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DISCOVERY OF FOUR ANGIOSPERM NEW RECORDS FOR BANGLADESH FROM MADHABKUNDO ECO-PARK UNDER MOULVIBAZAR DISTRICT

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Abstract

This paper deals with four angiosperm species new records for Bangladesh from the forest of Madhabkundo Eco-park under Moulvibazar district. These are: *Allophylus samarensis* Merr., *Atalantia kwangtungensis* Merrill, *Boeica filiformis* C.B. Clarke and *Trigonostemon viridissimus* (Kurz) Airy Shaw. Updated nomenclature, important synonyms, description, ecology, geographical distribution and photographs are provided for each species.

Introduction

One of the basic reasons of biodiversity loss from our planet is lack of floristic information. Floristic studies have acquired increasing importance in recent years to assess plant wealth of a country. In this connection regional floristic studies are of much importance and it can be achieved by intensive exploration of smaller areas. The Bangladesh National Herbarium (BNH) conducts floristic survey throughout the country. BNH program encompasses three elements. First, BNH collects and analyzes data on the status, location, and distribution of all plant species occurring in the country. Second, BNH determines rare and declining native plant species and exemplary natural communities that require protection. Third, BNH acts as an information resource program to assist and advise government agencies and private sector development projects upon request. Madhabkundo Eco-park is quite rich and varied in its plant composition. Recently, BNH has under taken a floristic study programs in Madhabkundo Eco-park area.

Madhabkundo Eco-park is a popular outdoor recreation destination for tourists. It is located in the North-eastern part of Bangladesh under Barolekha Upazila of Moulvibazar district and the area is managed by Barolekha Forest Range of the Sylhet Forest Division. It lies between 24°30′-24°32′ N and 91°37′- 91°39′ E and covering an area of 265.68 hectare. Previously, it was a part of Patharia Hill reserve forest. This area was declared as eco-parks in 2001 with a view to conserve the Madhabkundo waterfall and surrounding biodiversity. The topography of Madhabkundo Eco-park is mostly undulating with slopes and hillocks running from North-South direction. Many water courses (locally called *chara*) pass through and around the numerous hillocks (locally called *tila* of height about 10-60 m). The soils of the park are brown, sandy clay loam to clay loam of Upper Tertiary origin. The area enjoys a moist tropical maritime climate characterized by a period of high precipitation from May to August. Average annual precipitation is 390 cm and average temperature varies between 12°C - 32°C (Ibrahim *et al*., 2012). The forest of Madhabkundo Eco-park is of a semi-evergreen type and the canopy height varies from 10-30 m. The main tree species of the forest are: *Dipterocarpus turbinatus*, *Mangifera sylvatica*, *Vitex peduncularis*, *Bombax ceiba*, *Artocarpus lacucha*, *Terminalia bellirica*, *Phyllanthus emblica*, *Terminalia chebula*, *Hydnocarpus kurzii*, *Gmelina arborea*, *Tectona grandis*, *Artocarpus chaplasha*, *Tetrameles*

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nudiflora, Lagerstroemia speciosa, Castanopsis tribuloides, Chukrassia tabularis, Ficus racemosa, Toona ciliata, Aphanamixis polystachia, Ficus spp. Under the shade of trees a luxurious growth of herb, shrub, epiphyte and climbers are seen.

The main goal of this floristic survey was to discover new plant species for the country, locating and identifying occurrences of rare plant species, exemplary natural communities, and floristic novelties within the park boundaries.

Material and Method

The Bangladesh National Herbarium (BNH) conducted a floristic inventory and assessment of the park from 2009 and 2014. Botanical explorations throughout the Park were done by walking along the forest trails and springs (*charas*) to record all species encountered. At least one set of voucher specimen of each different species encountered in flowering state was collected, pressed and transported to the BNH for drying. Collection of voucher specimens were conducted in a manner that is consistent with conservation ethics. At each collection, location, date, habit and any other notable ecological characteristics were recorded. Both fresh materials and herbarium specimens were studied to identify the species by the first author using available taxonomic resources *viz.* literatures, herbarium specimens and botanical illustrations. Digital imagery of the species was also used to supplement plant identification and document their habitats. The new records are based on 6 specimens and all of them are deposited at DACB after labeled properly.

