

TAXONOMIC STUDIES OF GENUS *GONIOPHLEBIUM* AND *SELLIGUEA* OF DISTRICT TEHRI GARHWAL, INDIAN CENTRAL HIMALAYA

Pushpesh Joshi¹, V.K. Rawat*², Brijesh Kumar¹ and Himanshu Dwivedi¹

¹Botanical Survey of India, NRC, Dehradun, Uttarakhand, India

²Botanical Survey of India, APRC, Itanagar, Arunachal Pradesh, India

*Email: vkrawat@bsi.gov.in

Abstract

The present communication deals with the taxonomic studies of the members genus *Goniophlebium* (Blume) C.Presl, and *Selliguea* Bory of the family Polypodiaceae (Pteridophyta) from Tehri Garhwal of Indian Central Himalaya. In the present study, 5 species under 2 genera of Polypodiaceae, collected from the study area have been critically studied. Detailed microscopic photo-plates has also been prepared.

Keywords: Polypodiaceae, Pteridophyta, Uttarakhand.

INTRODUCTION

Tehri Garhwal is one of the western most mountainous Districts of Uttarakhand located on the outer ranges of the mid Himalayas. The District lies between the parallels of 30°03' to 30°53' north latitude and 77°56' to 79°04' east longitude, covering an area of 4,080 km². The District is bounded by Uttarkashi in the north, Rudraprayag in the east, Pauri Garhwal in the south and Dehradun in the west. On the western front, Yamuna river separates it from Jaunsar Praganza of the Dehra Dun while Bhagirathi rising from the north of the Gangotri in the Uttarkashi touches the district near Nagun village. Drainage of the area is mainly controlled by the major perennial rivers like Bhagirathi, Bhilangana, Alaknanda and their tributaries like Bal Ganga and Dharma Ganga. The climate of the District varies from cold temperate, tropical to sub-tropical zones. Average temperature varies from 4.6 – 36.5° C. The relative humidity varies from 25 % during May up to 85 % during August. The average annual rainfall is approximately 1,395 mm. The vegetation is broadly categorised into tropical, subtropical, temperate, subalpine and alpine types. The chir-pine forest, oak mixed and coniferous forest are the major dominated

forest types of the district. Maximum diversity of ferns is observed in the subtropical and temperate forests, whereas in the tropical and alpine region diversity of ferns is too meagre.

The district has been extensively explored by many botanists from time to time for higher plants. However, some workers like Gupta (1955), Bir et al., (1983), Negi et al., (1987, 88), Goel and Bhattacharya (1989), Uniyal et al., (1995), Khullar (1994, 2000) have published fragmented reports on the account of pteridophytes growing in the area. Hence, the present work on ferns of Tehri Garhwal District of Garhwal Himalaya was undertaken to fill up this lacuna.

METHODOLOGY

The present study is the outcome of several rigorous explorations taken in different areas of the Tehri Garhwal District. Several parameters such as locality of plant, habit, habitat, size, colour, frequency of occurrence in the study area, ecology and ethnobotany were recorded during the survey and collection tours. The collected plants were duly pressed, dried, poisoned by the standard methods as suggested by Jain and Rao (1976). The poisoned

specimens were further mounted and labeled on the standard herbarium sheets. Collected plants were identified with the help of protologues, monographs, taxonomic revisions and available regional literature, further the identity was confirmed by consulting regional herbaria.

microparts like scales, hairs, trichomes, indusium, sporangium and spores were done with the help of Cell'A Olympus measuring software. Each measurement of microparts represents an average of at least 10 counts.

SYSTEMATIC TREATMENT

Key to Genera:

Lamina pinnate 1. *Goniophlebium*

Lamina pinnatifid 2. *Selliguea*

1. *Goniophlebium* (Blume) C. Presl, Tent. Pterid., 185, pl. 7, f.13–14. 1836.

Plant epiphytic or lithophytic. Rhizome creeping, long, scaly. Stipe thin, slender, distinct, base scaly. Frond monomorphic. Lamina pinnate, herbaceous, surface hairy; pinnae many, sessile, opposite. Veins anastomose to form a single row of areolae along the both side of midrib, with free included veinlets, marginal veins free. Sori present at the end of veinlet in areolae, in two rows, each on either side of costae, round, exindusiate. Spore, bilateral, monolete, perinate, exine smooth.

