Annexure-I

Publications

A. Paper presented and Abstract published:


B. Research Paper Published


C. Research Paper Communicated


D. Achievement

Awarded First prize on Best Poster presentation In International Symposium on “Fern and Fern Allies: Diversity, Bioprospectation and Conservation”, held at IHBT, Palampur, Himachal Pradesh in 2011.
Taxonomic studies on Selaginellaceae of Assam, India

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Abstract
Northeastern region of India is regarded as a centre of biodiversity and one of the hotspots for diversity centers of Pteridophytes. Assam being a part of the Northeast India is also rich in pteridoflora. Selaginellaceae is a major group among the fern-allies and represented by about 63 species in India but only little information on this taxon is available for NE part of the country. A recent survey on this group, initiated in the year 2008 so far documented ten species of Selaginella namely: S. ciliaris (Retz.) Spring, S. chrysochloa Spring; S. hookeri Bak.; S. pennata (D. Don) Spring; S. pentagona Spring; S. repanda (Desv. ex Poir.) Spring; S. reticulata (Hook et Grev.) Spring; S. semicordata (Wall. ex Hook. et Grev.) Spring, S. wallichii (Hook. et Grev.) Spring and S. decipiens Warb. The study also deals with analysis of characters pertaining to leaf arrangement, morphology of leaves (lateral, median & axillary), sporophylls, microspore, megaspore along with distributional range, ecological attributes and other significant aspects.

Key words: Selaginellaceae, Selaginella, Assam.

INTRODUCTION
The genus Selaginella Pal. [Selaginellaceae] consisting of about 700 species are distributed throughout the globe but mainly in tropical and subtropical regions. In India the genus is represented by 63 species (Dixit 1992; Madhusoodanan & Nampy 1994). Although occurrence of different members of the Selaginella have been reported from time to time from erstwhile Assam by pioneer workers like Alston (1945), Panigrahi & Dixit (1969), Baisya & Rao (1982) but most of the collected materials were mainly from localities now within the present political boundaries of Meghalaya and Arunachal Pradesh, and to some extend to Manipur and Nagaland. Very few species have been included from the present geographical boundary of Assam by above earlier workers. Moreover, works published so far on Selaginella of this region of India are fragmentary in spite of the high biodiversity of the region. However, there are some works on other groups of pteridophytes in the state by workers like Clarke (1880), Beddome (1865-1870, 1883), Kachroo (1953, 1975), Panigrahi (1960, 1968), Panigrahi & Choudhury (1961, 1962), Panigrahi & Patnaik (1961a, b), Bir et al (1989) and Vasudeva et al (1990). Handique & Konger (1986) and Barua et al (1989) published enumeration of fern and fern-allies from Guwahati and Kamrup district respectively. Recently Borthakur et al (2001) published “Illustrated Manual of Ferns of Assam” which includes 221 species of ferns belonging to 87 genera and 47 families. This is the first work to include the ferns of the state as a whole but excluded the fern-allies. Therefore, a study on the fern-allies has been undertaken since 2008 and the outcome is the present communication which includes a in depth comprehensive analysis of characters pertaining to leaf arrangement, morphology of leaves (lateral, median & axillary), sporophylls, microspore, megaspore along with distributional range, ecological attributes and other significant aspects of eight species of Selaginella occurring in Assam.
MATERIALS AND METHODS

The study includes field survey, collection, identification and documentation of Selaginella Pal. species occurring in Assam. The standard field and herbarium techniques were followed in the process of collection, pressing and preparation of herbarium specimens (Jain & Rao 1977). Important characteristic features of the specimens like colour of leaf & stem, mode of bearing of rhizophore on the plant *i.e.* whether it is confined to base or extend upto upper parts of the plant body, branching pattern of the rhizophores, habit, habitat, size, etc. were noted down in the field during collection. Some specimens were also preserved in 4% formaldehyde solution for further critical studies. The identities of the specimens were confirmed at the ASSAM Herbarium. Microscopic preparations of different parts of each species of the genus were made, stained with safranin and then simple and compound microscopic observations were made. The study also includes the measurement of both micro- and megaspores. Graph paper of standard size were used to measure the length and breadth of each category of vegetative leaf (lateral, median and axillary leaves) and fertile leaves (both larger and smaller sporophylls). Detail morphological characters like margin of the both vegetative and fertile leaves, their shape, apex and base, etc. were studied under high magnification using both simple and compound microscopes.