Results

Authors collected 30 specimens belonging to families Euphorbiaceae, Gesneriaceae, Rutaceae and Sapindaceae. In the process, four angiosperm species were encountered for which no herbarium specimens had ever been collected from the country. After critical microscopic observations and matching with the help of floras, it was found that these are addition to the Flora of Bangladesh. Later on, those species have been identified as *Allophylus samarensis* Merr., *Atalantia kwangtungensis* Merrill, *Boeica filiformis* C.B. Clarke and *Trigonostemon viridissimus* (Kurz) Airy Shaw. Four specific taxa in the following list belong to 4 genera and 4 families. Literatures review (*i.e.* Heirn, 1875; Hooker, 1875, 1886, 1887 & 1888; Clarke, 1884; Kurz, 1877; Prain, 1903; Heinig, 1925; Cowan, 1926; Cowan and Cowan, 1929; Kanjilal *et al*., 1934, 1939 & 1940; Raizada, 1941; Datta and Mitra, 1953; Sinclair, 1956; Alam, 1988; Mia and Khan, 1995; Das & Alam, 2001; Rahman, 2004a, 2004b; Khan and Rahman, 2008; Uddin, 2009a & 2009b; Ullah, 2009) revealed that those plants have not been collected and reported previously from the country. Hence, they are being recorded here for the first time from the country.

Detailed taxonomic accounts including flowering and fruiting period, habitats, geographical distribution, citation of examined specimens, photographs of all the species is provided below and entries are arranged in alphabetical order.

1. Allophylus samarensis Merr., Philipp. J. Sci., C 11: 192. 1916. (**Fig. 1**)

Sapindaceae

Shrubs, up to 1 m high; branches slender, terete, glabrous, lenticellate, greyish-brown. Leaves unifoliolate, oblong-elliptic, 25-30 × 9-12 cm, chartaceous, shining on both surfaces, upper surface brownish-olivaceous, lower surface paler, glabrous or obscurely puberulent on the midrib, base subequal, acute, apex prominently acuminate, acumen distantly denticulate, margins coarsely and irregularly lobed toothed; lateral nerves ca. 11 pairs, prominent on lower surface; petioles sparingly puberulent, 3-5 cm long. Inflorescences axillary raceme or thyrse, pubescent, 3-5 cm

long, with one or two branches. Flowers white, pedicels 1.0-1.5 mm long. Sepals 4, glabrous, margins obscurely pubescent, two outer ones oblong to elliptic, rounded, ca. 2 × 1 mm, two inner ones orbicular to subreniform, 1.8-2.0 × 2.0 mm. Petals 4, ca. 1.8 mm long, limbs densely villous inside, subtruncate, triangular, narrowed below, claw glabrous or nearly so. Stamens 8, filaments villous, 1.8-2.0 mm long. Glands prominent, glabrous. Disc saucer-shaped, usually lobed, glabrous, orange. Ovary deeply 3-lobed, lobes obovoid, sparsely to densely pilose, styles 0.7-1.0 mm long, stigmas 3-forked. Fruits mostly with one mericarp developed, obovoid, narrowed at the base, 4-8 × 3-6 mm, smooth, green when young, red when ripe, black to brown when dry. Flowering and fruiting: May-November.

Fig. 1. *Allophylus distachys* (DC.) Radlk.

Ecology: Primary, broad leaf forests, hill slopes and along the chara; up to 300 m altitude.

Distribution: Indonesia (Sumatra) and the Philippines.

Specimen examined: **Moulvibazar**: Madhabkundo Eco-park; 20 v 2014, S.N. Uddin and MEH Khokan N5261 (DACB).

Note: Allophylus Linnaeus is a genus of about 200 species occurring mainly in tropical and subtropical regions (Nianhe and Gadek, 2008). From Bangladesh, Uddin (2009) listed two species (*viz. Allophylus cobbe* (L.) Raeuschel and Allophylus distachys (DC.) Radlk.) under the genus.

2. Atalantia kwangtungensis Merrill, Philipp. J. Sci. 21: 496. 1922. (**Fig. 2**)

Rutaceae

Atalantia hainanensis Merrill & Chun *ex* Swingle, Journ. Arn. Arb. 21: 20. 1940.

Atalantia roxburghiana J. D. Hooker var. *kwangtungensis* (Merrill) Swingle, J. Arnold Arbor. 21: 129. 1940.

