Bangladesh J. Plant Taxon. **27**(2): 251-260, 2020 (December)

NEW RECORDS OF THREE SPECIES AND A VARIETY OF ANGIOSPERMS FOR BANGLADESH

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Keywords: *Cleisostoma simondii*; *Volkameria heterophylla*; *Leucas martinicensis*; Angiosperms; Sundarban; Gazipur; Bangladesh.

Abstract

During the floristic explorations in Sundarbans mangrove forest of Bangladesh, conducted in 2016-2019, the authors collect some specimens of Angiosperms that are finally identified as *Cleisostoma simondii* (Gagnep.) Seidenf. of Orchidaceae and *Volkameria heterophylla* Vent. of Lamiaceae. Specimens of *C. simondii* are further identified as *C. simondii* var. *guandongense* Z.H. Tsi. The authors collect some specimens of another angiospermic plant in 2019 from Gazipur district of Bangladesh and confirm their identification as *Leucas martinicensis* (Jacq.) R. Br. of family Lamiaceae. All of these taxa are recorded here for the first time from Bangladesh. Detailed taxonomic description with notes on ecology, uses, distribution and distinctness from morphologically similar taxa, photographs and illustration are provided.

Introduction

The flora of Bangladesh comprises a total of 3873 species of Angiosperms including 262 new records (Haque *et al*., 2012; Rahman *et al*., 2016; Rahman and Hassan, 2017; Islam and Rahman, 2017; Sourav *et al*., 2017; Ara, 2018; Ara and Hassan, 2018; Islam *et al*., 2018; Rahman *et al*., 2018; Rahman and Uddin, 2018; Uddin *et al*., 2018; Uddin 2018; Alfasane *et al*., 2019, 2020; Hossain *et al*., 2019; Huda *et al*., 2019) reported so far after the publication of Encyclopedia of Flora and Fauna of Bangladesh by Siddiqui *et al*. (2007-2008) and Ahmed *et al*. (2008-2009).

In 2016-2019, we conduct botanical explorations in Sundarban Mangrove Forest of Bangladesh and collect many specimens of vascular plants that are currently housed in the Jahangirnagar University Herbarium (JUH). Recently, we find some of these specimens that do not match with any known plant species of Bangladesh, perform a detailed taxonomic investigation on these specimens and finally identify these as belonging to two angiospermic species namely, *Cleisostoma simondii* (Gagnep.) Seidenf. and *Volkameria heterophylla* Vent. (=*Clerodendrum heterophyllum*) of families Orchidaceae and Lamiaceae, respectively. The specimens of *C. simondii* are further identified as *Cleisostoma simondii* var. *guandongense* Z.H. Tsi. In 2019, we collect some specimens of another flowering plant during a botanical exploration conducted in Kapasia area of Gazipur district of Bangladesh, and recently we have confirmed their identification as *Leucas martinicensis* (Jacq.) R. Br. of Lamiaceae.

These species and the variety have never been reported before in any taxonomic literature covering the flora of Bangladesh (Hooker, 1885, 1894; Prain, 1903a, b; Heinig, 1925; Khan, 1972-1987; Khan and Rahman, 1989-2002; Ahmed *et al*., 2008-2009; Uddin and Hassan, 2010; Arefin

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et al., 2011;Rahman *et al*., 2015; Rahman and Hassan, 2017; Haque *et al*., 2018; Rahman and Uddin, 2018; Uddin 2018). Therefore, the species *Cleisostoma simondii* including the variety *C. simondii* var. *guandongense* and *Volkameria heterophylla* from Sundarbans mangrove forests and *Leucas martinicensis* from Gazipur are reported here as the new records of Angiosperms for Bangladesh.

Materials and Methods

The plant specimens were collected, processed, and managed using standard herbarium techniques (Hyland, 1972; Jain and Raw, 1977). These specimens were critically examined in Plant Systematics and Biodiversity Laboratory of Jahangirnagar University. Their taxonomic identification was confirmed through consulting the experts and taxonomic descriptions and keys available in the relevant literatures (Hooker, 1885, 1894; Prain, 1903a, b; Nasir and Ali, 1980-2005; Khanam and Hassan, 2005; Wu, *et al.*, 1994-2011; Ahmed *et al.*, 2008-2009) and matching with the voucher specimens of relevant genera and families preserved at Jahangirnagar University Herbarium (JUH) and Bangladesh National Herbarium (DACB), and clear images of the respective voucher specimens available on the websites of different international herbaria.