RESULT AND DISCUSSION

The eight species of Selaginallaceae recorded during the present survey all are belonging to Selaginella Pal. An artificial dichotomous Key has been presented below for the identification of these eight species recorded from Assam.

Key to the species of Selaginella

1. a. Sporophylls unimorphic ................ 2
   1. b. Sporophylls dimorphic ................ 5
2. a. Leaves heteromorphic at the base of the main stem .......... 3
2. b. Leaves isomorphic at the base of the main stem ........ 4
3. a. Leaves distant at the main branch .......... S. semicordata
3. b. Leaves contiguous at the main branch .......... S. repanda
4. a. Axillary leaves in branches are different from those of stem .......... S. hookeri
4. b. Axillary leaves are almost similar in branches and stem .......... S. pentagona
5. a. Inner-half of lateral leaf ciliate at base .......... 6
5. b. Inner-half of lateral leaf dentate at base .......... 7
6. a. Median leaf ovate. inner half of lateral leaf distantly ciliate at base .... S. ciliaris
6. b. Median leaf not ovate, inner-half of lateral leaf densely ciliate at base .... S. pennata
7. a. Median leaf shortly cuspidate .......... S. chrysorrhizos
7. b. Median leaf not cuspidate .......... S. reticulata

Plant body ca 35 – 150 cm., terrestrial, trailing, slender, growing in paddy field or marshland or shady areas among the grasses with abundant water content, sulcate. Branches arise alternately from the base of the plant, they are short, pinnately-decompound, flabellate and distant. Thick, long, straw-coloured rhizophores present almost all over the plant. Leaves dimorphic. Lateral leaves 2.2-2.5 x 0.8-1.2mm, oblique, white-marginated, with distinct midrib extend from base to almost apex, spreading, distant at main stem, contiguous at branches, oblong-lanceolate, sub-obtuse to sub-acute at apex, apex erose. Median leaves 1.6-1.8 x 0.5-0.7mm, oblique at base, entire, oblong, shortly cuspidate at apex, white-marginated, imbricated; Axillary leaf broad oblong-lanceolate, bright-green, and large ca. 2.2-2.6 x 1.5-1.8mm at the main stem; obovate, light-green and small ca. 1.5-2 x 0.6-0.9 mm at branches. Strobili 7.5-15 x 1.5-2.3mm, tetrasporangiate, single at the apex of branchlets. Sporophylls uniform, 1.8-2 x 0.8-1 mm, spiral, ovate, acute, keeled, entire. Microspore 35 – 50 μm, pale, exine with white, translucent wing-like perispore supported with hook-like structure. Megaspore 350 – 450 μm, dark-brown, perispore.

Note: In between two successive pair of alternating lateral leaves a pair of median leaves borne on the main stem and contiguously on the branches. Median leaf entire, at branches base of the interior half of a median leaf is overlapped by the apex of interior half of the leaf preceding it. Axillary leaf with distinct mid-vain, margin prominently wavy towards the apex. Inner half-leaf of lateral leaves of the main stem is semi-ovate and outer-half leaf is semi-oblong-lanceolate, of the branches inner half is lanceolate and dilated at base. Axillary leaf are of distinctly two types, at main stem broad oblong-lanceolate, bright-green, and large ca. 2.2-2.6 x 1.5-1.8 mm and at branches obovate, light-green and small ca. 1.5-2 x 0.6-0.9 mm at.


Plant body: ca 20 cm in length, terrestrial, suberect, bright green when young, pale-brown at maturity, pinnately compound branches arise from the base of the stem. Rhizophores develope from few basal nodes. Leaves dimorphic. Lateral leaf ca 2.5-2.6 x 1.2-1.5 mm at branches, 2.5-2.6 x 1.2-1.5 mm at main stem, drying-brown, ovate, cordate, sub-falcate, minutely ciliate at base, rest uniformly dentate, acute, light margin; inner-half semi-ovate; outer-half oblong-lanceolate. Median leaf 1-1.2 x 0.6-0.8mm, ovate, acuminate, dentate, oblique, a few cilia present at the base of larger-half. Axillary leaf ciliate at base, length of cilia decreases above, rest dentate; of branches are lanceolate, 1.8-2 x 0.8-1 mm; of stem are almost ovate, 2.2-2.5 x 1.2-1.5 mm, comparatively thicker than that of branches. Strobili 10-12 x 1-1.5 mm, tetragonal, terminal, 1 – 2 at the apex of the branchlet, Sporophylls uniform, 1.5-1.8 x 0.8-1 mm, ovate, keeled, long acuminate, uniformly dentate. Microspore 48 – 55 μm, many orange-red. Megaspore 200 – 275 μm, yellowish-brown, almost round.

