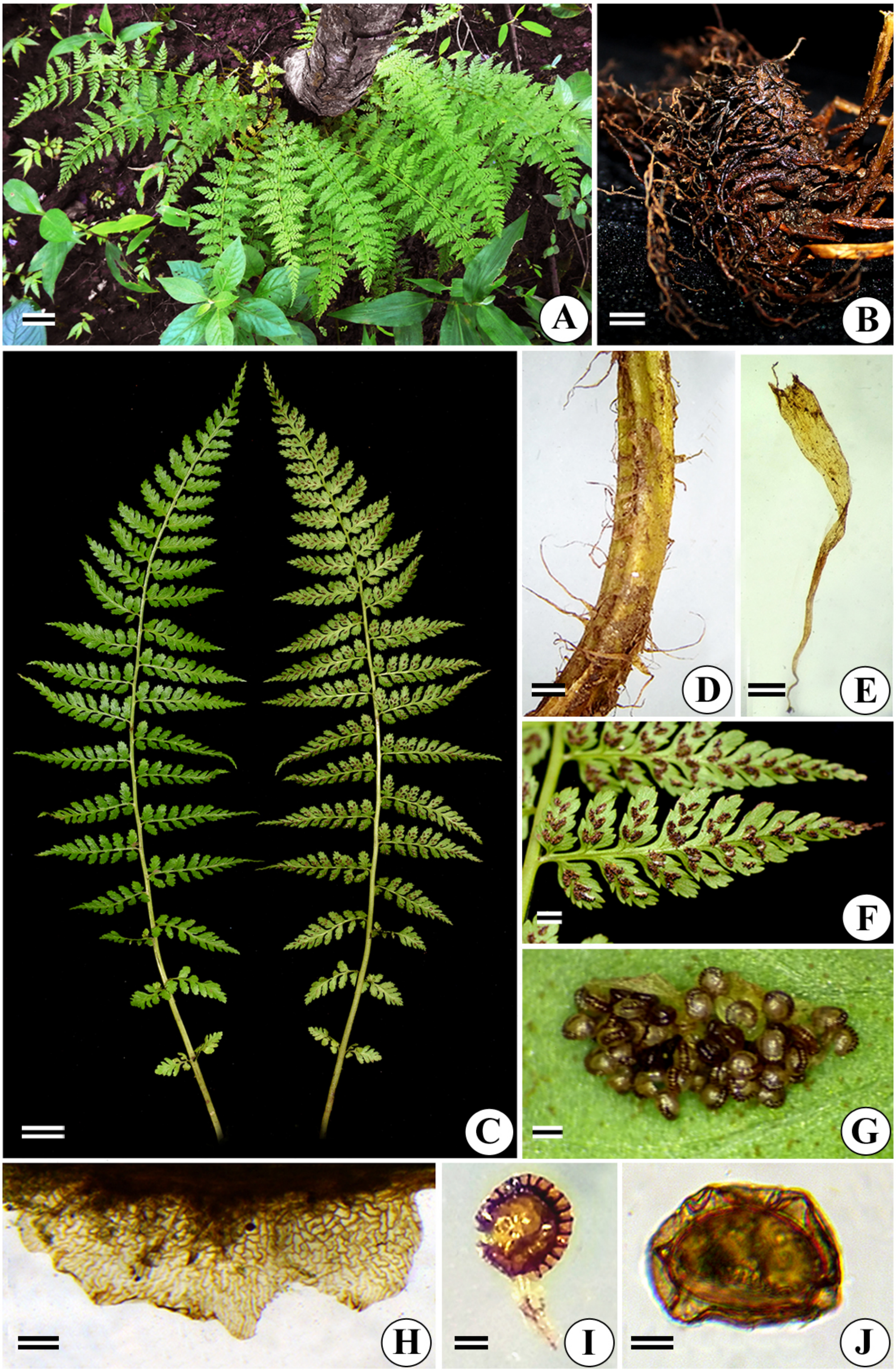
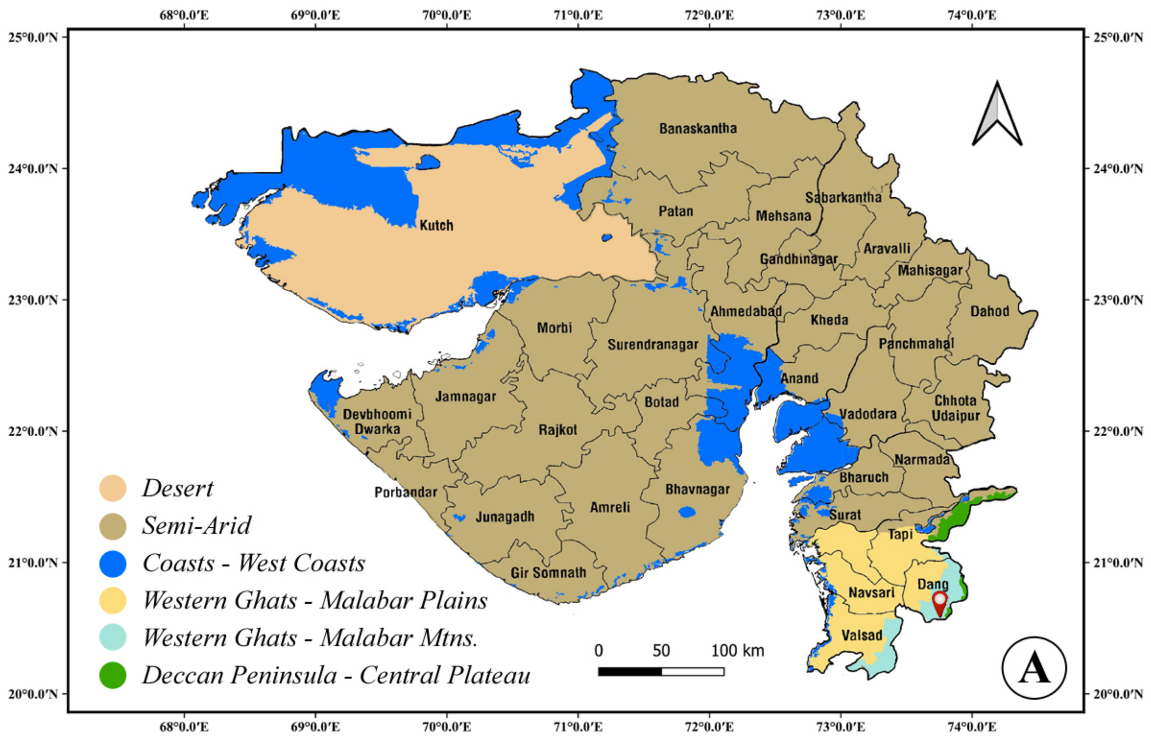


Figure 74: Athyrium parasnathense. A: Habit, B: Rhizome, C: Fronds, D: Stipe, E: Scale, F: Pinnae, G: Sori, H: Indusium, I: Sporangium, J: Spore. ***Scale Bar:*** A: 5 cm, B, F: 2 mm, C: 1 cm, D, H: 0.5 mm, E, I: 100 µm, G: 200 µm, J: 10 µm.

Distribution of *Athyrium schimperi* subsp. *biserrulatum* in different bio-geographical zones (A) and different regions (B) of Gujarat.



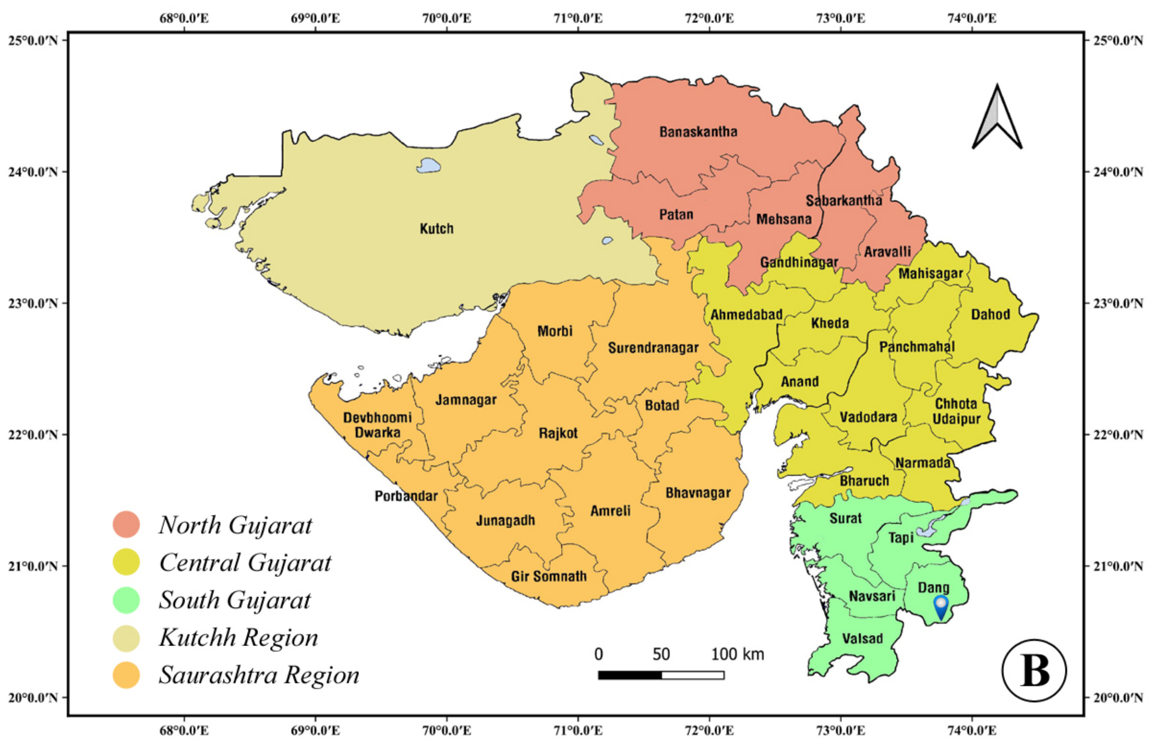


Figure: 75

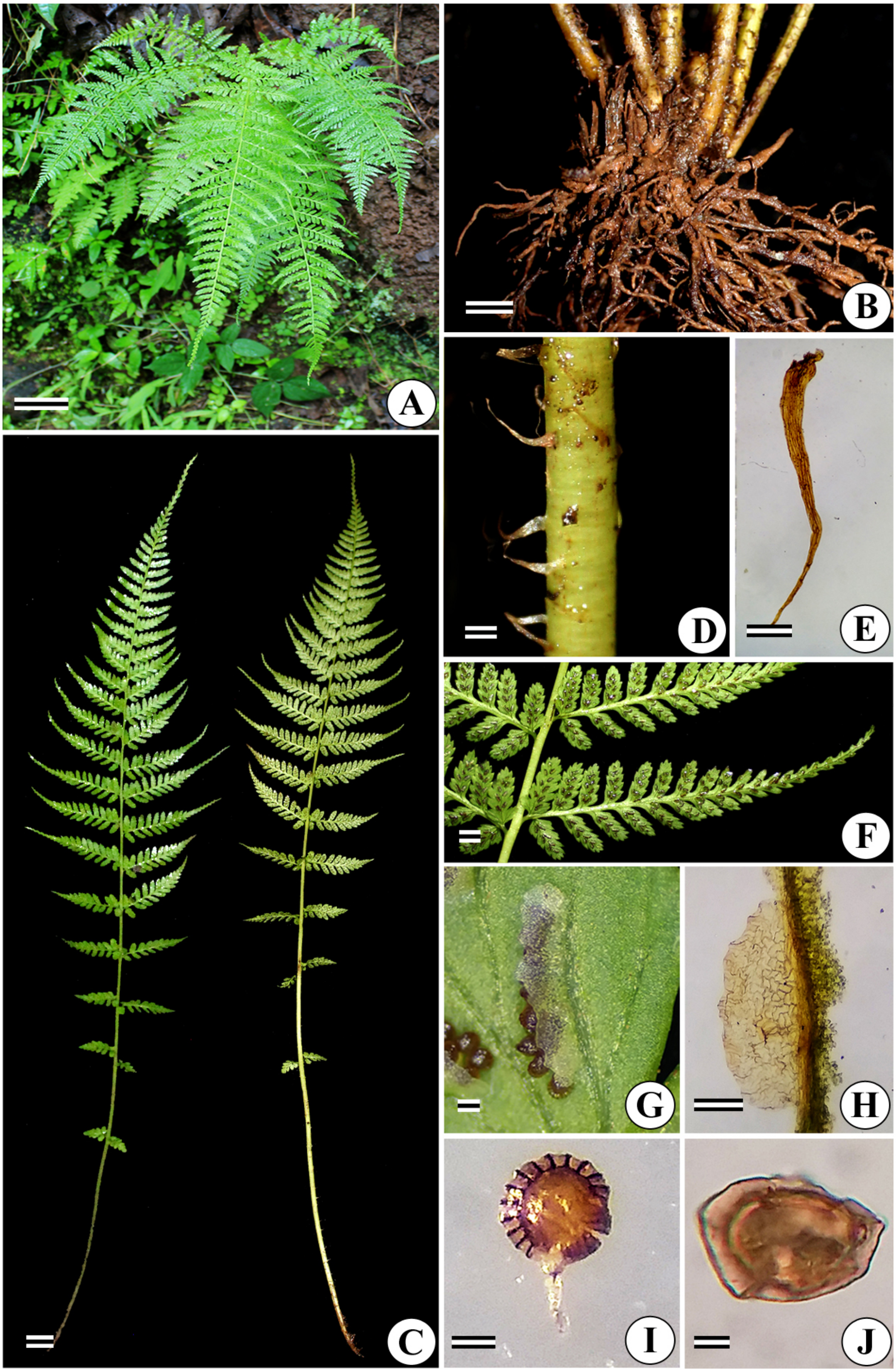
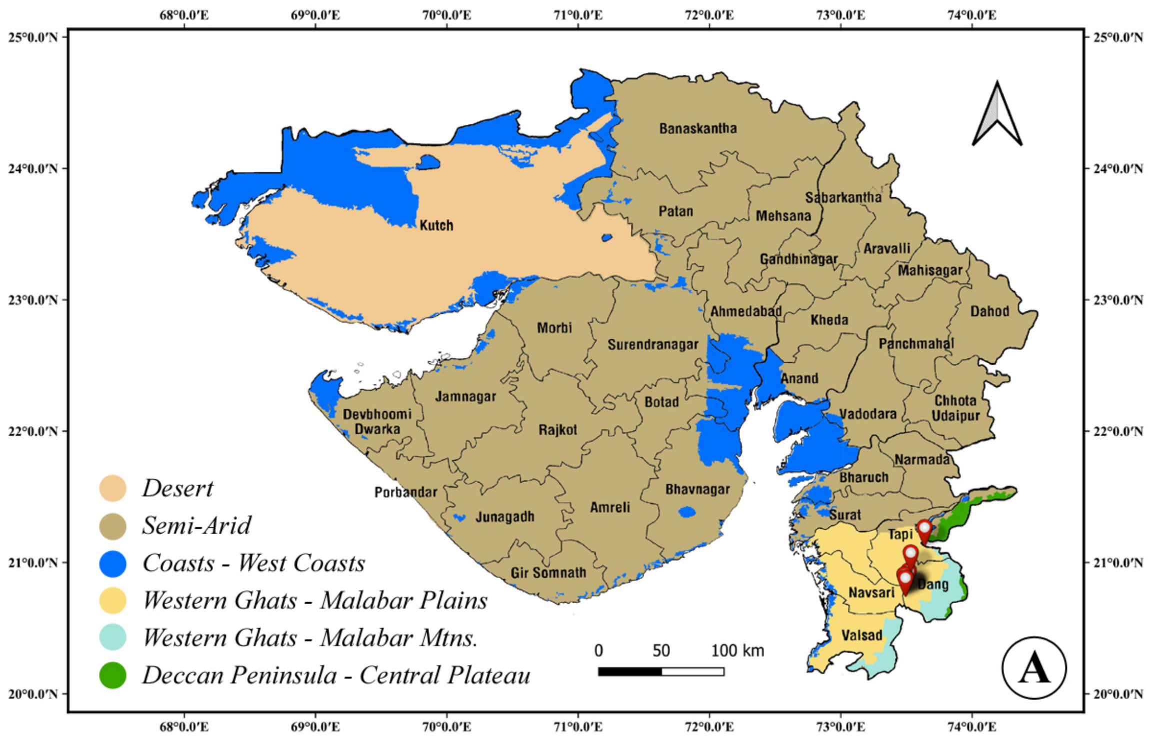