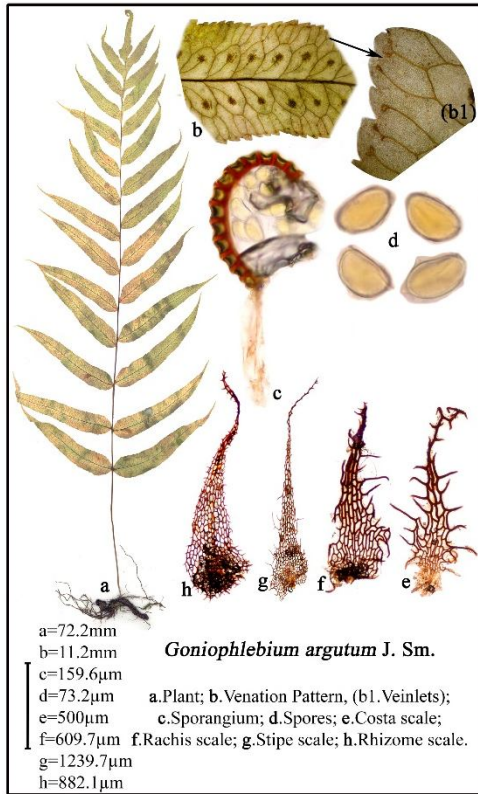
The genus is represented by 1 species from West Himalayas, Uttarakhand and the study area.

i. *Goniophlebium argutum* (Wall. ex Hook.) J. Sm. ex Hook., Genera Fil., t. 51. 1842; Bedd., Handb. Ferns Brit. India, 323. 1883; B.K. Nayar & S. Kaur, Companion Handb. Ferns Brit. India, 79. 1974; Bir, Satija, S.M. Vasudeva & P. Goyal, Pterid. Fl. Garhwal Himalaya, 17. 1983; Fraser-Jenk., New Sp. Syndr. Indian Pteridol., 145, 1997; Subh. Chandra, Ferns India, 390. 2000; Fraser-Jenkins, Taxon. Revis. Indian Subcontinental Pteridophytes, 535. 2008; P. Joshi, H.C. Pande & P.C.Pande, Ferns Cent. Himalaya 1: 149. t.19. 2009.



Fig.1: Tehri Garhwal in Uttarakhand

For critically examining the plant, relevant parts taken from the unmounted duplicate specimen were dissected and then mounted on slides and studied under dissecting and compound microscope. The morphology of macro parts such as rhizome scale, sori arrangement, venation pattern, etc. were studied under stereo-zoom dissecting microscope model Olympus SZ-51 and later on photographed along with a 12 cm measuring scale. The digital photographs were taken with the help of Nikon COOLPIX S8 camera. The morphology of micro parts such as hairs, stipe scales, costae scales, paraphysis, indusium cells, sporangium, spores were studied under compound microscope model Olympus CX-41 and were photographed with the help of Olympus E 330 attached camera. The measurement of the microscopically studied



linear, lanceolate, base cordate, margin eroded, with short projections throughout the scales, tip long, hairy. **Stipe** 10–15cm long, thin, slender, yellowish green, dark brown after drying, 1–2.5 cm distant on rhizome, glossy, base scaly; scales 3–4 mm long, marginal projections in lower half of the scales are long, rest similar to rhizome scales. **Lamina** 45–75 cm long, 14–20 cm wide, lower half pinnate, upper half pinnatifid, oblong, deltoid, base broad, texture herbaceous, membranous, surface hairy and scaly, margin deeply cut to the rachis, apex bearing single pinnae at terminal end; pinnae 1–12 cm long, 1.5–2 cm wide, 10–15 pairs, lower half pairs opposite to subopposite, upper half alternate, lowermost 2–5 pair longest, lanceolate to oblong-lanceolate, margin with rounded teeth, apex acuminate. **Rachis** dark brown, scaly; scales smaller, marginal projection longer than rhizome and stipe scale, rest similar to rhizome and stipe scales. **Costa** clear, scaly; among all the scale marginal projections are longest and throughout the scales, smallest, rest similar to other scales. **Venation** conspicuous, veins anastomose to form areolae with single included veinlet on both sides of costa, marginal veinlets present over the areolae, veinlets free or forked, terminating into swollen end. **Sori** present at the end of veinlet in areolae, in two rows, each on either side of costae, round, exindusiate. **Sporangia** globose, stalked, 13 celled annulus, paraphysis present. **Spores** 49–55 µm long, 31–36 µm wide, light-brown, bilateral, perisporiate, exine smooth.

Chromosome number: n=34 (diploid). (Khullar, 2000)

Specimens examined: Chandrabadani to Kandikhal, 1057 (BSD), 13-Sep-2009, PUSHPESH JOSHI; Gangi to Ghuttu, 1191 (BSD), 10-Oct-2009, PUSHPESH JOSHI; On way to Masartal, 111957, 111908, 111914,

Polypodium argutum Wall., Numer. List no. 308. 1829 (nomen); Hook., Sp. Fil. 5: 32. 1863; C. B. Clarke in Trans. Linn. Soc. London, Bot. 1: 551. 1880; Hope in J. Bombay Nat. Hist. Soc. 15: 197. 1903; Dhir, Biblioth. Pteridol. 1: 121. 1980.