Note: Axillary leaf lanceolate, ciliate at base, length of cilia gradually decreases upwards, rest dentate, acute- acuminate. Axillary leaf 2.2-2.5 x 1.2-1.5 mm, broadly-ovate at stem, 1.6-1.8 x 0.6-0.8 mm, narrowly-ovate at branches.


Plant body 25 – 50 cm., terrestrial, decumbent, thick, sulcate, simple at base, copiously branched above, lateral branches bipinate, arised alternately from the main stem, distant, erecto-patent, upper ones shorter than the lower ones. Thick and unbranched rhizophore confined to the basal
Selaginella of Assam

one part only. Leaves isomorphic and distant at the main stem; heteromorphic and contiguous at the branches. Lateral leaves 2-2.6 x 1.6-1.8 mm, ovate-oblong-lanceolate, falcate, cordate, acute, entire; of the branches and main stem are similar, inner-half leaf semi-ovate, base of the inner-half leaf is almost like an arc of a circle, rotundate at base, outer half-leaf semi-oblong-lanceolate; of ultimate branches oblong-lanceolate, dilated at base. Median leaves 2-2.5 x 0.6-0.8 mm, oblique, lanceolate, acuminate. Axillary leaf entire, acute, varied in size and shape; of the branches small, 1.6-2 x 0.5-0.8 mm, obovate, overlapping the stem; of the main stem large, 2.5-3 x 1.8-2 mm., broadly ovate. Strobili 4-6 x 1-2 mm., tetragonal, terminal and single at the branchlets, Sporophyll 1.6-1.8 x 0.8-1 mm, uniform, ovate, keeled, entire, cordate, acuminate. Microspore 22-28 μm, orange-red. Megaspore 225-260 μm, dark-brown.

Note: Two successive lateral leaves on the same side of a lateral branch followed by a branchlet on the same side and then alternated by the same arrangement of lateral leaves and a branch.


Plant body 3 - 10 cm., creeper, growing in patches in moist shady place, branches simple to compound and arise from the base of the stem, thin and wiry rhizophore present either in the base or up to the lower half of the plant but restricted to the main stem. Leaves dimorphic, dark green, membranous. Lateral leaves 1.5-2 x 1-1.4 mm, not spreading, oblique, obliquely cordate at base, acute or sub-obtuse; inner half leaf semi-ovate, distantly ciliated at base, rest minutely denticulate; outer half leaf semi-ovate or lanceolate, minutely denticulate. Median leaves 1-1.4 x 0.5-1 mm, ovate, acuminate, sub-falcate, cordate, distantly denticulate, mid- vein distinct and extends from base almost up to apex. Axillary leaves 1.5-2 x 0.8-1.2 mm, ovate-oblong, cordate, acute, midrib dividing the leaf into two slightly unequal parts; larger half is more densely ciliated at base compared to the base of smaller half, rest inconspicuously and minutely denticulate; if one half of an axillary leaf is interior (near to main stem) at a particular branch the same half of another axillary leaf in the immediate above remain as exterior (near to the branch). Strobili terminal, 1 - 2 in the branchlet, 7.5 - 10 x 2 - 2.5 mm. Sporophylls dimorphic; larger sporophylls towards the plane of median leaf, ovate-oblong, inner half denticulate, outer half auricled and ciliated with one or two cilia, both halves meet the base of margin to form an inflated structure to hold the sporangia; Smaller sporophylls towards the plane of lateral leaf, ascending, acute to acuminate, cordate, ovate, distantly ciliate; Microspore 30 - 37 μm, yellowish-brown; Megaspore 180 - 225 μm, yellow.

Note: In between alternation of two lateral leaves there is a single median leaf at main stem.