Shrubs 1-2 m tall; young branchlets green, slightly flat, ridged, unarmed. Leaves unifoliolate, blades elliptic-lanceolate, or rarely elliptic-oblong, 7-15 × 2-5 cm, coriaceous, glabrous, pale green, abaxially grayish yellow when dry, oil glands pellucid and conspicuous, base cuneate, apex acute or caudate-acuminate with 10-15 mm long acumen, notched at tip, margins entire, lateral nerves 8-11 pairs. Inflorescences axillary fasciculate raceme, up to 1.5 cm long, 3 to several flowered, glabrous, pedicels slender, ca. 7 mm long. Flowers small, 5-merous. Calyx small, with 4 minute acute sepals. Petals 4, obovate-oblong, 3-5 mm long, white. Stamens 8, filaments cohering from the base for about half their length instead of being free, anthers ovoid. Ovary seated on an annular disk, 2-locular, each locule with 2 collateral ovules, style as long as ovary; stigma slightly clavate. Fruit a berry, ovoid, ellipsoid, or rarely globose, 1.3-1.8 × 0.7-1.0 (-1.5) cm, smooth, with large oil glands, 1-3-seeded; exocarp ca. 0.5 mm thick. Seeds narrowly ovoid, 1.0-1.5 cm; embryo solitary. Flowering and fruiting: January-June.

Fig. 2. *Atalantia kwangtungensis* Merrill

Ecology: Moist and shady places in broad-leaved, evergreen forests; between 100-400 m altitude.

Distribution: India, Thailand and China.

Specimen examined: Moulvibazar: Madhabkundo Eco-park; 23 ix 2011, S.N. Uddin N4833 (DACB).

Note: Atalantia Corrêa is a genus of about 17 species occurring in South and South-east Asia (Zhang *et al*., 2008). From Bangladesh, Ullah (2009) listed only one species (*viz. Atalantia monophylla* (L.) DC.) under the genus.

3. Boeica filiformis C.B. Clarke, Comm. Cyrt. Beng. 118, t. 87. 1874. **(Fig. 3)**

Gesneriaceae

Chelone filiformis Buch.-Ham. *ex* C.B.Clarke, Monogr. Phan. 5: 134. 1883.

Perennial subshrubs or herbs, up to 2 m tall, rhizomatous, sometimes stoloniferous. Leaves few to many, alternate, crowded near stem apex; leaf blade oblanceolate or obovate, elliptic-lanceolate, 12-18 × 3-6 cm, base cuneate to attenuate, apex acuminate, margins minutely dentate, glabrous to glabrescent, lateral nerves about 9 on either half; petiole 8-10 mm long. Inflorescences lax, axillary, many-flowered cymes; peduncles solitary, 10-15 cm long with capillary branches and pedicels, glabrous; bracts 2, linear and opposite. Calyx actinomorphic, 5-sect from base; segments equal, narrowly triangular to linear-lanceolate, 2.0-2.5 mm long, outside puberulent, margin entire. Corolla dark pink to white, zygomorphic, inside glabrous or puberulent; tube campanulate, sometimes saccate at base, slightly shorter than limb, 3-7 mm in diameter; limb 2-lipped; adaxial lip 2-lobed, shorter than to abaxial lip; abaxial lip 3-lobed, lobes equal or subequal, apex rounded to acute. Stamens 4, adnate to corolla near base, included; anthers basifixed, purple, free, thecae subparallel, confluent at apex, dehiscing longitudinally, poricidally, or transversely; connective not projecting, filaments ca. 1.5 mm long; staminode 1, adnate to adaxial side of corolla tube. Disc ringlike or inconspicuous. Ovary conical, 1-loculed; placentas 2, parietal, projecting inward, 2-cleft; stigma 1, terminal, capitate, undivided. Capsule straight in relation to pedicel, linear to narrowly oblong, 8-12 mm long, glabrous, dehiscing loculicidally to base, valves 2, straight, not twisted. Seeds unappendaged. Flowering and fruiting: July-November.

Fig. 3. *Boeica filiformis* C.B. Clarke.

Ecology: Hilly broad leaved forests, along the spring; 300-600 m altitude.

Distribution: India.

Specimens examined: **Moulvibazar**: Madhabkundo Eco-park; 25 vi 2001, S.N. Uddin N1095 (DACB); 23 ix 2011, S.N. Uddin N4836.