Nomenclatural information and global distribution were fetched from relevant taxonomic publications (Moldenke, 1956; Chen and Gilbert, 1994; Li and Hedge, 1994; Chen *et al*., 2009; Forzza, 2010; Yuan *et al*., 2010) and the nomenclatural databases of IPNI (2019), The Plant List (2013) and TROPICOS (2020). All voucher specimens of the three species, one of which is delimited up to a variety, are deposited at JUH. The taxonomic descriptions including the photographs and illustration were produced from the specimens in the field and laboratory.

Results and Discussion

Cleisostoma simondii (Gagnep.) Seidenf., Dansk Bot. Ark. 29(3): 66 (1975).

Basionym: *Vanda simondii* Gagnep., Bull. Mus. Natl. Hist. Nat., Sér. 2 22(5): 628–629 (1950). TYPE: Vietnam: Haut-Tonkin, *Rives s.n.* (could not be located).

Synonym: *Echioglossum simondii* (Gagnep.) Szlach., Fragm. Florist. Geobot., Suppl. 3: 137 (1995).

Cleisostoma simondii var. **guangdongense** Z.H. Tsi, Bull. Bot. Res., Harbin 3(4): 84 (1983). TYPE: China: Hainan, in arborum truncis, 660 m, 17 Nov. 1932, C.L. Tso & N.K. Chun 44273, PE (HT). **(Fig. 1)**

A perennial herb, often ascending. Stems up to 50 cm long and ca. 3–4 cm in diam., slender, usually unbranched, many leaved, internodes 1–2.5 cm long. Leaves terete, 6–11 × ca. 2 mm, slender, fleshy, obtuse. Inflorescences lateral, ascending, 4–12 cm, unbranched, 3–6 flowered; floral bracts ovate, minute, ca. 1.5 mm, membranous. Flowers epigynous, pedicilate, ca. 5–6 mm, yellowish-green and whitish with purplish veins. Sepals 3, free, yellowish-green, oblong, 6–7 × 3–3.5 mm, rounded, lateral sepals slightly oblique, adnate to lower half of column foot from base. Petals 3, lateral petals yellowish-green, obtuse, 4–5 × 3–4 mm; lip comparatively larger, ca. 7 mm × 9 mm, whitish, with purplish spur, mid-lobe of lip yellowish-white, lip lateral-lobes erect, deltoid, mid-lobe ovate-triangular, thickly fleshy, acute, centrally slightly concave, base shallowly bilobed, densely papillate-hairy; spurs sub-globose, laterally compressed, ca. 3–3.5 × 2 mm in diam., apically concave, back wall callus inside spur subquadrate. Column ca. 3 mm, densely covered with unicellular elongated, ca. 0.1–0.3 mm, glands at base in front. Rostellum 4 × 3.5 mm, broadly triangular, anther cap slightly elongate, 2 × 1.8 mm, sub-truncate at apex. Pollinia 4,

appearing as 2 unequal masses, sub-globose, 0.8 mm in diam.; stipes semi-circular. Viscidium U-shaped or saddlelike. Overies inferior, tri-locular, elongated, 4–5 mm. Fruits a capsule, ca. 18–20 × 5-6 mm in diam., triangular.

Flowering and fruiting: November to March.

Ecology: Epiphytic on tree trunks in forest or lithophytic on rocks. This species can grow in pots filled with cocodust and coir.

Uses: This species can be used as an ornamental.

Distribution: Distributed in India, Bhutan, Cambodia, China, Hong Kong, eastern Himalayas, Laos, Myanmar, Nepal, Sikkim, Thailand, and Vietnam. In Bangladesh, this species is distributed in relatively freshwater zone of Sundarbans mangrove forest.

Representative specimens examined: **Bagerhat**: Shorankhola, Supati, Beside Supati khal, 10.10.2019, Mosharof 3370 (JUH); 26.12.2019, Mosharof 3504, 3505 and 3506 (JUH).