Figure 76: Athyrium schimperi* subsp. *biserrulatum . A: Habit, B: Rhizome, C: Frond, D: Stipe, E: Scale, F: Pinnae, G: Sorus, H: Indusium, I: Sporangium, J: Spore. ***Scale Bar:*** A: 5 cm, B: 2 mm, C, D: 500 µm, E-G, I: 200 µm, H: 400 µm, J: 10 µm.

Distribution of *Thelypteris dentata* in different bio-geographical zones (A) and different regions (B) of Gujarat.



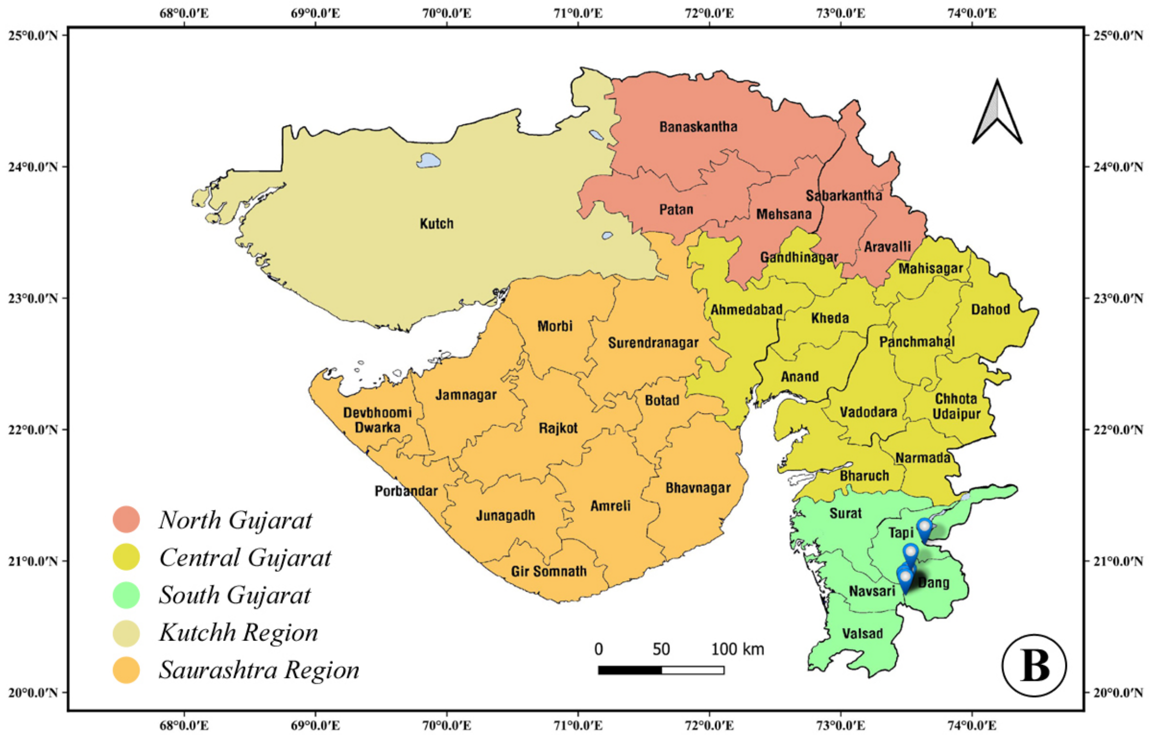


Figure: 77

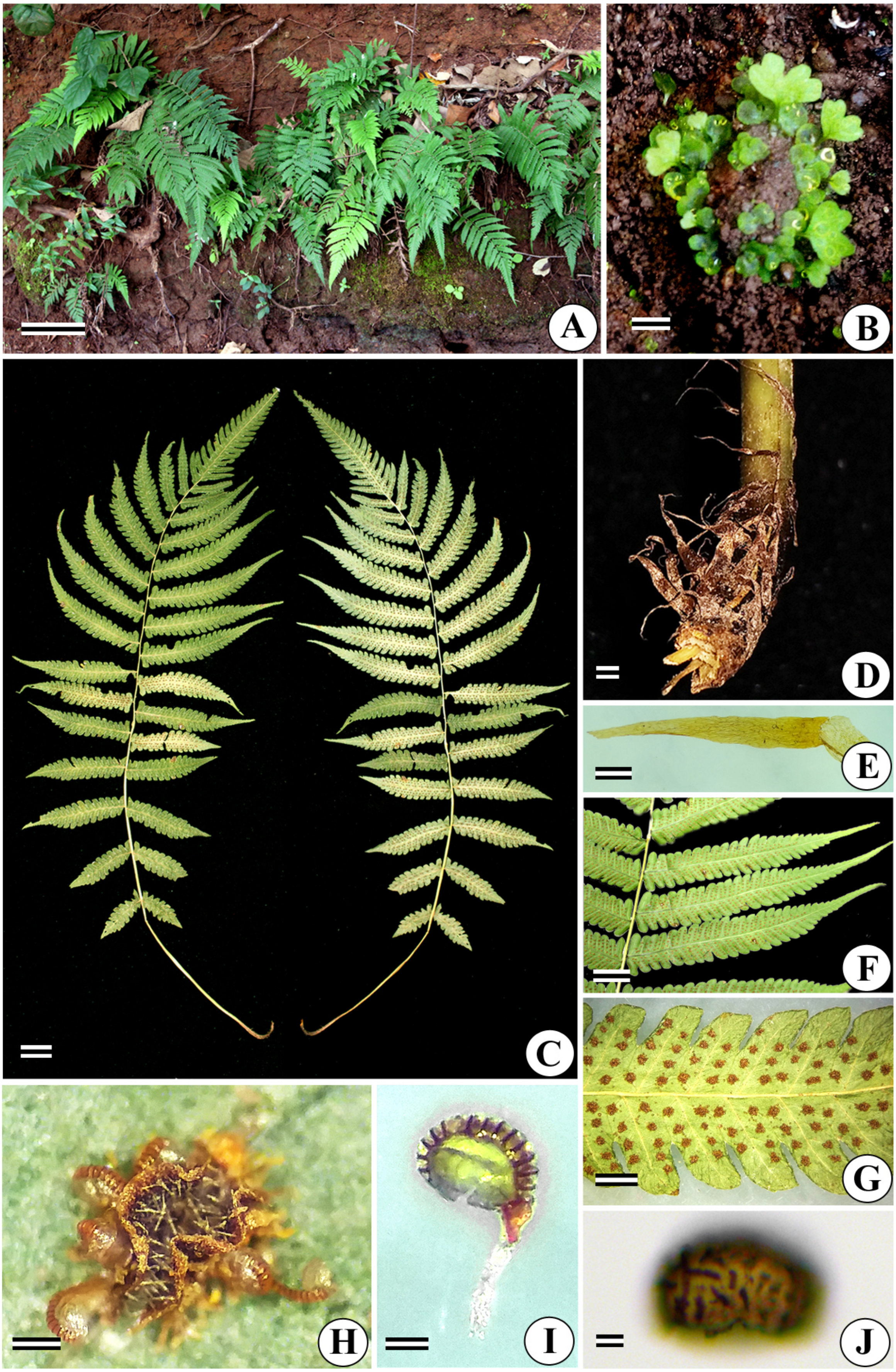
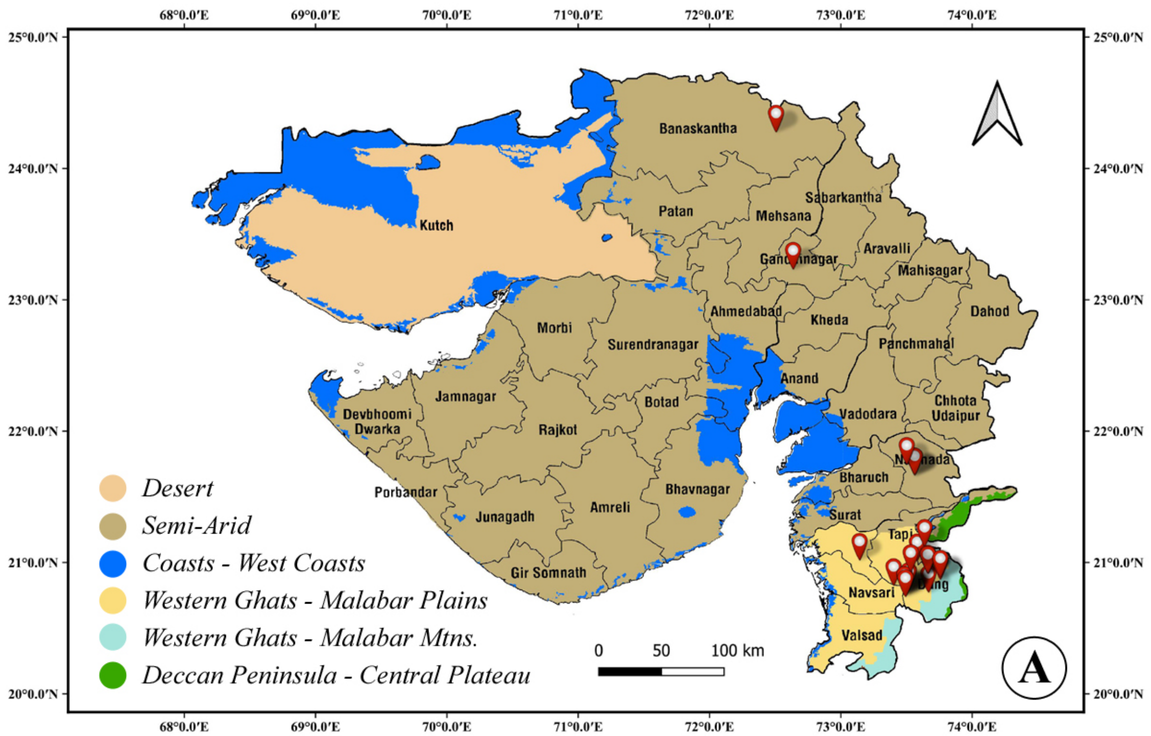


Figure 78: Thelypteris dentata. A: Habit, B: Gametophytes, C: Fronds, D: Stipe base, E: Scale, F: Pinnae, G: Sori, H: Sorus, I: Sporangium, J: Spore. ***Scale Bar:*** A: 15 cm, B, D: 2 mm, C: 3 cm, E: 1 mm, F: 2 cm, G: 5 mm, H: 200 μm, I: 100 μm, J: 10 μm.

Distribution of *Thelypteris prolifera* in different bio-geographical zones (A) and different regions (B) of Gujarat.



