SYSTEMATIC STUDIES OF THE GENUS ASPARAGUS TOURN. EX LINN. (LILIACEAE) IN BANGLADESH

SUMONA AFROZ¹, M. OLIUR RAHMAN² AND MD. ABUL HASSAN

Department of Botany, University of Dhaka, Dhaka 1000, Bangladesh

Keywords: Asparagus Tourn. ex Linn.; Taxonomy; Revision; Liliaceae; Bangladesh.

Abstract

The genus Asparagus Tourn. ex Linn, represented by five species in Bangladesh, viz., Asparagus adscendens Roxb., A. densiflorus (Kunth) J.P. Jessop, A. officinalis L., A. racemosus Willd. and A. setaceus (Kunth) J.P. Jessop is revised. Each species is described with updated nomenclature, important synonyms, phenology, specimens examined, chromosome number, habitat, distribution, economic value and mode of propagation. A dichotomous bracketed key to the species and illustrations along with photographs of four species are provided.

Introduction

The classification of the lilioid monocots has long been problematic (Chase et al., 2009). Some authors treated all lilioid monocots including the genus Asparagus Tourn. ex Linn. in the single family, Liliaceae s.l. (Cronquist, 1981). Asparagus species are currently grouped within the subfamily Asparagoideae sensu APG IV (2016), including species of Hemiphylacus S. Watson, a former small genus endemic to Mexico (Rudall et al., 1998). Three subgenera are currently recognized within the genus (Clifford and Conran, 1987): the subgenus Asparagus s.s. includes all the dioecious taxa with Eurasian distribution; the two other subgenera, Protasparagus Oberm. and Myrsiphyllum Willd., contain hermaphroditic taxa occurring mostly in Africa. However, this infrageneric subdivision was sometimes rejected (Fellingham and Meyer, 1995). Recent phylogenetic studies on the genus Asparagus (Kubota et al., 2012; Norup et al., 2015) have confirmed the monophyly of this genus with sexual dimorphism and polyploidy as the main force of evolution (Castro et al., 2013). All these phylogenetic studies have revealed conflicts between the different classifications, highlighting recurrent questions about delimitation of the currently recognized species.

The genus Asparagus comprises over 210 species, distributed throughout the world in temperate and tropical regions, with Africa and especially southern Africa as the main center of diversification (Kanno and Yokoyama, 2011). They are herbaceous perennials, woody shrubs and vines, characterized by photosynthetic stems (cladodes), leaves reduced to scales, and berries black or red (Clifford and Conran, 1987). Asparagus is remarkable with high variability in reproductive behaviour involving monoecious, dioecious, hermaphroditic, andromonoecious, and in some cases, supermale plants (Kanno and Yokoyama, 2011).

Asparagus species are economically and ecologically important. Many species of Asparagus have nutritional components, and the most significant species of the genus is Asparagus officinalis L., which is cultivated globally. Several species have long been used in traditional medicines and pharmacopoeia, viz. A. racemosus Willd., A. verticillatus L. and A. adscendens Kunth, while others are used as ornamental, i.e. A. plumosus Baker, A. densiflorus Kunth and A. virgatus Baker.

¹Present Address: Bangladesh National Museum, Shahbagh, Dhaka 1000, Bangladesh
²Corresponding author. Email: prof oliurrahman@gmail.com; oliur.bot@du.ac.bd
(Kumar et al., 2016). Ecologically, Asparagus species are tolerant to drought and high temperatures growing under forest cover as well as in open habitats including predesertic steppes. They constitute a lianascent layer characterizing the Mediterranean forests along with species of other genera, i.e., Smilax L. and Ruscus L. (Schnitzler and Arnold, 2010). These lianas play a key role in the ecology and dynamic of forests and may be helpful as indicators for the monitoring and management of forest ecosystems (Naidu et al., 2014).

In Bangladesh, Asparagus appears to be the second largest genus in the family Liliaceae, represented by five species including both wild and cultivated ones. Hooker (1892) recognized 17 Asparagus species from the Indian sub-continent, of which only three species were reported from the territory of the present Bangladesh. Afterward, Prain (1903) listed two Asparagus species from the area of present Bangladesh. Hassan (2007), and Afroz and Hassan (2008) documented four species of Asparagus occurring in Bangladesh with inadequate taxonomic description. In the recent past, Akter et al. (2017) studied the fluorescent banding in A. racemosus, A. officinalis and A. setaceus in Bangladesh with differential banding patterns. Despite a few studies on Asparagus were conducted earlier based on its morphology and cytology, however, there has been no detailed taxonomic study on this medicinally and ecologically important genus in Bangladesh. Therefore, the present study aims to revise the genus Asparagus in Bangladesh for the first time.

