BULL. BOT. SURV. INDIA
Vol. 43, Nos. 1-4 : pp. 151-194, 2001

A REVISION OF FAMILY POTAMOGETONACEAE OF INDIA

M. J. KOTHARI

Botanical Survey of India, Pune

ABSTRACT

'Potamogetonaceae' includes 2 genera and *ca* 100 species distributed in temperate and tropical regions of World. The present paper deals with its 2 genera *viz.*, POTAMOGETON L. including 17 species and 2 varieties and GROENLANDIA Gay with 1 species represented in India. Key to genera, subgenera and species as well as necessary illustrations are given for clear identity. Short description of each species including its correct binomial, basionym if any and synonyms, morphological characters, phenology, distribution in India as well as world, ecological notes and uses if any are provided. Specimens examined and approved acronyms of the herbaria where the specimens are deposited are cited.

INTRODUCTION

The family Potamogetonaceae is represented by 2 genera *viz.* POTAMOGETON L. including 17 species and two varieties and GROENLANDIA Gay with 1 species. Genus POTAMOGETON L. constitutes a natural genus with about 100 species (Airy Shaw, 1966), wide spread throughout the world except in polar regions, while GROENLANDIA Gay is restricted to W. Asia, N. W. Africa, N. America, Syria and Turkey.

Potamogetonaceae, was first established by Dumort in 1827. Formerly the family was included under Najadales by Bentham & Hooker f. (1880) and J. D. Hooker (1893). Later on Rendle (1904) placed it under Helobiales. Hutchinson (1960) placed the family under Potamogetonales and segregated family Potamogetonaceae from Ruppiaceae based on its fresh water habit, flower's perianth with 4 free clawed segments arranged valvately, lateral ovules and sessile fruiting carpels.

Potamogetonaceae is worked out by number of Indian and foreign workers at

Date of receipt : 03/01/2001. Date of acceptance : 31/10/2001.

country, regional or state level. Nairne (1894), Aescherson & Graebner (1907), Hagströem (1905, 1916), Biswas & Calder (1936), Bamber (1926), Butcher (1961), Haines (1961), Subramanyam (1962), Prain (1963), Dandy (1971, 1978, 1985), Aziz & Jafri (1975), Shah (1976), Mathew & Britto (1983), Kak (1984), Sharma *et al.* (1984), Karthikeyan *et al.* (1989), Pandey (1993), Srivastava (1996), Lakshminarasimhan (1996), Rao, (1997) etc.

Hagströem (1916) published his famous work on POTAMOGETON. Even though it has been criticized by St. John (1925) and Fernald (1932) with respect to the treatment of American species, it is still unchallenged. Recently, Haynes (1985) started series of revisions of some groups of POTAMOGETON aiming at a world wide monograph. In another paper Haynes (1986) checked original descriptions given by Linnaeus for POTAMOGETON spp. More recently, Wiegleb (1988) has given a review of the systematics of the genus POTAMOGETON L., on a world wide scale.

Cytological work in POTAMOGETON species was initiated by Palmgren (1939). Thereafter, Stern (1961) published chromosome numbers in nine taxa of POTAMOGETON. Mishra (1972) studied 3 species of the same genus. Kumar and Subramaniam (1989) from Botanical Survey of India published a Chromosome Atlas of flowering plants of Indian subcontinent' which includes chromosome numbers of *ca* POTAMOGETON species. Les (1983) made a world wide account on the taxonomy of the genus with special emphasis on chromosome numbers, distribution and evolutionary trends. However, his arguments were criticized by Wieglab (1988) because of wrong synonymizations, incorrect assignment of species and incomplete records of published choromosome counts.

Raunkiaer (1903) made anatomical studies on POTAMOGETON species. Paliwal and Lavania (1979) reported epidermal structure and ditribution of stomata in *Potamogeton nodosus* Poir. Wiegleb (1988) showed the value of stem anatomy and fruit morphology in the systematics of POTAMOGETON species.

The species of POTAMOGETON especially *P. crispus* L., *P. pectinatus* L. etc., are used as manure and important food resources for migrant birds (Kak, 1984). Root stocks of certain species e.g. *P. perfoliatus* L. and *P. natans* L. contain protein and carotene and are used as manure and serve as food for animals (Ambasta 1986). Most of the species are used for food and shelter by many fishes and crabs. Many of the POTAMOGETON species are decorative. Leaves of *P. malainus* Miq. and *P. crispus* L. contain pigment 'Rhodoxanthin' used in Homeopathic medicine (Kumar & Banerjee, 1999).

The present work is based on critical study of the herbarium specimens of the family housed in various herbaria (e.g. CAL,

ISIM, BSI, BSA, BSJO, MH, BLAT, SPUH, KASH & other Univ. Herbaria of the country, supplemented by recent literature and field work. Key to genera, subgenera and species alongwith illustrations for each species is provided for clear identity. Similarly, for each species citation, followed by complete description, phenology, distribution, ecological notes, available chromosomal data, specimens examined and uses if any, are given for easy reference.

POTAMOGETONACEAE

'Potamogetonaceae' Dumort, Anal. Fam. 56, 61. 1829 (Potamogetonaceae) ; Aschers.& Graeb. in Engler's. 4 (Potamogetonaceae) Heft. 31 : 39. 1907 ; Hutchinson, Fam. Fl. Pl. ed. 2, 2 : 556. 1959 ; Hook.f. in Hook.f. Fl. Brit. India 6 : 565. 1893 ; Subramanyam, Aq. Angio. 923. 1962 : Dandy in Reech.f. Fl. Iran. 83 : 1. 1971 & in Townsend & Guest, Fl. Iraq 8 : 19. 1985 ; Karthikeyan *et al.* Florae Indicae Enumeratio-Monocotyledonae 284. 1989 ; Cooke, C. D. K. Aqu. & Wet. Plants Ind. 331. 1996.

Aquatic, annual or perennial herbs ; stems creeping or rhizomatous, terete or compressed, leafy, jointed, branched or unbranched, rooting at lower nodes. Leaves alternate or opposite, submerged or floating, sessile or petiolate ; stipules membranous, tubular, free from the leaf base or if adnate then with a free tip. Flowers bisexual, regular, small, ebracteate in a pedunculate, axillary compact or interrupted spikes. Perianth segments 4, green, rounded, concave, greenish, valvate, shortly clawed. Stamens 4, free, filaments adnate to the perianth claw; anthers bilobed, didymous, extrorse, dehiscing, longitudinally ; pollen spherical, monoaperturate. Gynoecium superior; carpels 4, free, sessile, unilocular, uniovulate; ovule, campylotropus; placentation parietal. Drupelets 1-4, rounded or beaked. Seeds subreniform, non-endospermic, embryo coiled or hooked.

Distrib. : Temperate and tropical regions; 2 genera and about 100 species, 2 genera, 18 species and 2 varieties in India.

Key to the genera

1a. Leaves except involucral ones (at the base of the branch) alternate. Fruiting carpels drupaceous with hard endocarp and soft exocarp ; embryo hooked ... 2. POTAMOGETON

1b. Leaves all opposite. Fruiting carpels achenial with thin pericarp ; embryo spirally coiled ... 1. GROENLANDIA

1. GROENLANDIA Gay

GROENLANDIA Gay, Compt. Rend. Acad. (Paris) 38 : 703. 1854 ; J. E. Dandy in Rech. f. Fl. Iran. 83 : 8. 1971.

Leaves submerged, opposite, sessile, sheathing ; sheath in leafy involucre auriculate but in leaves exauriculate. Spikes few flowered. Flowers wind pollinated ; carpels 4, free. Fruits achenes ; embryo curved.

The monotypic genus is restricted to Europe, W. Asia, N.W. Africa, N. America, Syria and Turkey.

1. Groenlandia densa (L.) Fourr. Ann. Soc. Linn. Lyon, Noew. ser. 17 ; 169. 1869 ; J. E. Dandy in Rech. f. Fl. Iran 83 : 8. 1971. *Potamogeton densus* L. Spec. Plant. 126. 1753 ; Aeschers. & Graeb. in Engler's Pflanzenr. 4 (Potamogetonaceae) Heft 31 : 129. f. 29. A-F. 1907 ; Butcher, Illus. Brit. Fl. 2 : 622. f. 1418. A-F. 1961. *Opposite leaved pond weed.* (Eng.). (Fig. 13)

Herbs, stem terete with much branched, creeping rhizomes. Leaves 5-10 mm wide, opposite, sessile, ovate, acute, thin, translucent, margin wavy, entire, 3-5 veined, exstipulate. Flowers *ca* 2 mm across, 4, in a short spike ; pedicels recurved in fruit. Achenes *ca* 3.2 × 3 mm, orbicular obovate, compressed, ventrally convex, dorsally semicircular, strongly keeled ; beak short, terminal, recurved.

Type : Habitat in Gallia (France) ; Herb. L. Folicum No. 175. 4 ; *Willdenow* 3197 (Micro. CAL, BSI).

Distrib. : India : Uttar Pradesh, 'Kumaon' in Garhwal Himalayas, (Aeschers. & Graeb. 129. *op. cit.*) ; W. Asia, Europe, N.W. Africa, N. America, Syria, Turkey.

Specimens examined : UTTAR PRADESH : Kumaon in Garhwal Himalaya, *H.C. Watson* s.n. (Acc.No. 500312, CAL).

2. POTAMOGETON L.

1. POTAMOGETON L. Sp. Pl. 1 : 126. 1753 ; Gen. Pl. ed. 5 : 61. 1754 ; Hook.f. Fl. Brit. India 6 : 565. 1893 ; Nairne, Fl. Pl. W. India 367. 1894 ; Bennett, Fl. Trop. Africa 8 : 219. 1901 ; Aschers. & Graeb. in Engler's Pflanzer. (Potamogetonaceae) Heft, 31 : 39. 1907; Bamber, Pl. Punjab 631. 1926 ; Biswas & Calder, Handbook Common Water & Marsh Pl. India & Burma 110. 1936 ; Mitra, Fl. Pl. E. India 1 : 6. 1958 ; Subramanyam, Aq. Angio. 92. 1962 ; Mishra in Bull. Bot. Soc. Bengal 26 (1) : 47. 1972 ; Deb, Fl. Tripura State 2 : 347. 1983 ; Kak in J. Bombay Nat. Hist. Soc. 80 : 312 (1983) 1984 ; Wiegleb in Fedd. Rep. 99(7-8). 249. 1988 ; Kumar & Subramanium, Chromosome Atlas of Fl. Pl. Indian Subcontinent 2 : 656. 1989.

Aquatic submerged herbs with creeping

rootstock. Leaves submerged or floating, alternate or only involucral ones opposite, thin or coriaceous, elliptic to ovate or lanceolate, linear to orbicular, subulate, acute to obtuse at apex, cuneate to rounded, cordate or amplexicaul at base, margins entire or toothed, nerves 1 51. Flowers minute, 4-merous, hermaphrodite, spicate on a short or long axillary or leaf opposed peduncle ; bracts absent. Perianth of 4, free segments. Stamens 4 ; anthers sessile, at base of perianth segments, didymous. Carpels 4, free, sessile, 1-celled. Fruits of 4(-1) drupelets with soft exocarp and hard, bony endocarp.

Distrib. : About 100 species, cosmopolitan, though chiefly temperate ; 16 species and 2 varieties in India.

The name of the genus is derived from the Gr. *Potamos*, river, *Geiton* neighbour, referring to its habitat where there is running or even stagnant water ; pond weed. These common pond weeds are one of the most important good sources of food for water fowls (including migrant marsh birds and shore birds) and other vertebrates. Most of the species provide cover and breeding areas for many fishes and invertebrates. In floating islands of Kashmir lakes the important species 'curl pond weed' (*P. crispus*) is used as manure (Kak, 1984).

Key to the subgenera

1a. Flowers water pollinated ; the spikes not raised above the surface of the water ; leaf sheath united with the leaf base ... Subgenus I. COLEOGETON

1b. Flowers wind-pollinated, the spikes raised above the surface of the water ; leaf sheath almost free from the leaf base, stipular ... Subgenus II. POTAMOGETON

Subgenus I. COLEOGETON Reichenb.

1a. Stigma disc shaped, sessile or short stalked ; drupelets nearly beakless ; leaf apex obtuse or rounded ; stipular sheath tubular towards base ... 4. *P. filiformis*

1b. Stigma not discoid ; stigmatic tip prolonged and with evident swelling ; drupelets beaked ;

	leaf apex acute or mucronate ; stipular sheath open and convolute	...	13. *P. pectinatus*

Subgenus II. POTAMOGETON L.

1a.	Leaves under 3 mm broad, linear, filiform, sessile, submerged ; stipules wholly or partly adnate to the leaf base ; spikes loose or moniliform	...	2
2a.	Leaves with main lateral nerves quite in the middle between midrib and the margin	...	12. *P. orientalis*
2b.	Leaves with main 3-5 parallel nerves only	...	16. *P. pusillus*
1b.	Leaves over 3 mm broad, linear-lanceolate, ovate or sub-orbicular, submerged or floating ; stipules not adnate to the leaf base ; spikes stiff and compact	...	3
3a.	Upper leaves submerged or partly floating, linear to lanceolate	...	4
4a.	Leaves sessile and amplexicaul at base	...	5
5a.	Stem compressed ; leaves linear, usually crisped or serrulate, 3-5 longitudinal nerved	...	6
6a.	Leaf margin crisped ; stipules deciduous	...	2. *P. crispus*
6b.	Leaf margin serrulate, not crisped ; stipules persistant	...	3. *P. crispus* var. *serrulatus*
5b.	Stem terete ; leaves ovate or cordate, never crisped or serrulate, 5-9 longitudinal nerved	...	14. *P. perfoliatus*
4b.	Leaves narrowed at the base into short or elongated petiole	...	7
7a.	Leaves subsessile or petiole up to 2 cm long	...	8

8a.	Upper leaves submerged ; peduncles mostly solitary	...	9
9a.	Leaves elliptic, oblong, subsessile, 7 veined, tip mucronate ; spikes usually not curved	...	6. *P. lucens*
9b.	Leaves lanceolate, petioled, 3-5 veined, tip aristate, spikes usually curved	...	7. *P. lucens* var. *acuminatus*
8b.	Upper leaves slightly emergent or floating ; peduncles usually in clusters	...	18. *P. zizii*
7b.	Leaves petiolate ; petiole up to 9.7 cm	...	8. *P. malainus*
3b.	Upper leaves mostly floating ; ovate-suborbicular	...	10
10a.	Floating leaves oblong to lanceolate or elliptic-lanceolate ; petiole shorter than lamina	...	11
11a.	Beak of the nutlets very short, hooked	...	11. *P. octandrus*
11b.	Beak of the nutlets short and stout	...	12
12a.	Root stocks annuals, springing from resting bud ; internodes not thickened ; stem and peduncles usually red	...	1. *P. alpinus*
12b.	Rootstocks persistent, prostrate, internodes somewhat thickened ; stem and peduncles not red	...	5. *P. fluitans*
10b.	Floating leaves oval or ovate, as long as broad or longer than broad ;.petioles equal or much longer than lamina	...	13
13a.	Submerged leaves reduced to narrowly linear, bladeless phyllodes ; peduncles thick at the base of spike	...	9. *P. natans*
13b.	Submerged leaves linear to linear obovate ; peduncle not thickened at the base of spike	...	14

14a.	Stipules subpersistent, 2-4 cm long, obtuse ; upper leaves recurved; not keeled	...	15. *P. polygonifolius*
14b.	Stipules decaying early, linear, acute or obtuse, 3-9 cm long ; upper leaves more or less 2-keeled	...	15
15a.	Nutelets obovoid, 2.5-3.5 mm long, acutely keeled ; beak short, stout	...	10. *P. nodosus*
15b.	Nutlets obovoid, 3-4.9 mm long, scarcely keeled; beak slightly curved	...	17. *P. tepperi*

1. Potamogeton alpinus Balbis in Mem. Acad. Sci. Turin Ann. 10-11. Sci. Phys. Math. 1 : 329. 1804 ; Aschers. & Graeb. in Engler's Pflanzenr. 31 : 70. 1907 ; Kak in J. Bombay Nat. Hist. Soc. 80 : 316 (1983) 1984. *P. rufescens* Schrad. in Cham. Adnot. 5. 1815. *P. stylis* Hagstr. in Bot. Not. 1908 : 98. 1908. *Reddish pond weed* (Eng.). (Fig. 1)

Slender, rhizomatous, submerged herbs; stems terete, reddish-brown or dark olive green, tinged with red or purple. Leaves 4.8-8.2 × 1-1.8 cm linear-lanceolate with 2-5 mm long tip or oblanceolate-elliptic, base cuneate or semiamplexicaul, apices rounded or obtuse, sessile, pellucid reddish, coriaceous, 7-many nerved ; floating leaves with 2-3 mm long, petiole ; stipules 2.5-3.8 × 0.4-0.6 cm, hyaline, ovate, blunt, free. Spikes 2-3 cm long, terminal axillary ; peduncles stout. Flowers *ca* 3 mm across, in distant whorls ; perianth 2-2.5 mm long, reddish-green, clawed ; stamens and carpels 4. Drupelets ovate or obovate, convex on both sides, lenticular, dorsal edge, acutely keeled ; beak acute, subcentral.

Type : Described from Italy. Lectum fuit a cive in PIOTTA in lacu *Chamollet.*

Fl. & Fr. : October.

Distrib. : India : Jammu & Kashmir; Temperate and Arctic regions of Asia, Europe, N. America, U.S.S.R.

Ecology : In lakes at an altitude of *ca* 1500 m in Himalaya.

Specimens examined : JAMMU & KASHMIR: Zanskar, Aug. 1975, *A.M. Kak* 1165 ; Ladakh, Drass, *A.M. Kak* 3709 ; Tungboo, Zanskar, *A.M. Kak* 936 ; Nilang lake, 25.10.1975, *A.M. Kak* 1149 (KASH); *Wadhwa & Vohra* 353 ; Kashmir, *Falconer* s.n. (Acc. No. 499991, CAL).