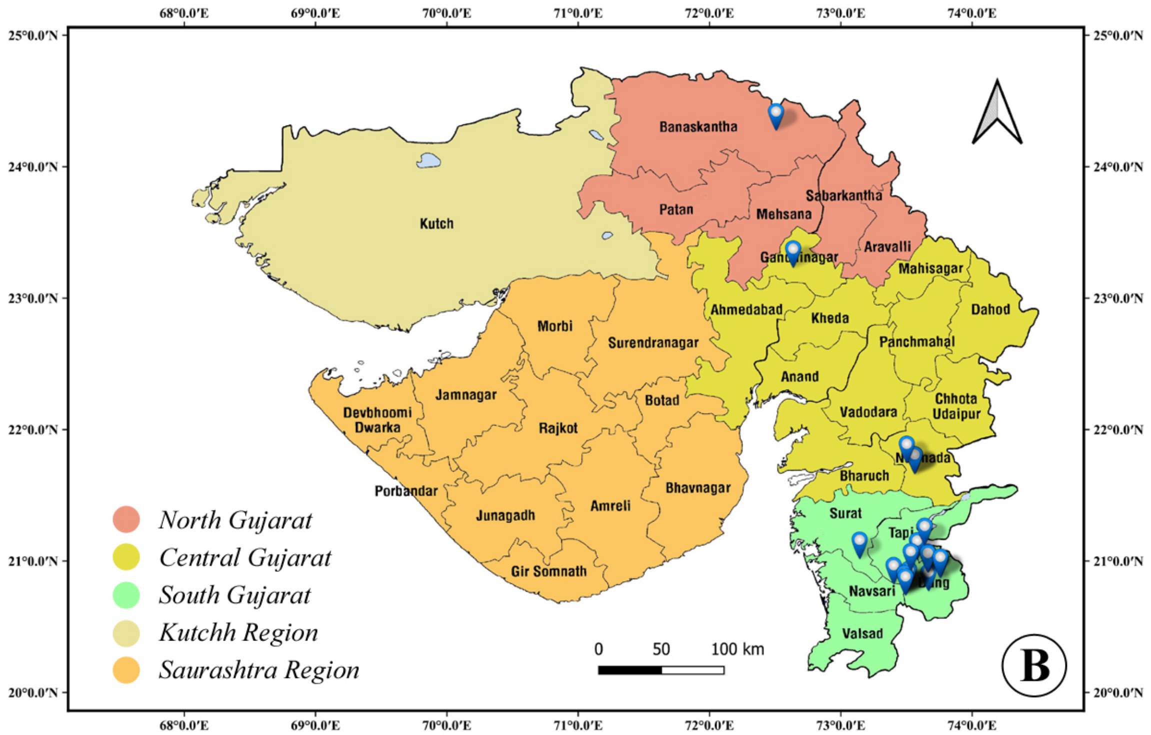


Figure: 79

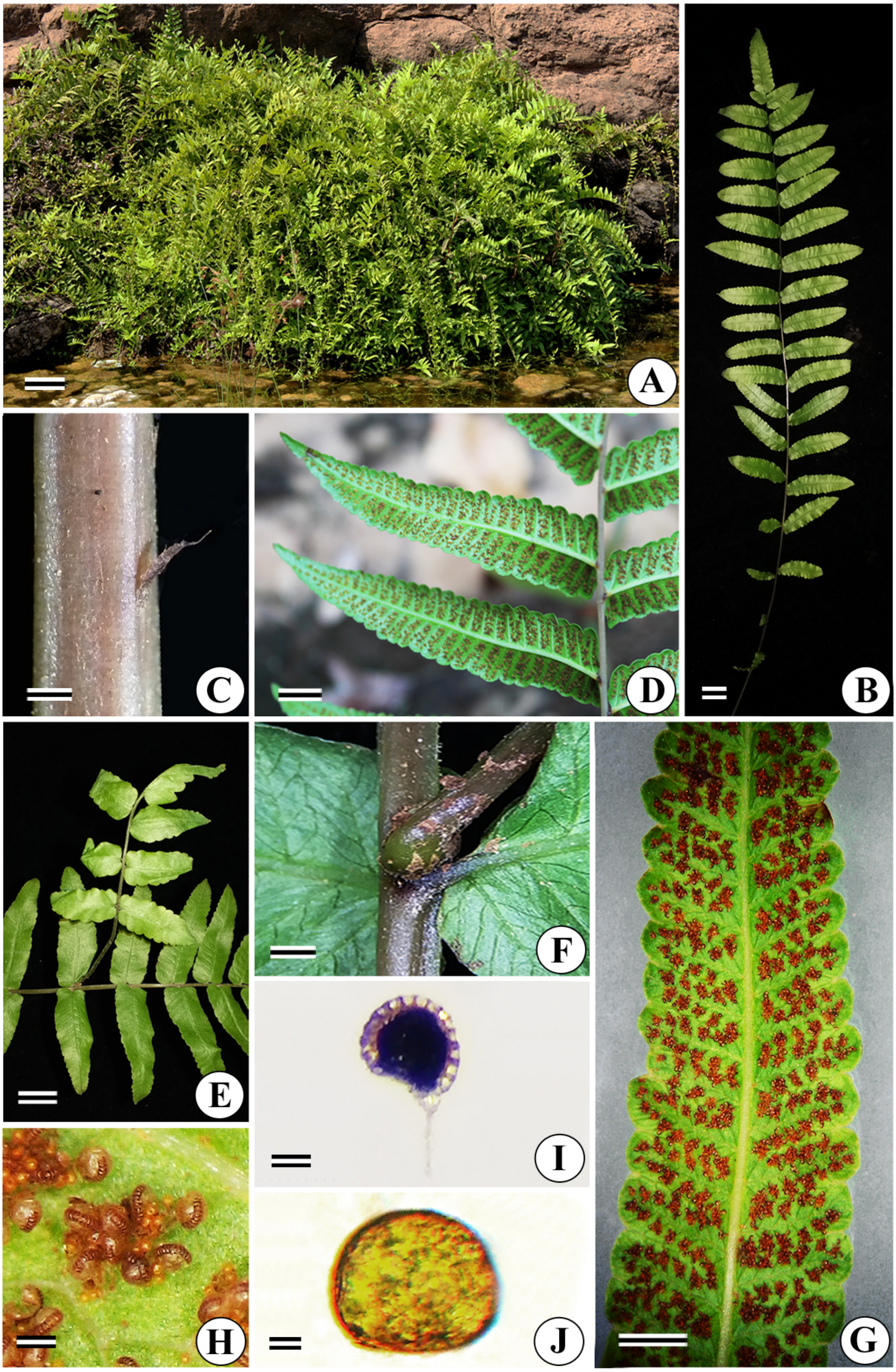


Figure 80: Thelypteris prolifera. A: Habit, B: Frond, C: Stipe, D: Rachis & pinnae, E, F: Vegetatively proliferating buds, G: Pinnae, H: Sori, I: Sporangium, J: Spore. ***Scale Bar:*** A: 20 cm, B, E: 2 cm, C: 1 mm, D, G: 1 cm, F: 2 mm, H: 500 μm, I: 100 μm, J: 10 μm.

Distribution of *Hypodematium crenatum* subsp. *crenatum* in different bio-geographical zones (A) and different regions (B) of Gujarat.