Polypodiastrium argutum (Wall. ex Hook.) Ching in Acta Phytotax. Sin., 16(4): 28 1978; R. D. Dixit, Census Indian Pterid., 51. 1984; Khullar, Ill. Fern Fl. West. Himalaya, 1: 144. t. 53. 1994; R. D. Dixit & R. Kumar, Pterid. Uttaranchal– Checklist, 41. 2002; P. C. Pande & H. C. Pande, Pterid. West. Himalaya, 28. 2002; H. C. Pande & P. C. Pande, Ill. Fern Fl. Kumaon Himalaya, 2: t.17. 2002 & 1: 53. 2003. **Plant** long 55–90 cm long. **Rhizome** 0.5–1 cm wide, long, creeping, thick, undersurface bearing long wiry roots, densely covered with scales; scales 2.3–2.5 mm long, 0.6–0.8 mm wide, dark brown to blackish,

111915, (BSD), Sep-2010, PUSHPESH JOSHI & BRIJESH KUMAR.

Earlier records from the study area: Nagtibba, Pinswar.

Habitat: Common fern, growing as an epiphyte on moist and mossy trees, between 1500–3200 m altitude.

Distribution: INDIA: Jammu and Kashmir, Himanchal Pradesh, Sikkim, Nagaland, West Bengal, Meghalaya, Uttarakhand (Garhwal: Dehradun, Tehri Garhwal, Uttarkashi, Pauri Garhwal, Chamoli, Rudraprayag; Kumaun: Nainital, Almora, Pithoragarh), BHUTAN, CHINA, JAPAN, PAKISTAN, NEPAL, MYANMAR, TAIWAN, THAILAND.

2. *Selliguea* Bory, in Dict. Class. Hist. Nat. 6: 587–588. 1824.

Key to species:

- A. Lobes margins with serrations *S. oxyloba*
 Lobes margins without serrations B
- B. Basal pair of pinna deflexed downwards, straight, pinna margin serrate C
 Basal pair of pinna pointing upward, slightly rounded, pinna margin spiny *S. malacodon*
- C. Rhizome scale linear, narrow, spores tuberculated *S. ebenipes*
 Rhizome scale ovate, broad, spores smooth *S. quasidivaricata*

i. *Selliguea oxyloba* (Wall. ex Kunze) Fraser-Jenk., Taxon. Revis. Indian Subcontinental Pteridophytes, 44. 2008.

Polypodium oxylobum Wall. ex Kunze, Linnaea, 24: 255. 1851.

Phymatopteris oxyloba (Wall. ex Kunze) Pic.Serm., Webbia, 28: 464. 1973; R. D. Dixit, Census Indian Pterid., 50.1984; Khullar, Ill. Fern Fl. West Himalaya, 1: 135. t. 50. 1994; R. D. Dixit & R. Kumar, Pterid. Uttaranchal–Checklist, 40. 2002; P. C. Pande & H. C. Pande, Pterid. West. Himalaya, 39. 2002; H. C. Pande & P. C. Pande, Ill. Fern Fl. Kumaon Himalaya, 2: t. 16(iv) 2002; 1: 80. 2003; Sarn.

Plant epiphytic or lithophytic. Rhizome long, creeping, thin, densely scaly. Stipes distant on rhizome, stramineous, base scaly. Lamina simple, texture coriaceous, glabrous; lobes lanceolate, margin entire, directed upward, basal lobe largest gradually reduced upwards, apex acuminate. Veins conspicuous, veinlets anastomose to form areolae, areolae bearing free included veinlet, veinlet swollen at terminal end. Sori round, exindusiate, in two rows, each on either side of the costa, between two lateral veins. Spores yellowish to golden yellow, oval, elliptical, nonperisporiate, exine shortly spinulose.

The genus is represented by 5 species in West Himalaya and Uttarakhand and 4 species in the study area.

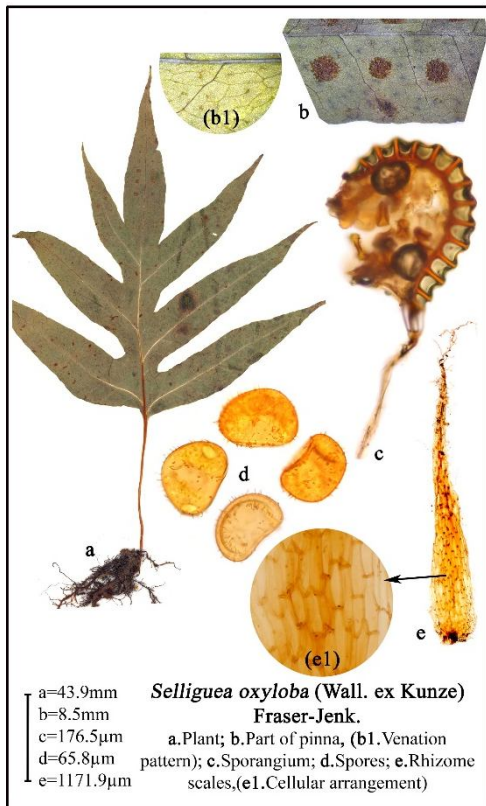
Singh & Panigrahi Ferns Fern-Allies Arunachal Pradesh 2: 494. 2005; P. Joshi, H. C. Pande & P. C. Pande, Ferns Cent. Himalaya 1: 180. t.35. 2009.

Polypodium oxylobum Wall. ex Kunze, Linnaea, 24: 255. 1851; Hope in J. Bombay Nat. Hist. Soc. 15: 94. 1903.