Materials and Methods

Plant samples of different Asparagus species were collected from different parts of the country and planted in the Dhaka University Botanical Garden for further study. The collected plant specimens were critically studied and examined, and were supplemented by the specimens housed at the Dhaka University Salar Khan Herbarium (DUSH) and Bangladesh National Herbarium (DACB). Identification of the Asparagus species were confirmed in consultation with standard literature (Hooker, 1892; Deh, 1983; Karthikeyan et al., 1989; Noltie, 1994; Raven and Zhengyi, 2000; Utech, 2002; Hassan, 2007) and matching with authentically identified herbarium specimens deposited at DUSH and DACB. Each species is described with updated nomenclature, important synonyms, English and Bangla names, flowering and fruiting period, specimens examined, chromosome number, habitat, distribution, economic value, and mode of propagation. The updated nomenclature has been determined using The Plant List (2013), and The Plants of the World Online (POWO, 2022). A dichotomous bracketed key to the species and illustrations with photographs of four species are also provided. The voucher specimens are deposited at DUSH.

Results

Genus Asparagus Tourn. ex Linn.,
Syst. ed. 1 (1735); L., Gen. ed. 1: 93 (1737); Benth. & Hook. f., Gen. Pl. 3: 765 (1883); L., Sp. Pl.: 313 (1753); Gen. Pl. ed. 5: 147 (1754). Asparagopsis Kunth, Abh. Akad. Berl. : 35 (1842). Elide Medic., Phil. Bot. 2: 71 (1791). Hecatris Salisb., Gen. Pl. Fragm. : 66 (1866).

Herbs, shrubs or vines, perennial, form rhizomes, usually with fusiform tubers, often with fern-like appearance. Stem erect, straggling or climbing, terete, grooved or angled. Roots many, clustered. Leaves small, scale-like, membranous or sometimes spiny with hardened base, subtending cladophylls. Inflorescence axillary or terminal, racemose or umbellate, paired or solitary; racemes short. Flowers bisexual or unisexual; pedicels jointed. Perianth greenish, white or yellowish, campanulate to rotate. Tepals 6, distinct or shortly connate basally, equal. Stamens 6, distinct, equal; filaments free; anthers versatile, oblong, 2-locular, dehiscence introrse. Ovary
superior, 3-locular, septal nectaries present; style 3-branched distally. Fruits baccate, red or purplish black, globose, often with tepals persisting at base. Seeds 1-6, black, globose to angular.

**Key to the species of Asparagus**

1. Inflorescence an axillary raceme; flowers bisexual
   - Inflorescence a solitary flower or a cluster of flowers; flowers unisexual or bisexual
   2
2. Stem suberect; cladodes ascending, erect or recurved
   - Stem climbing; cladodes flat
   3
3. Spines 1.5-2.0 cm on the main stem and 0.5-1.0 cm on branches; lower half of the articulated pedicel longer than the bract
   - Spines 0.3-0.5 cm on the main stem and indistinct on branches; lower half of the articulated pedicel shorter than the bract
   4
4. Stem climbing; pedicel articulated near the middle or below
   - Stem erect; pedicel articulated above the middle
   5

**Asparagus adscendens** Roxb., Fl. Ind. 2: 153 (1832); Hook. f., Fl. Brit. Ind. 6: 317 (1892); Hassan, Encycl. Flora & Fauna of Bangladesh 11: 337 (2007). *Asparagopsis adscendens* Kunth, Enum. Pl. 5: 102 (2850).

English name: Asparagus.
Bangla name: Shatamuli.

A dioecious evergreen shrub with white tuberous roots. Stem tall, stout, suberect, terete, smooth, branchlets grooved, ascending, angled, spines 1.3-2.0 cm long, stout, straight. Cladodes 6-20 nate, 1.3-5.0 cm long, slender, filiform, terete, erect or recurved. Inflorescence of racemes, many-flowered, bracts minute. Flowers pedicellate, c. 2.5 cm in diam., jointed above or below the middle, bracts minute. Perianth segments 6. Stamens 6. Carpels 3, syncarpous, ovary 3-celled; placentation axile. Fruit a berry, 1-seeded.