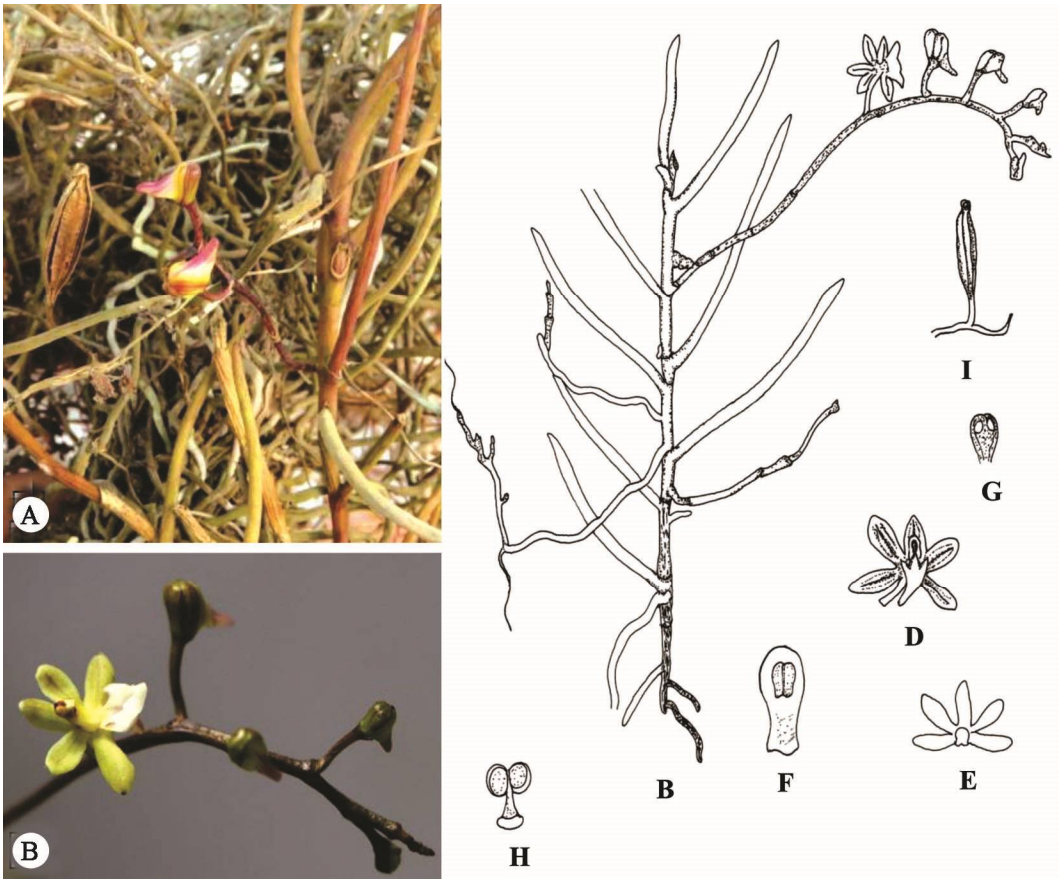

Fig. 1. *Cleisostoma simondii* var. *guandongense*. A = A partial view of habit; B = Habit (× 0.75); C = Inflorescence; D = Flower; (× 2.4); E = Sepals and lateral petals (× 2); F = Column (× 11); G = Abaxial view of anther cap (×6.5); H = Pollinia with viscidium (× 7.5); I = A fruit (× 1.25).

The genus *Cleisostoma* Blume is taxonomically very difficult group of Orchidaceae family. Molecular analyses support the placement of the genus in the subtribe Aeridinae, under the tribe

Vandeae and subfamily Epidendroideae of Orchidaceae (Hidayat *et al.*, 2012; Chase *et al.*, 2015; Zou *et al*., 2015). Despite its well-supported phylogenetic position, the morphologically delimited genus *Cleisostoma* seems to be polyphyletic (Carlsward *et al.*, 2006; Hidayat *et al*., 2012; Chase *et al*., 2015; Zou *et al*., 2015). The number of accepted species of this genus varies around 100 (Xinqi and Wood, 2009; Wood, 2014; Govaerts, 2015). It is distributed in tropical and subtropical regions of the Indian Subcontinent, South East Asia, China, Indonesia, New Guinea, Philippines and Pacific Island to Australia (Chen *et al*., 2009; Wood, 2014).