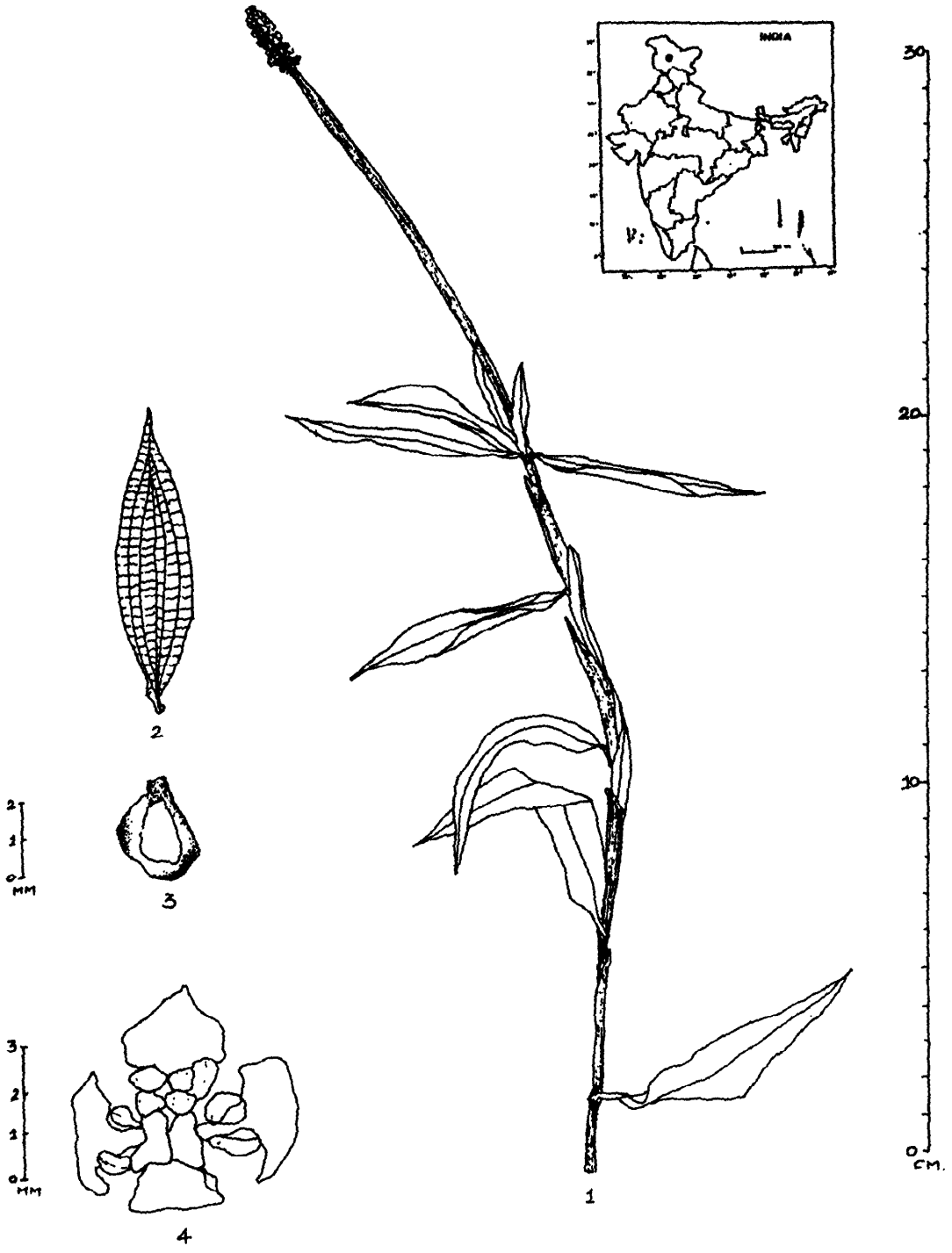


Fig. 1 : *Potamogeton alpinus* Balbis : 1. Plant bearing spike ; 2. Leaf ; 3. Fruit; 4. Flower.

2. Potamogeton crispus L. Sp. Pl. 126. 1753; Hook.f. Fl. Brit. India 6 : 566. 1893 ; Aschers. & Graeb. in Engler's Pflanzenr. 31 : 97. 1907 ; Kak in J. Bombay Nat. Hist. Soc. 80. 316. (1983) 1984. *P. tuberosus* Roxb. Fl. India 1 : 453. 1820. *Curled pond weed* (Eng.) *Zai hill* (Kash.), *Karela* (Hindi). (Fig.2)

Submerged, glabrous, flaccid herbs attached with branched, 8-11 cm long roots ; stem simple or branched, slender, compressed, tips of young branches with chartaceous base. Leaves 1.1-9.5 × 0.2-0.7cm, flat, membranous, linear or linear-oblong, acutely serrate when young, strongly undulate or crisped at maturity, apex obtuse or finely serrulate, sessile ; semiamplexicaul, 3-nerved; stipules small, caducous, lower soon decaying. Spikes 5-10 mm long peduncles 1.6-5.3 cm long, often curved, tapering upwards. Flowers few, minute, white or greenish-pink, emergent, wind pollinated ; drupelets 2.3-2.6 mm long, obliquely ovoid, beaked, 3-keeled, central keel slightly winged and crested with a long fleshy tooth at base.

Type : "Habitat in Europae Fossis and rivulis".

Fl. & Fr. : Greater part of the year.

Distrib. : India : Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, Bihar, W.Bengal, Sikkim, Assam, Nagaland, Manipur, Madhya Pradesh, Tripura, Rajasthan, Gujrat, Maharashtra, Andhra Pradesh, Tibet, Iran, Asia, Europe, Africa, Australia, Pakistan, Nepal, Bhutan, Bangladesh, Myanmar.

Ecology : In fresh water ponds, rivers, ditches, tanks and lakes, almost the plains of India ascending an altitude of 1200-2000 m in Temperate Himalaya e.g. Nilang lake in Kashmir.

Chromosome no. : 2n = 50 ; variation No. 2n = 56 (Mishra, 1972) ; 2n = 52 (Ghosh & Bhattacharya, 1980).

Specimens examined : JAMMU & KASHMIR: Wallar lake, Kashmir, 10.5. 1892, *J.F. Duthie* 10860 (CAL) ; *Banihal V.Y*; 12. 9. 1958, *T.A. Rao* 7502 ; Nilang lake 2000 m, 11.6.1959, *T.A. Rao* 9410 (BSI) ; Srinagar, Dal lake, July 1974, *A.R. Naqshi* 4070 (KASH). UTTAR PRADESH : Kumaon, Ramnagar, 400 m, 19.4.1962, *U.C. Bhattacharyya* 20349 (BSD); Allahabad, near Minto park, 7.5.1965, *T. Rajgopal* 9147 (BSA) ; Nainital 1800 m, 25.9.1982 ; *V.N. Naik* 5005 (Univ. Herb. Aurangabad). PUNJAB : Sangrur, 2.3.1966, *N.C. Nair* 36709 (BSD). HIMACHAL PRADESH: Naham (Sirmur), Mar. 1957, *M.A. Rau* 202 (BSD). SIKKIM : E. Himalaya, *without coll. name* 5605/2 (Acc. No. 499884 CAL). TRIPURA : Agartala, 12.2.1957, *D.B. Deb* 786 (CAL). MANIPUR : 1881-82, *G. Watt* s.n. CAL's Dist. 7410 (CAL). MADHYA PRADESH : Saugor, Hirapur tank, 430 m, 3.3.1960, *K. Subramanyam* 10156 (BSA) ; Gwalior, 1890, *C. marwi* 306; Central India, 1867, *G. King* s.n.(Acc.No.49989,CAL) ; Bhopal, 14.4.1916

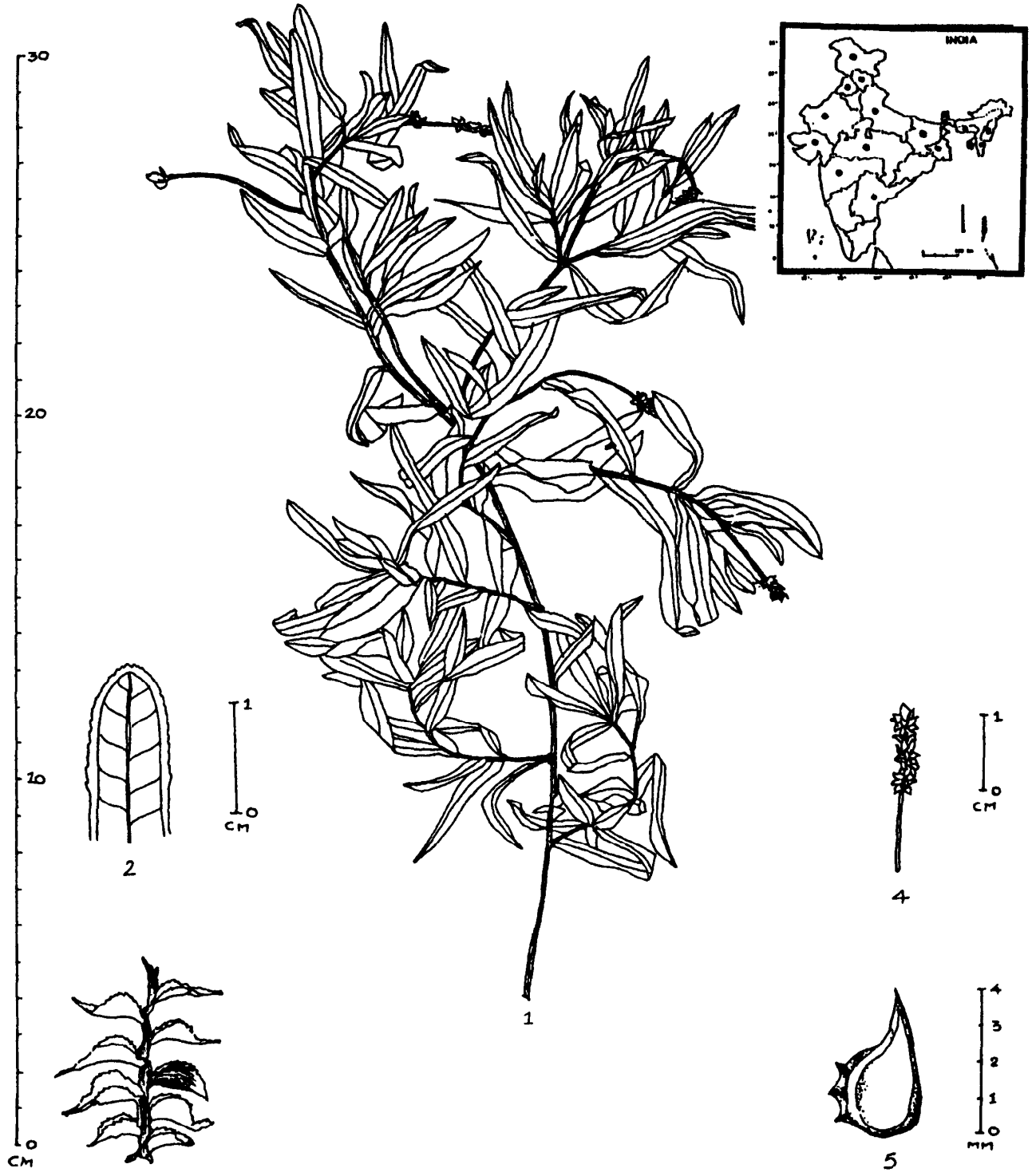


Fig. 2 : *Potamogeton crispus* L. 1. Plant bearing fruiting spike ; 2. Upper part of leaf ; 3. Young leafy branch ; 4. Fruiting spike ; 5. Fruit.

without coll. name (Acc. No. 34954, ISIM). WEST BENGAL : Deulti, Howrah, 31.5.1963, *S.S. Bennet* 375 ; Jaipur bil, Howrah, 6.2.1977, *R.N. Banerjee* s.n. (CAL). RAJASTHAN : Jodhpur, Oct. 1917, *Blatter & Co.* 334 (BLAT) ; Jodhpur, 9.5.1973, *D.M. Verma* 601 ; Pali, Lodra tank, 23.2.75, *B.V. Shetty* 1633 ; Bharatpur, Ghana, bird sanctuary, 27.3.1982, *P.J. Parmar* 8701 (BSJO). GUJARAT : Panchmahals, Chakalia, 5.9.1972, *R.G. Bhatt* 2539 ; Pattan, 9.1.1972, *R.G. Bhatt* 2375 ; Chhoaudepur, 12.4.1972, *Y.Y. Karatela* 2635 (SPUH). MAHARASHTRA : Pune, College garden, July 1893, *BNHS* s.n. (Acc. Nos. 78676, 78677, BLAT) ; Pune, July 1893, *Talbot* s.n. (Acc. No. 566, dated 4.7.1974, BSI) ; Aurangabad, Kaygaon, 1800 ft, 18.10.1974, *Pokhle & Pardeshi* 216 (Univ. Herb. Aurangabad).

Uses : In Kashmir, the plant is used as manure and in preparation of floating islands with other emergent aquatic plants. Fruits are eaten by ducks and other water fowl. Young leaves are used as fish food. As a fodder and fertilizer in sugar refinery the plant is also used. In Myanmar, the plant is used as a vegetable and sold in market (CAL's Acc. No. 499911).

3. Potamogeton crispus L. var. **serrulatus** (Schrad.) Reichb. Icon. Fl. Germ. 7. 1845 ; Aschers. & Graeb. in Engler's Pflanzenr. 31 : 99. 1907 ; Naqshi & Javeid in Curr. Sci. 42 (2) : 70. 1973. *P. serrulatus* Schrad. ex Opiz. in Flora 5 : 267. 1822. *P. crispus* var. *A. planifolius* Mey., Chloris Hanov. 523. 1836. (Fig.3).

Aquatic, submerged herbs. Leaves 5.5-12 × 0.2-0.8 cm, 3-nerved, oblong-lanceolate, not crisped, serrulate, obtuse ; sessile ; stipules small, 0.4-0.8 cm long, corona like, ligulate. Peduncle *ca* 4.5 cm long. Flowers ebracteate, sessile, lax ; perianth segments green, obovoid, clawed ; stamens 4 ; carpels 4, separate, sessile. Drupelets 2-4 mm long, obliquely ovoid ; beak *ca* 8 mm long.

Type : Habitat in Europe rivulis.

Fl. & Fr. : September.

Distrib. : India : Jammu & Kashmir.

Ecology : In lakes.

Specimens examined : JAMMU & KASHMIR : Srinagar, Dal lake, Sept., *A.R. Naqshi* 401 (KASH).

4. P. filiformis Pers. Syn. Pl. 1 : 152. 1805 ; Aschers. & Graeb. in Engler's Pflanzenr. 31 : 126. 1907 ; Kak in J. Bombay Nat. Hist. Soc. 80 : 317 (1983) 1984. *P. setaceus* Schum. Enum. Pl. Saell. 1 : 51. 1801 ; *auct. non.* L. (1753). *P. pectinatus* subsp. *filiformis* Hook. Steud. Fl. Brit. Isl. ed. 2. 397. 1878. *P. pamiricus* Baagöe, Vid. Meddel. Nat. Foren. Kjoben. 1903 : 182. 1903. (Fig. 11)

Slender, submerged herbs with creeping rhizomes and stolons bearing white tubers ; stems 20-30 cm long, terete, simple or branched. Leaves 3-5.8 × 0.1-0.2 cm, filiform

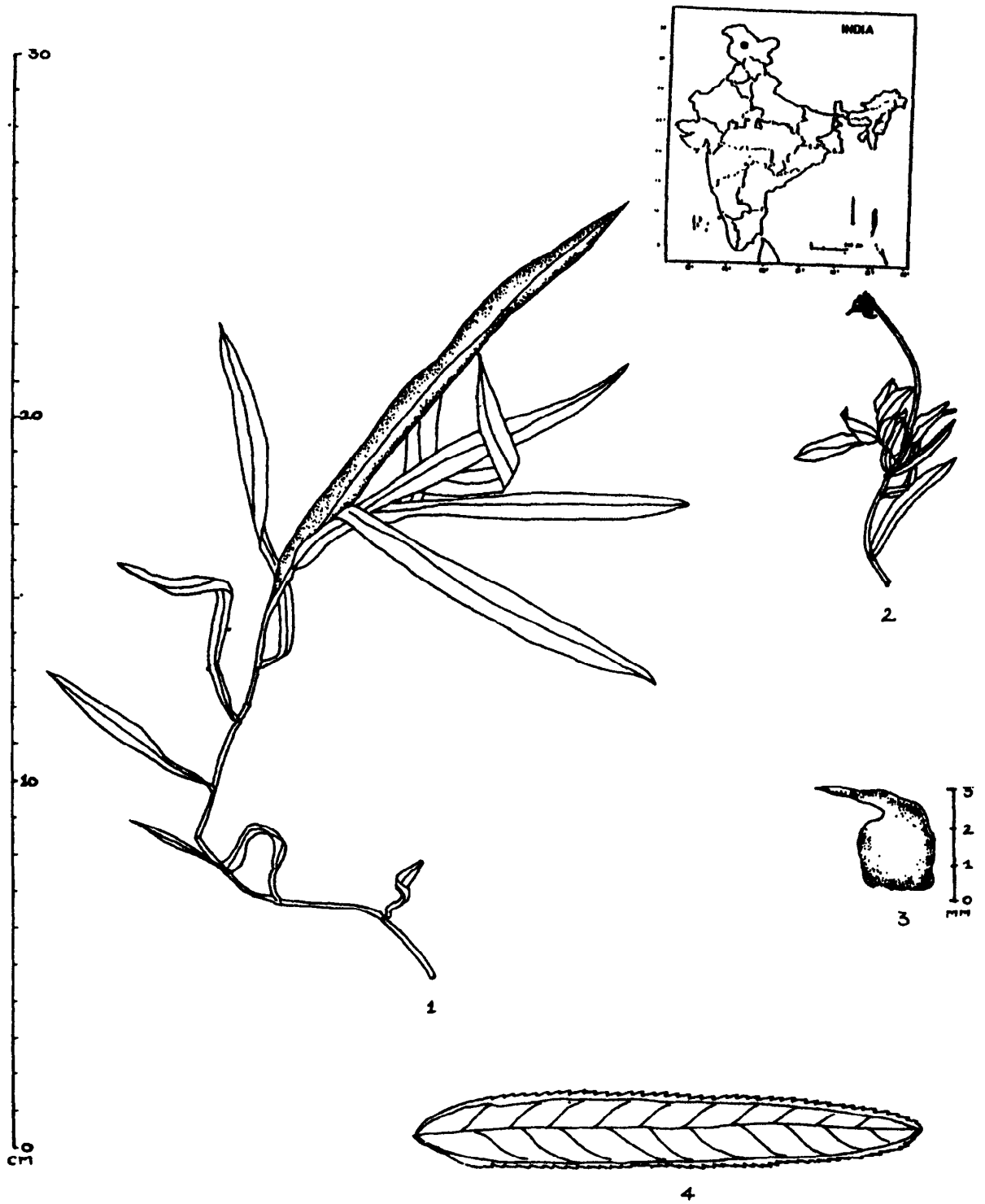


Fig. 3 : *Potamogeton crispus* L. var. *serrulatus* (Schrad). Reichb. : 1. Vegetative plant; 2 Branch bearing terminal fruiting spike; 3. Fruit; 4. Leaf.

or setaceous, 1-3 nerved; stipules 0.8-1.2 cm long, free but clasping at base, adnate to the leaf and sheathing stems, lanceolate, scarious. Spikes 8-12 cm long on a filiform or flexuous peduncle. Flowers 3.5-4 mm across, in distant clusters ; perianth reddish-green, suborbiculate, clawed ; stamens 4 ; carpels 4, free. Drupelets 2 × 1.5 mm, ovoid, ventrally convex, dorsally semicircular, apex rounded or truncate, faintly reticulately veined.