Polypodium hastatum var. *oxylobum* (Wall. ex Kunze) C.B. Clarke Trans. Linn. Soc. London 1: 563.1885

Pleopeltis oxylobum (Wall. ex Kunze) Bedd., Ferns S. India, 175. 1863.

Phymatodes oxyloba (Wall. ex Kunze) C. Presl ex Ching in Contr. Inst. Bot. Natl. Acad. Peiping 2: 67. 1933; Dhir, Biblioth. Pteridol., 1: 126.1980.



Crypsinus oxylobus (Wall. ex Kunze) Sledge in Bull. Brit. Mus. (Nat. Hist.), Bot. 2: 145. 1960.

Phymatopteris hastata (Thunb.) Pic.Serm., Webbia, 28: 462. 1973. sensu auct. India non.

Plant small to medium sized, 21–40 cm long. **Rhizome** 0.3–0.6 cm thick, brown, short, creeping, undersurface bearing long wiry roots, scaly; scales concolorous, golden brown, linear, lanceolate, margin fimbriate, with hairy projections, apex hairy. **Stipe** 6–10 cm long, pale to rust brown, slender, glabrous. **Lamina** 15–30 cm long, 15–20 cm wide, simple, pinnatifid, ovate, glabrous, texture herbaceous to subcoriaceous, margin pinnatifid to pinnae; pinnae 8–12 cm long, 2–2.4 cm wide, 3–5

pairs, linear, lanceolate, sessile, alternate, apex acuminate, margin entire, lowest pair.

Venation veins conspicuous veinlets anastomose to form areolae, areolae bearing free veinlet, veinlet swollen at terminal end. **Sori** circular, exindusiate, in two rows, each on either side of the costa, between two lateral veins. **Sporangia** stalked, with 14 celled annulus. **Spores** 52.4–60 µm long, 34–44.6 µm wide, yellowish to golden yellow, oval, elliptical, nonperisporiate exine shortly spinulose.

Chromosome number: n=34 (diploid). (Khullar, 2000)

Specimens examined: Chandrabadani, 1045, 1058 (BSD), 12-Sep-2009, PUSHPESH JOSHI; Ghuttu to Reeh, 1151 (BSD), 8-Oct-2009, PUSHPESH JOSHI; on way to Masartal, 111919 (BSD), Sep-2010, PUSHPESH JOSHI & BRIJESH KUMAR.

Earlier records from the study area: Bhatgaon, Nagtibba, Dhanolti.

Habitat: Extremely common fern mostly lithophytes, sometimes epiphytes, growing on exposed or partially exposed rocks or as base epiphyte on the trunk of moss covered trees, between 1800–2800 m altitude.

Distribution: INDIA: Himanchal Pradesh, Sikkim, West Bengal, Uttarakhand (Garhwal: Dehradun, Tehri Garhwal, Uttarkashi, Pauri Garhwal, Chamoli, Rudraprayag; Kumaun: Nainital, Almora, Pithoragarh), BHUTAN, CHINA, JAPAN, NEPAL, THAILAND, TAIWAN, VIETNAM.

ii. *Selliguea malacodon* (Hook.) S.G. Lu, Hovenkamp & M.G. Gilbert, Fl. China 2–3: 785. 2013.

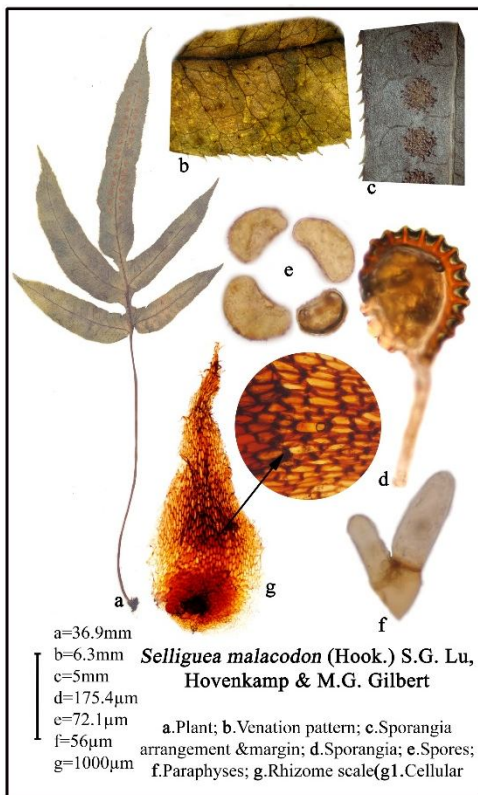
Pichisermollia malacodon (Hook.) Fraser-Jenk., Taxon. Revis. Indian Subcontinental Pteridophytes 50. 2008.