Specimen examined: Gazipur: Sal forest, 10.12.1944, Balwant Singh, s.n. (DUSH).
Chromosome number: 2n = 20 (Kumar and Subramaniam, 1986).
Habitat: Sal forests and well-drained moist soils in semi-shady condition.
Distribution: Afghanistan, Argentina, Bhutan, India, Iran and Pakistan (GBIF, 2020).
Economic value: Tuberous root is a source of nutritious starch. The roots are demulcent, diaphoretic, galactogogue and stimulant, and are useful in the treatment of diarrhoea, dysentery and general debility (Hassan, 2007).
Propagation: By seeds.

**Asparagus densiflorus** (Kunth) J.P. Jessop, Bothalia 9: 51 (1966). *Asparagopsis densiflora* Kunth, Enum. Pl. 5: 96 (1850); *Asparagus sprengerii* Regel., Act. Hort. Petrop. 11: 302 (1890); *Asparagus aethiopicus* L., Mant. 1 (1767); *Protasparagus densiflorus* (Kunth) A.A. Oberm., Fl. S. Afr. 5(3): 49 (1992).

English names: Sprenger Asparagus, Basket Asparagus, Asparagus-fern, Lace-fern.
Bangla name: Shatamuli.
Evergreen, perennial herb. Tuber more or less globose, c. 4 × 2 cm. Stem stiff or spreading-arching, up to 20 cm long. Larger branches usually bearing minute axillary spines, spines c. 4 mm long. Cladodes scale-like, linear, light green, c. 1.7 × 0.1 cm, 2-9 nate, clustered at branch nodes. Inflorescences arise from the main branch, c. 5-9 flowered. Flowers small, bell-shaped, greenish-white, fragrant; perianth segments 6, c. 2 × 1 mm; pedicel c. 2 mm long, atriculate at middle. Stamens 6; filament c. 2 mm long, white; anthers oblong, c. 1 mm long, orange. Carpels 3, syncarpous, ovary globose, c. 3 mm long, ovules many; stigma minute; placentation axile. Fruit a bright-red berry, oval, c. 8 mm in diam., 1-3 seeded.

*Flowering and fruiting*: February-April.

*Specimens examined*: Dhaka: Baldha Garden, 23.03.2007, Sumona 11 (DUSH); Baldha Garden 26.04.2007, Sumona 23 (DUSH).

---

![Fig. 1. Asparagus densiflorus (Kunth) J.P. Jessop, a) Habit (×1); b) Flower (×3); c) L.S. of a flower (×6); d) T.S. of ovary (×8).](image-url)
Plate 1. Different species of *Asparagus*: A. *Asparagus densiflorus*; B-C. *Asparagus officinalis*; D-E. *Asparagus racemosus*; F. *Asparagus setaceus*.

*Chromosome number*: $2n = 20$ (Kumar and Subramaniam, 1986).

*Habitat*: Waste places and also cultivated in gardens.

*Distribution*: Australia, Brazil, Chile, China, Greece, India, Mexico, Portugal, Puerto Rico, South Africa and Spain (GBIF, 2020).

*Economic value*: An infusion of the leaves is used to treat thrush and ulcers in the mouth, for abdominal pains, as a tonic to boost immunity, as a cleansing agent to rid the body of “poison” and “dirty blood” (Mfengwana and Mashele, 2019).

*Propagation*: By seeds.

*Asparagus officinalis* L., Sp. Pl. 1: 313 (1753); Roxb., Fl. Ind. 2: 163 (1832); Noltie, Fl. Bhutan 3(1): 62 (1994); Raven and Zhengyi, Fl. China 24: 214 (2000); Utech, Fl. North. America 26: 214 (2002). *Asparagus polyphyllus* Steven, Bull. Soc. Imp. Natur. Mosc. 30(3): 91 (1857).

(Fig. 2, Plate 1B-C).

*English names*: Garden Asparagus, White Asparagus, Sparrow Grass, Common Asparagus.

*Bangla name*: Asparagus.