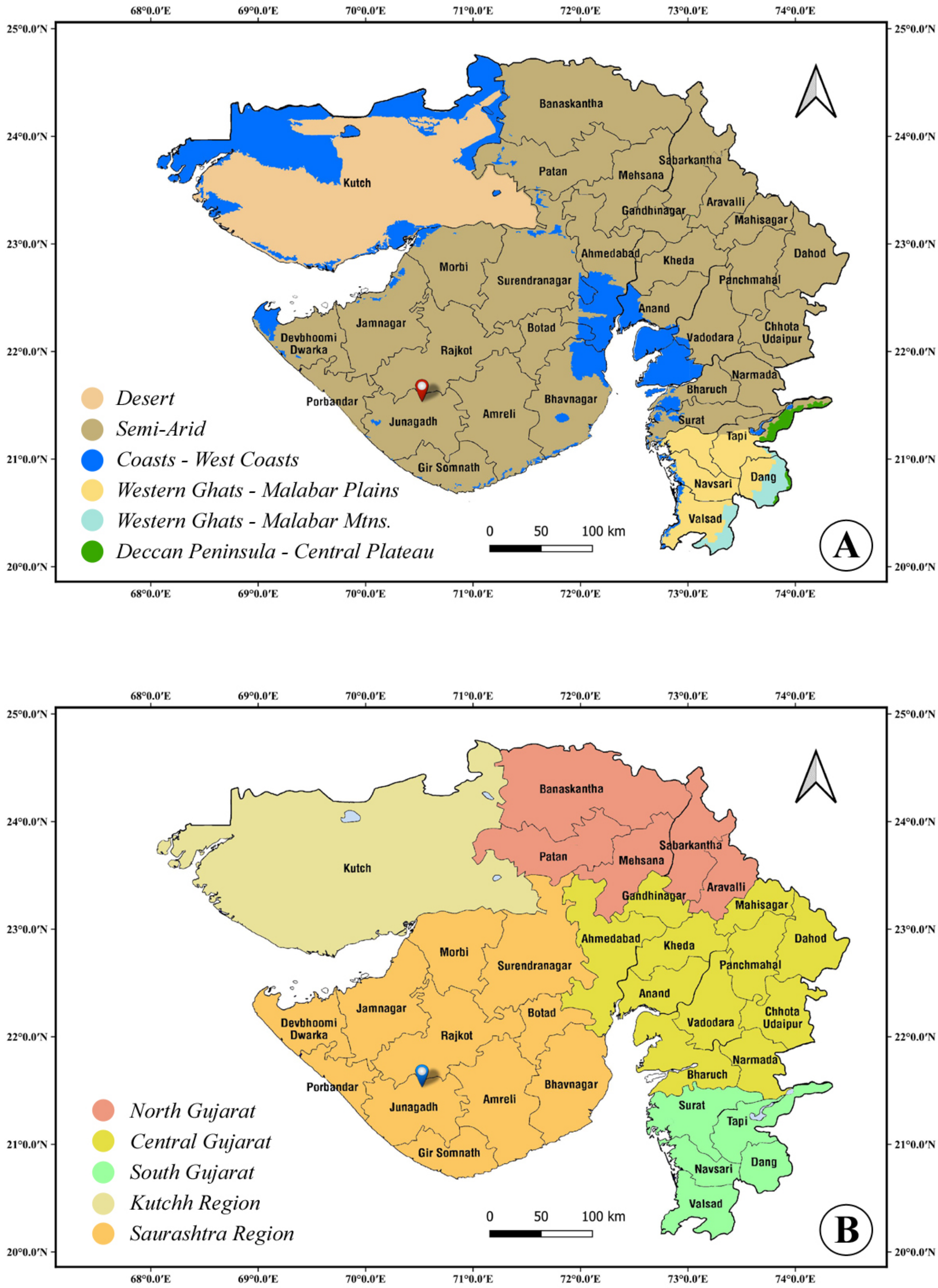


Figure: 81

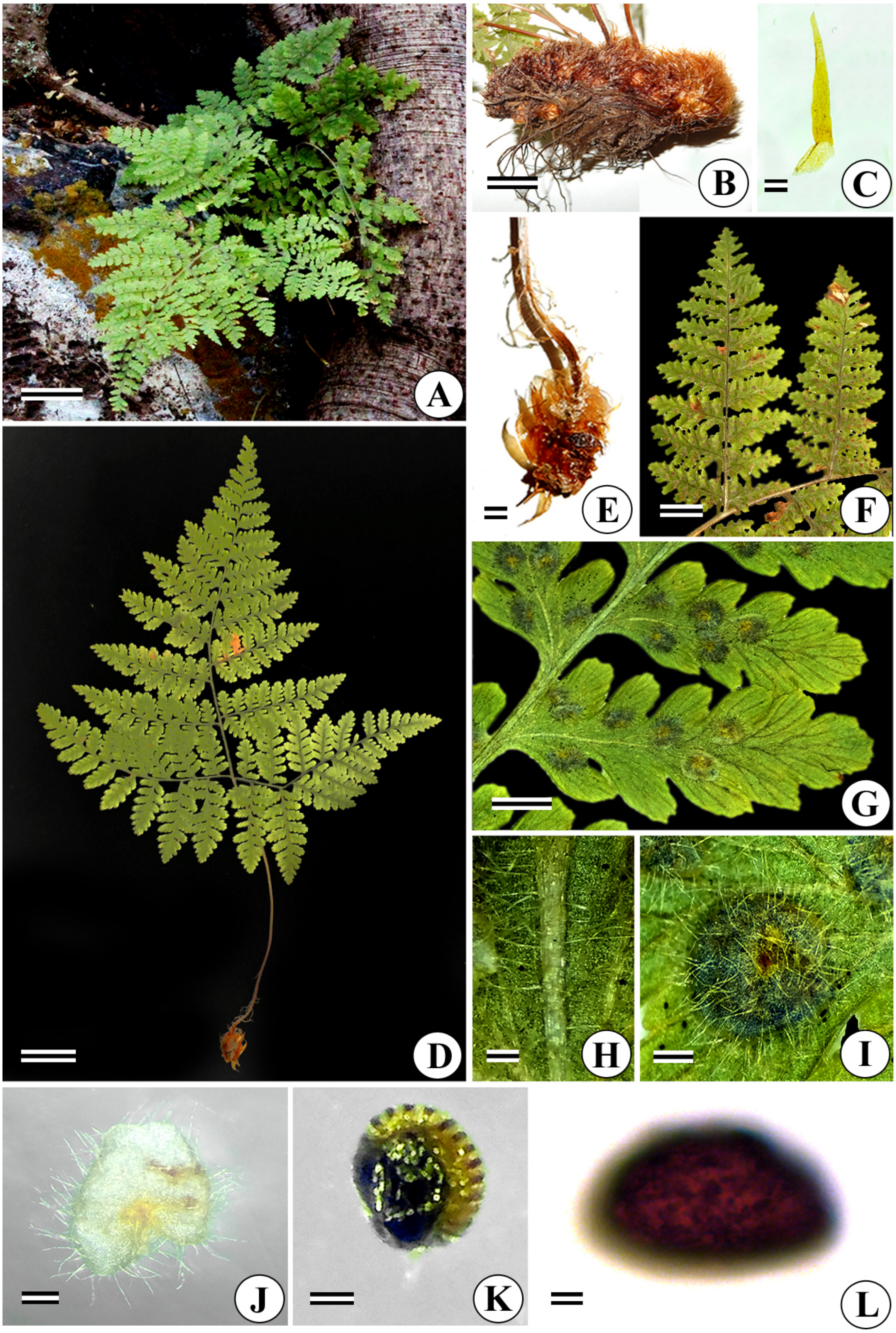
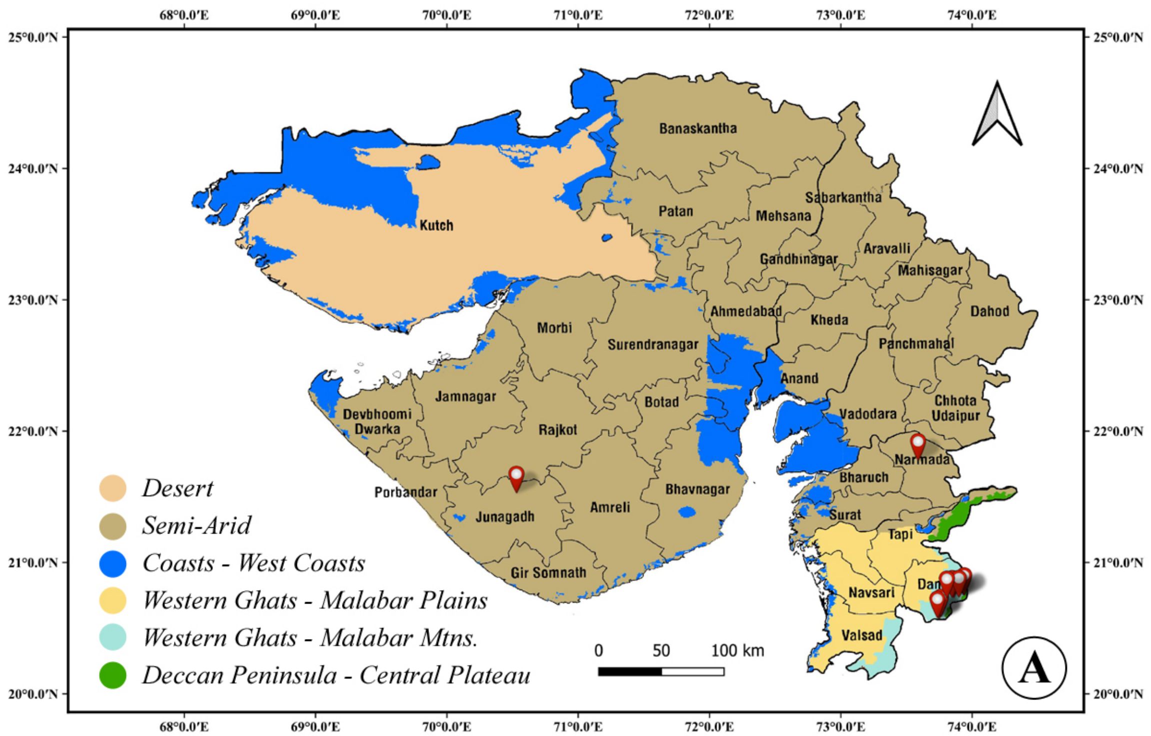


Figure 82: Hypodematium crenatum* subsp. *crenatum. A: Habit, B: Rhizome, C: Rhizome scale, D: Frond, E: Stipe, F: Pinnae, G: Pinnules, H: Costules, I: Sori, J: Indusium, K: Sporangium, L: Spore. ***Scale Bar:*** A: 3 cm, B: 1 cm, C: 100 µm, D, G: 2 mm, F: 5 mm, H: 1 mm, I, J: 200 µm, K: 50 µm, L: 10 µm.

Distribution of *Tectaria coadunata* in different bio-geographical zones (A) and different regions (B) of Gujarat.



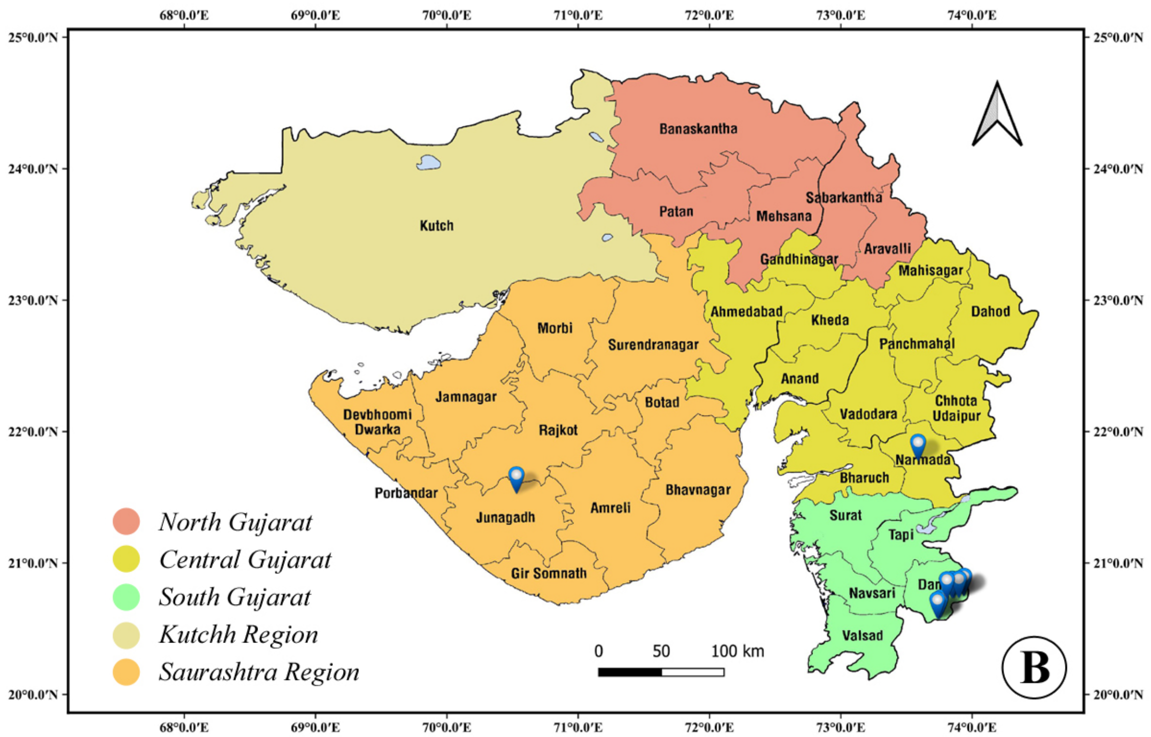


Figure: 83

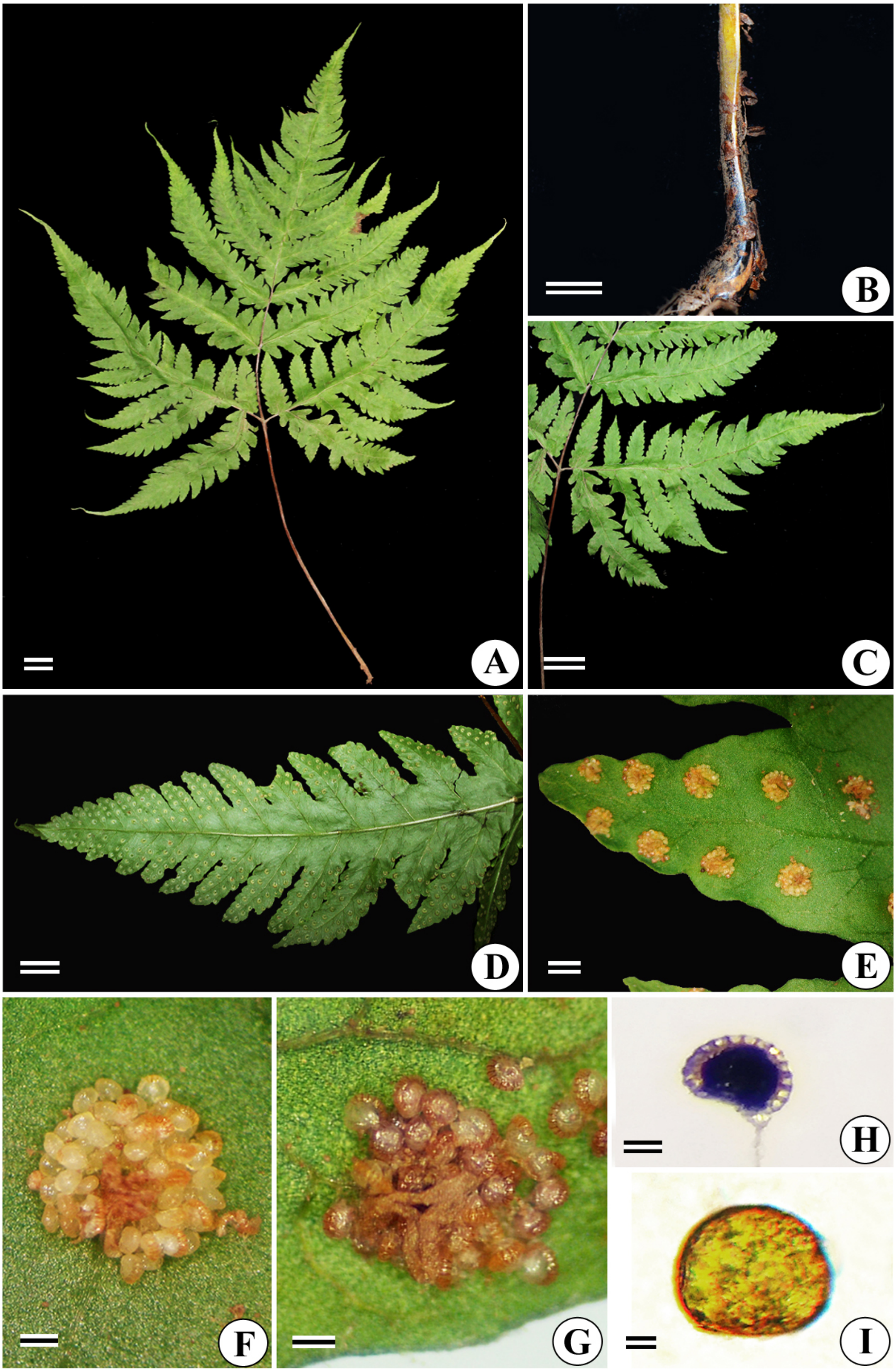
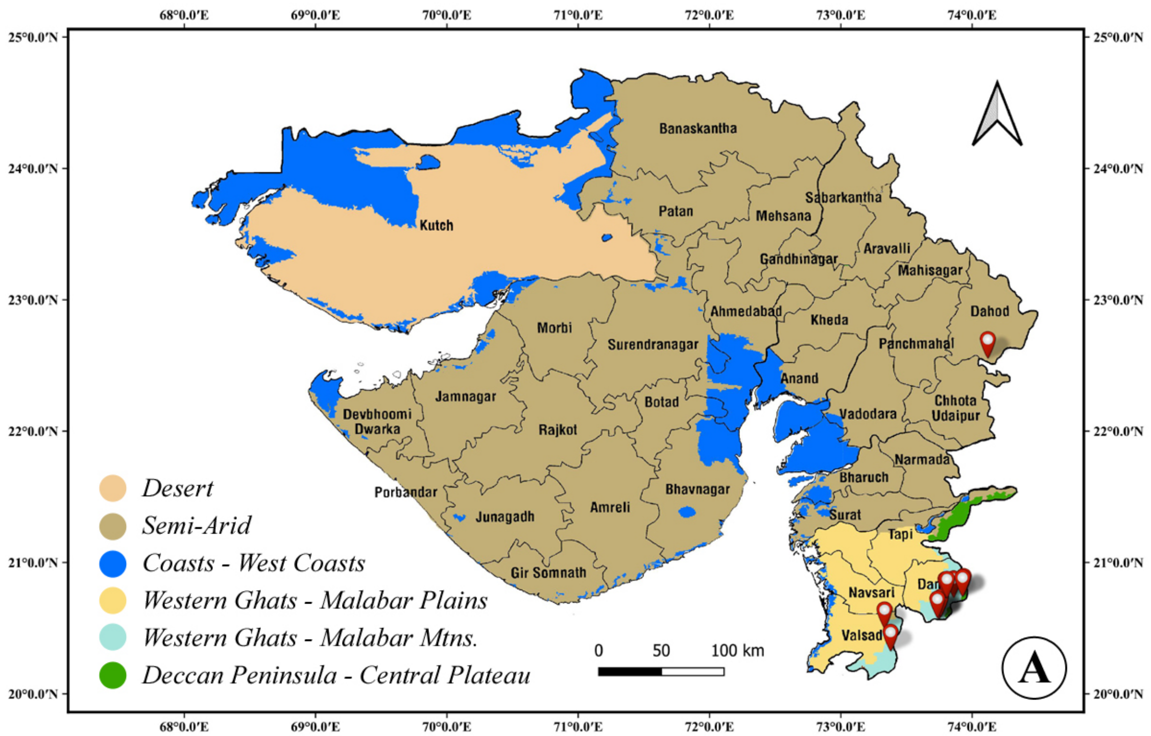


Figure 84: Tectaria coadunata. A: Plant, B: Stipe, C: Pinnae, D: Pinnules, E: Ultimate segment & sori, F, G: Sorus, H: Sporangium, I: Spore. ***Scale Bar:*** A, B: cm, C, D: 1 cm, E: 1 mm, F, G: 200 µm, H: 100 µm, I: 10 µm.