Type : Denmark, Sjaelland.

Fl. & Fr. : August.

Distrib. : India : Jammu & Kashmir, Temperate and arctic regions of Asia, Europe & N. America.

Ecology : In slow or fast moving streams at an altitude of 3000-4000 m in Kashmir Himalaya.

Specimens examined : JAMMU & KASHMIR : Panikar, Aug. 1975, *A. M. Kak* 1165 ; Drass, *A.M. Kak* 3709 ; Tungboo, Zanskar, *A.M. Kak* 936 (KASH).

Notes : Morphologically, it resembles with *Potamogeton pectinatus* L., but it can be distinguished in the field by its 'branching' *i.e.* it branches uniformly from base to apex.

Uses : Root stocks contains starch, edible.

5. Potamogeton fluitans Roth, Tent. Fl. Germ. 1 : 72. 1788 ; Bennett in Journ. Bot. 23 : 375. 1885 ; Aschers. & Graeb. in Engler's - Pflanzenr. 31 : 58. f. 16 E,& G-J 1907 ; Kak in J. Bombay Nat. Hist. Soc. 80 : 316. (1983) 1984. *P. oblongus* var. *fluitans* G.F. May. Chloris, bannov. 519. 1836. *P. natans* var. *explanatus* Mert. U. Koch. Deut. Fl. 1 : 837. 1838. (Fig. 4)

Aquatic, submerged, stout, polymorphic herbs. Leaves upper floating, oblong or linear-lanceolate, acute-acuminate, membranous, margin entire or slightly wavy; stipules 4.5-6 cm long, lanceolate, tapering at apex ; petiole 3.2-6.5 cm long, slender. Spikes 3.5-5 cm long, axillary or leaf opposed; peduncle *ca* 11 cm long, slender. Flowers minute, many, dense ; perianth segments 4, *ca* 2 mm long, suborbicular, clawed ; stamens 4 ; carpels 4, free, stigma exserted. Drupelets *ca* 2.5 mm long, subglobose ; beaked, 3-keeled, central one acute.

Fl. & Fr. : September.

Distrib. : India : Jammu & Kashmir, N.W. Himalaya ; Bangladesh, Europe, Asia, Africa.

Ecology : In fast flowing streams, irrigation channels, lakes etc.

Specimens examined: JAMMU & KASHMIR: Kashmir, Nagin lake, Sept. 1975, *A.M. Kak* 751 (KASH) ; N.W. Himalaya ;

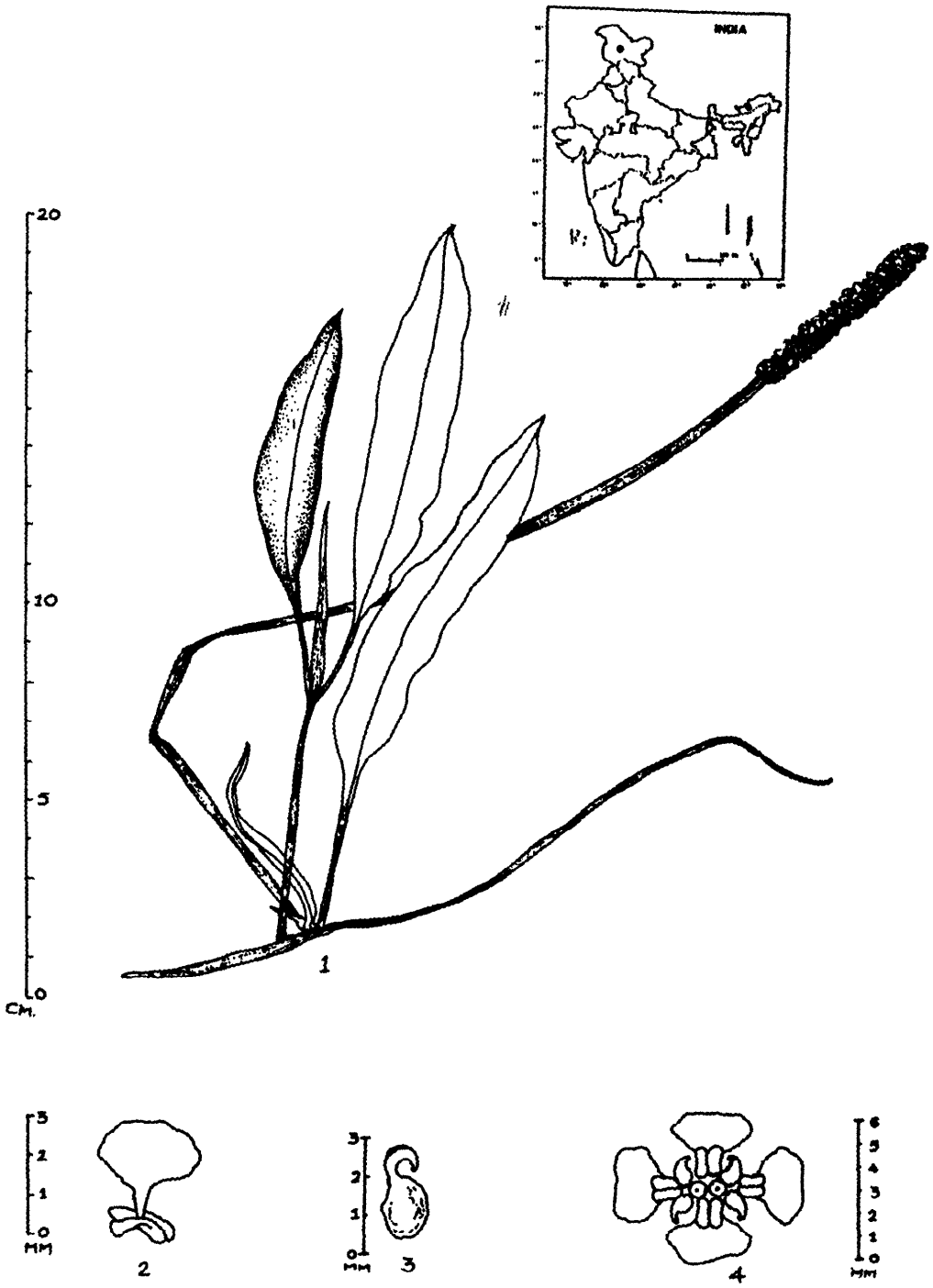


Fig. 4 : *Potamogeton fluitans* Roth : 1. Flowering Plant ; 2. Perianth lobe with adnate stamen ; 3. Carpel ; 4. Flower.

July, 1901, *P.W. Mackinon* s.n. (Acc. No. 499486, CAL).

Notes : This species can be distinguished by its long petioled thin leaves and exserted stigma.

6. Potamogeton lucens L. Sp. Pl. 126. 1753 ; Hook.f. Fl. Brit. India 6 : 567. 1893 ; Collett, Fl. Siml. 448. 1902 ; Aschers. & Graeb. in Engler's Pflanzenr. 31 : 76. 1907 ; Chowdhery in Fl. Himachal Pradesh 3 : 734. 1984 ; Kak in J. Bombay Nat. Hist. Soc. 80 : 314. (1983) 1984. *Shining pond-weed* (Eng.). (Fig. 5)

Submerged stout herbs ; stem terete, branched, rhizomatous. Leaves 3.8-11.7 × 1-2.6 cm, alternate or upper ones opposite, elliptic, lanceolate or oblong-ovate, sessile or shortly petiolate, margins undulate, apex acute or cuspidate, reticulately veined, 7-more nerved ; stipules 2.7 × 0.6 cm long, conspicuous, 2 winged, keeled. Spikes 3.2-5.2 cm long ; peduncle 6-14 cm long, stout. Flowers many, wind pollinated ; perianth segments 0.2 cm long, subreniformed, clawed; stamens 6 ×14 cm long ; carpels 4, free. Drupelets 2.5-4 × 2.3-3 mm, obovoid-rounded, turgid, lateral ribs obscure, convex, beak short, subcentral.

Type : Habitat in Europae lacubus stagnis, flaviis arigillosis ; Herb. Linn. Micro. No. 175.5 (CAL).

Fl. & Fr. : May October.

Distrib. : India : Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh ; Nepal, Myanmar, Afghanistan, U.S.S.R., Africa, America.

Ecology : In stagnant water *i.e.* in pools, ponds, rivers, lakes on clayey soil ascending an altitude up to 2,100 m (Nainital lake in N.W. Himalaya).

Chromosome no. : 2n = 52 (Palmgren, 1939).

Uses : This species is used for manure along with other aquatic weeds and in pisciculture (fish industry). It is used as a fodder in Kashmir and also employed in sugar refinery.

Specimens examined : JAMMU & KASHMIR: Woolar lake, Kashmir, 5150 ft., 16.4.1876, *C.B. Clarke* 29139 ; Woolar lake, 5-6000 ft. 10.3.1892, *J. F. Duthie* 10,861 (CAL) ; Woolar lake, Kashmir, 1560 m, July 1909, *Keshawanand* 1267 ; Srinagar Dal lake, Srinagar, May 1928, *M. N. Bahuguna* s.n. DD's Acc. No. 46287, 29.8.1928 (DD) ; Kashmir's Dal lake, 1730 m, 21.6.1959, *T.A. Rao* 9601 ; Kashmir on way to Nagin lake, 18.9.1960, *S. K. Malhotra* 12278 (BSD). UTTAR PRADSEH : Kumaon National Park, 2100 m, 8.10.1957, *T. A. Rao* 4862 (BSD). Kumaon National lake 1200 m, *Strachey & Winterbottom* 2, CAL's Acc. No. 499939 (CAL).

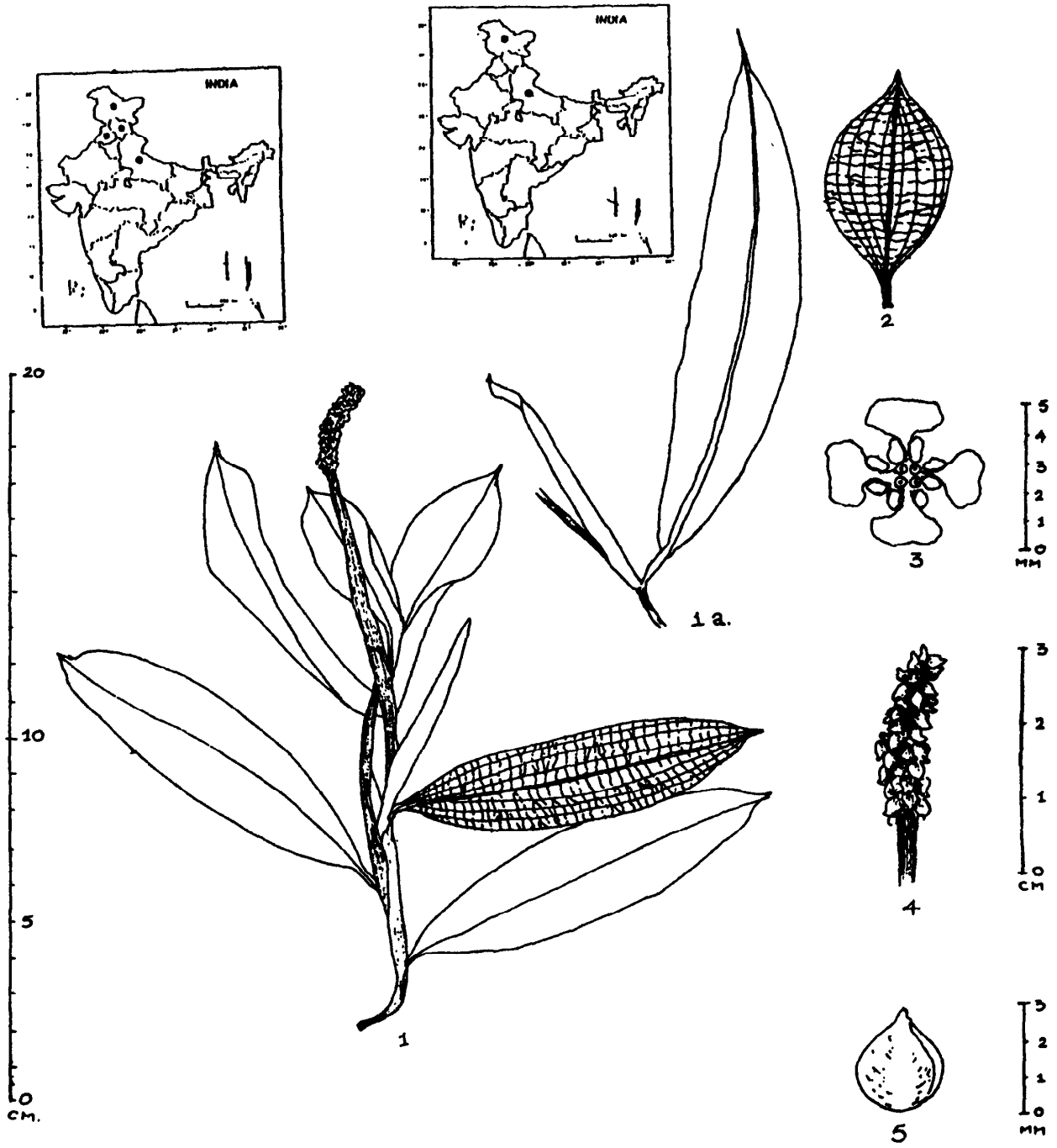


Fig. 5. *Potamogeton lucens* L. : 1. Plant bearing spike ; 2. Leaf ; 3. Flower; 4. Fruiting spike ; 5. Fruit. 1a. *P. lucens* L. var. *acuminatus* (Schum.) Fries.

7. Potamogeton lucens L. var. **acuminatus** (Schum.) Fries. Novit. Fl. Suec. ed. 1. 46. 1816 ; Naqshi & Javeid in Curr. Sci. 42 (2) : 70. 1973. *P. acuminatum* Schum. Enum. Pl. Saell. 1 : 49. 1801.[Fig. 5 (1a)].

Submerged aquatic herbs. Leaves 3.2 15 × 0.8-3 cm, linear-lanceolate, sessile or subsessile, 3-5 nerved, acuminate or aristate at apex : leaves of upper branches elliptic-oblong, apex mucronate, base tapering ; stipules 6.5-7.5 cm long, linear, membranous, multi-nerved, sheathing. Spikes *ca* 4.8 cm long ; peduncle *ca* 5 cm long, slightly curved. Flowers many, sessile, ebracteate ; perianth segments, *ca* 2 mm long, green, suborbicular, clawed ; stamens 4, sessile ; carpels 4, free. Drupelets 3 × 2 mm, oblique, shortly beaked; beak 0.2-0.4 mm long, compressed.

Type : Herb. of Linn. folium no. 175.5 (CAL).

Fl. & Fr. : June - September.

Distrib. : India : Jammu & Kashmir: Uttar Pradesh ; Myanmar,.U.S.S.R., W. Asia.

Ecology : In lakes up to 2000 m alt.

Specimens examined : JAMMU & KASHMIR: Srinagar, Dal lake, 12.6.1968, *G.N. Javid* 996 ; Srinagar, Dal lake, *Naqshi* 402 (KASH). Kashmir, Dal lake, 2000 m, *T.A. Rao* 761 (Acc. No. 4278, dt. 4.4.1958, BSD); Kashmir, July 1956, *T.A. Rao* 761 (CAL).

Notes : This variety can be distinguished from species proper by sessile, lanceolate, 3-5 veined, aristate tipped leaves and curved spikes.

8. P. malainus Miq. Fl. Arch. Ind. 46. 1871; Aschers. & Graeb. in Engler's Pflanzenr. 31. 83. f. 18 E, f. 1907. *P. mucronatus* Presl. Epimel. Bot. 245. 1895 ; Hook.f. Fl. Brit. India 6 : 567. 1893 ; Prain, Pl. Bengal 2: 845. 1963 (Repr. ed.) ; Verma *et al.* Fl. Raipur, Drug & Rajnandgaon 402. 1985 (Fig. 6)

Submerged, perennial herbs. Leaves 5-17.2 × 1.3-2 cm, elliptic or oblong-lanceolate, serrulate, 7-nerved, membranous, apex acute or mucronate, base cuneate, reticulately veined ; stipules 2.5-3.2 cm long, membranous amplexicaul. Spikes 2-4.7 cm long ; peduncle 1.5 5.7 cm long. Flowers many, lax, persistent ; segments 4, *ca* 2 mm long, greenish, suborbicular. Stamens 4 ; carpels suborbicular, 4, free. Drupelets *ca* 3 mm long, orbicular, shortly beaked.

Types : Celebes dans la prov. Menado pres de Tondado ; TEYSMANN. Java, dans le lac Talaga Patenganau mois de Juillet : JUNGHUHN.

Fl. & Fr. : June.