Erect herb, 1.0-2.5 m tall; rhizomes fibrous. Stem annual, densely branched distally; branches finely dissected, ascending to perpendicular, unarmed; cladophylls in clusters of (2) 4-15(-25) per
node, filiform, straight or curved, 1-3 cm long. Leaves scale-like, cladodes 0.5-3.0 cm long; blade lanceolate, base hardened. Inflorescence axillary raceme, 1-3-flowered. Flowers of both sexes solitary or in clusters of 2-4; pedicel 0.8-1.2 cm long, jointed at or above middle. Male flowers: perianth yellowish-green, campanulate, c. 5-6 mm long; filaments adnate to perianth segments for about half of their length; anthers c. 1 mm long. Female flowers: perianth c. 3 mm long. Berries red, 0.6-1.0 cm in diam., 2-3-seeded.

Fig. 2. Asparagus officinalis L., a) Habit (×1); b) Flower (×5); c) L.S. of a flower (×10); d) T.S. of ovary (×10); e) Stamen (×10).

Flowering and fruiting: May-August.

Specimen examined: Dhaka: Dhaka University Botanical Garden, 25.09.2016, Sumona 109 (DUSH).

Chromosome number: 2n = 20, 40 (Kumar and Subramaniam, 1986).

Habitat: Fields, fence rows and roadsides. The species is cultivated since ancient Greek times.
**Distribution:** Argentina, Australia, Austria, Canada, Denmark, Ecuador, France, Germany, New Zealand, Norway, Slovakia, Spain, Sweden, Switzerland and Ukraine (GBIF, 2020).

**Economic value:** *Asparagus officinalis* possesses anticancer, antimicrobial, antioxidant, hypolipidemic and antidiabetic properties (Snafi, 2015). This is eaten as a green vegetable, and it is widely cultivated for its young shoots. Mature asparagus can cause poisoning in cattle. Young plants can cause dermatitis, and the red berries are poisonous (Utech, 2002).

**Propagation:** By dividing the crowns.

*Asparagus racemosus* Willd., Sp. Pl. 2: 152 (1799). Hook. f., Fl. Brit. Ind. 6: 316 (1892); Prain, Beng. Pl. 2: 805 (1903); Haines, Bot. Bih. Or.: 1089 (1924); Fischer in Gamble, Fl. Pres. Madras: 1517 (1928) & Rec. Bot. Surv. Ind. 12(2): 146 (1938); Hassan, Encycl. Flora & Fauna of Bangladesh 11: 337 (2007). *Asparagus dubius* Decne, Nouv. Ann. Mus. Paris 3: 363 (1834). *Asparagopsis decaisnei* Kunth, Enum. Pl. 5: 103 (1850). *Asparagopsis javanica* Kunth, Enum. Pl. 5: 100 (1850). *Asparagopsis schoberioides* Kunth, Enum. Pl. 5: 70 (1850). (Fig. 3, Plate 1D-E).

**English name:** Asparagus.

**Bangla names:** *Shatamuli*, *Satmuli*, *Shaktichara* (Chakma), *Mimong Tamache* (Garo).

A perennial, slender, scandent shrub. Leaves scale-like, minute. Cladodes present in scale-like leaf axils, 2-6 nate, acicular, triquetrous, falcate, finely acuminate, 1.0-2.5 cm long. Inflorescence a raceme, solitary or fascicled, simple or branched. Flowers bisexual, greenish-white at initiation, then light pink and finally dark maroon, sweet-scented, bracteate, bracts minute, c. 3 × 1 mm, off white, pedicellate, pedicel c. 4 mm long. Perianth segments 6, spreading, obovate, c. 4 × 1 mm, off white with vertical green line. Stamens 6, adnate to the base of the perianth lobes; filaments free, c. 2 mm long; anthers minute, oblong, purplish. Carpels 3, syncarpous, ovary superior, c. 2 mm long, trigonous, 3-celled, 2-several ovules in each cell; stigma 3-fid; placentation axile. Fruit a berry, globose, c. 5-8 mm in diam., green, turn red when ripe.