Phymatopteris malacodon (Hook.) Pic.Serm. in *Webbia* **28**: 463. 1973; Bir et al. *Pterid. Fl. Garhwal Himalaya*, 21. 1983; R. D. Dixit, *Census Indian Pterid.*, 49.1984; Khullar, Ill. *Fern Fl. West Himalaya*, **1**: 132. t. 49. 1994; Subh. Chandra, *Ferns India*, 415. 2000; R. D. Dixit & R. Kumar, *Pterid. Uttaranchal–Checklist*, 40. 2002; P. C. Pande & H. C. Pande, *Pterid. West. Himalaya*, 38. 2002; H. C. Pande & P. C. Pande, Ill. *Fern Fl. Kumaon Himalaya*, **2**: t. 16(ii). 2002; **1**: 78. 2003; P. Joshi, H. C. Pande & P. C. Pande, *Ferns Cent. Himalaya*, **1**: 178. t.34. 2009.

Phymatodes malacodon Ching in *Contr. Inst. Bot. Natl. Acad. Peiping* **2**: 83. 1933; Dhir, *Biblioth. Pteridol.*, **1**: 126.1980.

Phymatodes malacodon (Hook.) Ching, *Contr. Inst. Bot. Nat. Acad. Peiping*, **2**: 83. 1933; Dhir, *Biblioth. Pteridol.*, **1**: 128. 1980; Goel & U. C. Bhattach., *Indian J. Forest.*, **4**(1): 35. 1981.

Crypsinus malacodon (Hook.) Copel., *Genera Fil.*, 206. 1947; Naithani, *Bull. Bot. Surv. India*, **11**: 233. 1969; M. A. Rau, *Bull. Bot. Surv. India*, **3**: 251. 1961; P. Chandra, *J. Bombay Nat. Hist. Soc.*, **74**: 648. 1979.



Plant small, 22–26 cm long. **Rhizome** 0.1–0.2 cm thick, short, thin creeping, covered with scales; scales ovato-lanceolate, blackish at the point of attachment, surrounded by reddish cells, central part blackish red, surrounded by yellowish cells, margin hyaline, apex acuminate, apical margin with small hairy projections. **Stipe** 9–12 cm long, pale when fresh, brown after drying, thin, glabrous, non scaly. **Lamina** 11–15 cm long, simple, 9–11 cm wide, pinnatifid, deltoid, texture herbaceous to subcoriaceous, margin cut almost to the rachis; lateral pinnae 5–7 cm long, terminal pinnae longest 9.5–10.5 cm long, upto 1.5 cm wide, all pairs pointing upwards, pinnae lanceolate, deltoid, base broadest, apex acuminate, margin spiny. **Rachis** clear, glabrous. **Venation** veins distinct, parallel, fall short to the margin, veinlets anastomose to form areolae, areolae bear free veinlet with swollen terminal end. **Sori** round, brown, exindusiate, in two rows, each on either side of the costa. **Sporangia** globose, stalked, 13 celled annulus, paraphyses present. **Spores** 48–56.5 µm long, 30–35.7 µm wide, pale brown, bilateral, non-perinate, exine smooth.

Polypodium malacodon Hook., *Sp. Fil.* 5. 87. 1863; C.B. Clarke in *Trans. Linn. Soc. London Bot.*, **1**: 564. 1880; Hope, *J. Bombay Nat. Hist. Soc.* **15**: 94. 1903.

Pleopeltis malacodon Bedd. *Handb. Ferns Brit. India*, 363. 1883; *pro parte*; *Suppl. Ferns British India*, 23 t. 387. 1876.

Chromosome number: n=34 (diploid). (Khullar, 2000)

Specimens examined: Chandrabadani to Kandikhal, 1048 (BSD), 12-Sep-2009, PUSHPESH JOSHI; on way to Masartal, 111961, 111939 (BSD), Sep-2010, PUSHPESH JOSHI & BRIJESH KUMAR.

Earlier records from the study area: Dhanolti, Nagtibba, Masartal.

Habitat: Common epiphytic fern on moss covered trunk of *Quercus*, between 1900–3400 m altitude.

Distribution: INDIA: Jammu and Kashmir, Himanchal Pradesh, Sikkim, Meghalaya, West Bengal, Uttarakhand (Garhwal: Dehradun, Tehri Garhwal, Uttarkashi, Pauri Garhwal, Chamoli, Rudraprayag; Kumaun: Nainital, Almora, Pithoragarh), BHUTAN, CHINA, TIBET, NEPAL.

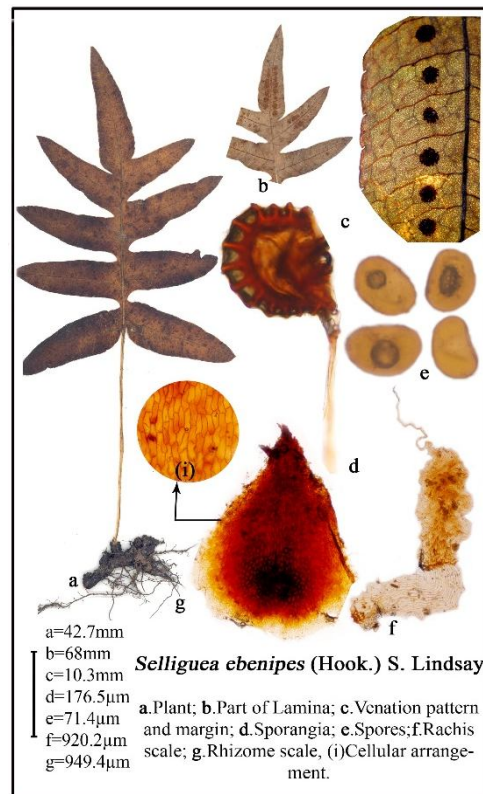
iii. *Selliguea ebenipes* (Hook.) S. Lindsay, Edinburgh J. Bot. 66: 356. 2009.