In Bangladesh, only three species of *Cleisostoma, viz. C. appendiculatum* (Lindl.) Benth. & Hook. f. *ex* B.D. Jacks., *C. filiforme* (Lindl.) Garay and *C. subulatum* Blume are described so far (Ahmed *et al*., 2008-2009). The species *Cleisostoma simondii* has never been reported before from Bangladesh, and hence it is a new species record for this country. *C. simondii* seems morphologically similar to *C. filiforme* but differs by its subglobose and laterally compressed spur, and U-shaped or saddle-like viscidium in contrast to broadly conical and dorsiventrally compressed spur, and suborbicular viscidium as found in *C. filiforme*. It is distinct from *C. subulatum* by its terete and slender leaves, yellowish-green colored sepals and petals, and laterally compressed subglobose spur in contrast to 5-nerved, distichous, narrowly linear-lanceolate leaves, red with white or yellowish margin sepals and petals, and conoco-infundibular spur in *C. subulatum*. *C. simondii* differs from *C. appendiculatum* by its whitish or yellowish colored lip where rose-pink colored lip is evident in *C. appendiculatum.*

Before this study the variety *C. simondii* var. *guangdongense* under *Cleisostoma* was not reported from Bangladesh. This study reports it for the first time from this country. It is morphologically very close to *C. simondii* var. *simondii*, from which it differs by its yellowish white mid-lobe of lip and subquadrate back wall callus inside spur in contrast to purple-red mid-lobe of lip and T-shaped back wall callus inside spur of that variety.

Volkameria heterophylla Vent., Jard. Malmaison, 2: sub pl. 70 (1804), TYPE: Mauritius: l'Isle de France, Riche s.n., G (G00368624)/ BC, (HT; herb. non-desig.).

Synonym: *Clerodendrum heterophyllum* (Vent.) R. Br., Hortus Kew. (ed.2) 4:64 (1812); Fl. Mauritius & Seychells: 254 (1877); H.N. Moldenke, Verbenacees, Fl. Madagasc., 174: 1–264 (1956). Mold. in Dassanayake & Fosberg., Fl. Ceylon 4: 430 (1983); A.J. Scott, Verbénacées, Fl. Mascareignes, 137:1–29 (1994). **(Fig. 2)**

A low shrub. Stems 2–3.5 m high, much-branched, branches twiggy, subterete or obscurely tetragonal, puberulous, glabrescent when matured, nodes often distinctly marked with leaf-scars, internodes short. Leaves opposite decussate or more often ternate, crowded, petioles slender, minutely puberulous, 2–8 mm long, leaf-blades linear or narrowly elliptic or lanceolate-elliptic, entire, short-acuminate, 2.5–10.5 × 0.5–3.5 cm, bright green adaxially, light to bright green abaxially, glabrous or puberulous on main nerves beneath. Inflorescences axillary, sub-terminal, 2.0–5.0 cm long, usually lax corymbiform cyme, once or twice dichotomously branched, densely greyish-puberulous, primary lateral peduncles 10–25 mm long. Flowers pedicellate, pedicels slender, 3–12 mm long, densely puberulous, central flowers often with longer pedicels. Calyces distinctly 5-toothed, glandular and sparsely puberulous on the outside and glabrous inside, teeth minute, ovate, acuminate, triangular, 1.5–2.0 × 4–4.5 mm; tube cylindrical, 3–5 × 2–3 mm. Corollas white, glandular and very minutely puberulous or almost glabrous outside, villous inside tube, tubes slender, cylindrical, 7–14 mm long, 1–1.3 mm in diam., lobes subequal, oblong or obovate-oblong, obtuse, glabrous and non-glandular on inner surface. Stamens purple, exerted, filaments inserted above the middle of corolla-tube, glabrous, filiform, 12–20 mm long, anthers oblong, 1–1.5 mm long. Ovaries glabrous, non-glandurar, obovoid-globose, faintly 4-lobed, ca. 1

mm in diam.; styles exerted, surpassing the stamens, filiform, glabrous, 18–32 mm long, stigma minutely bi-lobed. Fruits subglobose, glabrous, 12–15 mm in diam. Seeds 1 × 0.6 cm, brownish-black.