Distrib. : India : Jammu & Kashmir, N.E. Bengal, Madhya Pradesh, Bihar : Rare ; Asia, Java, Sumatra, China, Japan, Korea, Formosa,

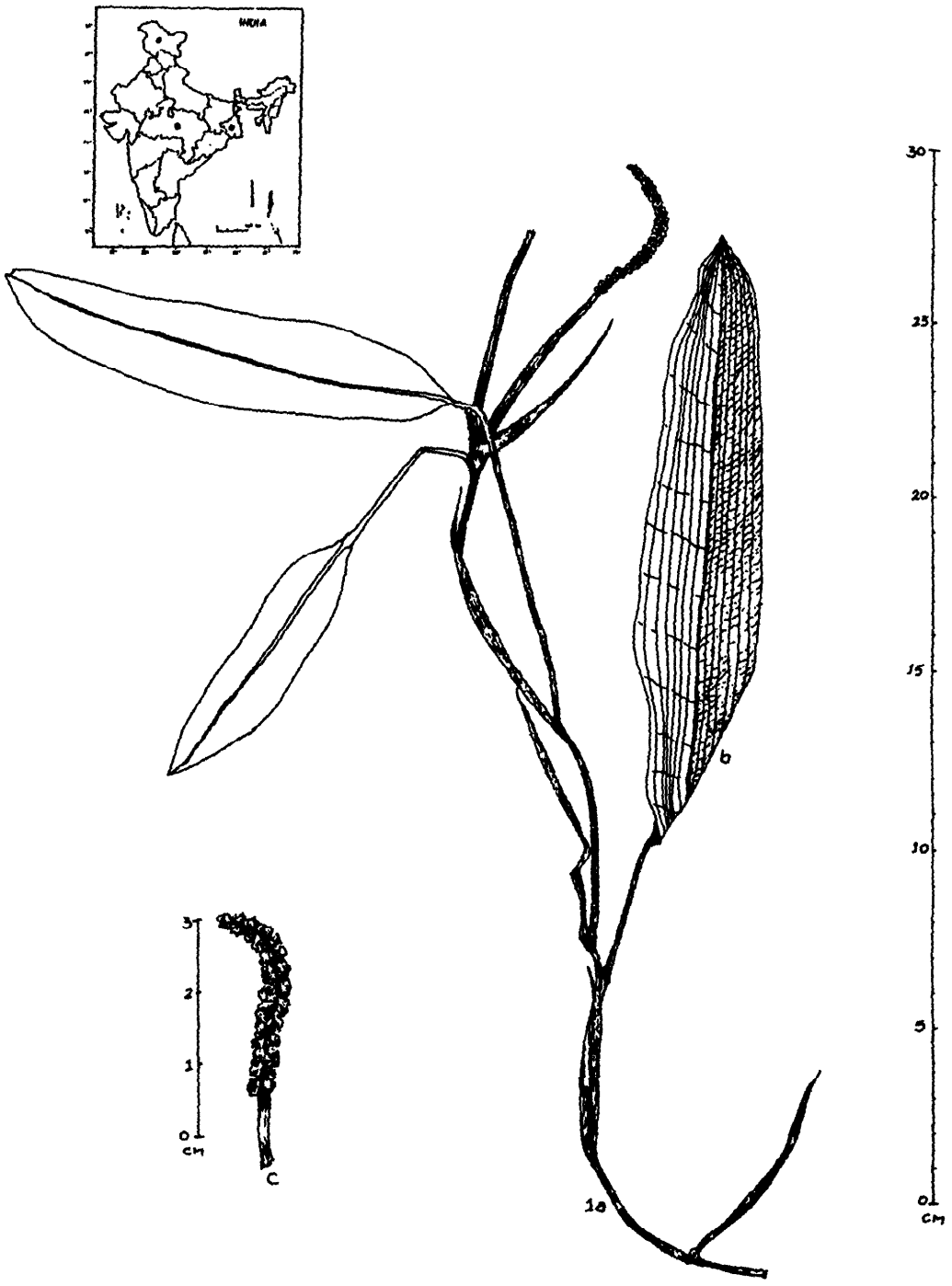


Fig. 6 : *Potamogeton malainus* Miq. : a. Plant bearing zp spike ; b. Leaf variation ; c. Spike.

Borneo, Philippine Islands.

Ecology : In ponds up to an elevation of 550-1900 m.

Chromosome no. : 2n = 52 (V.Kumar & Subramaniam, 1989).

Specimens examined : MADHYA PRADESH : Tourenga, Deodarha, Raipur, 6.6.1972, *D.M. Verma* 17575 (BSA).

9. Potamogeton natans L., Sp. Pl. 126. 1753; Hook.f. Fl. Brit. India 6 : 565. 1893 ; Aschers. & Graeb. in Engler's Pflanzenr. 31 : 42. f. 13. 1907 ; Mitra, Fl. Pl. E. India 1 : 7. 1958 ; Chowdhery in Fl. Himachal Pradesh Ana 3 : 734. 1984 ; Kak in J. Bombay Nat. Hist. Soc. 80 : 314. (1983) 1984. (Fig.7)

Stout, rhizomatous herbs, stem cylindric, simple or branched. Leaves 5.7 17.4 x 3.2-3.7 cm, heterophyllous *i.e.* upper leaves floating, leathery, ovate-oblong or elliptic-lanceolate, sub-obtuse, multinerved ; petiole 5-23.2 cm long with a discoloured joint at tip; lower submerged leaves linear, stipules 5-8 cm long, linear-lanceolate, free, loosely sheathing, persistent. Spikes 1.5 - 4.2 cm long; peduncles 5.4-7 cm long, stout. Flowers many, 5 mm across ; perianth segments 4, *ca* 2-3 mm long, suborbicular, clawed ; stamens 4, sessile ; carples 4. Drupelets 4 x 3 mm, ventral margin straight, dorsally convex, keeled, beak short, stout.

Types : Habitat in Europe locubus & fluviis : Herb. L. folium No. 175. 1 (Linn.) (CAL) ; Willdenow 3190 (CAL, BSI) ; Sumatra, pres d' Alahan pandjang, dans le lac Dano di Attas : TEYSMANN.

Fl. & Fr. : July - September.

Distrib. : India : Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, E. India ; Temperate & Arctic regions of Europe, Asia, N. America, Australia, Sumatra.

Ecology : In lakes and valleys up to an altitude of 150-156 m.

Chromosome no. : 2n = 42 (Stern, 1961); 2n = 52 (Palmgren, 1939).

Specimens examined : JAMMU & KASHMIR : Wullar lake, 5150 ft., 16.7 1876, *C.B. Clarke* 29145 ; Sind river below Gandarbal, 5000-6000 ft. 22.6.1892, *J.F. Duthie* 11444 ; Kashmir, 20.9.1961, *Vohra & Wadhwa* 120 (CAL) ; Wullar lake, Kashmir, 5-5200 ft. 9.7.1907, *Keshvanand* 1265 (DD) ; UTTAR PRADESH : Tihri-Garhwal, above Derali, 9000 ft, *Duthie* 190 (CAL).

Notes : This species can be distinguished in the field with submerged leaves all linear and floating leaves elliptic, leathery with long petiole.

Uses : The plant is used as fodder (Ambasta, 1986).

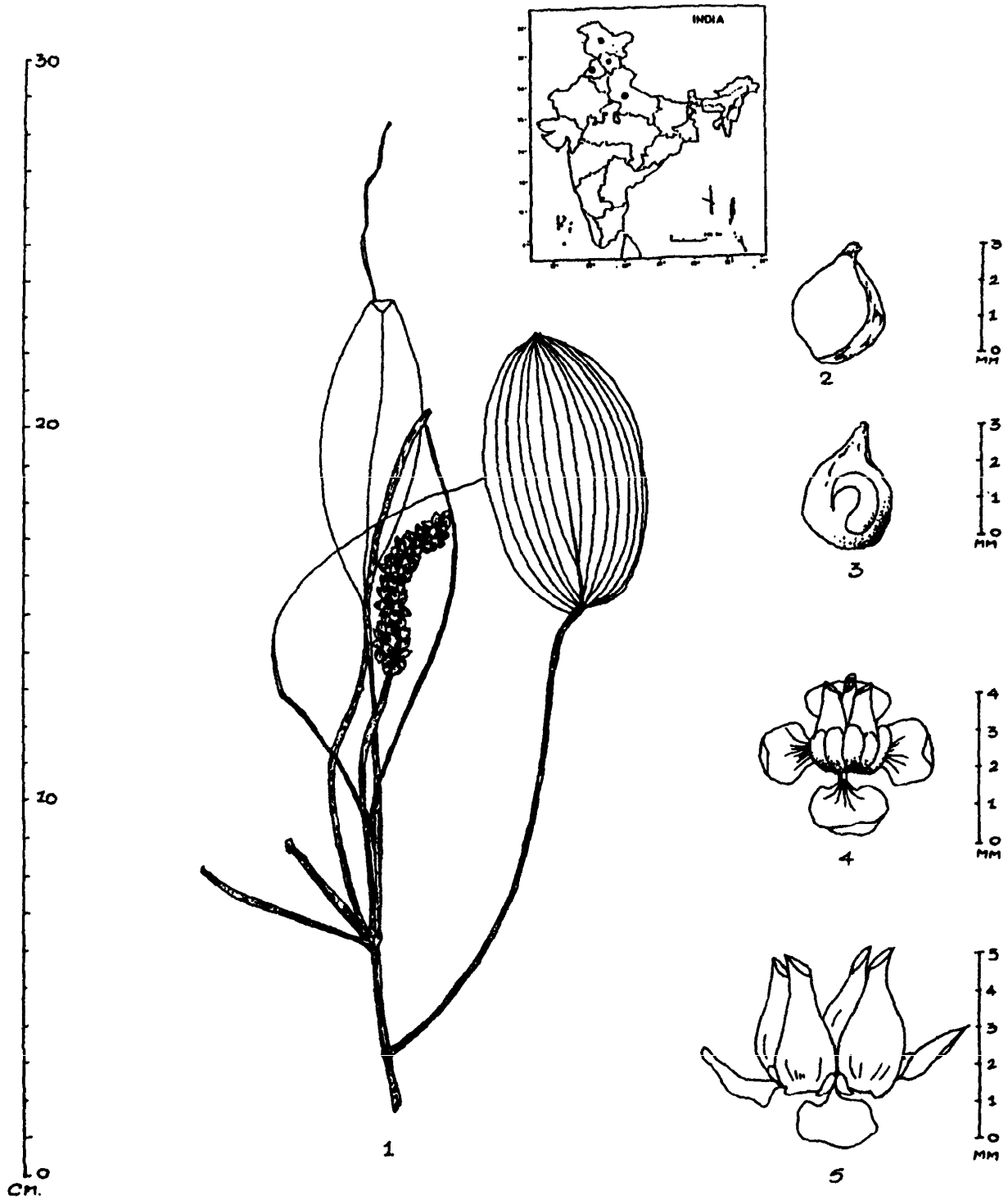


Fig. 7 : *Potamogeton natans* L. : 1. Fruiting plant ; 2. Fruit ; 3. L.S. of Fruit ; 4. Young flower ; 5. Mature flower.

10. Potamogeton nodosus Poir. in Lam. Encycl. Meth. Bot. Suppl. 4 : 535. 1816. Subramanyam, Aq. Angio. 95. 1962. *P. indicus* Roxb. Fl. Ind. ed. Carey, 1 : 471. 1820, *non* Roth (1818) ; Hook. f. Fl. Brit. India 6 : 565. 1893 ; Aschers. & Graeb. in Engler's Pflanzenr. 31 : 97. 1907. *P. oblongus sensu* Aitch. in J. Linn. Soc. Bot. 18 : 99. 1880, *non* Viv. (1804) ; Hook.f. Fl. Brit. India 6 : 566. 1893, *p.p.* *Kolhune* (Kash). (Fig. 8)

Submerged, stoloniferous herbs ; stem terete, branching. Leaves 2.5 19.5 × 1.1 4.3 cm, floating, alternate, uppermost opposite, flat, oblong-ovate, elliptic-suborbicular or elliptic-lanceolate, coriaceous, entire, acute-obtuse, base rounded or cuneate, glabrous ; petiole 1.3 16.2 cm long, terete ; stipules 2-15 cm long free, keeled, lanceolate. Spikes 2-5 cm long, solitary, cylindric ; peduncle axillary or leaf opposed up to 6.5 cm long. Flowers many, dense, green or reddish-brown, regular, 4-merous ; perianth segments 4, 1.5-2.5 mm long, suborbicular, entire, obtuse, concave, veined, clawed. Stamens 4, *ca* 1.5 mm long, subsessile, attached to claw of perianth. Carpels 4, *ca* 2 mm long, ovate. Drupelets, obliquely ovoid, beaked.

Type : Canary Islands, Broussonet.

Fl. & Fr. : Almost throughout the year.

Distrib. : India : Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, Bihar, West Bengal, Sikkim, Arunachal Pradesh, Manipur, Meghalaya, Orissa, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala, Andamans ; Nefa, Pakistan, Nepal, Bhutan, Bangladesh, Myanmar, Sri Lanka. Warmer regions of Asia, Europe, Africa, America.

Ecology : In fresh water areas including canals, tanks, ditches, ponds and lakes throughout the plains of India ascending an altitude up to 2000 m in Himalaya. Usually associated with ANACHARIS, CHARA, NITELLA, UTRICULARIA etc.

Chromosome no. : 52 (Ghosh & Bhattacharya, 1980).

Specimens examined : JAMMU & KASHMIR : Nilang lake, 2000 m, 11.6.1959, *T.A. Rao* 9404 (BSD) ; Srinagar, Dal lake, Aug. 1974, *A.R. Naqshi* 460 (KASH). NEFA: ASSAM : *R.S. Rao* 1658, (Acc. No. 6992). UTTAR PRADESH : N.W. Himalaya, 4000, June 1901. *P.W. Mackinson* s.n. Acc. No. 499785 (CAL) ; Vijayanagar Tal, Mahoba, 7.7.1962, *C.L. Malhotra*, 21468 ; Kumaon, Vasavgad, 1200 m, 28.4.1962, *U.C. Bhattacharyya*, 21294 ; Mahoba, Hamirpur, 31.3.1962, *U.C. Bhattacharyya* 20998 ; Corbett Nat. Park, 8.5.1971, *P.C. Pant* 43868 (BSD) ; Kumaon, July 1923, *H.G. Champion* 4926 (DD) ; Tanda fall, Mirzapur, 21.10.1964, *Panigrahi* 3644 (BSA) ; Nainital, 6000 ft, 25.9.1982, *V.N. Naik* 5003 (Aurangabad, Univ. Herb.).

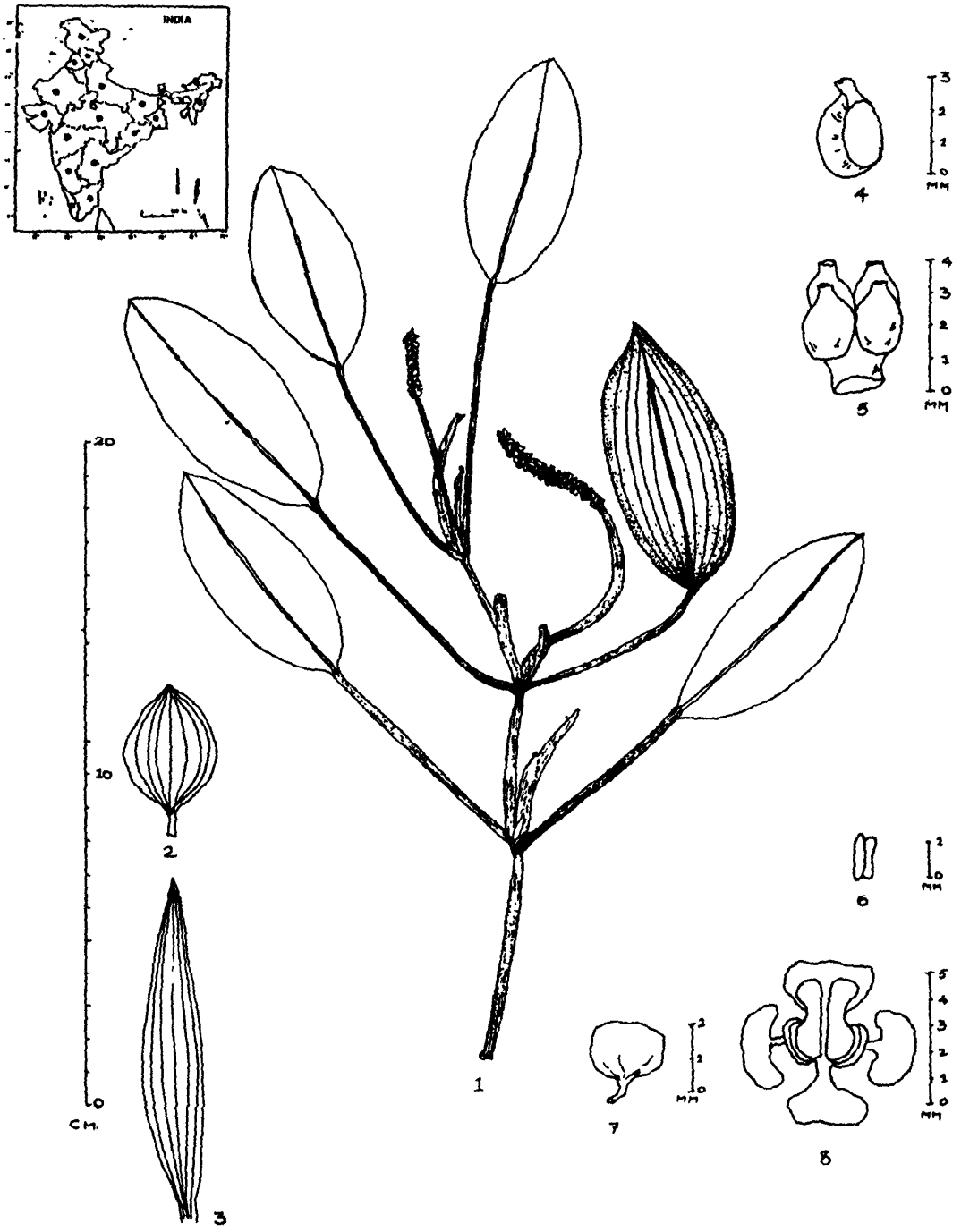


Fig. 8 : *Potamogeton nodosus* Poir. : 1. Plant bering spikes ; 2 & 3. Leaf variation ; 4. Fruit ; 5. Mature carpels ; 6. Stamen ; 7. Perianth lobe ; 8. Flower.