Plant body 20 - 40 cm. long, terrestrial, erect, pinnately branched, lower branches elongated, stem and branches are distinctly pale but on drying branches are stramineous in color, rhizophore are thick, long and are developed up to half of the length of the plant. Leaves heteromorphic, membranous and pale green in color; Lateral leaves oblique, spreading, 2.5-3.5 x 1-1.5 mm in the main stem, slightly smaller in the branch and in ultimate branches, elliptic in stem and branches, oblong-lanceolate in ultimate branches, outer half-leaf lanceolate, entire, denticulate at apex, inner half leaf semi-ovate-lanceolate or semi-oblong-lanceolate, denticulate, ciliate at base; median leaves 0.5-1 x 2-2.5 mm in the main stem, slightly smaller in ultimate branches, sub-falcate, oblique, aristate, arista is equal to or less than half of length of the leaf, entire, sometime 1-3 denticules present at the apex of the leaf; Axillary leaves of the main stem are larger, 1-1.5 x 2.5-4 mm,
ovate, densely ciliate at base, number of cilia abruptly decreases in upper portion, denticulate at apex, acute and of the branches are smaller, oblong, minutely ciliated at base. Strobili 5-10 x 1.5-2.5 mm, solitary and occupies terminal position in the ultimate branches. Sporophylls dimorphic, membranous; larger sporophylls towards the plane of median leaf, 1-1.5 x 3-4 mm, ovate-oblong, ciliate at base, rest denticulate; smaller sporophylls towards the plane of lateral leaf, 0.5-1 x 2-3 mm, ovate, denticulate to ciliate, cilia are prominent at base and at apex, acuminate. Microspores 26 – 35 μm, yellow. Megaspore 350 – 450 μm, brown, number of megaspore 4 within each megasporangium.


Plant body erect, terrestrial, tufted, yellow, branch copiously pinnate, stem angular. Leaves heteromorphic, membranous, white margined. Lateral leaves spreading, 0.6-0.8 x 1-2 mm, oblique, cordate, sub-obtuse; inner half-leaf semi-ovate, base broad-round, distinctly dentate at base, rest regularly denticulate; outer half-leaf semi-oblong, distinctly dentate at apex, rest entire. Median leaves 1.8-2 x 0.5-0.8 mm, sub-falcate, ovate, denticulate, and shortly cuspidate. Axillary leaves 1.8-2 x 0.8-1 mm, more broadly ovate in the main stem than that of branches, dentate at base, denticulate at apex, acute. Strobili 3-6.5 x 1.5-2 mm, resupinate, copious. Sporophylls dimorphic; larger sporophyll 2-2.5 x 1-1.5 mm bright green, oblong-rhomboid, erecto-patent, outer-half part entire, ciliate at base, inner half-part dentate; smaller sporophylls 1.6-1.8 x 0.6-0.8 mm, ovate, cuspidate, ciliate; microspores 20 – 35 μm, pale brown, verrucoid; megaspores 180 – 200 μm, dark-brown.


Plant body terrestrial, growing in patches in moist shady places or inclined bases of hills, small ca 6 – 15 cm long, tufted. Stem erect, slender, profusely branched, branches alternate. Rhizophorea wiry, confined to lower one-third portion of the stem, unbranched. Leaves heteromorphic, light green. Lateral leaves ca 1.8-2 x 0.8-1 mm with prominent, dark mid-vain, mid-vain of the leaf forming an angle of about 30° - 60° with the stem or branch, ascending, dentate, base rotundate, apex sub-acute; inner-half leaf semi-ovate, prominently dentate; outer-half leaf oblong-lanceolate, inconspicuously dentate. Axillary leaf 1-1.3 x 0.6-0.8 mm, with prominent mid-vain, narrow-ovate, dentate at intervals, sub-acute at apex. Median leaf 0.8-1 x 0.3-0.5 mm, ovate, oblique, dentate, apex sub-acute, distantly serrulate, at branches base of the exterior-half of a median leaf overlap a part of the the inner-half of a lateral leaf below it and apex of the exterior-half of the same median leaf overlap a part of the outer-half of the lateral leaf above it by virtue of contiguous nature of the leaves. Strobili 5-7 x 2-3 mm, Strobili solitary at the apices of branchlet. Sporophylls dimorphic. Larger sporophyll ca 1.8-2 x 0.3-0.5 mm, are in the plane of median leaf, fertile, microsporangiate, uniformly dentate except the base; outer-half part auricled at base, ciliate; inner-half part shows only 1 or 2 cilia at base. Smaller sporophyll are in the plane of lateral leaf. Microspores 27 – 29 μm, bright orange. Megaspore 200 – 210 μm, dark-brown, sometime at some parts exine is wavy.