Distribution of *Lepisorus nudus* in different bio-geographical zones (A) and different regions (B) of Gujarat.



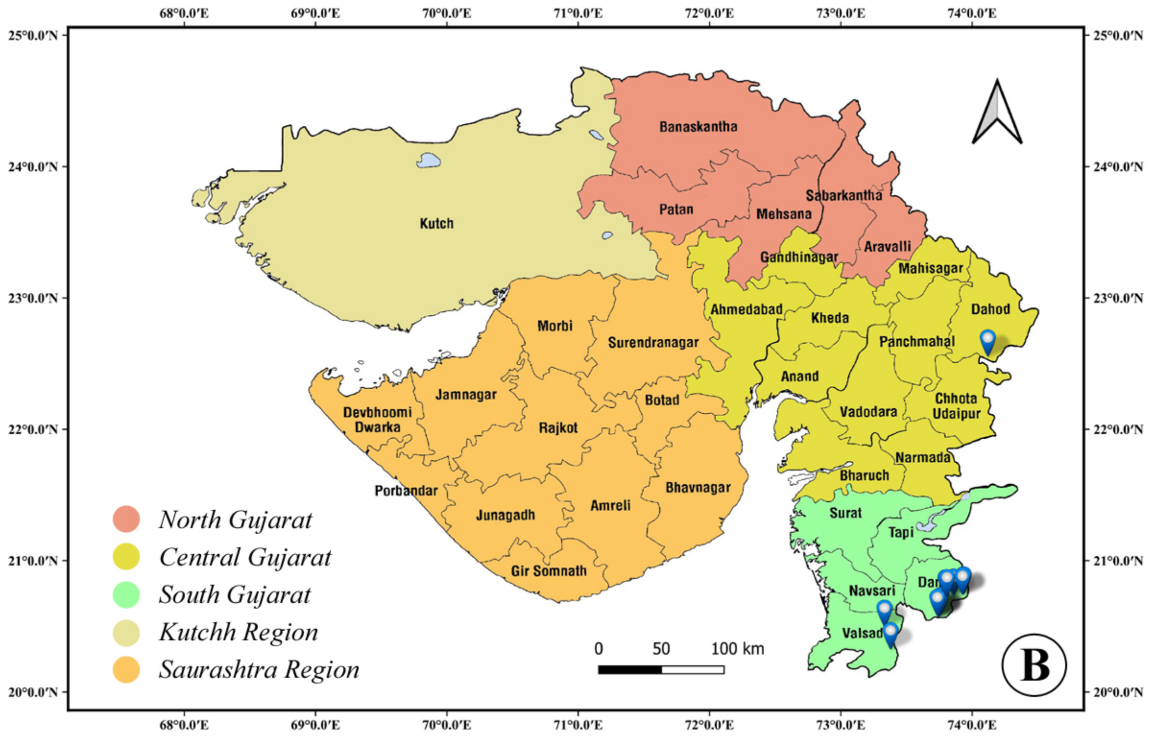


Figure: 85

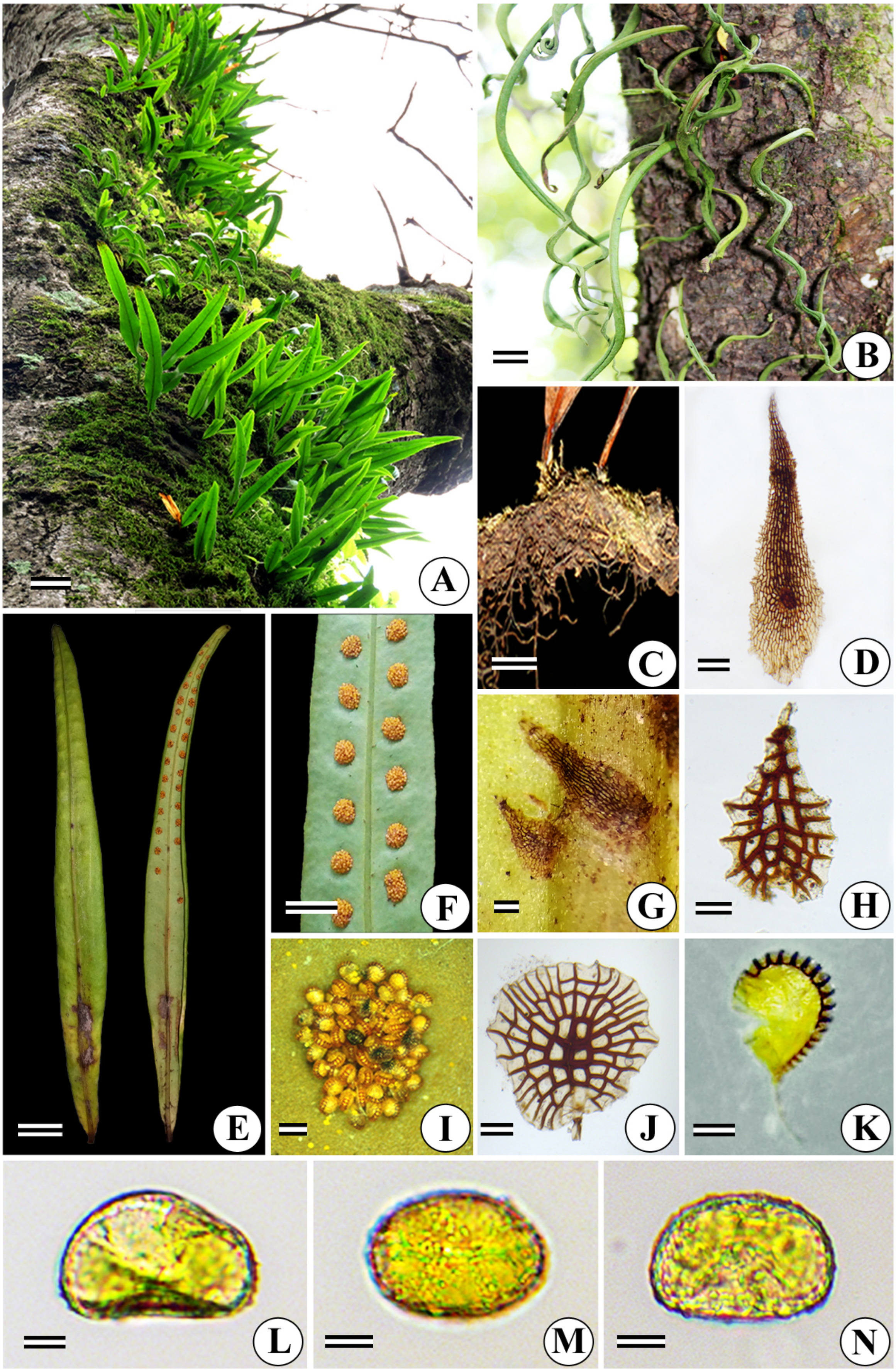
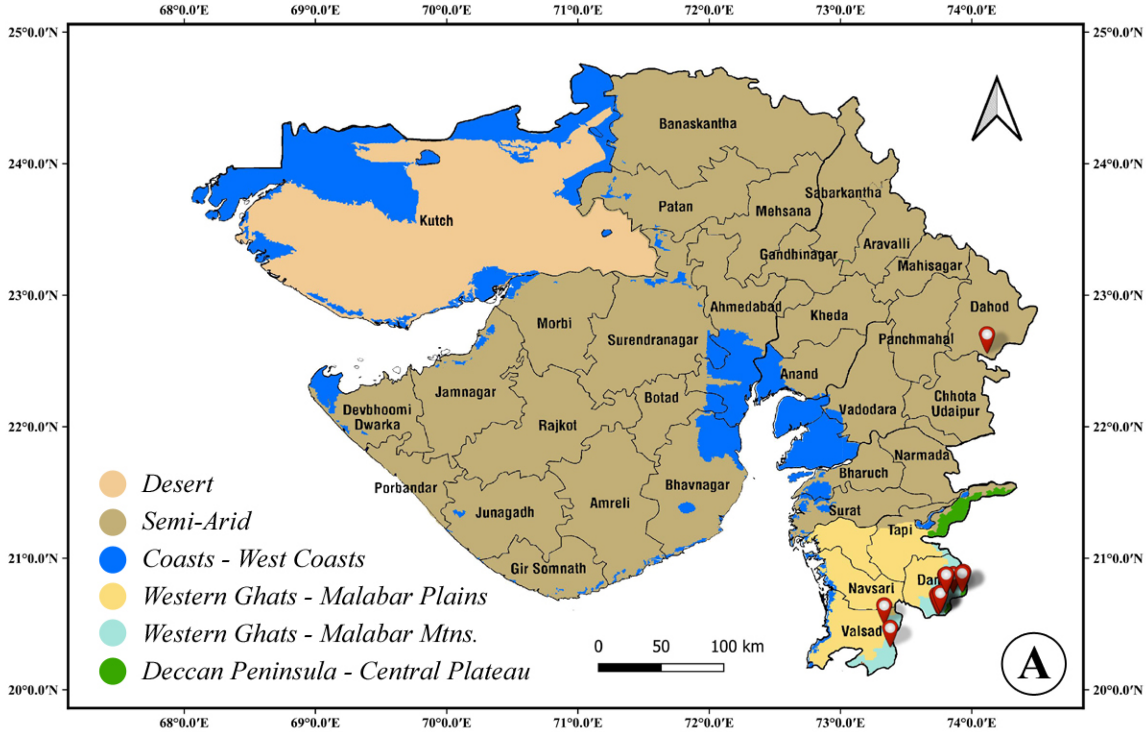


Figure 86: Lepisorus nudus. A, B: Habit, C: Rhizome, D: Rhizome scale, E: Lamina, F: Sori, G, H: Costa scale, I: Sorus, J: Paraphyses, K: Sporangium, L-N: Spores. ***Scale Bar:*** A, B: 2 cm, C, E: 1 cm, D, I: 200 µm, F: 3 mm, G-I: 50 µm, J, K: 100 µm, L-N: 200 µm.

Distribution of *Microsorum membranaceum* in different bio-geographical zones (A) and different regions (B) of Gujarat.