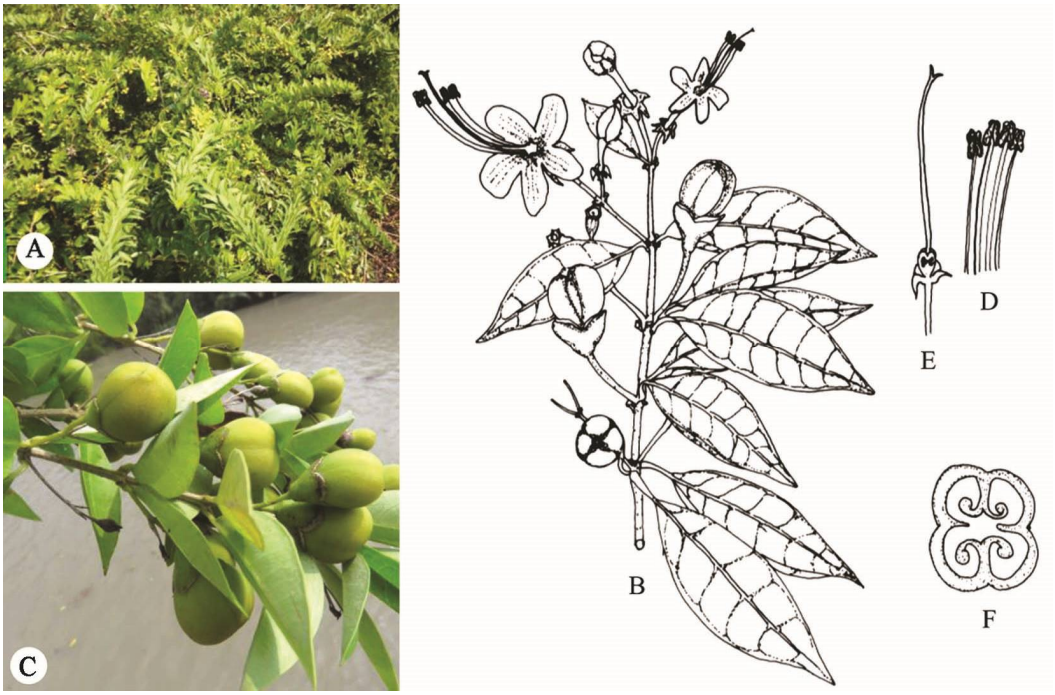

Fig. 2. *Volkameria heterophylla.* A = A view of habit; B = Habit (× 0.6); C = Fruiting twig; D = Androecium; (× 2); E = Gynoecium (× 1.8); F = TS of a ovary (× 30).

Flowering and fruiting: July-February.

Ecology: Found usually along tidal river or canal banks.

Uses: *Volkameria heterophylla* is reported as "employed medicinally as an antisyphilitic. It contains some ethereal oil, but no alkaloides nor glycosides".

*Distribution***:** This species is widely distributed in the tropical and subtropical regions of Australia, Asia, Africa, Central and South America and the West Indies. In Bangladesh, this species is found to occur in Sundarban Mangrove Forest.

Representative specimens examined: **Bagerhat**: Shorankhola, Kotka, Beside Jamtola khal, 07.09.2016, Mosharof 2104 (JUH), Sayedur 3740, 3741 (JUH); 28.09.2017, Mosharof 2511 (JUH); 09.10.2019, Mosharof 3488–3493 (JUH).

Volkameria L. is a pantropical genus of the family Lamiaceae which is mostly distributed in the coastal areas. Briquet (1895) broadly circumscribed the genus *Clerodendrum* L. to include all species now placed in *Rotheca* Raf., *Clerodendrum*, *Volkameria*, and *Ovieda* L. This circumscription was followed since many years, mostly due to the confusion and uncertainty regarding this group comprising at least 200 species (Yuan *et al*., 2010). Based on molecular phylogenetic analysis of chloroplast DNA regions *trnT-L*, *trnL-F*, *trnD-T*, and *trnS-fM*, Yuan *et al*. (2010) showed that most of the *Clerodendrum* species that had been in *Volkameria* were more

closely related to *Aegiphila* Jacq., *Ovieda*, *Tetraclea* A. Gray, and *Amasonia* L. f. than to other species of *Clerodendrum* and finally revived the genus *Volkameria*.