Pichisermollia ebenipes (Hook.) Fraser-Jenk. Taxon. Revis. Indian Subcontinental Pteridophytes, 49. 2008.

Phymatopteris ebenipes (Hook.) Pic. Serm. in Webbia 28(2): 462. 1973; Bir, Satija, S. M. Vasudeva & P. Goyal, Pterid. Fl. Garhwal Himalaya, 21. 1983; R. D. Dixit, Census Indian Pterid. 48.1984; Khullar, Ill. Fern Fl. West Himalaya 1: 128. t. 47. 1994; Subh. Chandra, Ferns India, 412. 2000; R. D. Dixit & R. Kumar, Pterid. Uttaranchal– Checklist, 39. 2002; P. C. Pande & H. C. Pande, Pterid. West Himalaya, 38. 2002; H. C. Pande & P. C. Pande, Ill. Fern Fl. Kumaon Himalaya, 2: t. 16(i). 2002; 1: 76. 2003; Sarn. Singh & Panigrahi Ferns Fern-Allies Arunachal Pradesh 2: 492. 2005; P. Joshi, H. C. Pande & P. C. Pande, Ferns Cent. Himalaya 1: 176. t.33. 2009.

Polypodium ebenipes Hook., Sp. Fil. 5: 88. 1863; C. B. Clarke in Trans. Linn. Soc.

London, Bot. 1: 564. 1880; Hope in J. Bombay Nat. Hist. Soc. 15: 96. 1903.



Pleopeltis ebenipes Bedd., Ferns Brit. India, t. 138. 1866; Bedd., Handb. Ferns Brit. India, 363. 1883.

Phymatodes ebenipes Ching in Contr. Inst. Bot. Natl. Acad. Peiping 2: 86. 1933; Dhir, Biblioth. Pteridol. 1: 128.1980.

Crypsinus ebenipes (Hook.) Copel., Genera Fil., 206. 1947; M. A. Rau, Bull. Bot. Surv. India, 3: 251. 1961; P. Chandra, J. Bombay Nat. Hist. Soc., 74: 648. 1979.

Plant small to medium sized, 30–40 cm long. **Rhizome** 4–7 cm across, creeping, long, stout, branched, densely covered with scales; scales 2.3–2.5 mm long, 1.7–1.85 mm wide base, colored, dark black central portion surrounded by reddish brown portion, which is further surrounded by red portion, again

surrounded by yellowish part, margin translucent, ovato-lanceolate, margin with small projections toward the apex, apex pointed. **Stipe** 12–16 cm long, 1–2 mm across, pale, thin, slender, upper part sparsely scaly, base scaly; scales 3.5–4 mm long, 0.2–0.4 mm wide, bicolorous, light brown to brown, consist irregularly arranged cells, margin irregular, tip hairy, elongated. **Lamina** 18–25 cm long, 10–15 cm wide, oblong, lanceolate, base broad, texture herbaceous to subcoriaceous, margin deeply cut almost to the rachis; lobes 5–7 cm long, 1.6–2.2 cm wide, 4–7 pairs of lobe, oblong, lanceolate, sessile subopposite to alternate, basal pinna deflexed downward, apex acute, margin serrate, serration minute. **Rachis** hairy and scaly. **Venations** veins distinct, reaching to the margin, veinlets anastomose to form areolae, areolae bearing 1–2 free veinlets with swollen terminal end. **Sori** round to elliptical, exindusiate, in two rows, each on either side of costa; paraphysis 3–5 celled. **Sporangia** stalked, with 12 celled annulus. **Spores** 50.4–56.5 μm long, 38–43.6 μm wide, brownish, bilateral, non-perinate, exine smooth.

Chromosome number: $n=34$ (diploid). (Khullar, 2000)

Specimens examined: Gangi to Ghuttu, 1195 (BSD), 10-Oct-2009, PUSHPESH JOSHI, on way to Masartal, 111906 (BSD), Sep-2010, PUSHPESH JOSHI & BRIJESH KUMAR.