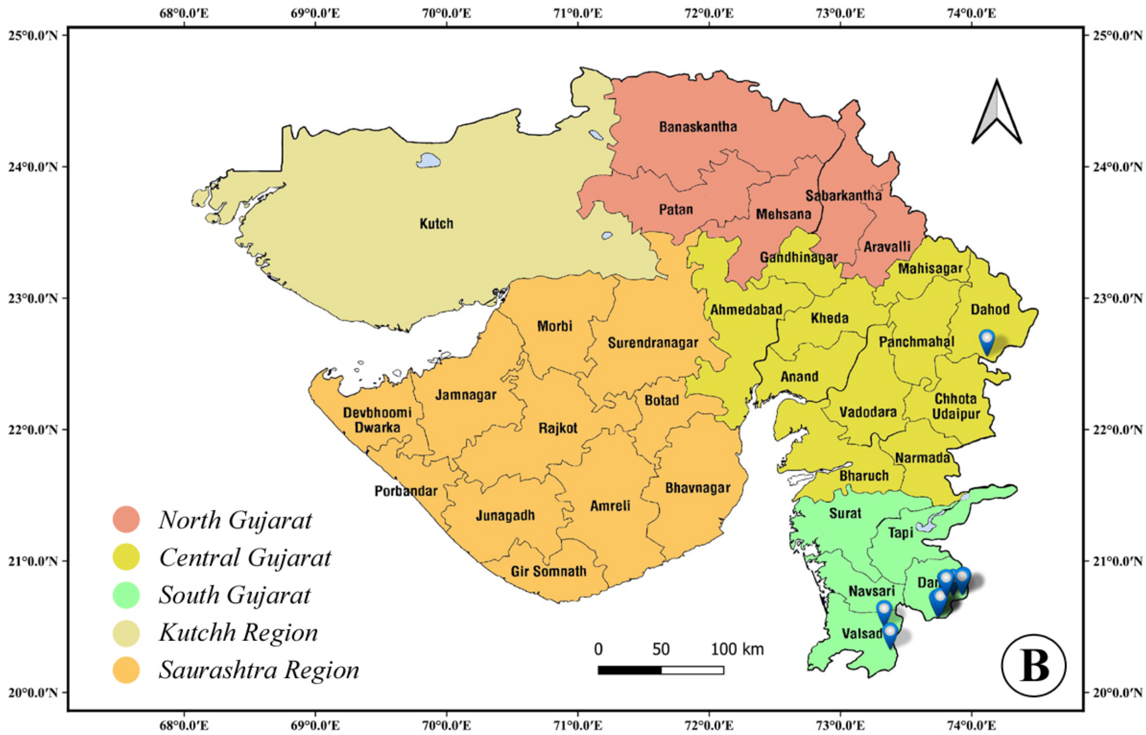


Figure: 87

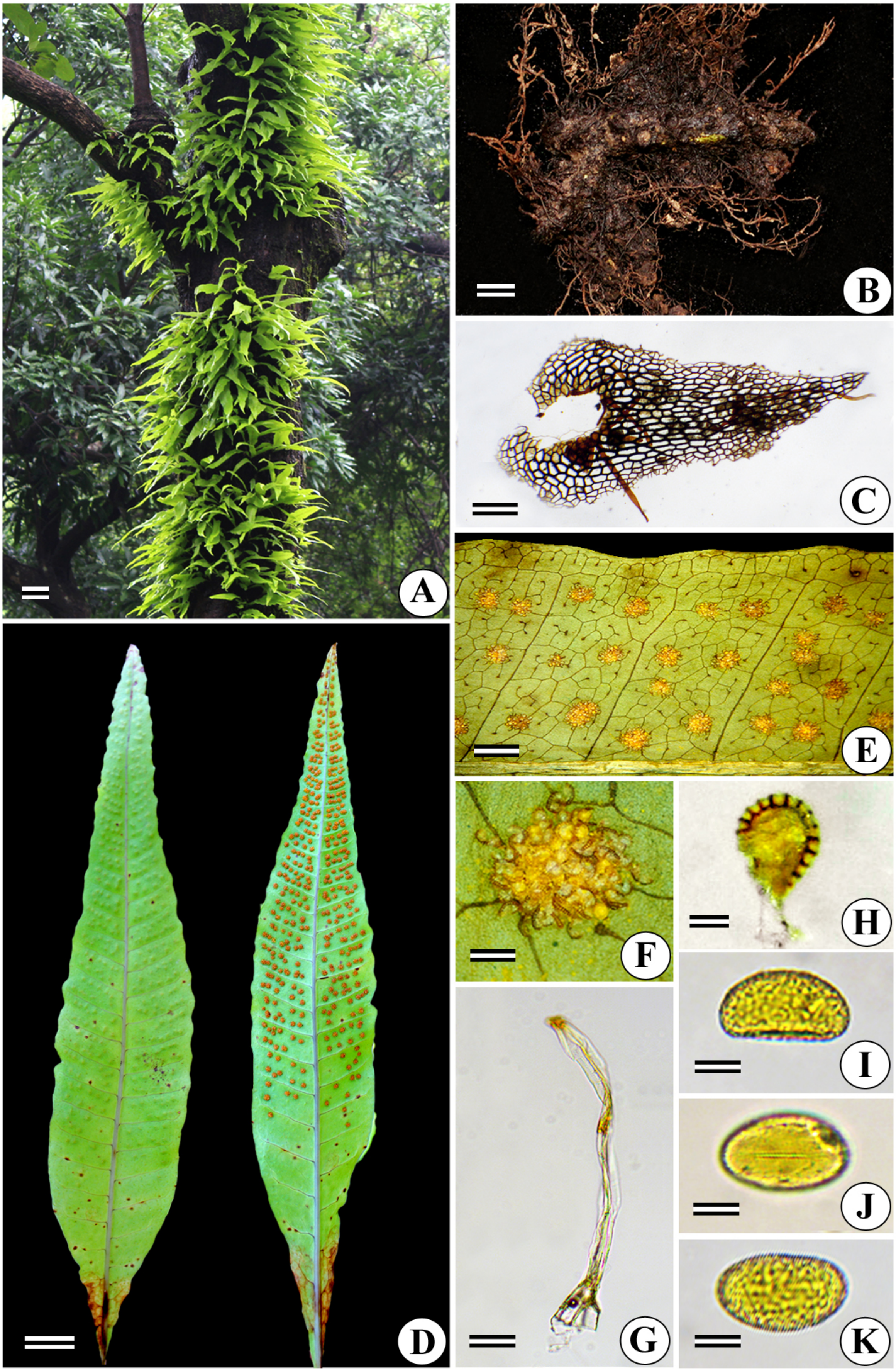


Figure 88: Microsorum membranaceum. A: Habit, B: Rhizome, C: Rhizome scale, D: Fronds, E: Sori, F: Sorus, G: Paraphyses, H: Sporangium, I-K: Spores. ***Scale Bar:*** A: 10 cm, B: 5 cm, C: 500 µm, D: 2 cm, E: 2 mm, F: 0.5 mm, G, H: 50 µm, I-K: 20 µm.

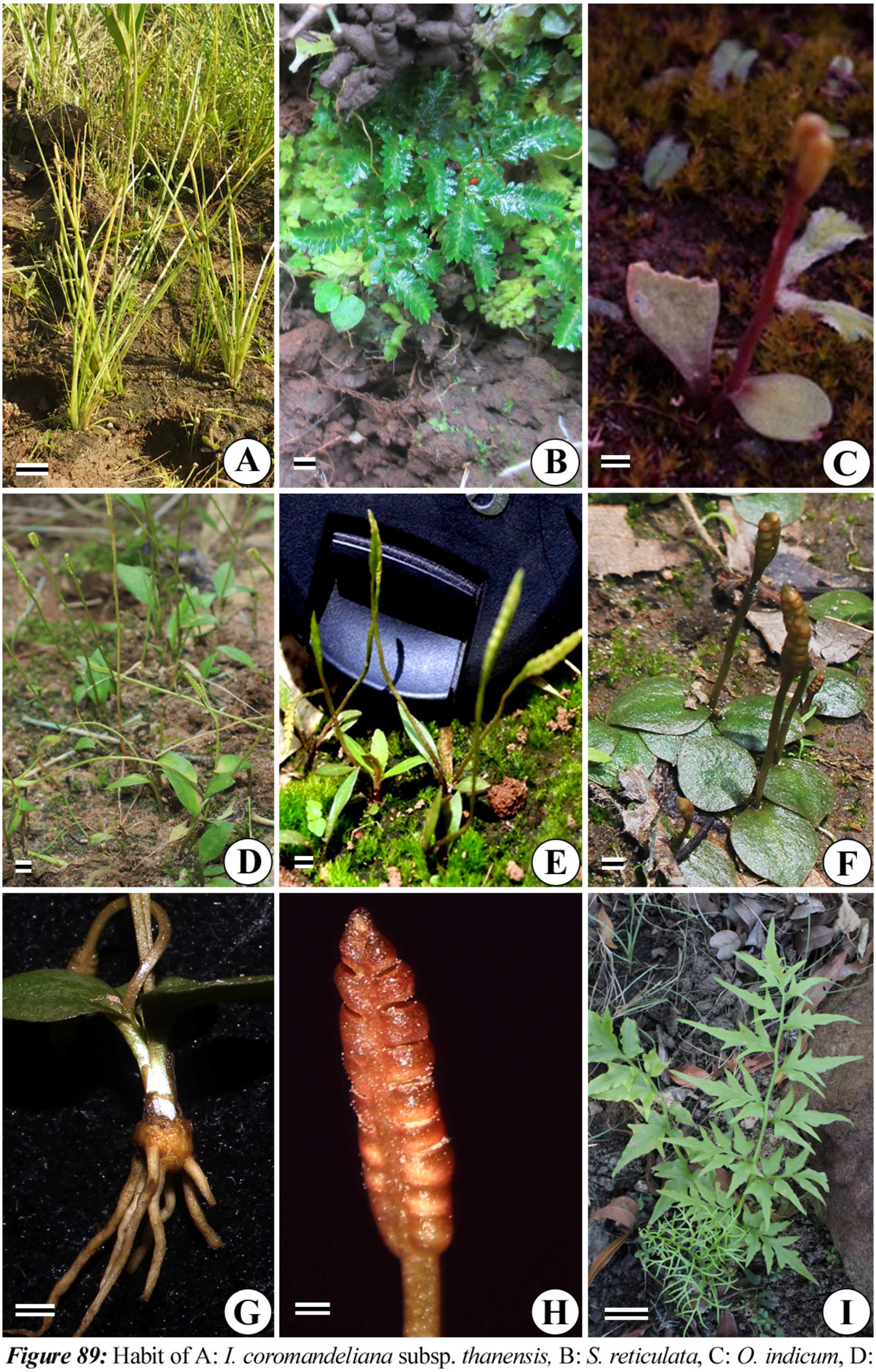
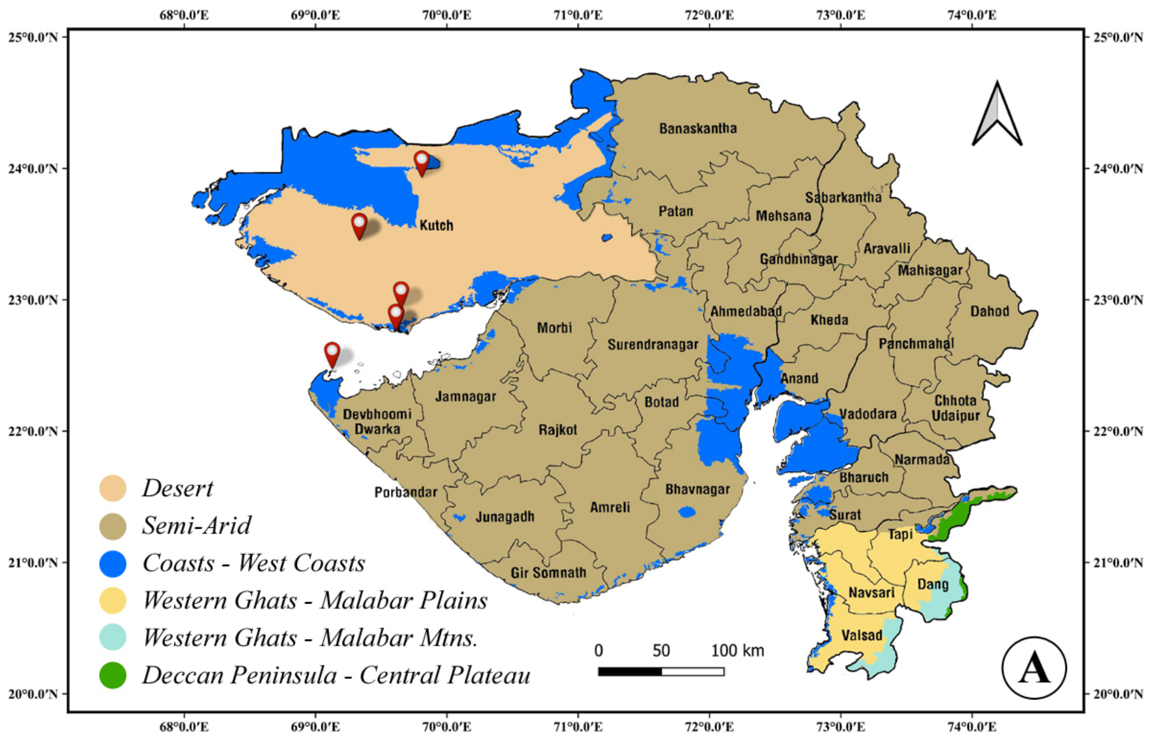


Figure 89: Habit of A: *I. coromandeliana* subsp. *thanensis,* B: *S. reticulata*, C: *O. indicum*, D: *O. lancifolium*, E: *O. lusitanicum*, F-H: *O. rubellum*, I: *C. thalictroides* subsp. *gaudichaudii*. ***Scale Bar:*** A: 1 cm, B, D, G: 5 mm, C, E, F: 3 mm, H: 1 mm, I: 10 cm.

Distribution of *Ephedra foliata* in different bio-geographical zones (A) and different regions (B) of Gujarat.