PUNJAB : Hoshiarpur, Jawar, 14.4.1972, *O.P. Mishra* 46961 (BSD). BIHAR : Champaran, 4.4.1963, *K. Thothathri* 9939 (CAL). ORISSA : Maubhang, 12.11.1959, *G. Panigrahi* 21014 (CAL). MADHYA PRADESH : Raigarh, Sarangarh, 29.9.1976, *Radhakrishnan.* 24351; Piparia, 21.3.1975, *L. K. Banerjee* 22142 ; Shivpur, 19.11.1962, *Panigrahi* 6021 ; Bilaspur, Khuria, 560 m, 25.7.1973, *S.K. Murti* 19345 ; Raipur, 12.10.1976, *D.M. Verma* 25734 (BSA). RAJASTHAN : Jhalawar, 22.4.1964, *D.M. Verma*, 3314 (CAL) ; Tonk, Chandali dam, 50 m, 13.5.1977, *R. P. Pandey* 4738 ; Chandalai village, 285 m, 16.9.74, *B.V. Shetty* 1256 ; Jodhpur, Akherajaji tank, 4.10.1977 *A.N. Singh* 9483 ; Bhilwara, 27.9.1978, *A.N. Singh* 6022 ; Bikaner, Canal road, 25.7.1975, *G. P. Roy* 2158 ; Banswara, 28.3.1977, *V. Singh* 4602 ; Bharatpur, Bandh-Baretha, 23.2.1982, *Parmar* 8656 (BSJO) ; Ajit Sagar, Khetri, 17.3.1962, *N.C. Nair* 20700 (BSD). GUJARAT : Dwarka, 12.10.1953, *M.B. Raizada* 23796 (DD) ; Broach, 0.9.1070, *K. J. Vyas* 2994 ; Chhota Udepur, Gabadia, 11.10.1972, *Y.Y. Karatela* 4273 ; Bulsar, Umargaon, 15.4.1985 ; *A.S. Reddy* 3397 ; Bulsar, Dhamori, 9.12.1985 (SPUH). MAHARASHTRA: Pune, Katraj, 28.5.1902, *G.A. Gammie* 15224. Khandala lake 9.3.1962, *R.S. Rao* 78894 (BSI) ; Parbhani, Kalamnari, 11.12.1971, *V.N. Naik* 687 ; Aurangabad, Dec. 1978, *Pardeshi* 4080 (Univ. Herb. Aurangabad) ; Purandhar, 7.11.1957, *Santapau* 13865 (BLAT). KARNATAKA : Someshwar tank, Biligirirangan, Mysore dist. 25.4.1962, *A.S. Rao* 79786 (BSI) ; Shikmagalur ; Belur road, 28.7.1979, *Saldanha & Greenata* 8599 (CAL) : KERALA: Travancore, 20.12.1893, *M.A. Lawson* 307. (CAL). TAMIL NADU : Nilgiris, 7000 ft. 28.5.1907, *G.A. Gammie* 650 (BSI) ; Coimbatore, Velankulam, 30.6.1966, *Chandrabose* 28882 ; Nilgiri dist. Emerland, 1925 m, 19.10.1972, *Vivekananthan* 43001 (MH) ; Ootakamand, 7000 ft. 1973, *V.N. Naik* 1965 (Univ. Herb. Aurangabad) ; ANDAMANS: April, 1891, *Dr. King's Coll.* s.n. (Acc. No. 499816, CAL).

11. Potamogeton octandrus Poir. in Lam. Encycl. Meth. Bot. Suppl. 4 : 534. 1816; Subramanyam, Aq. Angio. 95. 1962 : Kak in J. Bombay Nat. Hist. Soc. 80 : 314 (1983) 1984. *P. javanicus* Hassk. in Act. Soc. Ind.-Neerl. 1 : 26. 1856 ; Hook.f. Fl. Brit. India 6 : 566. 1893 ; Aschers. & Graeb. in Engler's Pflanzenr. 31 : 46. f. 14 A-C. 1907. (Fig. 9)

Aquatic herbs ; stem slender, wiry. Leaves 1.4 10.5 × 0.2-2.4 cm, submerged leaves very narrowly linear or filiform, acuminate without distinct petiole ; floating leaves membranous, elliptic-ovate, ovate-oblong or lanceolate, acute at both ends, 5-7 nerved ; petioles slender, 5.2-9.5 cm long ; stipules 1.0-3.4 cm long, free. Spikes 0.5 - 4.5 cm long, interrupted ; peduncles 2.5 - 8.2 cm long, slender, leaf opposed. Flowers

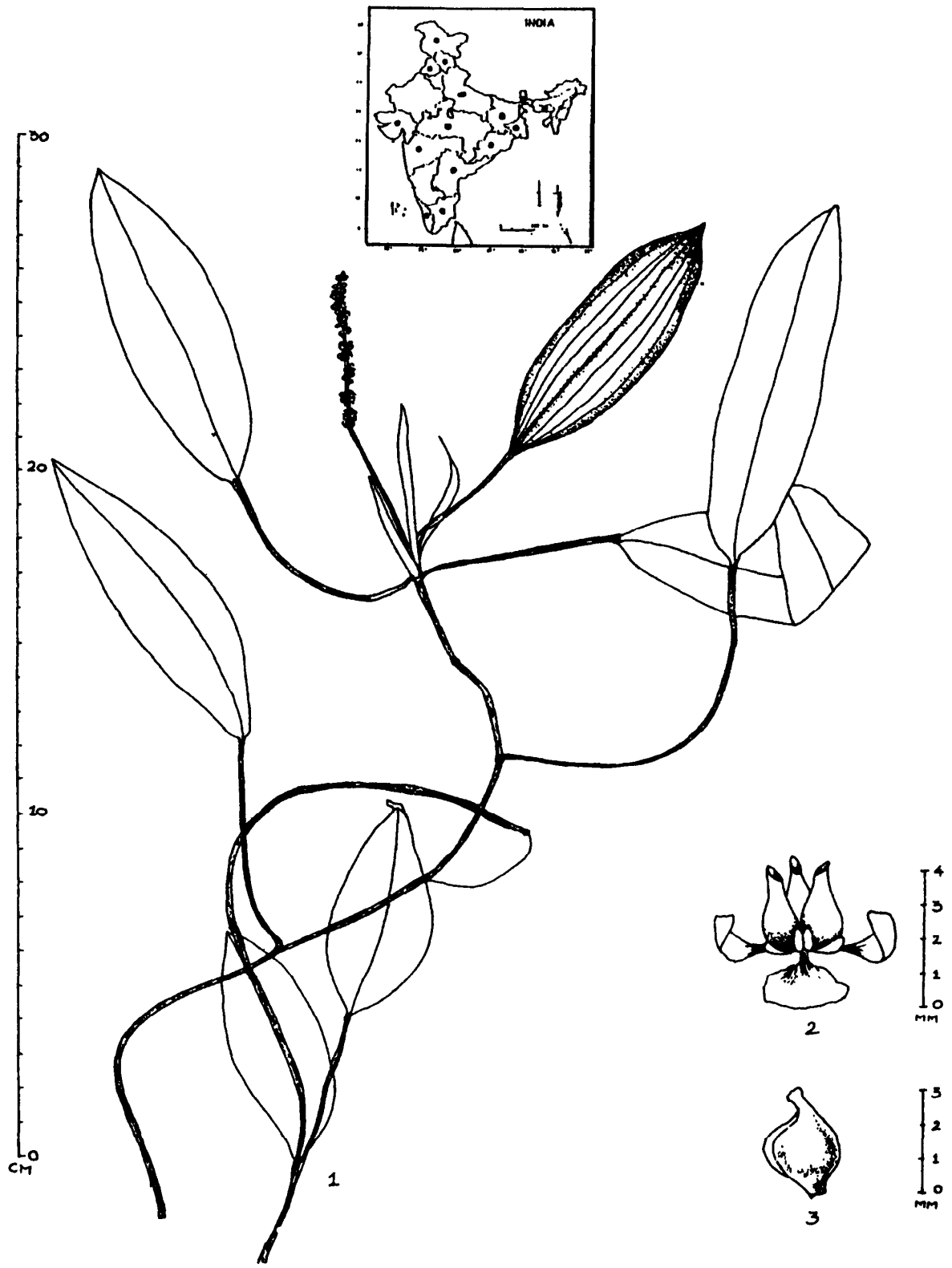


Fig. 9 : *Potamogeton octandrus* Poir. : 1. Plant bearing spike ; 2. Flower ; 3. Fruit.

minute, hermaphrodite, perianth segments 4, green, obovoid or suborbicular, clawed, 1.5-2 × 0.2 mm, anthers 4, white, adnate to claw ; carpel 4, free. Drupelets 1.5-3 mm long, subglobose, turgid with a hooked beak and ribs, often toothed on the back, tubercled.

Type : Cochin China, Loureiro B-8, Kashmir, Skardu, Poonch etc. (Stewart 1972). Wallich Sheet No. 5181, Acc. No. 499834 (CAL).

Fl. & Fr. : Almost throughout the year.

Distrib. : India : Jammu & Kashmir, Himachal Pradesh, Punjab, Uttar Pradesh, W. Bengal, Sikkim, Meghalaya, Orissa, Madhya Pradesh, Gujarat, Maharashtra, Andhra Pradesh, Tamil Nadu, Kerala ; Bangladesh, Tropical & N.E.S. Africa, Madagaskar, S.E. Asia, N.E. Australia.

Ecology : Near the margins of tanks, pools, rivers back waters and lakes in plains of India ascending an altitude up to 2700 m in Himalayas.

Specimens examined : JAMMU & KASHMIR : Srinagar, Dal lake, 9.7. 1974, *A.R. Naqshi* 4638 ; Dal lake, Aug. 1975, *A.M. Kak,* 3283, Sindh Valley, Prag, 1800 m, 12.7.1983, *G.H. Dar* 6631 (KASH). UTTAR PRADESH : Dehra Dun, Asan river, *Mackinnon* s.n. (CAL). HIMACHAL PRADESH : Simla hills, *J.S. Gamble,* 6254 B (DD). MEGHALAYA : Khasia hills, 5000-6000 ft, *Hooker* s.n. (CAL). MADHYA PRADESH : Sabag, Ambikapur, 20.2.1976, 970 m, *G. Sen Gupta* 24046 (BSA). GUJARAT : Baroda, College Campus, 30.4.1955, *G.L. Shah* 4303, 4306 (BLAT). MAHARASHTRA : Khandala, May 1919, *without collector's name,* [Acc. Nos. 78699, 78700 (BLAT)]. KERALA : Cattayam, Travancore, Dec. 1910, *A. Meebold* 12711 (BSA).

12. Potamogeton orientalis Hagstroem in Bot. Not. 1908 : 102. 1908. (Fig.10.)

Herb ; stem branched, slender, flattened; internodes short, 5-35 mm long. Leaves 15-50 × 1-2 mm, stem-like, linear, apex acute, gradually narrowed, 3-nerved at apex, 5-nerved in middle ; median nerve on both sides with whitish streaks ; leaves on branches acute-subcuspidate, 3-nerved ; stipules 10 15 mm long, scarious, deciduous. Spikes 8-10 mm long with 3-4 verticillate, subinterrupted flowers ; peduncles 15-20 mm long, straight or zigzag. Fruits wanting.

Type : Japonia : Yokohama 10/22 Aug. 1862. Maximowicz. Iter scundum : Mus. petropol.

Fls. : July.

Distrib. : India : Assam ; China, Japan.

Ecology : In rivers, rare.

Specimens examined : ASSAM : River Brahmaputra at Dilmgarh, July 1896, *Dr. King's collector,* s.n. (Acc. Nos. 499998, 500000, (CAL).

Notes : This species can be differentiated from others having leaves with main lateral

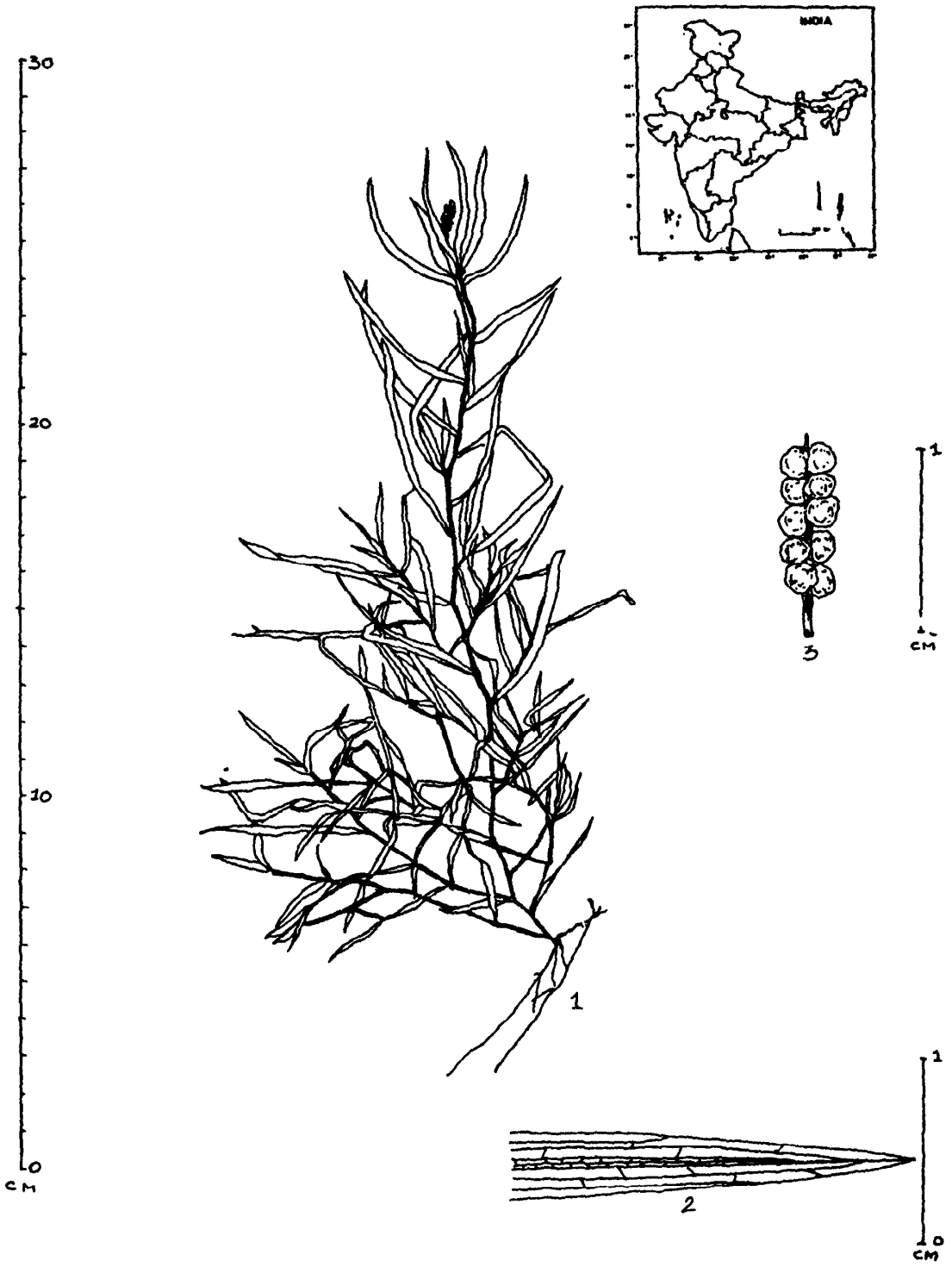


Fig. 10 : *Potamogeton orientalis* Hagstr. : 1. Plant bearing spike ; 2. Upper part of stem-leaf ; 3. Spike.

nerves quite in middle between midrib and margin. Moreover, broader leaves on each side have a faint nerve outside the main lateral nerve.

13. Potamogeton pectinatus L., Sp. Pl. 127. 1753 ; Hook.f. Fl. Brit. India 6 : 567. 1893 ; Aschers. & Graeb. in Engler's Pflanzenr. 31 : 121. 1907 ; Subramanyam, Aq. Angio. 95. 1962 ; Kak in J. Bombay Nat. Hist. Soc. 80 : 318. (1983) 1984. *P. pusillus* subsp. *flabellatus* Hook.f. Fl. Brit. India 6 : 567. 1893. *Khanki* (Punjabi), *Fennel leaved pondweed* (Eng.) [Fig.11(B)]

Slender to robust, rhizomatous, submerged herbs ; stem filiform, profusely branched. Leaves 2-20.5 × 0.1-0.3 cm, alternate, linear or filform, setaceous, 1-3-nerved with thickened inrolled margins ; stipules adnate to the leaf sheaths with free tips. Spikes 0.5-3.5 mm long, compact or interrupted peduncles slender, axillary, elongate, filiform. Flowers few, minute, greenish-white in distant whorls. Drupelets 3 × 2 mm, turgid, obovoid-semicircular, veined, ventral margin slightly convex, dorsal semicircular, beak short, forming a prolongation of ventral margin. Seed small, subreniform.

Type : Habitat in Europae fossis and Paludibus (Sweden).

Fl. & Fr. : Greater part of the year.

Distrib. : India : Jammu & Kashmir, Himachal Pradesh, Manipur, Punjab, Uttar Pradesh, Orissa, Bihar, West Bengal, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, temperate and tropical regions of Pakistan, Burma, Sri Lanka, Iraq, Europe, Africa, Asia America and Australia.

Ecology : In fresh water pools, tanks, ponds, canals, lakes, coastal area throughout the plains and hills ascending an altitude 4000-5200 m in W. Himalayas (Kumaon).

Chromosome no. : 2n = 42 (Mishra 1972).