In Bangladesh, total 16 species of *Clerodendrum* are reported so far (Ahmed *et al*., 2009). Among these, two species, namely *C. inerme* (L.) Gaertn. and *C. neriifolium* (Roxb.) King & Gamble *ex* Schau are now the synonyms of *Volkameria inermis* L. The species *Volkameria heterophylla* Vent., previously circumscribed as *C. heterophyllum*, was never reported from Bangladesh before this study. *V. heterophylla* seems close to *V. inermis*, from which it distinctly differs by its longer (10–25 mm) peduncle, shorter (7–14 mm) corolla tube, non-glandular ovary and larger (12–15 mm in diam.) fruit in contrast to shorter (2–4 mm) peduncle, longer (15–40 mm) corolla tube, glandular ovary, and smaller (6–11 mm in diam.) fruit of *V. inermis*.

Leucas martinicensis (Jacq.) R. Br., Prodr. : 504 (1810). C.Y. Wu, P.H. Raven & D.Y. Hong (Eds), Fl. China 15: 1-387 (1996).

Basionym: *Clinopodium martinicense* Jacq., Enum. Syst. Pl.: 25 (1760). TYPE: West Indies.

(**Fig. 3)**

Annual erect herb, 40–60 cm tall. Stems retrorse pubescent. Leaves opposite, petioles 0.6–1.3 cm long; leaf blades narrowly ovate to lanceolate, 4–5 × 1.5–2.5 cm, reduced upward, densely pubescent, rounded to cuneate basally, coarsely crenate-serrate marginally, acuminate apically, lateral veins 5 pairs. Verticillasters 1.5–3.0 cm in diam., many flowered; bracts subulate, ciliate, spinescent, 5–8 mm long. Calyces membranous, reflexed in fruit, c. 10–12 mm long, densely villous outside, glabrous inside, veins conspicuous, throat enlarged, mouth constricted, teeth 10, unequal, upper teeth longest, spinescent. Corollas white tinged red, slightly exerted, slender, 7–10 mm long, tube 4–6 mm long, slightly dilated in throat, not villous, annulate inside, lower lip subpatent, lobes oblong, c. 2.5 mm long. Nutlets dark brown, oblong-ovoid, c. 1.5 mm, shiny.

Flowering and fruiting: October-February.

Ecology: Grown mainly on dry or disturbed open ground, grassy areas with sandy soil, waste land near habitations, and often as a weed of cultivated lands.

Uses: The plant is used as mosquito repellant due to its minty odor. It is used traditionally to manage diverse medical ailments including infectious diseases, inflammatory conditions, rashes, diarrhoea, epilepsy and convulsions (Timothy *et al*., 2016). Also useful in headache, fever, gonorrhea and anti-vomiting, rheumatism, kidney and urinary disorders (Chouhan and Singh, 2011).

Distribution: This species is widespread in tropical America, tropical Africa and Southern Africa, Madagascar, Arabia, India, Southeast Asia and Australia.

Representative specimen examined: **Gazipur:** Kapasia, 15.02.2019, MA Rahim 100045, 100046, 100047 (JUH).

The genus *Leucas* R. Br. was first described by Robert Brown in 1810 and later on, Bentham in 1832-1836 and 1848 recognized six sections under this genus. However, recent phylogenetic studies (Scheen and Albert, 2009) suggest the segregation of this genus into two different groups: Asian *Leucas s.s.* and 'African *Leucas*'. *Leucas* is one of the largest genera in the subfamily Lamioideae under the family Lamiaceae. It is composed of about 100 species worldwide, and distributed mainly on dry or disturbed ground in tropical to southern Africa, Arabian Peninsula, Iran to South China, Taiwan, Japan and SE Asia. Northeast tropical Africa is considered as the centre of origin of the genus, from here *Leucas* species gradually migrated over Arabia to Indian subcontinent (Ryding, 1998; Singh, 2001).