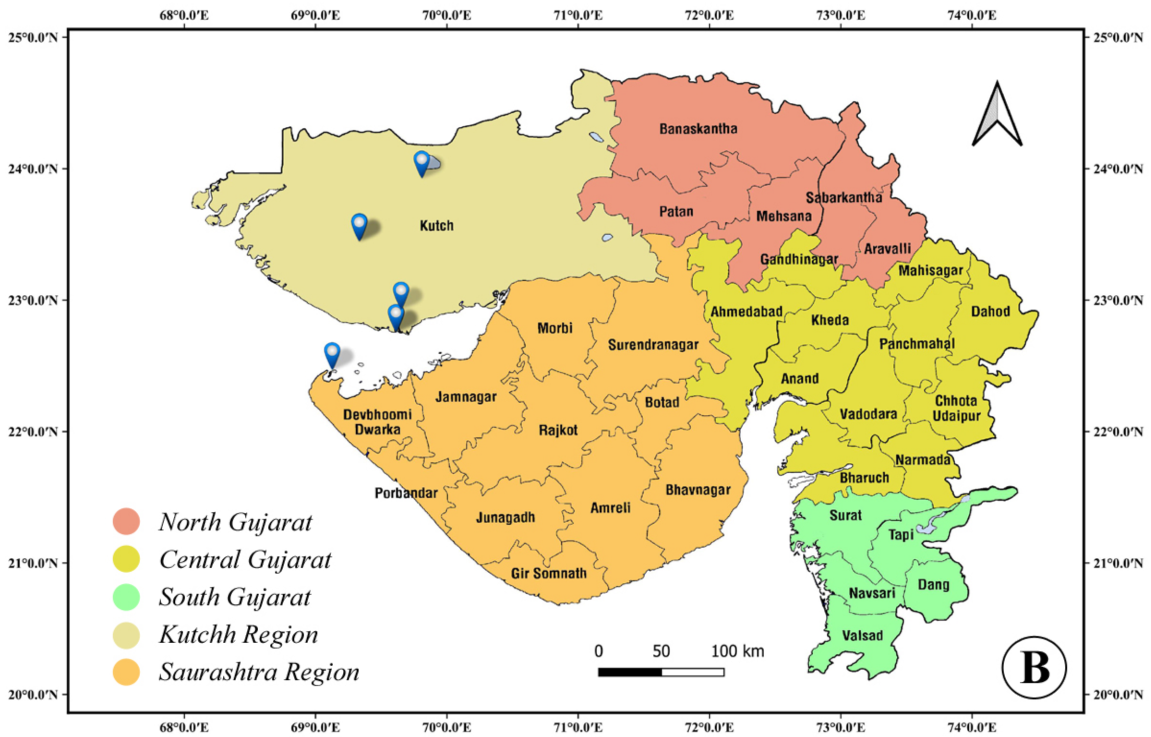


Figure: 90

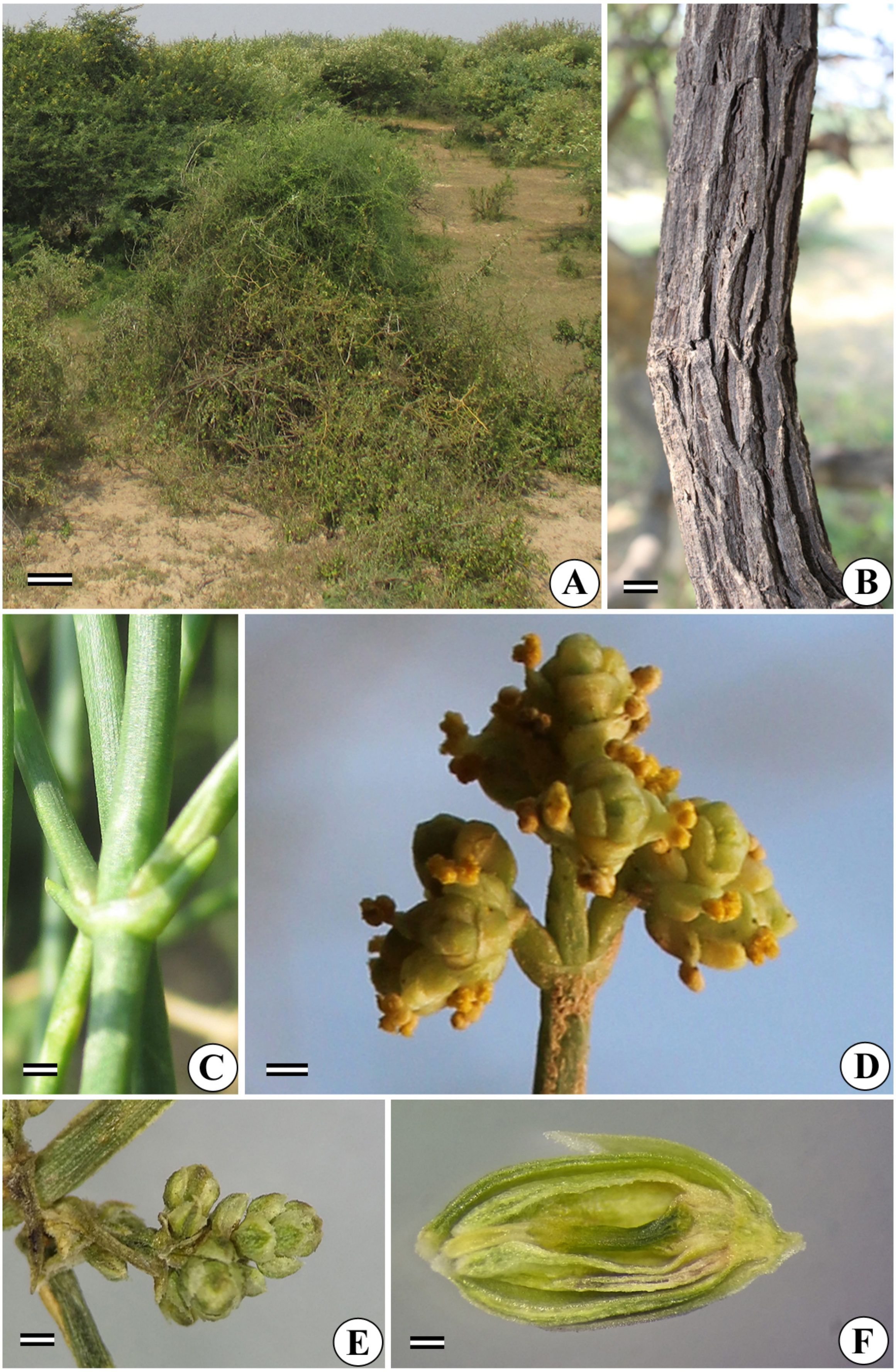
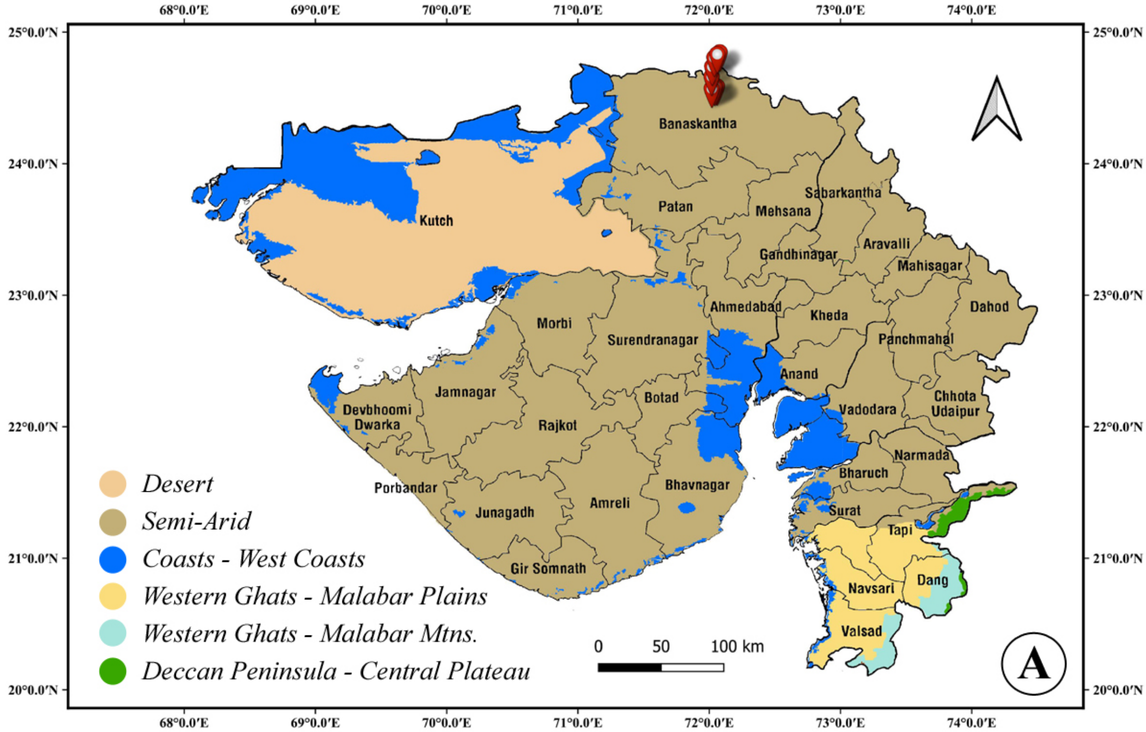


Figure 91: Ephedra foliata. A: Habit, B: Stem, C: Branches and leaf, D, E: Male cones, F: Female cones. ***Scale Bar:*** A: 10 cm, B: 2 cm, C: 1 mm, D, E: 2 mm, F: 0.5 mm.

Distribution of *Ephedra karumanchiana* in different bio-geographical zones (A) and different regions (B) of Gujarat.



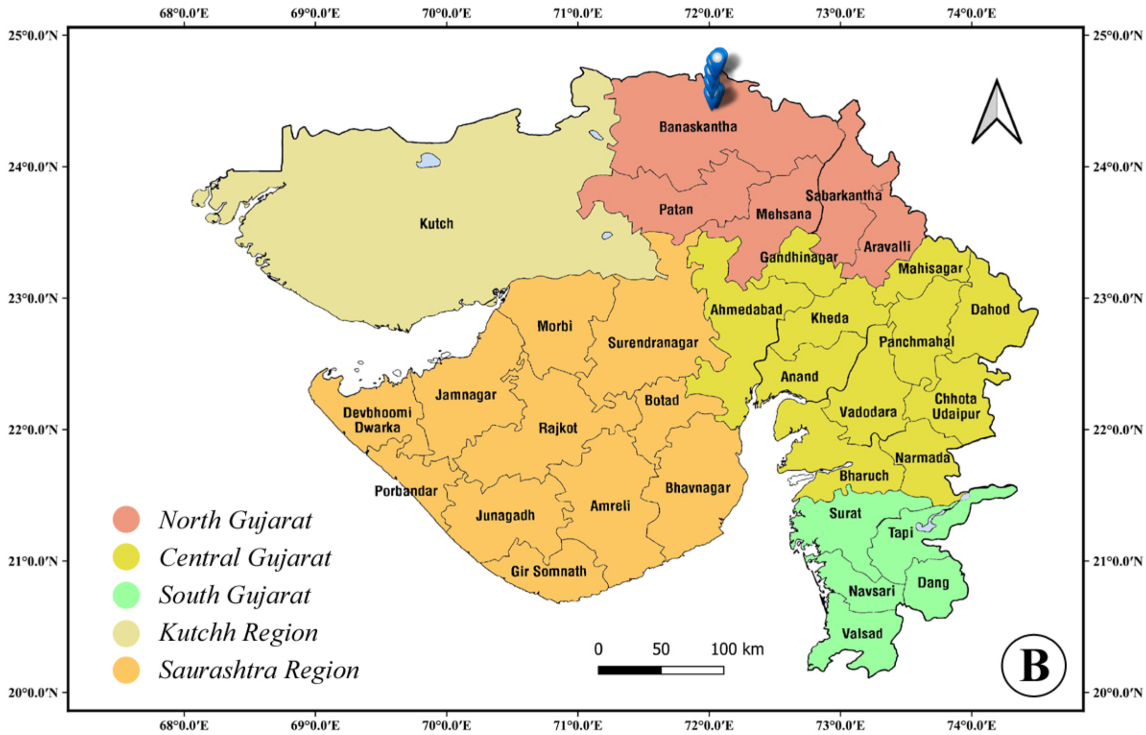


Figure: 92

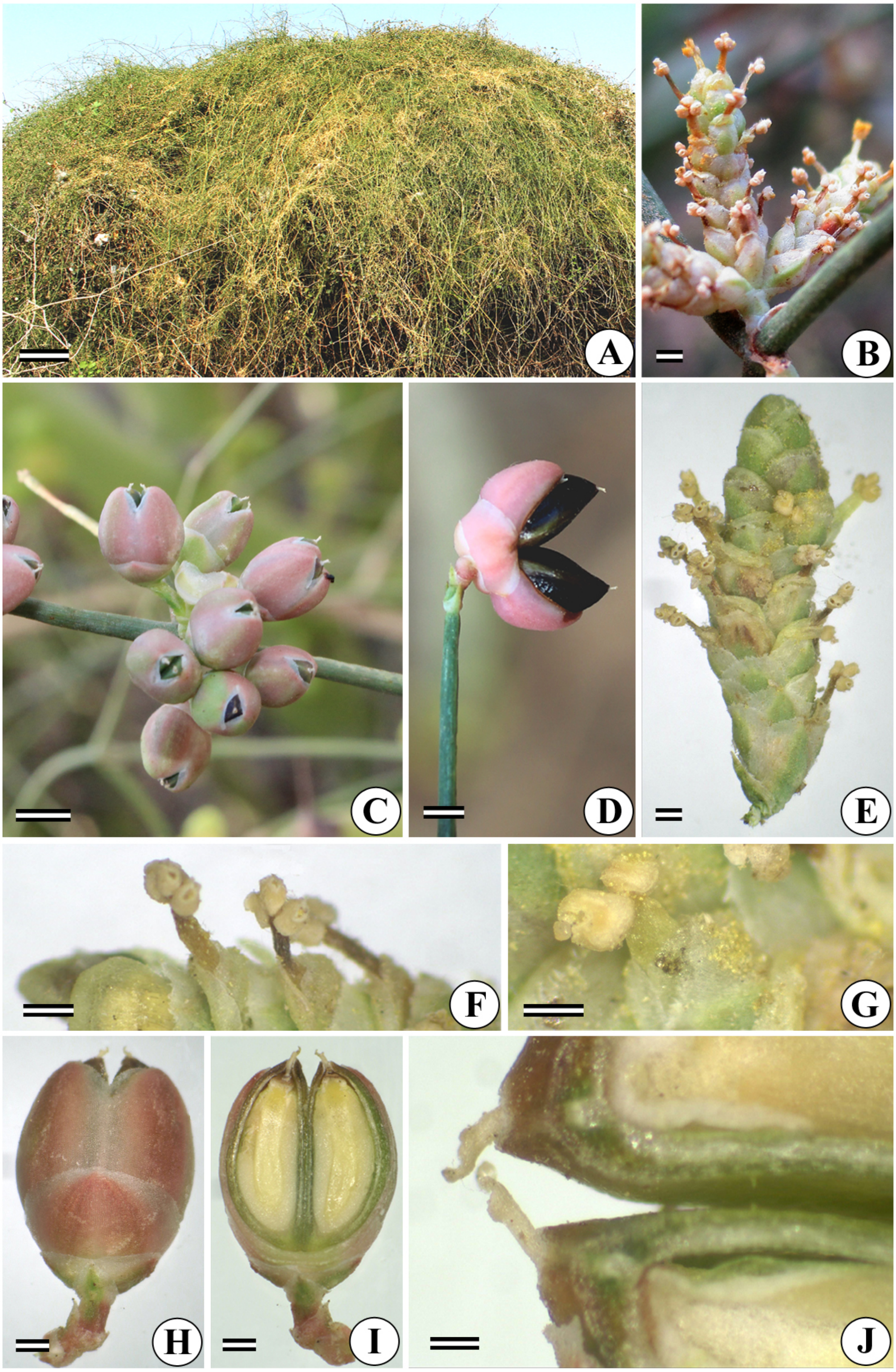


Figure 93: Ephedra karumanchiana. A: Habit, B, E-G: Male cone, C, D, H-J: Female cone. ***Scale Bar:*** A: 10 cm, B, D, H, I: 2 mm, C: 5 mm, E, F: 1 mm, G: 100 µm, J: 10 µm.