Specimens examined : JAMMU & KASHMIR : Dal lake, Srinagar, 5,500 ft. 4.9.1954, *K.M. Vaid*, s.n. Acc. No. 117544 (DD) ; Kashmir, July 1956, *T. A. Rao* 753 (CAL) ; Wullar lake, 1075 m, 16.6.1959, *T.A. Rao* 9486 ; Mansbal lake, Kashmir, 2300 m, 17.6.1959, *T.A. Rao* 9516 (BSD) ; Nubra, 28.7.1980, *Naqshi & Dar* 7456 (KASH). UTTAR PRADESH : Garhwal, Gohna, 2000 m, 9.6.1959, *M.A. Rau* 10050 ; On way to Sikar, 25.3.1961, *M.A. Rau* 14483 ; Hamirpur, Betrar, 29.3.1962, *U.C. Bhattacharyya* 20966; Dudhwa, 22.4.1964, *C.L. Malhotra* 31528 ; Dehra Dun, 6.12.1968, *P.C. Pant* 38549 (BSD). MANIPUR : Manipur 1881-82, *G. Watt* 6307 (CAL). PUNJAB : Hansi, 13.2.1963, *N.C. Nair* 25902 ; Hissar, 5.4.1965, *N.C. Nair* 34566 ; Hoshiarpur, Jawar, 14.4.1972, *O.P. Mishra* 46959 (BSD); Punjab ; 1000 ft. *Hook.f. & Thoms.* (Acc. No. 49979, CAL). HIMACHAL

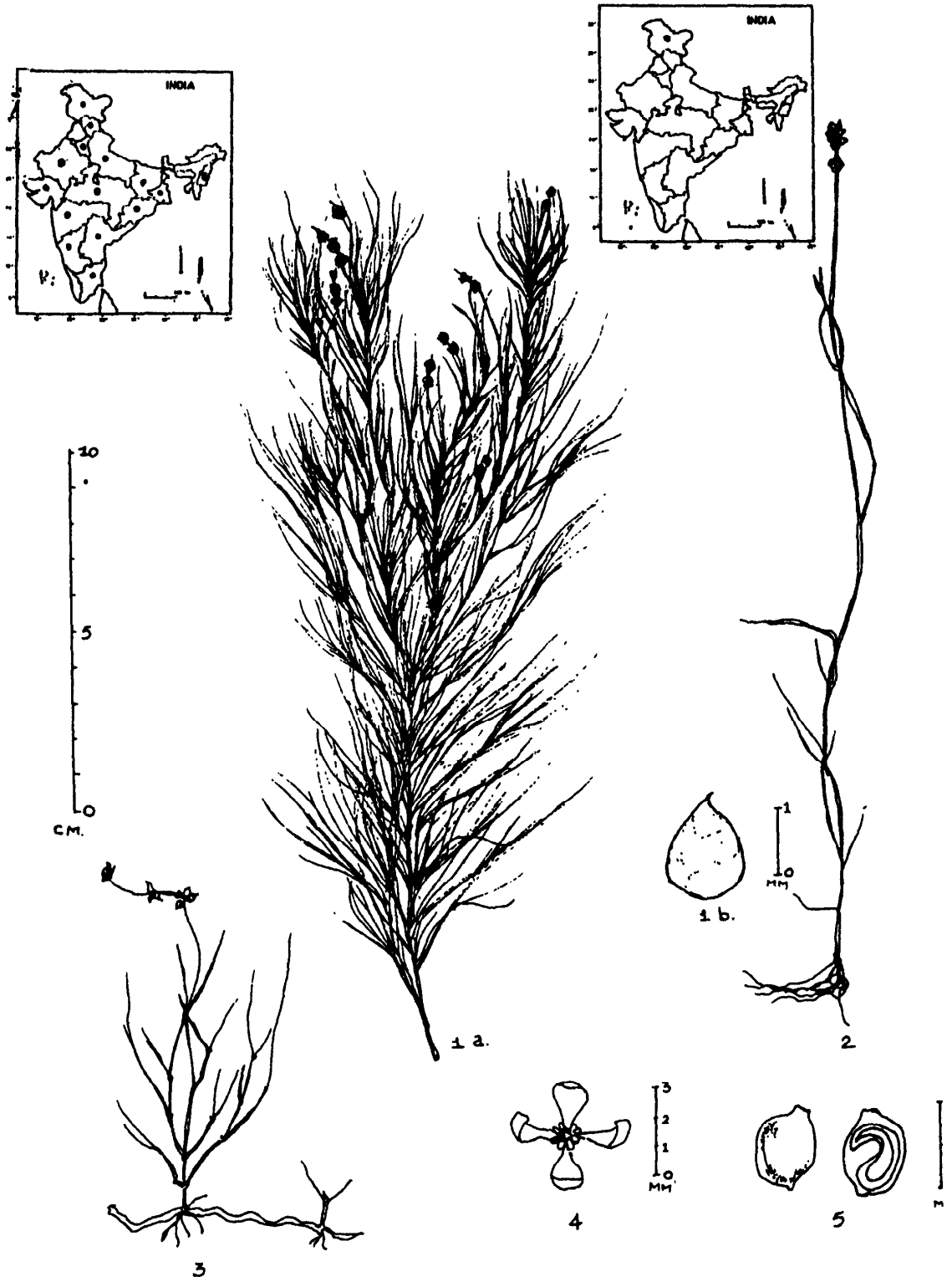


Fig. 11 (1a-1b) : *Potamogeton pectinatus* L. 1a. Plant bearing spikes ; 1b. Fruit.

Fig.11 (2-5) : *Potamogeton filiformis* Pers. : 2-3. Plant bearing spikes ; 4. Flower ; 5. Fruit.

PRADESH : Spiti, Rangrik, 3800 m, 5.8.1972, *U.C. Bhattacharyya* 49342 ; Lahul, Darcha, 3500 m, 10.7.1973, *U.C. Bhattacharyya* 51993, (BSD) ; Lahul, Juspa, 10,200 ft. 23.6.1941, *N.L. Bor* 14921 (DD) : Spiti, Logur, 4100 m, 27.7.1972 *U.C. Bhattacharyya* 49035 (CAL). SIKKIM : Sikkim Himalaya, 1100 ft. 14.10.1928, *J.D. Hooker* 368 (CAL). BIHAR : Dumaroon, 7.4.1920, *Ramyadlali* 1 (Acc. No. 499955, CAL). ORISSA : Bargud, 15.2.1961, *G. Panigrahi* 23852 (CAL). WEST BENGAL : Kambajang (Herb. Hort. Bot. Calcuttensis), Sept. 1903, *Maj. D. Prain* s.n. (BSI, Acc. No. 2149, 3.2.1975) ; 24-Parganas, Falta fort (surrounding lake), 23.11.1988, *M.K. Ghosh* 835 (CAL). RAJASTHAN : Mt. Abu, Achaleshwar Talao, 16.4.1960, *K.C. Kanodia* 62212 (BSI) ; Jodhpur, Agolai Tank, 15.11.1972, *B.V. Shetty* 298 ; Tonk, Banas river bed near Bisalpur, 15.2.1973, *B.V. Shetty* 541 ; Jodhpur, Luni river near Pichiyak, 28.2.1977, *A.N. Singh* 3533 ; Bhilwara, Koshithal village, 23.9.1978, *A.N. Singh* 6529 ; Banswara, Talwara village, 28.3.1977, *V. Singh* 4299 (BSJO) GUJARAT: Ranjit Sagar, Navanagar state, 3.11.1945, *H. Sant.* 7928, 7939, 7940, 7941 ; Dwaraka, 22.8.1952, *H. Sant.* 14706, 14707 ; Dwaraka near station, 1.10.1953, *H. Sant.* 16614, 16649 ; Rajkot, Pradumn Park, 21.10.1957, *H. Sant.* 13678 (BLAT) ; Kutch, Sudasna hill, 29.1.1957, *S.K. Jain* 11393 ; Viramgam, 11.9.1958, *Raghavan* 114591 (BSI) ; Ahmedabad, Nalsorovar, 11.1.1965, *G.L. Shah* 11394 ; Rajpipla, Garudashwar, 25.12.1966, *G.L. Shah* 12018 ; Panchmahals, Lunawada, 19.12.1971, *R. G. Bhatt* 2127 ; Chhota-Udepur, Hampheshwar, 12.6.1972, *Y.Y. Karatela* 2638 (SPUH) ; Dwaraka, 12.10.1953, *Raizada* 23856 (DD). MAHARASHTRA : Pashan tank, Pune, 26.5.1910, *R.K. Bhide* s.n. (BSI's, Acc. Nos. 2109, 2110, 2112, 2113, 2140, 2150, 30.1.1975) ; Pashan, near Pune, 25.2.1903, *G.A. Gammie* s.n. (BSI's, Acc. Nos. 2136, 2138) ; Pune, 1986 Pashan tank, *M.J. Kothari* s.n. (BSI) ; Aurangabad, Kaygaon, 20.2.73, *Pardeshi* 298 ; Sahaghar, Aurangabad 6.10.72. *Pardeshi* s.n., Kalamnuri, Parbhani 11.12.1971. *V.N. Naik* 688. Hingoli, Parbhani, *A.L. Vaidya* 393; Kinklat, Nanded, 19.2.1976, *B.R. Zate* 183 ; Mahur, Nanded, 1.2.1976, *B.R. Zate* 204 (Univ. Herb. Aurangabad). MADHYA PRADESH : Ghoghwa, 21.11.1962, *Panigrahi* 6127 (BSA). KARNATAKA : Mysore, Lingsagar, 28.9.1958. *B.M. Wadhwa* 44788; N. Kanara, Pala, Nov. 1925, *W.A. Talbot*, s.n. (Acc. No. 565, 4.7.1974, BSI). TAMIL NADU: Velamkulam, Coimbatore dist., 467 m, 30.1.1966, *M. Chandrabose* 8882 (MH).

Notes : It differs from *P. filiformis* Pers. in having an open stipular sheath, larger fruitlets and a short style.

Uses : Plants are used as manure and its rootstock occasionally as food due to starch content (Ambasata, 1986).

14. Potamogeton perfoliatus L. Sp. Pl. 126. 1753 : Hook.f. Fl. Brit. India 6 : 566. 1893 ; Aschers. & Graeb. in Engler's Pflanzenr. 31 : 92. f. 21A E. 1907 ; Subramanyam, Aq. Angio. 95. 1962 ; Kak in J. Bombay Nat. Hist. Soc. 80 : 316 (1983). 1984. *P. densus sensu* A.W. Bennett, Journ. Bot. (London) 33 : 371. 1895 *p.p. non* L. (1753). (Fig.12)

Aquatic, submerged, stoloniferous herbs; stem dichotomously branched, terete. Leaves 0.8-4.5 × 0.3-1.2 cm, suborbicular, ovate, cordate, apex obtuse, base amplexicaul, entire or wavy, translucent, 5-9 nerved ; stipules small, caducous, 5-9 nerved. Spikes 0.8 2.5 cm long purplish-brown ; peduncle 2 5.3 cm long, axillary, stout. Flowers many, dense; perianth segments 4, *ca* 2 mm long, elliptic-obovate or suborbicular, clawed ; stamens 4, sessile ; carpels 4, free, hooked. Drupelets compressed, subglobose ; beak short, curved.

Type : Habitat in Europae, Laccubus, fluviisque argillosis (Sweden) Herb. L. folium 175 : 3 (CAL), (LINN).

Fl. & Fr. : Throughout the year.

Distrib. : India : Jammu & Kashmir, Himachal Pradesh, Punjab, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu ; Pakistan, Asia, Europe, Africa, N. America, Australia.

Ecology : In tanks, pools, rivers, canals, lakes and dam area in plains and hills up to an altitude of 300 m in Himalaya.

Chromosome no. : 2n = 52 (Palmgren, 1939).

Specimens examined : JAMMU & KASHMIR: Panikar, Kashmir, Aug. 1975 ; *A.M. Kak* 2031 (KASH). UTTAR PRADESH : Garwal, Gothma, 2000 m, 7.6.1959, *M.A. Rau* 10051 ; Kumaon, Narkachaya Tal, 15.9.1961, *M.A. Rao* 14162; Hamirpur, 29.3.1962, *U.C. Bhattacharyya* 20963 (BSD). Gauna lake, Garhwal, 5,500 ft., 2.5.1932, *A. E. Osmaston* 1489 (DD). PUNJAB: Hoshiarpur, Talwara, 23.4.1972, *O. P. Mishra* 47195 (BSD). HIMACHAL PRADESH : Mandi, Beas river, 1000 m, 19.6.1958, *M.A. Rau* 5728 ; Lahul, 3000 m, 5.5.1973, *Bhattacharyya* 51841 (BSD). MADHYA PRADESH : Saugar dist., Bina river, Rahatgarh, 450 m, 1.3.1960, *K. Subramanyam* 10106 (MH). RAJASHTHAN : Mt. Abu, 14.11.1962, *Panigrahi* 5857 ; Allahabad, 3.7.1965, *R. Prasad* 3259 (BSA); Bhilwara, Guwari dam, 12.2.1979, *A.N. Singh*, 7098. Sariska Tiger Reserve, Alwar dist. 12.4.1984, *P. J. Parmar* 9712 (BSJO). GUJARAT : Ahmedabad, 30.3.1902, *ARP'S TOUR* s.n. (Acc. No. 34963, ISIM) ; Pattan, *Dalzell* s.n. : Rajkot, 17.2.1890 (CAL). Unai, Dangs, 9.3.1954, *H. Sant.* 18316 ; Rajkot, Prdumna park, 23.10.1957, *H. Sant.* 13718 ; Rajkot, Ranjitsagar, Navanagar state, 3.11.1945, *H. Sant.* 7926 (BLAT) ; Rajpipla, Garudeshwar, 25.12.1966, *G.L. Shah* 12023; Broach, Kabirwad, 20.4.1971, *K.J. Vyas* 5395; Panchmahals, Lunawada, 19.12.1971, *R.G. Bhatt* 2397 ; Chhota Udepur,

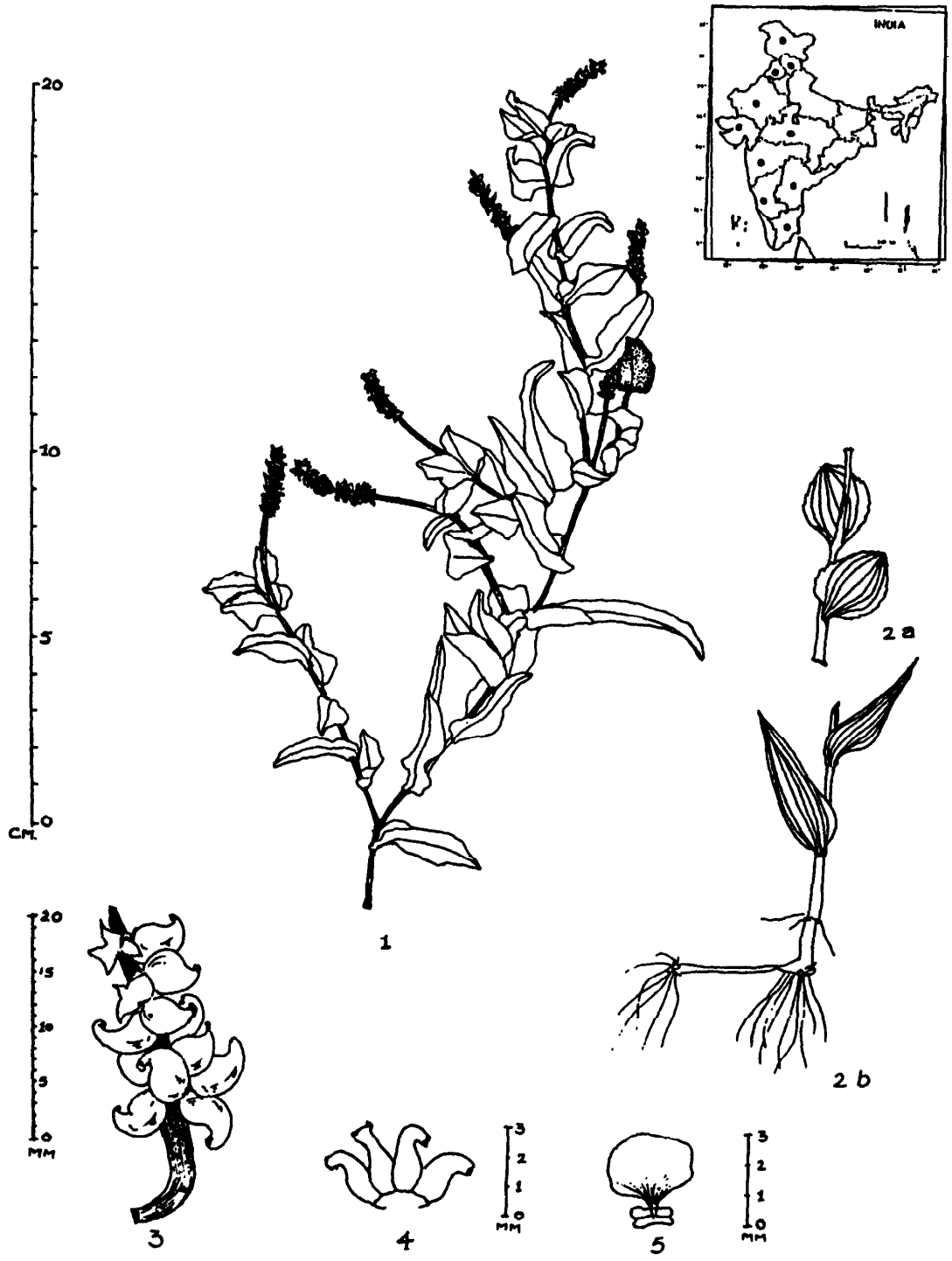


Fig. 12 : *Potamogeton perfoliatus* L.: 1. Plant bearing spikes ; 2a. Leaf variation ; 2b. Plant roots; 3. Fruiting spike ; 4. Mature carpels ; 5. Perianth lobe with adnate stamen.

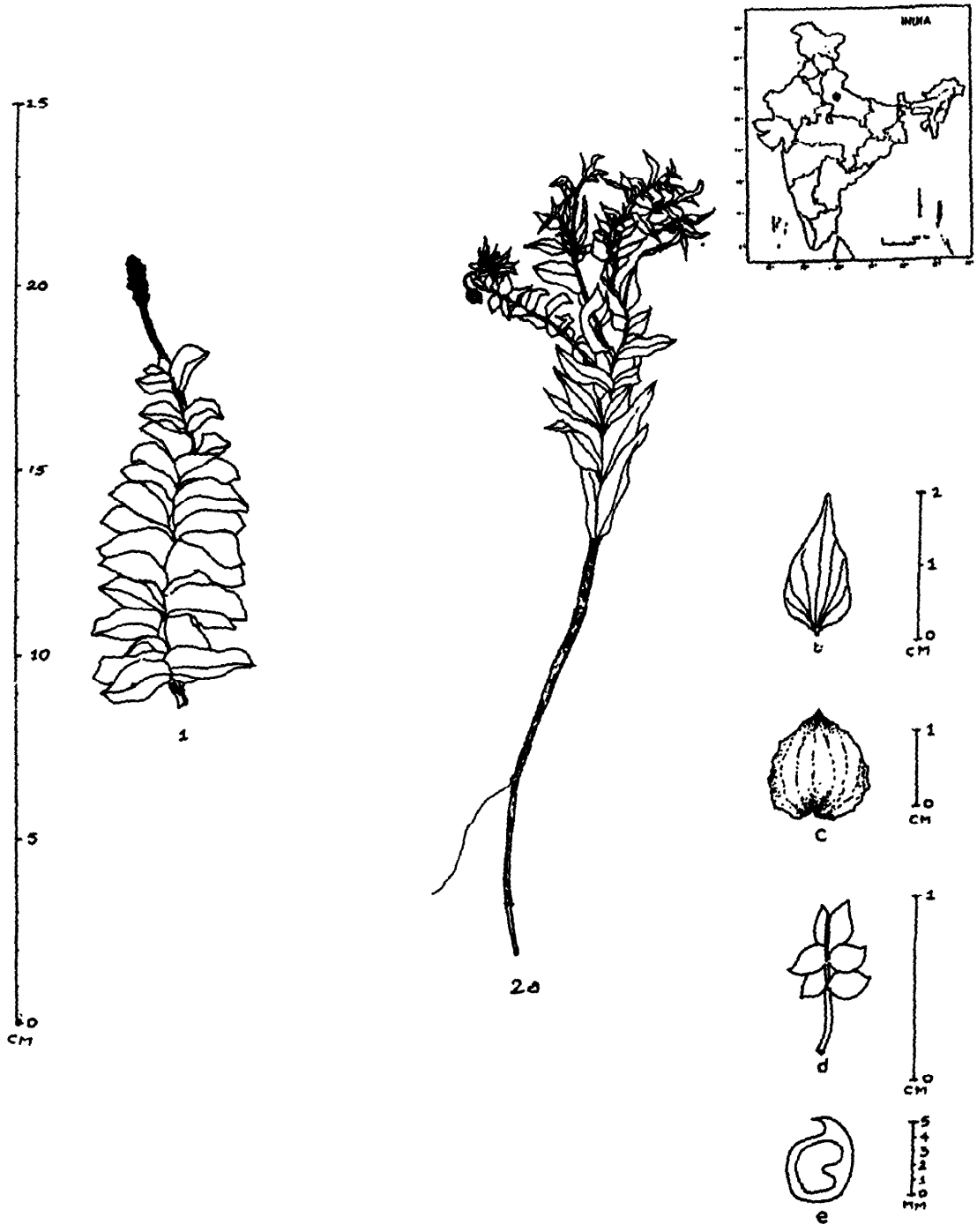


Fig. 13 : 1. *Potamogeton perfoliatus* L. Proles *I. pseudodensus* Ascher's & Graebn. 2. *Groenlandia densa* (L.) Fourr : a. Habit ; b. & c. Leaf variation ; d. Spike ; e. Fruit.

