

TAXONOMIC STUDY OF THE GENUS *ZIZIPHUS* MILL. (RHAMNACEAE) OF BANGLADESH

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Abstract

A taxonomic account of six species of *Ziziphus* Mill., viz. *Z. funiculosa* Buch.-Ham. ex Lawson, *Z. glabrata* Heyne ex Roth, *Z. mauritiana* Lam., *Z. oenoplia* (L.) Mill., *Z. rugosa* Lam., and *Z. xylopyrus* (Retz.) Willd. occurring in the flora of Bangladesh has been given. A dichotomous key to the species has been furnished. An updated nomenclature including important synonyms, selected references, description of the taxa along with illustrations, ecological notes, specimens examined and geographical distribution have been provided. Bangla and English names, flowering and fruiting periods, chromosome number and economic importance have also been presented where available.

Introduction

The genus *Ziziphus* Mill., belonging to the family Rhamnaceae, is characterized for its 3 or 5-nerved leaves and drupaceous fruits with a solitary pyrene. It consists of about 135 species, distributed in the temperate and tropical parts of the world, mostly concentrated in Asia and America; although a few of them extend in the Pacific Islands and Australia (Bhandari and Bhansali 2000). There are 17 species in India (Bhandari and Bhansali 2000) and six species in Pakistan (Qaiser and Nazimuddin 1981). Long and Rae (1991) listed seven species in Bhutan, while Hara and Williams (1979) recorded eight species in Nepal.

There has been no systematic study of the genus *Ziziphus* in Bangladesh. Prain (1903) recorded five species and one variety for the greater Bengal of which only four fall in the territory of Bangladesh. Hooker (1875) included 18 species from the whole of British India out of which five were mentioned from the area of present Bangladesh. Uddin *et al.* (2000) added one species to the account of *Ziziphus*, viz. *Z. xylopyrus* for Bangladesh. A literature survey of relevant floristic works, viz. Roxburgh (1832), Hook. f. (1875), Prain (1903), Brandis (1906), Heinig (1925), Cowan (1928), Cowan and Cowan (1929), Kanjilal *et al.* (1934), Raizada (1941), Datta and Mitra (1953), Sinclair (1955), Khan and Afza (1968), Khan and Banu (1972), Huq and Khan (1984), Khan *et al.* (1984), Alam (1988), Khan *et al.* (1994), Mia and Khan (1995), Rahman and Hassan (1995), Rahman and Uddin (1997), Uddin *et al.* (1998), Uddin and Rahman (1999),

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Rashid *et al.* (2000), Khan and Huq (2001), and Rahman (2004a, b) and the study of the herbarium materials at different herbaria revealed that only six species have so far been reported from Bangladesh. No type specimens for the genus or any species have been seen.

The present paper deals with the detailed account of all the six *Ziziphus* species of Bangladesh. The illustrated taxonomic descriptions with bracketed key to the species, updated nomenclature along with important synonyms, notes on ecology, geographical distribution on global context and within Bangladesh are presented under each taxon. Flowering (*Fl.*) and fruiting (*Fr.*) time of the species have been cited while chromosome numbers, Bangla and English names have been provided where available. All the specimens examined have been cited. The district names given under specimen citation are in an alphabetical order. The enumeration is presented in an alphabetical order of the accepted names of taxa.

Materials and Methods

The present work is mainly based on the herbarium specimens housed at Bangladesh National Herbarium (DACB), Central National Herbarium (CAL), and Dhaka University Herbarium indicated in the text as DUH as well as on the survey of literature, namely Farr *et al.* (1979), Hara and Williams (1979), Qaiser and Nazimuddin (1981), Bhandari and Bhansali (1990, 2000) and Long and Rae (1991).

Enumeration of taxa

***Ziziphus* P. Miller,**

Gard. Dict. Abr. ed. 4 (1754). *Zizyphus* Tourn. *ex* Linn., Syst. ed. 1 (1735).