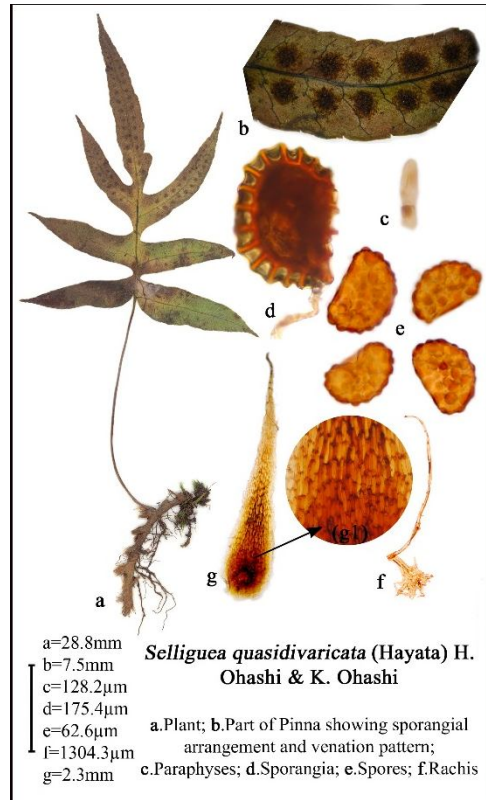
Earlier records from the study area: Nagtibba.

Habitat: Common fern, both epiphytic or lithophytic, growing on moss covered trees and big boulders, between 1800–3300 m altitude.

Distribution: INDIA: Jammu and Kashmir, Himanchal Pradesh, Sikkim, Meghalaya, West Bengal, Assam, Arunachal Pradesh, Uttarakhand (Garhwal: Dehradun, Tehri Garhwal, Uttarkashi, Pauri Garhwal, Chamoli,

Rudraprayag; Kumaun: Nainital, Almora, Pithoragarh), CHINA, BHUTAN, NEPAL, THAILAND, TIBET.

iv. *Selliguea quasidivariata* (Hayata) H. Ohashi & K. Ohashi, J. Jap. Bot. 84(5): 307. 2009.



Pichisermollia quasidivariata (Hayata) Fraser-Jenk., Taxon. Revis. Indian Subcontinental Pteridophytes, 53. 2008.

Polypodium quasidivariatum Hayata in J. Coll. Sci. Imp. Univ. Tokyo, 30: 446. 1911.

Phymatopteris stracheyi (Ching) Pic.-Serm., Webbia, 28: 464. 1973; Bir, Satija, S. M. Vasudeva & P. Goyal, Pterid. Fl. Garhwal Himalaya, 22. 1983; R. D. Dixit, Census Indian Pterid., 50.1984; Khullar, Ill. Fern Fl. West Himalaya, 1: 141. t. 52. 1994; R. D. Dixit & R. Kumar, Pterid. Uttaranchal– Checklist, 40. 2002; P. C. Pande & H. C. Pande, Pterid. West.

Himalaya, 40. 2002; H. C. Pande & P. C. Pande, Ill. Fern Fl. Kumaon Himalaya, 2: t. 16(vii). 2002; 1: 83. 2003; P. Joshi, H. C. Pande & P. C. Pande, Ferns Cent. Himalaya, 1: 182. t.36. 2009.

Polypodium stewartii (Bedd.) C. B. Clarke in Trans. Linn. Soc. London, Bot., 1: 563. 1880; Hope, J. Bombay Nat. Hist. Soc. 15: 96. 1903.

Crypsinus stracheyi (Ching) Panigrahi & Patnaik in Proc. Natl. Acad. Sci. India, B 34: 482. 1964.

Plant small, 13–25 cm long. **Rhizome** upto 5 cm long or more, 0.2–0.5 cm across, creeping, scaly; scales bicolorous, linear, lanceolate, base round, margin having fine filamentous projections. **Stipes** 5–9 cm long, 1.5 cm distant on rhizome, thin, dark brown, glabrous. **Lamina** 8–16 cm long, 6–9 cm wide, simple, pinnatifid, deltoid, texture subcoriaceous, base truncate, margin deeply cut to pinnae; pinnae 3.5–4.5 cm long, 1–1.5 cm wide, 3–4 pairs deltoid, lanceolate, alternate, basal pair of pinna deflexed downward, base broad, apex acuminate, margin serrate, serration minute, terminal pinna longest. **Rachis** scaly; scales 2.8–3.5 mm long, pale, base broad, hair tipped. **Venations** veins prominent, lateral veins clear, parallel, veinlets anastomose to form areolae, areolae bear terminal veinlet having swollen end at terminal portion. **Sori** small, round, brown, exindusiate, between two parallel lateral veins, in two rows, each on either side of costae; **Sporangia** stalked, with 14 celled annulus; paraphysis 96 µm long, 1–2 celled. **Spores** 48–62.6 µm long, 31–35 µm wide, reddish brown, bilateral, non-perinate, exine tuberculated.

Chromosome number: n=34 (diploid). (Khullar, 2000).

Specimens examined: Reeh to Gangi, 1170 (BSD), Sep-2010, PUSHPESH JOSHI; on way

to Masartal, 111940, 111938 (BSD), Sep-2010, PUSHPESH JOSHI & BRIJESH KUMAR.

Earlier records from the study area: New to study area.

Habitat: Rare fern, prefers to grow as epiphyte on mossy tree trunk, in moist and humid forest, between 2100–3000 m altitude.