Hambheshwar, 3.3.1971, *Y.Y. Karatela* 769; Rajpipla, Indravarna, 22.1.1970, *A.I. Patel* 2679 ; Kevadia, 24.3.1970, *A.I. Patel*, 2887 (SPUH). MAHARASHTRA : Poona-Khandala, Kamshet, 22.5.1953, *H. Sant.* 15584, 15585, 15586 (BLAT) ; Pune, Mutha river bank, 23.9.1921, *V. Narayana* s.n. BSI's Acc. Nos.(2198, 2200, 2201, 2202, 04.2.1975) ; Pune, Lonavli, 22.4.1906, *W.A. Talbot* 569 ; Mulshi, Pune 6.2.1964, *R.V. Kammathy* 78351 (BSI) ; Kayeson, Aurangabad, 20.2.1973, *Pardeshi* 297 ; Paithan, Aurangabad, 18.2.1973, *Pardeshi* 261 ; Parbhani, 11.12.1971, *V.N. Naik* 685 ; Hingoli, Parbhani, *Vaidya* 155 ; Degboor, Nanded, 21.4.1979, *B. R. Zate*, 640 ; Kinwat, Nanded, 3.2.1981, *B.R. Zate* 1742 (Univ. Herb. Aurangabad). TAMIL NADU: Ootakamand, May 1920, *C.M.C.* 50042, (BLAT).

Uses : As the plant contains crude protein up to 13.5% and carotene up to 11.3 mg / 100 gm the plant is used as manure and root stocks as food for animals (Ambasta, 1986).

Notes : Aschers. & Graebn. (1907) has further classified *P. perfoliatus* L. based on length of internodes and shape of leaves as follows :

A.	Internodes 3-15 mm long ; leaves distinctly distichous	...	var. *pseudodensus*
B.	Internodes 3-30 cm long	...	1
	1a. Leaves almost circular	...	var. *L. rotundifolius*
	1b. Leaves ovate to lanceolate	...	2
	2a. Leaves broadly ovate	...	var. *B. typicus*
	2b. Leaves ovate-lanceolate	...	var. *Y. cordatilanceolatus*

Incidentally, above vegetative variations are also observed by the present author [see figs. 13 (1), 12 (2a, 2b). To avoid confusion in segregation of *P. perfoliatus* L. based on above vegetative characters, I strictly followed Dandy (1971) and merged all above varieties in *P. perfoliatus* L. only.

15. Potamogeton polygonifolius Pourret in Mem. Acad. Sci. Toulouse 3 : 325. 1788. Aschers. & Graeb. in Engler's Pflanzenr. 31: 65. 1907 ; Mitra, Fl. Pl. E. India 1 : 7. 1958 ; Kak in J. Bombay Nat. Hist. Soc. 80 : 314 (1983) 1984. *P. oblongus* ('*P. oblongum*') Viv. in Ann. Bot. 1, 2 : 102, 1802. *'Bog pond weed'* (Eng.). (Fig. 14)

Large perennial herbs with creeping stocks ; stems 10-30 cm long, cylindric with

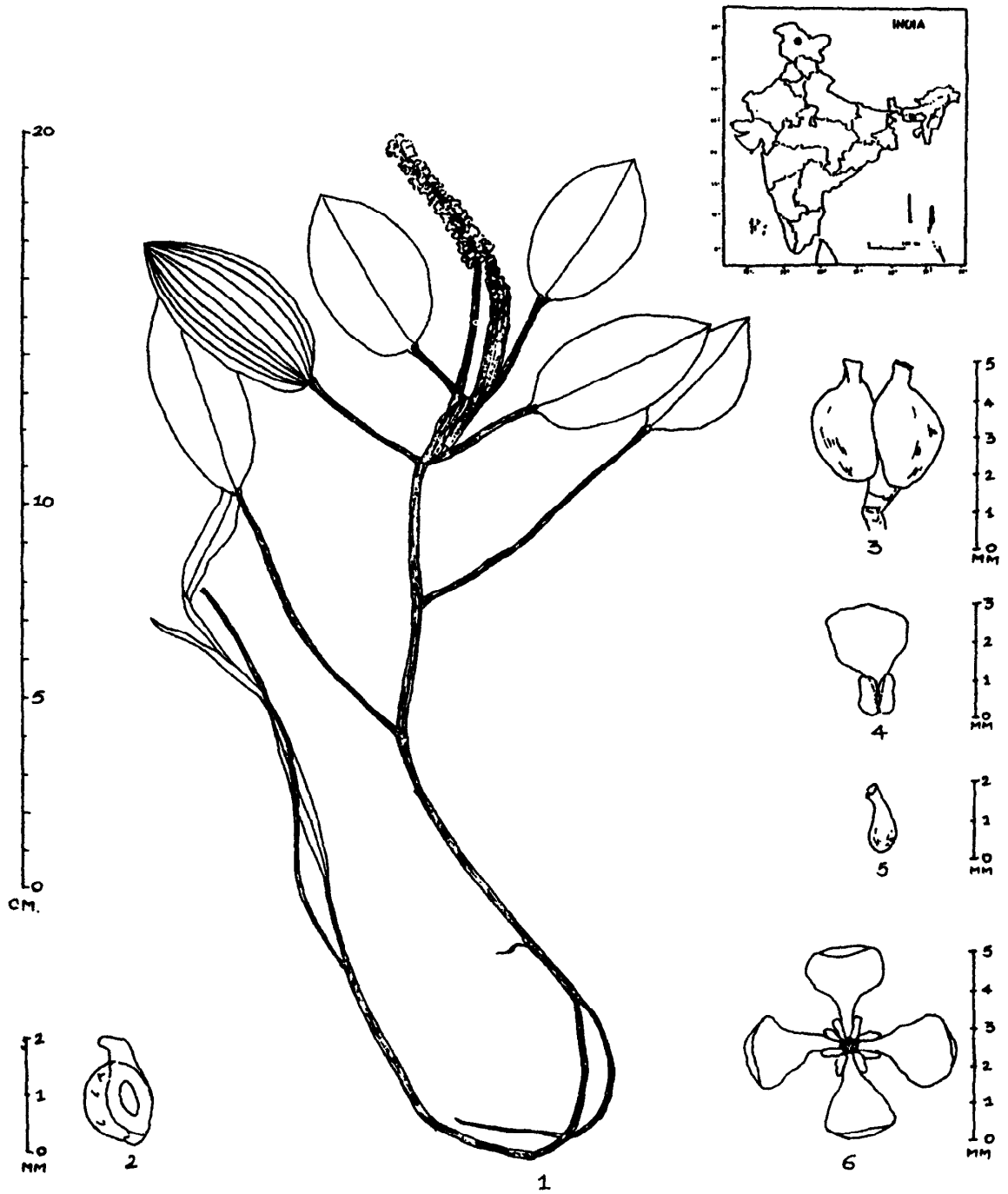


Fig. 14 : *Potamogeton polygonifolius* Pourr. : Plant bearing spikes ; 2. Fruit ; 3 & 5 : Mature and young carpel ; 4. Perianth lobe with adnate stamen ; 6. Flower.

longer internodes. Leaves 3.7 5.6 × 1.8 2.3 cm, upper floating coriaceous, elliptic-ovate, suborbicular, broadly lanceolate, apex acute or slightly mucronate, base rounded or cordate, prominently veined beneath ; lower submerged, membranous, lanceolate or linear-lanceolate ; stipules 2.5 - 3.2 cm long, hyaline, ovate, sheathing ; petioles 0.5-6.3 cm long, slender. Spikes 1.5-3.8 cm long, erect, slender, cylindric ; peduncles 2-5 cm long, cylindrical. Flowers many, loosely arranged; perianth *ca* 2 mm long, obovate-suborbicular, clawed ; stamens 4 ; carpels 4. Drupelets 2 × 1.5 mm, ellipsoid, ventrally straight, dorsally convex, beak slightly curved.

Type : A Fontlaurier, dans le ruiffeau du fommet de la montagne. Java : zollingern. 3784.

Fl. & Fr. : June.

Distrib. : India : N.W. Himalaya (Jammu & Kashmir), E. India (Khasia hills in Meghalaya) ; Asia, Europe, British Islands, Africa, N. America.

Ecology : In lakes and irrigation channels of Himalayan valleys between alt. of 1500-1800 m.

Chromosome no.: 2n = 52 (Takusagawa, 1961).

Specimens examined : JAMMU & KASHMIR : Kashmir, Nagin lake, 2.6.1975, *A.M. Kak* 3367 (KASH).

Notes : Morphologically, this species is very close to *P. natans* and *P. nodosus* from which it can be differentiated by its persistent, obtuse stipule, 2-4 cm long and upper leaves recurved, not keeled.

16. Potamogeton pusillus L. Sp. Pl. 127. 1753; Hook. f. Fl. Brit. India 6 : 567. 1893 ; Aschers. & Graeb. in Engler's Pflanzenr. 31 : 113. f. 27. 1907 ; Mitra, Fl. Pl. E. India 1 : 8. 1958 ; Kak in J. Bombay Nat. Hist. Soc. 80 : 318. (1983) 1984. *P. panormitanus* Biv. Nuov. Piante 6. 1838. (Fig.15)

Aquatic, submerged herbs ; stem slender, terete, much branched, winter buds axillary, slender. Leaves 1.5-4.1 × 0.1-0.2 cm, semiamplexicaul, narrowly linear, thread like, tapering to an acute point, 3-5 nerved ; stipules 3-12 mm long, membranous to scarious, connate to almost half way up, subacute, free. Spike 4-8 mm long, peduncle 4-15 mm long ; slender. Flowers few, clustered, hermaphrodite ; perianth segments 4, green, suborbicular, clawed ; stamens 4, sessile ; carpels 4, free. Drupelets 1-2 mm long, obovoid or obliquely elliptic, 3-keeled on the dorsal surface, slightly convex on the ventral.

Type : Habitat in Europe paludubus (Sweden) ; Herb. Linn. No. 175. 15 (LINN!) Micro in (CAL) ; *Wallich* 5180 (CAL).

Fl. & Fr. : July - August.

Distrib. : India : Jammu & Kashmir,

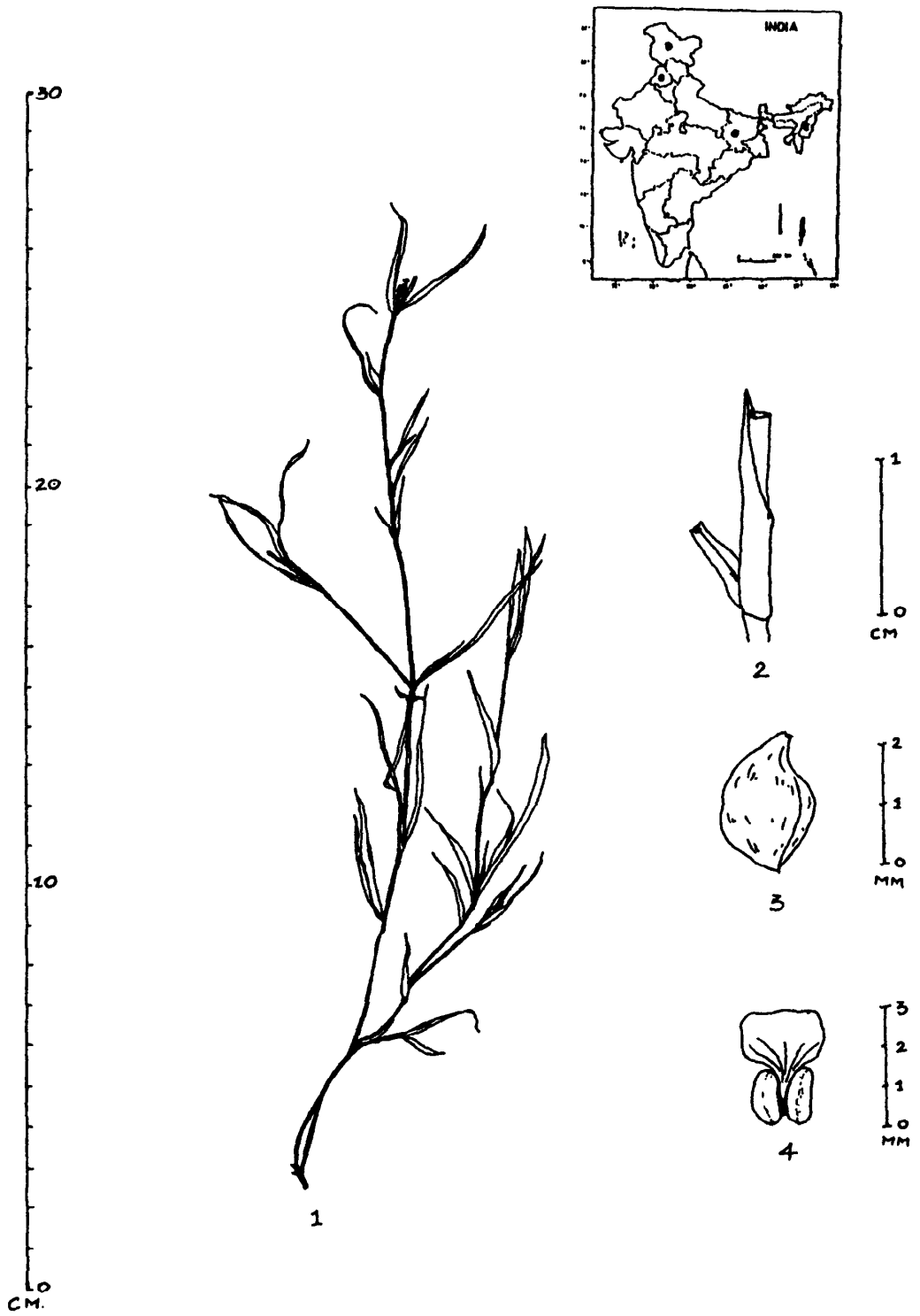


Fig. 15 : *Potamogeton pusillus* L. : 1. Plant bearing terminal spike ; 2. Stipule ; 3. Fruit ; 4. Perianth lobe with stamen.

Punjab, Bihar, Manipur ; Pakistan, Nepal, Afghanistan, Iran, Java, S. Asia, Europe, North Temperate Zone southward into Tropical America, S. Africa including Jordan, Egypt, Arabia, Turkey, Siberia, U.S.S.R.

Ecology : In Marshy paddy fields, ditches altitude and lakes ascending an altitude up to 1650 m in Himalaya.

Chromosome no. : 26 (Palmgren, 1939).

Specimens examined : JAMMU & KASHMIR : Sajda Kadal, 1600 m, July, 1976, *A.M. Kak* 3024 ; Sind Valley, Doderhama, 1650 m, 28.8.1981, *G. Dar* 3165 (KASH) ; MANIPUR : Ching 1010, 4-5000 ft. April 1882, *G. Watt* 6743 (CAL).

17. Potamogeton tepperi A.W. Bennett in J. of Bot. 25 : 178. 1887 ; Aschers. & Graeb. in Engler's Pflanzenr. 31 : 62. 1907 ; Kak in J. Bombay Nat. Hist. Soc. 80 : 313 (1983) 1984. *P. odontocarpus* Gandog. Bull. Bot. France 3, ser. 6, 393. 1899. (Fig. 16)

Floating herbs ; stem simple, terete. Leaves 7.5-11.8 × 3.5-5.4 cm, upper floating, ovate-lanceolate, apex obtuse or slightly acute, base cordate, light pink beneath with 20-30 prominent nerves, submerged leaves linear-obovate tapering at base. Stipules 5.5-7.4 × 0.6-1 cm, ovate-lanceolate, acuminate; petiole 6.4 8.6 cm long, slender cylindric. Spikes 2.5-5 cm long ; peduncle 8.2 10 cm long, axillary, slender, thickened upwards. Flowers many, dense hermaphrodite ; perianth segments 4, 2 3 mm long, elliptic-suborbicular ; stamens 4, sessile, carpels 4, free. Drupelets obovoid, ventrally straight, dorsally convex.

Types : Described from Berlin ; Kashmir, *C.B. Clarke* n. 29142, 1895 (K) ; River Cygnet, Knicks, S. Australia, *J.G.O. Tepper.*

Fl. & Fr. : July - August.

Distrib. : India : Jammu & Kashmir, Meghalaya (Khasia hills 2000 m) ; Asia, America, Australia, Philippine Islands.

Ecology : Lakes in Kashmir Himalaya & Meghalaya up to an altitude of 2000 m.

Specimens examined : JAMMU & KASHMIR : Anchar lakes, Aug. 1977, *A. R. Naqshi* 5715 (KASH).