5.4 Habitat Diversity:

Lycophytes and ferns show characteristic preferences to the specific habitat conditions. They are the important integral component of the most common plants in moist and shaded forest area. Some pteridophytes having the ability to grow on soil and on tree trunk as well as upon hard rocky surfaces and many others species are restricted only on rocks, where they can flourish well in such habitats as rock crevices, fissures and boulders. In some instance, hot climatic such as desert plants which include terrestrial or lithophytic species apparently exhibit structural adaptations to dry and harsh environmental conditions. They are adapted with the presence of thick scales or hairs on the rhizome, stipe and sometimes on lamina, too. A fleshy lamina and thick cuticle covering are some of the adaptations to withstand this type of dry condition. On the other hand, gymnosperms of the state, exhibit only two wild species *i.e*. *Ephedra foliata* and *E. karumanchiana*, prefer to grow in the desert and arid or semi-arid regions with sandy dry soil.

During the survey and collection of pteridophytes, there are four major substrate liking groups of pteridophytes were observed *viz*., 1) terrestrial; 2) lithophytes; 3) epiphytes and 4) hydrophytes.

1) Terrestrial pteridophytes

The impressive diversity of pteridophytes was noted in this habitat due to humus-rich soil, well aeration, stable moisture content and cool pleasant temperature, which supports the most species diversity on terrestrial habitat. The diversity in this habitat was noted to grow in the area like high moisture content and shady places of the forest. Out of 47 pteridophytes species, 40 species were known to flourish well in terrestrial habitat (fig. 94). Some of the pteridophytes were collected among grasses at low altitude like *Ophioglossum*. Fern-like *Lygodium flexuosum* prefer to arise by subterranean rhizomes from the deep forest floor and growing as a climber with the help of climbing rachis on the adjacent tree branches or shrubs and reaches to the light-exposed area of forest.

Terrestrial pteridophytes prefer various ecological niches, like Moist shaded forest floors, Roadsides, Fully exposed or shaded areas in slopes, Forest fringes or edges, Riverine and stream banks with shaded areas and fully exposed areas in grassland:

***Moist shaded forest floors*:** This habitat provides exclusively humus-rich soil and moist forest floor along with a deep shade of the large trees. This type of habitat shows very low disturbance to the vegetation. The very common species found in this environment are *Selaginella ciliaris*, *S. reticulata*, *Ophioglossum costatum*, *O. gramineum*, *O.*

gujaratense, *O. indicum*, *O. jaykrishnae*, *O. lancifolium*, *O. nudicaule*, *O. parvifolium*, *O. reticulatum*, *O. rubellum*, *O. thermale*, *Lygodium flexuosum*, *Adiantum incisum*, *A. philippense* subsp. *philippense*, *Aleuritopteris bicolor* and *Tectaria coadunata*.

***Roadsides*:** The pteridophytes species are growing well during the monsoon and post-monsoon seasons and at the time of winter and summer they become dried. Such habitat has natural vegetation that is sparsely exposed to the sun and a very disturbing habitat for the vegetation. In this habitat, the growing vegetation adds the green beauty of the forest floor. The common fern species found in this environment are *Selaginella ciliaris*, *S. delicatula*, *S. repanda*, *S. reticulata*, *Lygodium flexuosum*, *Actiniopteris radiata*, *Pteris vittata* subsp. *vittata*, *Adiantum incisum*, *A. philippense* subsp. *philippense*, *Aleuritopteris anceps*, *A. bicolor*, *A. formosana*, *A. albomarginata*, *Athyrium hohenackerianum*, *A. falcatum*, *A. micropterum*, *A. parasnathense*, *Athyrium schimperi* subsp. *biserrulatum* and *Tectaria coadunata*.

***Fully exposed or shaded areas on slopes*:** This kind of habitat grasps enormous ferns diversity of common terrestrial pteridophytes that thrives only in well-drained soil and a continuous mild wind current. Hence, abundant vegetation shows in well-sloped terrain. This type of habitat is preferred by *Selaginella ciliaris*, *S. reticulata*, *S. delicatula*, *S. repanda*, *Lygodium flexuosum*, *Actiniopteris radiata*, *Anogramma reichsteinii*, *Pteris vittata* subsp. *vittata*, *Adiantum incisum*, *A. philippense* subsp. *philippense*, *Aleuritopteris anceps*, *A. bicolor*, *A. formosana*, *A. albomarginata*, *Athyrium hohenackerianum*, *A. falcatum*, *A. micropterum*, *A. parasnathense*, *Athyrium schimperi* subsp. *biserrulatum*, *Hypodematium crenatum* subsp. *crenatum* and *Tectaria coadunata*.

***Forest fringes or edges*:** This habitat is affected by environmental pollution, vegetation clearing, urbanization, more exposure to wind and other anthropogenic pressure. Thus, the vegetation of pteridophyte species can handle change in such conditions. Some common pteridophyte species that are observed on forest fringes and ages are *Selaginella ciliaris*, *S. reticulata*, *S. delicatula*, *S. repanda*, *Ophioglossum costatum*, *O. gramineum*, *O. gujaratense*, *O. indicum*, *O. jaykrishnae*, *O. lancifolium*, *O. lusitanicum*, *O. nudicaule*, *O. parvifolium*, *O. reticulatum*, *O. rubellum*, *O. thermale*, *Lygodium flexuosum*, *Ceratopteris thalictroides* subsp. *thalictroides*, *Cheilanthes tenuifolia*, *Athyrium hohenackerianum*, *A. falcatum*, *A. micropterum*, *A. parasnathense*.

***Riverine and stream banks with shaded areas*:** Such type of habitat provides a luxurious growth of lycophytes and some ferns. It harbours very rich soil that is rich with humus content, high humidity, moisture content and shows an excellent growth of perennial and annual pteridophyte species. The commonly occurring species in this habitat are *Selaginella ciliaris*, *S. reticulata*, *Equisetum ramosissimum*, *Lygodium flexuosum*, *Marsilea minuta*, *Ceratopteris thalictroides* subsp. *thalictroides*, *Adiantum capillus-veneris*, *A. incisum*, *A. philippense* subsp. *philippense*, *Aleuritopteris bicolor*, *Cheilanthes tenuifolia*, *Athyrium hohenackerianum*, *A. parasnathense*, *Thelypteris dentata* and *T. prolifera*.

***Fully exposed areas in grassland*:** This type of habitat shows encompassing pteridophytes that are exposed to direct sunlight. The soil has a rocky substratum, which is covered with a thin layer of clefts of rocks and sometimes logged with water. In such a habitat, the commonly occurring species are *Isoetes coromandeliana* subsp. *coromandeliana*, *Ophioglossum costatum*, *O. gramineum*, *O. gujaratense*, *O. indicum*, *O. jaykrishnae*, *O. lancifolium*, *O. lusitanicum*, *O. nudicaule*, *O. parvifolium*, *O. reticulatum*, *O. rubellum*, *O. thermale* and *Marsilea minuta*.

2) *Lithophytes*

A large number of pteridophytic species reveal an obvious preference for rocky substratum for growing. They grow on land feedstuff nutrients from rainwater and nearby decaying plants, dead tissue and attached to rock surfaces, boulders, near the area of waterfalls and slopes. These types of pteridophyte prefer various ecological niches which include both epipetric and epiphilic species. They occur in diverse habitats such as rock clefts, mossy rocks, rocks along roadsides and rocks along the streams. Nineteen taxa of pteridophytes were known to occur in lithophytic habitat (fig. 94).

Rock clefts: This habitat showed the pteridophyte species growing in the clefts of the rock. In such a habitat, the common occurring pteridophytes are *Selaginella ciliaris*, *S. repanda*, *S. reticulata*, *Actiniopteris radiata*, *Anogramma reichsteinii*, *Pteris vittata* subsp. *vittata*, *Adiantum incisum*, *A. philippense* subsp. *philippense*, *Aleuritopteris anceps*, *A. bicolor*, *A. formosana*, *A. albomarginata*, *Athyrium hohenackerianum*, *A. falcatum*, *A. micropterum*, *A. parasnathense*, *Hypodematium crenatum* subsp. *crenatum* and *Tectaria coadunata*.

Mossy rocks: In such habitat, pteridophyte species grow on the rocky substratum predominantly covered with the matts of mosses, which harbour very high moist conditions to the rhizome. Some species occurring in such habitat are *Selaginella ciliaris*, *Adiantum incisum*, *A. philippense* subsp. *philippense*, *Aleuritopteris bicolor* *Lepisorus nudus* and *Microsorum membranaceum*.

Rocks along road sides: This habitat show diminutive disturbing habitat for the growth of pteridophyte species. Some common pteridophytes found in such habitat are *Selaginella ciliaris*, *S. reticulata*, *S. repanda*, *Actiniopteris radiata*, *Pteris vittata* subsp. *vittata*, *Adiantum incisum*, *A. philippense* subsp. *philippense*, *Aleuritopteris anceps*, *A. bicolor*, *A. formosana*, *Athyrium hohenackerianum*, *A. falcatum* and *A. parasnathense*.

Rocks along the streams: In such habitats, pteridophytes grow in the moist condition with the exposed and/or shady places. Some of the common pteridophytes are *Selaginella ciliaris*, *S. repanda*, *Equisetum ramosissimum*, *Pteris vittata* subsp. *vittata*, *Adiantum incisum*, *A. philippense* subsp. *philippense*, *Aleuritopteris bicolor* and *Cheilanthes tenuifolia*.

3) *Epiphytes*

Epiphytic taxa grow on the surface of a plant for the support, moisture and nutrients from the debris accumulating around it. They ordinarily grow on wet trunks and branches of trees and attached via rhizomes and adventitious roots. Sometimes, they form nets of their rhizome along with the stiff root hairs which helps them to absorb more water. This type of habitats is merely formed by the luxuriant growth of bryophytes and mosses on the tree trunks and their branches, which aid as a sponge and retain a sufficient amount of water and moisture content for the growth of the epiphytic taxa. On the other side, the lack of availability of the soil indicates very high risk of desiccation. In such habitat, pteridophytes species are likely to grow in the shaded and/or exposed area, on mossy tree trunks and their branches etc. The common ferns are naturally occurring as epiphytes are *Lepisorus nudus* and *Microsorum membranaceum*.

4) *Hydrophytes*

These types of plants are naturally growing in, on or near water and are emergent, submergent or floating environments. These types of species are adapted to form floating leaves, aerenchyma and finely dissected leaves. Some of the common types of hydrophytes are emergent, floating leaved, free-floating plants.

***Emergent*:** The plant species which grows in water but stabs to the surface and showing partially in air. Some common pteridophytes are *Isoetes coromandeliana* subsp. *coromandeliana*, *I. coromandeliana* subsp. *thanensis*, *Equisetum ramosissimum*, *Marsilea minuta* and *Ceratopteris thalictroides* subsp. *thalictroides*, *C. thalictroides* subsp. *gaudichaudii*.

***Floating leaved*:** In such type of habitat, species are forming root systems attached to the substratum and leaves are floating on the water surface. The best example suit in such a habitat is *Marsilea minuta*.

***Free-floating*:** The hydrophytes that are found floating on water surface with their root systems are not attached to substrate, sediment, or bottom of the water body. They are effortlessly puffed by air. Some common free-floating pteridophytes are *Azolla pinnata* subsp. *asiatica* and *Salvinia molesta*.

The highest species diversity was reported in the terrestrial habitat with 40 taxa (57%). Followed by, 22 taxa as lithophytic (31%), 6 taxa (9%) as hydrophytes and 2 species (3%) were epiphytes (fig. 94).

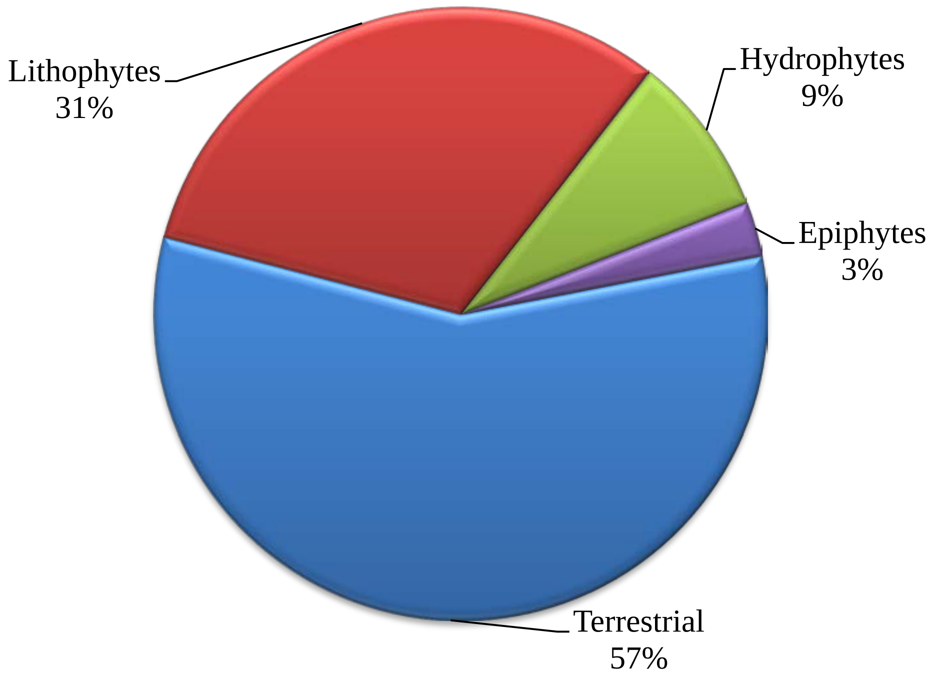


Figure 94: A pie chart showing distribution of pteridophyte species (in %) of various habitats.