**Flowering and fruiting:** November-March.

**Specimens examined:** Dhaka: Baldha Garden, 17.02.1988, Rezia Khatun 249 (DACB). Dhaka University Botanical Garden, 05.02.1983, M.A. Hassan 501 (DUSH); Dhaka University Science Library compound, 04.02.2006, Sumona 1 (DUSH); Science Library compound, 01.01.2012, Sumona 72 (DUSH); Dhaka University Omor Ekushey Hall compound, 02.12.2006, Sumona 4 (DUSH); Dhaka University Botanical Garden, 21.05.2007, Sumona 34 (DUSH); Savar, Jahangirnagar University campus, 05.01.2009, Sumona 61 (DUSH). Sunamganj: Near Pashua Haor, 23.05.1992, Khan et al. K. 8669 (DACB). Tangail: Madhupur forest, 05.08.1976, Huq, Rahman & Khan K. 4173 (DACB). Chittagong: Bariyadhala, 17.11.1986, A.M. Huq & M.K. Mia H. 7992 (DACB); Sandwip, Horishpur, Hazipara, 10.02.1988, Mia & Mahfuz M. 1522 (DACB); Chunneli Wildlife Sanctuary, 25.02.1999, Rahman et al. 4029 (HCU). Sylhet: Chattak, 05.01.1978, Huq & Rahman H. 3662 (DACB). Patuakhali: Mirzaganj, Subidkhali, 20.11.2004, M. Sultana 567 (DUSH); Dumki, Srimangal, 17.05.2005, M. Sultana 899 (DUSH); Patuakhali Sadar, Laukathi, 15.05.2006, M. Sultana 1262 (DUSH). Cox’s Bazar: Whykeong Range, Raikeong, 11.09.1999, Rahman et al. 5916 (HCU). Rangamati: Belaichari, 23.07.1999, Rahman et al. 5101 (HCU).

**Chromosome number:** 2n = 20, 22, 30, 40, 48 (Kumar and Subramaniam, 1986).

**Habitat:** Scrub jungles.

**Distribution:** Afghanistan, Australia, Bhutan, India, Kenya, Liberia, Madagascar, Nepal, Somalia, South Africa, Spain, Tanzania, Thailand and Uganda (GBIF, 2020).
Fig. 3. Asparagus racemosus Willd., a) Habit (×0.5); b) L.S. of a flower (×5); c) T.S. of ovary (×10); d) Bract (×5); e) Fruit (×1).

*Economic value:* Tuberous roots are used as aphrodisiac, alterative, tonic, demulcent and diuretic. Ethanol extracts of aerial parts possess anticancer properties (Ghani, 2003). The plant is ground with other ingredients, made into pills, and fed to cattle for diarrhoea (Alam, 2000). Tubers are used as a vegetable (Deb, 1983). Root is used as antidepressant, anti-diarrhoeal, antibacterial, analgesic, anti-inflammatory and antioxidant (Hasan *et al.*, 2016). The species can improve the milk production and reproduction capacity of dairy animals (Kushwah *et al.*, 2018).

*Ethnobotanical information:* Tuberous root paste mixed with sesame oil or coconut oil is used as a hair tonic. Root taken with milk is useful in gonorrhoea (Hassan, 2007).

*Propagation:* By seeds and tuberous root with crown.
**Asparagus setaceus** (Kunth) J.P. Jessop, Bothalia 9: 51 (1966); Hassan, Encycl. Flora & Fauna of Bangladesh 11: 338 (2007). *Asparagopsis setacea* Kunth, Enum. Pl. 5: 82 (1850); *Asparagus plumosus* Baker, Journ. Linn. Soc. 14: 613 (1875).

English names: Climbing Asparagus-fern, Lace-fern.

Bangla name: Fern Asparagus.

A woody vine, scrambling or climbing, up to 5 m long, smooth, much branched, branches spreading horizontally, branchlets and cladodes arranged in one plane, like a fern frond. Cladodes in fascicles of 10-15 per node, very slender, 4-10 × c. 0.5 mm. Leaves membranous, 1-2 mm long, blade forming a short spine with reflexed apex, mostly on the main stem. Inflorescence terminally umbellate, 1-4 flowered. Flowers bisexual, short pedicellate, pedicel c. 4 mm long. Perianth of 6 tepals, c. 3.0 × 1.2 mm, campanulate, spreading, white, fragrant. Stamens 6; filament c. 1.5 mm long; anthers oblong, c. 1.0 × 0.5 mm. Carpels 3, united, ovary superior, 3-celled, c. 3 × 3 mm; style minute, style with stigma c. 1 mm long; stigma 3-fid; placentation axile. Fruit a berry, purplish-black, 5-6 mm in diam., 1-3 seeded.