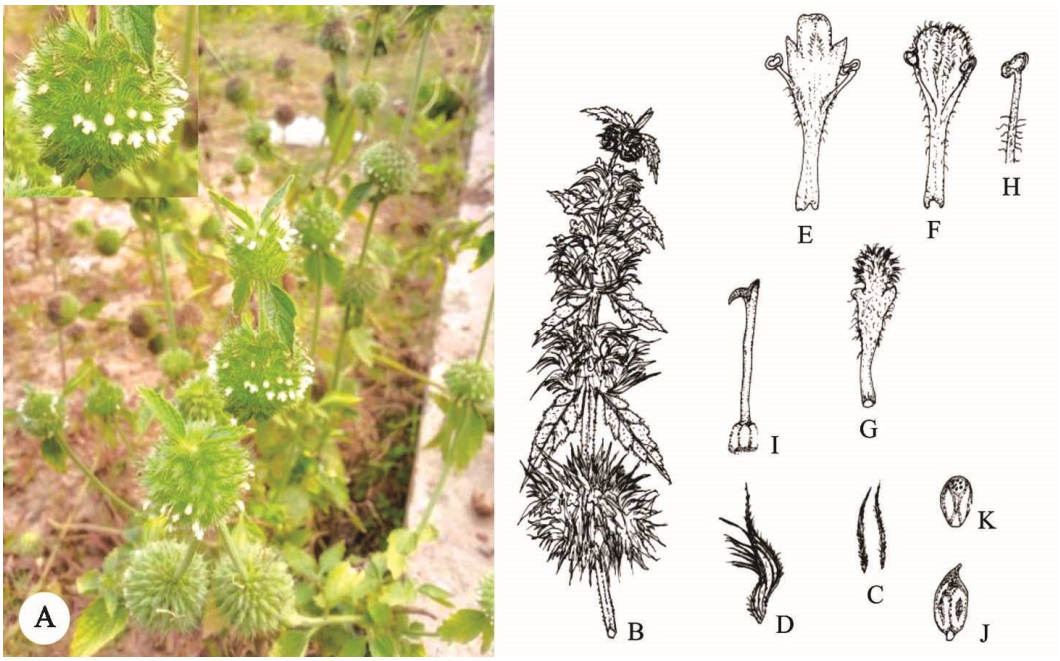

Fig. 3. *Leucas martinicensis*. A = A view of habit; B = Flowering twig (× 1.2); C = Bracts (× 3.2); D = Calyx (× 2.5); E = Upper lip (× 5.5); F = Lower lip (× 5.6); G = Petal (× 4.5); H = Androecium (× 6.2); I = Gynoecium (× 6.5); J = Fruit; K = Seed (×10.6).

In Bangladesh, eight *Leucas* species, *viz. L. aspera* (Willd.) Link, *L. biflora* (Vahl) Sm., *L. cephalotes* (Roth) Spreng., *L. ciliata* Benth., *L. indica* (L.) Sm., *L. mollissima* Wall. *ex* Benth., *L. vestita* Benth. and *L. zeylanica* (L.) W.T. Aiton are reported so far (Hooker, 1894; Prain, 1903a; Khanam and Hassan, 2005; Ahmed *et al.*, 2009). *L. martinicensis*, reported here for the first time from Bangladesh, is clearly distinct from these species by its constricted calyx mouth and reflexed fruiting calyx in contrast to non-constricted or dilated calyx mouth and non-reflexed fruit calyx. Morphologically, *L. martinicensis* seems very similar to *L. zeylanica* and *L. cephalotes*. *L. martinicensis* differs from *L. zeylanica* by its retrorse pubescent stem, 5-pairs lateral veins in leaves and dark brown nutlets, in contrast to hispid-villous or villous-hirsute stem, 3–4 pairs lateral vein in leaves and chestnut brown nutlets in *L. zeylanica*. On the other hand, it differs from *L. cephalotes* by its retrorse pubescent stem, longer petioles (7–15 mm), and smaller corollas (ca. 8 mm) and nutlets (ca. 1.5 mm), in contrast to hispid stem, shorter petioles (ca. 5 mm), and larger corollas (ca. 15 mm) and nutlets (ca. 3mm) of *L. cephalotes*.

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(Manuscript received on 13 April, 2020; revised on 17 November, 2020)