**Note:** Larger sporophyll microsporangiate, uniformly dentate except the base. The base of outer-half of the larger sporophyll is auricled, ciliate whereas base of inner-half part shows only 1 or 2 cilia. Smaller sporophyll, microsporangiate to megasporangiate, small, ovate, ciliate at base, dentate above, number of megaspore four per megasporangium.

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Plant body ca 35 cm, erect, terrestrial, simple in basal region, branched above. Leaves isomorphic and distant at base of the stem, heteromorphic and contiguous at above and branches, dark green, ascending; isomorphic leaves oblique at base, acute, one-half part is broadly semi-ovate, whereas other half part is lanceolate; lateral leaves 3.8-4.0 x 1.8-2 mm, more or less like the isomorphic leaves at base of the main stem except slightly elongated, oblique at base, entire, outer half leaf semi oblong-lanceolate, inner half leaf semi ovate-lanceolate; axillary leaves 2.5-3 x 1-1.5 mm, ovate, oblique, inconspicuously denticate, light green; median leaves 2.8-3 x 1.7-2 mm, oblique, ovate, cuspidate, denticate. Strobili 8-10 x 1.5-2 mm, tetragonous, solitary at apex of ultimate branches, isomorphic; sporophylls ovate, dentate, long acuminate. Microspore orange red, 25-30 μm. Megaspore 235-240 μm, dark red, verrucoid.

A total of 200 herbarium specimens of allied fern have been collected by undertaking extensive field works during 2008-2010, of which more than 80 specimens were belong to the genus Selaginella Pal. After through analytical studies eight species viz., S. semicordata, S. repanda, S. hookeri, S. ciliaris, S. pennata, S. chrysochloris have been identified so far out of the collected specimens and studies on the remaining specimens are in progress. Detail characterisation has been included for all the species recorded in the present communication and many of the characters included have not been recorded by earlier workers. Species S. pentagona, which is endemic to northeastern India, has been recorded so far only from Arunachal Pradesh (Ahor Hills) and Meghalaya (Cherapunji) (Singh & Panigrahi 2005; Ahor Hills, Burkill 36291, CAL and Meghalaya, Cherapunji, Biswas 3889, CAL) but the present study has confirmed its occurrence in Assam also. The S. reticulata has been known from Arunachal Pradesh and Meghalaya in India and from Myanmar but the present investigation established its presence in Assam also. In different herbaria of the region (ASSAM, CAL, Gauhati University Herbarium, ARUN, etc.) the genus is not well represented. In addition to the above it is interesting to find certain algae/fungi association with S. pentagona. However, the nature of association is yet to be confirmed. Further studies on the genus are expected to yield much more interesting results.

LITERATURE CITED


Selaginella reticulata (Hooker ex Greville) Spring (Selaginellaceae):
a new record for Assam

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Abstract
The fern-alley Selaginella reticulata (Hooker ex Greville) Spring (Selaginellaceae) is a new record for the state of Assam in India.

Key words: Selaginella reticulata, New record, Assam.

INTRODUCTION
Northeastern region of India represents the transition zone of the Indian, Indo-Malayan and Indo-Chinese biogeographic regions and a meeting place of the Himalayan mountains and Peninsular India. The region is at the conjunction of the Eastern Himalayan and Indo-Burma biodiversity hotspots which is regarded as a major center of biodiversity and one of the hotspots biodiversity centers of Pteridophytes. The Northeastern region is the richest region of India in Pteridophytic flora (Bir et al 1989). Assam is one of the eight states of Northeastern India with rich pteridophytic flora, and has distinctiveness on account of their species diversity and peculiar formations. In spite of this, fern-allies of the state have not been studied in detail so far, except a few sporadic works (Alston 1945; Barua et al 1989; Bhattcharya et al 1995; Bir et al 1992; Dixit 1992; Dutta et al 1980; Handique & Konger 1986; Islam 1983; Nath & Bhattacharya 2002; Panigrahi 1960; Thakur 1962). Most of the earlier works cover parts of northeast India other than present Assam as a part of undivided Assam of fifties and sixties of the last century.