---

Fig. 4. *Asparagus setaceus* (Kunth) J.P. Jessop, a) Habit (×0.5); b) Flower (×3); c) L.S. of a flower (×3); d) T.S. of ovary (×5).

Flowering and fruiting: February-June.

Specimens examined: Dhaka: Dhaka University Botanical Garden, 05.07.2016, Sumona 106 (DUSH); Nazimuddin Road, 20.1.1956, Shaliqehan (DUSH); Baldha Garden, 17.2.1988, Rezia et al. 249 (DACB). Patuakhali: Dumki, Srirampur, 17.05.2005, M. Sultana 900 (DUSH).

Chromosome number: 2n = 20 (Kumar and Subramaniam, 1986).
Habitat: Waste places.

Distribution: Argentina, Australia, Bermuda, Brazil, China, Colombia, Ecuador, Mexico, New Zealand, Portugal, South Africa and Uruguay (GBIF, 2020).

Economic value: Asparagus setaceus is used as a popular ornamental plant because of its attractive characters of extremely feathery, soft leaves, and an elegant posture (Li et al., 2020). This species is reported to have multiple uses in traditional oriental medicine (McGaw and Eloff, 2008).

Ethnobotanical information: Foliation is used for decorative purposes by florists (Hassan, 2007).

Propagation: By seeds.

References
Afroz, S. and Hassan, M.A. 2008. Systematic studies in the family Liliaceae from Bangladesh. Bangladesh J. Plant Taxon. 15(2): 115–128.

Akter, S., Begum, K.N., Sultana, S.S. and Alam, S.S. 2017. Karyotype diversity in three Asparagus L. species. Cytologia 82(5): 551–557.

Alam, M.B. 2000. Medicinal Plants for Livestock and Poultry in Disaster Prone Areas like Chilmari, Bangladesh. SUMUL, Bangladesh. 104 pp.

APG IV. 2016. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. Bot. J. Linn. Soc. 181: 1–20.

Castro, P., Gil, J., Cabrera, A. and Moreno, R. 2013. Assessment of genetic diversity and phylogenetic relationships in Asparagus species related to Asparagus officinalis. Genet. Resour. Crop. Evol. 60: 1275–1288.

Chase, M.W., Reveal, J.L. and Fay, M.F. 2009. A subfamilial classification for the expanded asparagalean families Amaryllidaceae, Asparagaceae and Xanthorrhoeaceae. Bot. J. Linn. Soc. 161: 132–136.

Clifford, H.T. and Conran, J.G. 1987. Asparagaceae. In: George, A.S. (Ed.), Flora of Australia. Canberra, Australia: Australian Government Publishing Service, pp. 140–142.

Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia University Press, New York, 1262 pp.

Deb, D.B. 1983. The Flora of Tripura State. Vol. 2. Today and Tomorrow's Printers and Publishers, New Delhi, India, 601 pp.

Fellingham, A.C. and Meyer, N.L. 1995. New combinations and a complete list of Asparagus species in southern Africa (Asparagaceae). Bothalia 25: 205–209.

GBIF 2020. GBIF Backbone Taxonomy. <https://doi.org/10.15468/39omei> <Accessed on 13 January 2020>.

Ghani, A. 2003. Medicinal Plants of Bangladesh – Chemical Constituents and Uses (Second edition). Asiatic Society of Bangladesh, Dhaka, 460 pp.

Hasan, N., Ahmed, N., Zohrameena, S., Khalid, M. and Akhtar, J. 2016. Asparagus racemosus: For medicinal uses & pharmacological actions. Int. J. Adv. Res. 4(3): 259–267.

Hassan, M.A. 2007. Liliaceae. In: Siddique, K.U., Islam, M.A., Ahmed, Z.U., Begum, Z.N.T., Hassan, M.A., Khondker, M., Rahman, M.M., Kabir, S.M.H., Ahmad, A.T.A., Rahman, A.K.A. and Haque, E.U. (Eds), Encyclopedia of Flora and Fauna of Bangladesh. Vol. 11. Angiosperms: Monocotyledons (Agavaceae-Najadaceae). Asiatic Society of Bangladesh, Dhaka, pp. 339–343.

Hooker, J.D. 1892. The Flora of British India, Vol. 6. L. Reeve & Co. Ltd., London, pp. 314–319.

Kanno, A. and Yokoyama, J. 2011. Asparagus. In: Kole, C. (Ed.), Wild Crop Relatives: Genomic and Breeding Resources: Vegetables. Berlin, Germany: Springer, pp. 23–42.