Note: Boeica C.B. Clarke is a genus of about 12 species occurring in Bhutan, China, India, Myanmar and Vietnam (Wentsai *et al.*, 1998). From Bangladesh, Uddin (2009) listed no species under the genus.

4. Trigonostemon viridissimus (Kurz) Airy Shaw, Kew Bull. 25: 545. 1971. (**Fig. 4**)

Euphorbiaceae

Sabia viridissimum Kurz, in J. Asiat. Soc. Bengal, Pl. 2, Nat. Hist. 41(2): 304. 1872.

Kurziodendron viridissimum (Kurz) N.P. Balakr., in Bull. Bot. Surv. India 8: 68-71, figs. 1-7. 1966.

Shrub or sub-shrub, 1-2 m tall. Leaves crowded towards ends of branches, blades elliptic or elliptic-lanceolate to oblong or obovate to oblanceolate, 5-20 × 2-8 cm, base acute or cuneate or obtuse to rounded, apex acuminate to caudate, margins distantly serrulate or shallowly denticulate to entire, membranous to chartaceous, glabrous above, glabrous or sometimes sparsely pubescent on the nerves beneath, lateral nerves 3-10 pairs; petioles 3-5 cm long; stipules caduxous. Inflorescence terminal and axillary pyramidal-thyrsoid or dichasial branching or racemiform or pseudo-racemose, terminating in a female flower, 2.5-12.0 cm long, often pedunculate; bracts subulate to ovate, 0.5-1.5 mm long. Male flower: pedicels 5-15 mm long; sepals 5, elliptic, oblong to ovate, 0.8-2.0 × 0.6-1.2 mm; petals 5, orbicular-obovate to spathulate, 3-7 × 1.5-4.0 mm, yellow or orange-yellow; disc cupular or often campanulate, crenate, 0.5-0.9 × 0.5-1.2 mm; stamens (-4) 5, connate; column 1.0-2.5 mm long; anthers widely ellipsoid to oblong, initially vertical, finally horizontal, 0.5-0.8 mm long. Female flowers: pedicels 6-30 mm long; sepal 5, ovate to suborbicular or triangular-oblong, 1.0-2.5 × 0.8-2.0 mm; petals 5, obovate, orbicular-obovate or spathulate, 4-5 × 3.0-3.5 mm, yellow; disc shortly cucular, fleshy, 0.6-1.0 × 1.5-1.8 mm; ovary globose, 1-2 mm in diameter, glabrous; style 3, 1-2 mm long, often shortly connate below; stigmas capitate or reniform. Fruits slightly depressed, 6-8 × 10-13 mm, shallowly 3-lobed, glabrous, brown or orange-brown when dry; pedicels 1.5-3.0 cm long; seeds trigonous-orbicular, 5-9 mm in diameter.

Ecology: Common in costal forests or thickets of mixed forests or inland forests on sandy or rocky loam up to above 200 m altitude.

Distribution: India (Andaman & Nicobar Island), Myanmar, Malaysia, Indonesia, Philippines,Timor and Lesser Sunda Islands.

Specimen examined: **Moulvibazar**: Madhabkundo Eco-park; 25 vi 2001, S.N. Uddin N1105 (DACB); 28 iii 1981, M.S. Khan *et al.,* K6236 (DACB).

Note: Trigonostemon Blume is a genus of about 50-80 species occurring in tropical Asia, extending from India and Sri Lanka to New Guinea (Li and Gilbert, 2008). From Bangladesh, Rahman (2008) listed one species (*viz. Trigonostemon semperflorens* Muell.-Arg.) under the genus.

Fig. 4. *Trigonostemon viridissimus* (Kurz) Airy Shaw.

Discussion

Floristic studies and diversity assessments at local and regional levels are essential to understand the present diversity status and conservation of forest biodiversity. This study added four new and rare plants like *Allophylus samarensis* Merr., *Atalantia kwangtungensis* Merrill, *Boeica filiformis* C.B. Clarke and *Trigonostemon viridissimus* (Kurz) Airy Shaw to the flora of Bangladesh. The significance of such field research is the detection of novel additions to a floristic region, which subsequently improve our understanding of plant biogeography as well as species diversity of the country. The purpose of the survey was to gather data on the floristic and ecological diversity of the Eco-park, which can be used by the Forests Department for the management of park biodiversity.

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