During the course of on going studies on Fern-allies of Assam, the authors collected some specimens of Selaginella Beauverd and later identified as Selaginella reticulata (Hooker ex Greville) Spring. Careful scrutiny of relevant literatures (Alston 1945; Baishya & Rao 1982; Barua et al 1989; Bhattcharya et al 1995; Bhattcharya et al 1998; Bir et al 1992; 1989; Borthakur et al 2001; Dixit 1984; 1992; Dixit & Vohra 1984; Dutta et al 1980; Fraser-Jenkins 2008; Handique & Konger 1986; Islam 1983; Jain 1991; Kachroo et al 1989; Kaur & Chandra 1994; Manickam & Irudayaraj 1992; Mukhopadhyay 2001; Nath & Bhattacharya 2002; Panigrahi 1960; Panigrahi & Choudhury 1962; Panigrahi & Dixit 1967; 1967a; 1968; Singh & Panigrahi 2005; Thakur 1962) revealed that the species has never been reported before from the present political boundary of Assam and hence the occurrence of Selaginella reticulata (Hooker ex Greville) Spring has been recorded for the first time in Assam.

A brief description of the species along with photographs is provided here for easy identification. The newly collected specimens were processed and mounted on standard herbarium sheets following Jain & Rao (1976) and have been deposited in the Herbarium of Botany Department, Gauhati University (GUBH).


Plant body (Fig. A) terestrial, light-green, turns light-brown on maturity or on bearing sporangium (Fig. A), ca 6 – 15 cm long, tufted; stem (Fig. B) erect, slender, profusely branched from base, branches alternate. Rhizophores wiry, unbranched, confined mostly to lower one-third part of...
New record of *Seluginella reticulata* from Assam

Figure 1. *Selaginella reticulata*: A. Habit; B. Main stem with leaves; C. Lateral leaf; D. Axillary leaf; E. Median leaf; F. Larger sporophyll; G. Smaller sporophyll; H. Microspore; Megaspore
stem. Leaves heteromorphic, light green; lateral leaf (Fig. C) ca 1.8 - 2 x 0.8 - 1 mm with prominent dark mid-vein an angle of about 30°-60° with the stem or branch, dentate, ascending, rotundate at base, apex sub-acute, inner half-leaf semi-ovate, prominently dentate, outer half-leaf oblong-lanceolate, inconspicuously dentate; Axillary leaf (Fig. D) 1 - 1.3 x 0.6 - 0.8 mm, narrow-ovate, dentate, mid-vein prominent, apex sub-acute, distantly dentate; median leaf (Fig. E) ca 0.8 - 1.0 x 0.3 - 0.5 mm, ovate, oblique at base, apex sub-acute, distantly dentate. Strobili 5 - 7 x 2 - 3 mm, solitary at the apices of branchlet. Sporophylls fertile, dimorphic; larger sporophyll (Fig. F) ca 1.8 - 2 x 0.3 - 0.5 mm, are in the plane of median leaf, microsporangiate, ovate-oblong, acute, uniformly dentate throughout except the base of the outer half-part auricled and ciliate, inner-half part shows only 1 or 2-few cilia at base. Smaller sporophyll (Fig. G) are in the plane of lateral leaf, ca 1.4 - 1.6 x 0.7 - 0.9 mm, micro or mega sporangiate, ovate, ciliate at base, dentate above, acuminate, number of megsapore four per megasporangium. Microspore (Fig. H) bright orange, ca 29 - 42 im, smooth or granulose. Megaspores (Fig. I) ca 80 - 220 im, dark-brown, sometime at some parts exine is wavy in nature, granulose.

**Distribution:** INDIA: Arunachal Pradesh, Meghalaya, Assam; MYANMAR

**Ecology:** Terrestrial herb generally grows in patches in damp forest floor rich in humus or in moist shady places along the inclined hill slopes and in association with species of Begonia, Adiantum, mosses, etc.

**Exsiccatea:** Assam, NC Hills, Lower Haflong, 11.01.2009, Himu Roy 104 (GUBH).

**LITERATURE CITED**


New record of *Selaginella lehculata* from Assam


This is to certify that Mr. Himu Roy from Guwahati University, Assam, India has participated in the International Symposium on "Ferns and Fern Allies: Diversity, Bioprospection and Conservation" organized by the Institute of Himalayan Bioresource Technology, CSIR Palampur, Himachal Pradesh, India and The Indian Fern Society, Chandigarh, India during November 10-12, 2010. Also that his poster was adjudged the FIRST BEST POSTER presented at the Symposium.