Karthikeyan, S., Jain, S.K., Nayar, M.P. and Sanjappa, M. 1989. Flora of India. Ser. 4. Botanical Survey of India, Pune, India, pp. 1–102.
Kubota, S., Komno, I. and Kanno, A. 2012. Molecular phylogeny of the genus Asparagus (Asparagaceae) explains interspecific crossability between the garden Asparagus (A. officinalis) and other Asparagus species. Theor. Appl. Genet. 124: 345–354.

Kumar, V. and Subramaniam, B. 1986. Chromosome Atlas of Flowering Plants of the Indian Subcontinent. Vol. 2, Monocotyledons. Botanical Survey of India, Calcutta, India, pp. 465-1095.

Kumar, M., Naik, P.K., Sarla and Chhocar, V. 2016. Genetic variations in Asparagus racemosus, an endangered medicinal herb endemic to India using RAPD markers. British Biotech. J. 10: 1-11.

Kushwah, P., Ghaulaxe, S.P.C., Mandloi, N., Singh, S. and Patel, R. 2018. Review on Medicinal value of Asparagus racemosus in Woman’s. Research J. Pharm. & Tech. 11(1): 418–420.

Li, S.-F., Wang, J., Dong, R., Zhu, H.-W., Lan, L.-N., Zhang, Y.-L., Li, N., Deng, C.-L. and Gao, W.-J. 2020. Chromosome-level genome assembly, annotation and evolutionary analysis of the ornamental plant Asparagus setaceus. Horticulture Research 7: 48.

McGaw, L.J. and Eloff, J.N. 2008. Ethnoveterinary use of southern African plants and scientific evaluation of their medicinal properties. J. Ethnopharmacol. 119: 559–574.

Mfengwana, P.H. and Mashele, S.S. 2019. Medicinal properties of selected Asparagus species: A Review. Phytochemicals in Human Health. Central University Technology, South Africa, 23 pp.

Naidu, M.T., Kumar, O.A. and Venkaiah, M. 2014. Taxonomic diversity of lianas in tropical forests of Northern Eastern Ghats of Andhra Pradesh, India. Not. Sci. Biol. 6: 59–65.

Noltie, H.J. 1994. Flora of Bhutan. Vol. 3, Part 1, Royal Botanic Garden, Edinburgh, 456 pp.

Norup, M.F., Petersen, G., Burrows, S., Bouchenak-Khelladi, Y., Leebens-Mack, J., Pires, J.C., Peter Linder, H. and Seberg, O. 2015. Evolution of Asparagus L. (Asparagaceae): Out-of-South-Africa and multiple origins of sexual dimorphism. Mol. Phylogenet. Evol. 92: 25–44.

POWO 2022. Plants of the World Online. Facilitated by the Royal Botanic Gardens, Kew. http://www.plantsoftheworldonline.org <Accessed on 14 April 2022>.

Prain, D. 1903. Bengal Plants. Vol. 2. Indian reprint 1981. Bishen Singh Mahendra Pal Singh, Dehra Dun, India, pp. 663–1319.

Raven, P. and Zheng-Yi, W. (Eds) 2000. Flora of China, Vol. 24, Flagillariaceae through Marantaceae. Science Press, Beijing, and Missouri Botanical Garden Press, St. Louis, pp. 1–431.

Rudall, P.J., Engleman, E.M, Hanson, L., Chase, M.W. 1998. Embryology, cytology and systematics of Hemiphylacus, Asparagus and Anemarrhena (Asparagales). Plant Syst. Evol. 211: 181–199.

Schnitzler, A. and Arnold, C. 2010. Contribution of vines to forest biodiversity in the Mediterranean basin. Ecologia Mediterranea 36: 7–23.

Snafi, A.E. 2015. The pharmacological importance of Asparagus officinalis - A Review. J. Pharmaceut. Biol. 5(2): 93-98.

The Plant List 2013. The Plant List, a working list of all plant species. http://www.thepantlist.org <Accessed on 14 April 2022>.

Utech, F.H. 2002. Flora of North America: North of Mexico. Vol. 26, Flora of North America Editorial Committee (Eds), Oxford University Press, New York. 752 pp.

(Manuscript received on 12 July 2021; revised on 17 May 2022)