18. P. zizii Mert. et Koch. Deutschl Fl. 1 : 845. 1823 (nomen Solum) emend Cham. et Schlechd. in Linnaea 2 : 202. 1827 ; Aschers. & Graeb. in Engler's Pflanzenr. 31 : 81. 1907 ; Kak in J. Bombay Nat. Hist. Soc. 80 : 315 (1983) 1984. *P. lucens* L. subsp. *zizii* Roth ; Hook. Steud. Fl. ed. 3, 433. 1884. *P. lucens* L. var. *heterophyllus* Fries Novit. Fl. Suec. ed. 2, 34. 1828. (Fig. 17)

Submerged or partly floating, rhizomatous herbs ; stem cylindric, *ca* 1 m

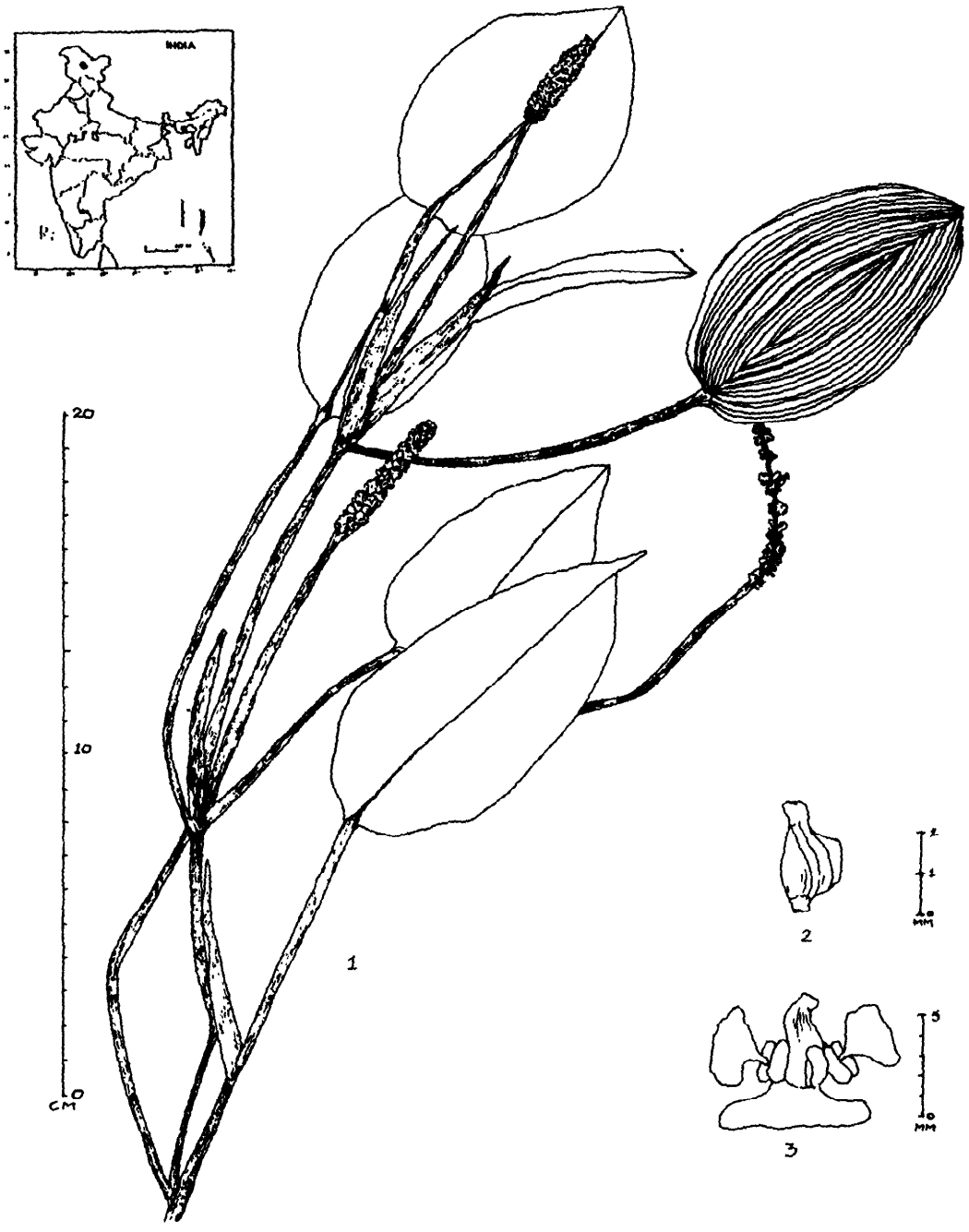


Fig. 16 : *Potamogeton tepperi* A. Benn. : 1. Plant bearing spikes ; 2. Carpel; 3. Flower.

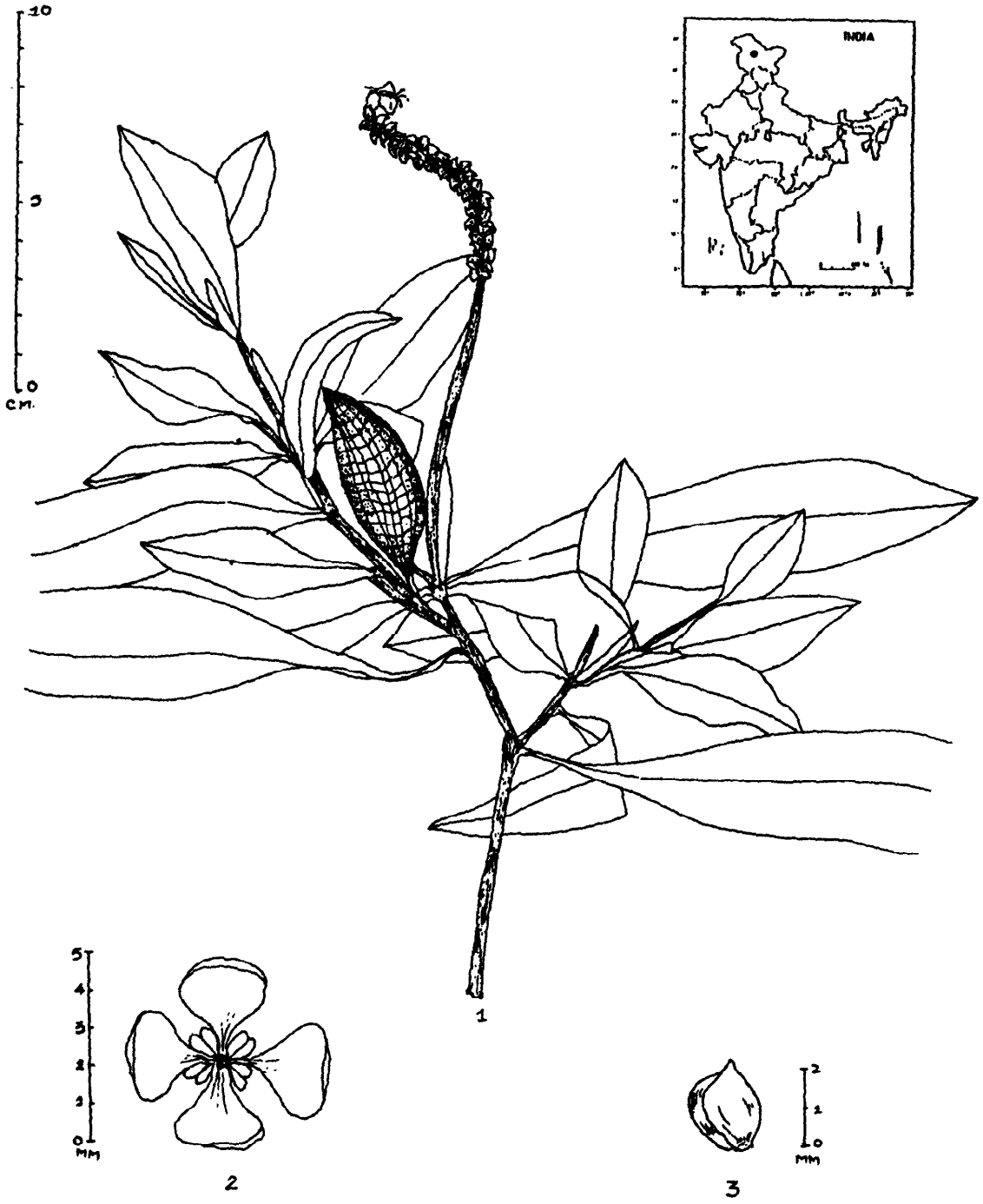


Fig. 17 : *Potamogeton zizii* Mert. et Koch. : 1. Plant bearing spike ; 2. Flower ; 3. Fruit.

long. Leaves 3-14.1 × 1.5-2.6 cm, multinerved, veined, upper ones floating, elliptic, submerged ones, linear-lanceolate, curved backwards ; stipule 1-5.5 cm long, linear, acute-acuminate ; petiole 1-1.5 cm long slender, terete. Spike up to 5.5 cm long; peduncle slender, 5-8.2 cm long, clustered. Flowers many ; perianth segments 4, 2-3 mm long, obovate-suborbicular, clawed, stamens 4, sessile, carpels 4, free. Druplets *ca* 2 mm long, ellipsoid-ovate, ventrally straight, dorsally convex ; beak short, acute, curved.

Types : Suecia (Upasaliae), Germania (Rugia), Gallia (Parisiis).

Fl. & Fr. : September - October.

Distrib. : India : Jammu & Kashmir; Myanmar, Asia, Europe, Africa, N. America, West Indies.

Ecology : In lakes up to an altitude of 1700-2100 m in Kashmir Himalaya.

Specimens examined : JAMMU & KASHMIR: Srinagar, Manshbal, Sept. 1973, *A.M. Kak* 3404 (KASH). Kashmir, July 1956, *T.A. Rao* 826 (CAL).

Notes : This species is distinguished by emergent or floting petiolate, upper leaves and clustered peduncles.

DOUBTFUL SPECIES :

Potamogeton macrophyllus Wolfg. in Roem. et Schult. Mant. 3 : 358. 1827. *P. lucens* subvar. *longifolius* (Gay) Cham. et Schlechtd. Linnaea 2 : 198. 1827 ; Aschers. & Graeb. in Engler's Pflanzenr. 4. Heft 31 : 78. f. 18D. 1903.

Herbs, 20-30 cm long. Leaves alternate, linear-lanceolate, flat, tapering at both ends, acute-mucronate, 5-veined ; 19 21 × 1 1.2 cm ; petiole 3 5 cm long ; stipule up to 4.5 cm long.

Type : Tampo River, Victoria, *F. Muller* in Herb. Kew. (*P. lucens* var. *longifolius*).

Fl. & Fr. : Not seen.

Ecology : Aquatic in rivers up to an elevation of 400 m.

Notes : The specimen was identified earlier as *P. mucronatus* Presl., but it is determined by J. Baägoe on 30.3.1902 as *P. macrophyllus* Wolfg. Since the plant is in vegetative condition only, it has been kept under doubtful species, occurring in Assam, India.

Specimens examined : ASSAM : Dibrugarh, Feb. 1896, *Dr. King's collector* 36 (CAL Acc. No. 499928).

ACKNOWLEDGEMENTS

Author is grateful to Dr. N.P. Singh, Ex-Director, Botanical Survey of India, (BSI), Calcutta for facilities and permission to attend

and present this paper in the National Seminar, Calicut. He is also thankful to Sri M.K. Vasudeva Rao, Joint Director, Botanical Survey of India, Western Circle, Pune for encouragement and Dr. Jayasri Bhattacharya, Indian Liaison Officer, Kew for sending relevant literature.

REFERENCES

AIRY, SHAW, H.K. Willis Dictionary of the Flowering Plants and Ferns. Cambridge. pp. 939-940. 1966.

AMBASTA, S.P. The useful plants of India. C.S.I.R., New Delhi, p. 486. 1986.

ASCHERSON, A. AND P. GRAEBNER. Potamogetonaceae in Engler's Das *Pflenzenrich* Regni, Veg. Cons. IV Heft 31 : 1-184. Germany. 1907.

AZIZ KHATIJA AND S.M.H. JAFRI. Potamogetonaceae. Fl. W. Pakistan No. 79. Karachi. 1975.

BAMBER, C.J. Plants of Punjab, Lahore. 631-632. 1926.

BENTHAM, G. AND J.D. HOOKER. Genera Plantarum 3: 1014. London. 1880.

BISWAS, K AND C.C. CALDER. Hand book of Common Water & Marsh Plants of India & Burma pp. 110-112. Delhi. 1936.

CHOWDHERY, H. J. In : Chowdhary, H. J. & B.M. Wadhwa (Eds.) Flora of Himachal Pradesh Analysis. Vol. 3 : 733-735. Botanical Survey of India, Howrah. 1984.

COOK, C.K.D. Aquatic and Wetland plants of India, Oxford University Press. 1996.

DANDY, J. E. 'Potamogetonaceae' In : K. H. Reichnger (Ed.) *Fl. Iranica* 83 : 1-9 Graz-Austria. 1971.

—— 'Potamogetonaceae' in : Hara *et al* (Eds.) *Enum. Fl. Pl. Nepal* 1 : 94-95. London. 1978.

—— 'Potamogetonaceae' in Toronsend & Guests (Eds.) *Fl. Iraq* 8 : 19-26. Baghdad. 1985.

FERNALD, M.L. The linear-leaved North American species of POTAMOGETON section *Axillares. Mem. Amer. Acad. Arts. Sci. s.n.* 17 : 1-183. 1932.

GHOSH, D.K. AND G.N. BHATTACHARYYA. Chromosomes in some species of POTAMOGETON and APONOGETON. Proc. 67th Indian Sci. Congr. part 3 : 53-54. 1980.

HAGSTRÒEM, O. Potamogetonaceae from Asia. *Bot. Notis.* 141-142. 1905.

—— Critical researches on the Potamogetones. K. Svenska Vetensk. *Akad. Handl.* 55(5) : 1-281. 1916.

HAINES, H.A. Botany of Bihar & Orissa 3 : 888-890. Calcutta. 1961.

HAYNES, R.R. A revision of the clasping leaved POTAMOGETON. SIDA 11 : 173-188. 1985.

——Typification of Linnean species of POTAMOGETON (Potamogetonaceae) *Taxon* 35: 563-573. 1986.

HOOKER, J.D. in Hook. f. Fl. Brit. India 6 : 565-567. Dehra Dun. 1893.

HUTCHINSON, J. Families of Fl. Pl. ed. 2.2 : 556. Clerandon Press, Oxford. 1960.

KAK, A.M. POTAMOGETON in N.W. Himalayas. *J. Bombay Nat. Hist. Soc.* 80 (2) : 312-319. 1984.

KARTHIKEYAN, S., S.K. JAIN, M.P. NAYAR AND M. SANJAPPA. Florae Indicae Enumeration : Monocotyledonae. Botanical Survey of India. Calcutta. pp. 284-285. 1989.

KUMAR, P.S. AND L.K. BANERJEE. POTAMOGETON L. the common pond weed in Eastern India. *ENVIS* 6 : 12-14. 1999.

KUMAR, V. AND B. SUBRAMANIAM. Chromosome Atlas of Flowering Plants of Indian Subcontinent. Vol. 2 : 656. Botanical Survey of India. Calcutta. 1989.

LAKSHMINARASIMHAN, P. 'Potamogetonaceae' In Fl. Maharashtra State, Monocotyledonae, [Eds. Sharma, B.D., S. Karthikeyan & N.P. Singh.] Botanical Survey of India. Calcutta. pp. 240-241. 1996.

LES, D.H. Taxonomic implications of aneuploidy and polyploidy in POTAMOGETON (Potamogetonaceae). *Rhodora* 85 : 301-323. 1983.

MATTHEW, K.M. AND S.J. BRITTO. Flora of Tamil Nadu Carnatic 3(2) : 1715-1717. 1983.

MISHRA, M. P. Cytological studies in some Indian POTAMOGETON and APONOGETON species. *Bull. Bot. Soc. Bengal* 26(1) : 47-51. 1972.

MITRA, J.N. Flowering Plants of Eastern India 1 : 6-8, Calcutta. 1958.

NAIRNE, A.K. Flowering Plants of Western India 367-368. Bombay & London. 1894.

NAQSHI, A.R. AND G. N. JAVEID. Two new plants records from Kashmir valley. *Curr. Sci.* 42 (2): 70. 1973.

PALIWAL, S.C. AND G.S. LAVANIA. Epidermal structure and distribution of stomata. *Potamogeton nodosus* Poir. *Sci. & Cult.* 45 : 75-76. 1979.

PALMGREN, O. Cytological studies in POTAMOGETON (Preliminary note). *Bot. Not.* 246-248. 1939.

PANDEY, R.P. Potamogetonaceae. In Flora of Rajasthan (Eds. Shetty B.V. & V. Singh) 3 : 876-878. Botanical Survey of India. Calcutta. 1993.

PRAIN, D. Bengal Plants. 2 : 845-846. Calcutta. 1963.

RAO, R.P. Potamogetonaceae in. : Flora of Andhra

Pradesh, (Ed. T. Pullaiah) 3 : 1036-1038. Jodhpur. 1997.

RAUNKIAER, C. 1903. Anatomical POTAMOGETON studies and POTAMOGETON fluitans. *Bot. Tidsskr.* 25 : 253-280. 1903.

RENDLE, A.B. The classification of Flowering Plants. 1 : 202. Cambridge. 1904.

SHAH, G.L. Flora of Gujarat State 2 : 704-705. Vallabh Vidyanagar. 1976.

SHARMA, B.D., N.P. SINGH, R.S. RAGHAVAN AND U.R. DESHPANDE.Flora of Karnataka Analysis. Botanical Survey of India. Howrah. p. 299. 1984.

SRIVASTAVA, R.C. 'Potamogetonaceae' In Flora of Sikkim (Eds. Hajra P.K. & D.M. Verma) 1 : 196. Botanical Survey of India. Calcutta. 1996.

ST. JOHN, H. A consideration of Hagströem's work on POTAMOGETON. *Bull. Torrey Bot. Club.* 52 : 138-461. 1925.

STERN, K.R. Chromosome numbers in nine taxa of POTAMOGETON. *Ibid.* 88 : 411-414. 1961.

STEWART, R.R. Anoot. Cat. Vas. Pl. W. Pak. & Kash. 29-30. 1972.

SUBRAMANYAM, K. Aquatic Angiosperms C.S.I.R., New Delhi. pp. 92-95. 1962.

TAKU SAGAWA, H. Cytological studies in the genus POTAMOGETON of Japan. *Bull. Shimane Agric. Coll.* 9 : 1-34. 1961.

WIEGLEB, G. Notes on Pondweeds-Outlines for a monographical treatment of the genus POTAMOGETON L. (with 3 tables) *Fedd. Rep.* 99 (7-8) : 249-266. 1988.