Distribution: INDIA: Kashmir, Himanchal Pradesh, Sikkim, West Bengal, Uttarakhand (Garhwal: Dehradun, Tehri Garhwal, Pauri Garhwal, Chamoli; Kumaun: Nainital, Almora), CHINA, TIBET.

REFERENCES

- Beddome, R.H., 1866.** The Ferns of British India: t. 95. Gantz Brothers, Madras. India.
- Beddome, R.H., 1883.** A Handbook to the Ferns of British India, Ceylon and Malaya Peninsula, Supplement. Thacker Spink and Co., Calcutta.
- Bir, S.S., Satija, C.K., Vasudeva, S.M., Goyal, P., 1983.** The Pteridophytic flora of Garhwal Himalaya. Jugal Kishore and Co. Dehradun.
- Chandra, P., 1979.** Ferns of Kedarnath, Madhyamaheshwar and Tungnath. Journal of the Bombay Natural History Society. 74, 640–650.
- Chandra, S., 2000.** The Ferns of India (Enumeration, Synonyms of Distribution). International Book Distributors, Dehradun, India.
- Clarke, C.B., 1880.** A review of the ferns of Northern India. Transactions of the Linnean Society of London, 2nd series. 1, 425–611.
- Dhir, K.K., 1980.** Ferns of North-Western Himalayas. Bibliotheca Pteridologica. 1, 1–158.
- Dixit, R.D., Kumar, R., 2002.** Pteridophytes of Uttaranchal (A Checklist). Bishen Singh Mahendra Pal Singh, Dehradun, India.

- Dixit, R.D., 1984.** A Census of the Indian Pteridophytes. Botanical Survey of India, Howrah.
- Fraser-Jenkins, C.R., 1997.** New Species Syndrome in Indian Pteridology and the Ferns of Nepal. International Book Distribution, Dehradun, India.
- Fraser-Jenkins, C.R., 2008.** Taxonomic Revision of Three Hundred Indian Subcontinental Pteridophytes with a Revised Census List. Bishen Singh Mahendra Pal Singh, Dehradun, India.
- Goel, A.K., Bhattacharya, U.C., 1989.** Contribution to the pteridophytic flora of Tehri District (Garhwal). Indian Journal of Forestry. 4(1), 30–37.
- Gupta, R.K., 1955.** Botanical exploration in the Billangana valley of the erstwhile Tehri Garhwal State– I. Journal of the Bombay Natural History Society. 53, 581–594.
- Hope, C.W., 1899–1904.** The ferns of North Western India including Afghanistan, the Trans-Indus protected states and Kashmir. Journal of the Bombay Natural History Society. Reprint: Bishen Singh Mahendra Pal Singh, Dehra Dun, 1976, pp. 1–306.
- Jain, S.K., Rao, R. R., 1976.** Handbook of Field and Herbarium Methods, New Delhi.
- Joshi, P., Pande, H.C., Pande, P.C., 2009.** Ferns of Central Himalaya– I (Chamoli and Rudraprayag). Bishen Singh Mahendra Pal Singh. Dehradun, India.
- Khullar, S.P. 1994.** An illustrated Fern Flora of West Himalaya, vol 1. International Book distributors, Dehradun, India.
- Khullar, S.P. 2000.** An Illustrated Fern Flora of West Himalaya, vol. II. International Book Distributors, Dehradun, India.
- Naithani, B.D. 1969.** Plants Collection with the Kedarnath Parbat Expedition, 1967. Bulletin of Botanical Survey of India. 11(3–4), 224–233.
- Nayar, B.K., Kaur, S., 1974.** Companion to R.H. Beddome’s Handbook to the ferns of British India, Ceylon and Malay Peninsula. Chronic Botanica, New Delhi.
- Negi, K.S. Tiwari. J.K., Gaur, R.D., 1987–88.** A Contribution to the flora of Khatling Glacier in the Garhwal Himalayas (District Tehri) Uttar Pradesh. Journal of the Bombay Natural History Society. 84, 585–598.
- Pande, H.C., Pande, P.C., 2002.** An Illustrated Fern Flora of the Kumaon Himalaya, Vol. II, Bishen Singh Mahendra Pal Singh, Dehradun, India.
- Pande, H.C., Pande, P.C., 2003.** An Illustrated Fern Flora of the Kumaon Himalaya, Vol. I, Bishen Singh Mahendra Pal Singh, Dehradun, India.
- Pande, P.C., Pande, H.C., 2002.** Pteridology in Western Himalaya (Kumaon). Bishen Singh Mahendra Pal Singh, Dehradun, India.
- Rau, M.A., 1961.** Flowering Plants and Ferns of North Garhwal, Uttar Pradesh, India. Bulletin of the Botanical Society of India. 3(3&4), 215–251.
- Singh, S., Panigrahi, G., 2005.** Ferns and Fern-Allies of Arunachal Pradesh. Bishen Singh Mahendra Pal Singh, Dehradun. 1, 1–426; 2, 427–881.
- Uniyal, B.P., Singh, S., Singh, D.K., 1995.** Plant Diversity in the Tehri Dam Submersible Area, Botanical Survey of India, Howrah, Calcutta.