Lectotype: *Z. jujuba* P. Miller

Shrubs or trees, erect or straggling, often climbing, evergreen or deciduous, often spinose. Leaves alternate, petiolate, entire or crenate, coriaceous, 3-5 nerved at the base, stipules usually 1 or rarely 2 or curved spines or absent. Inflorescence axillary or terminal cymes or thyrses. Flowers small, pentamerous, bisexual, pedicellate, yellow-green. Calyx tube shallow. Sepals ovate-triangular or triangular, keeled within. Petals cucullate, deflexed or incurved, rarely absent. Stamens 5, included or excluded, inserted below the disc. Disc shallow or flat, 5-10-lobed. Ovary globose, 2-4-loculed, sunk in the disk and adnate to its base; styles 2-4, usually free or partially united; stigma papillose. Fruit a globose or oblong drupe, base with persistent calyx tube, apex mucronulate; putamen woody, 1-3-celled. Seed 1-3, plano-convex, testa thin, smooth shining; cotyledons thick; radicle short.

Key to the species

1	Plant armed, young shoots rusty pubescent / rusty tomentose	2
-	Plant unarmed, young shoots glabrous	Z. glabrata
2	Flowers fascicled or in sessile axillary cymes	3
-	Flowers in peduncled cymes arranged in large panicle	4
3	Trees, leaf blade broadest at middle	Z. mauritiana
-	Scandent or erect shrubs, leaf blade broadest at lower part	Z. oenoplia
4	Leaves rusty tomentose beneath, petals absent	Z. rugosa
-	Leaves pubescent beneath, petals present	5
5	Spine single, fruit yellow when ripe	Z. funiculosa
-	Spines in pair, fruit white when ripe	Z. xylopyrus

1. **Ziziphus funiculosa** Buch.- Ham. *ex* Lawson in Hook. f., Fl. Brit. Ind. 1: 636 (1875-reprint 1973). Brandis, Ind. Trees: 172 (1906-reprint 1971); Haines, Bot. Bih. Or.: 196 (1922); Deb, Fl. Tripura State 1: 407 (1981); Kanjilal *et al.*, Fl. Assam 1: 282 (1934-reprint 1982); Alam, Pl. Taxon. Series, Bull. 5: 93 (1988); Bhandari and Bhansali in M.P. Nayar *et al.*, Fasc. Fl. Ind. 20: 95 (1990); Long and Rae, Fl. Bhut. 2(1): 141 (1991); Bhandari and Bhansali in N.P. Singh *et al.* (eds.), Fl. Ind. 5: 227 (2000). **(Plate 1)**

Large scrambling shrub; young shoots rusty pubescent, glabrous with age; internodes 1-5 cm long; prickles short, stout, recurved, usually solitary, glabrous or slightly pubescent at the base. Leaves 7-10 × 3-4 cm, alternate, obliquely ovate or elliptic-oblong, acuminate, crenate, coriaceous, oblique at the base, glabrous, slightly pubescent on nerves, basally 3-nerved; petioles short, 0.8-1.0 cm long, pubescent, slightly channeled. Inflorescence paniced cymes. Flowers 5 mm across, sweet scented, in axillary and terminal pedunculate. Pedicels very short. Calyx lobes deltoid, 2 mm long, acute, glabrous within, rusty velvety outside. Petals 1.5 mm long, obovate, clawed, spreading. Stamens 5, equal to petals; filaments flat. Disc thin, glabrous, 5-lobed, sometimes faintly 10-lobed. Ovary 2-celled, glabrous; styles 2, divided to nearly the base, curved near apex. Drupes ovate, 1.3-1.8 cm long, 1-celled, fleshy, glabrous, yellow when ripe. Seed 1, 1 × 1 cm, black. *Fl. & Fr.*: March-October.

Ecology: Grows in evergreen forests.

Geographical distribution: India, Myanmar, Malesia and Borneo.

Economic importance: The fruits are edible (Deb 1981).

Specimen examined: **Chittagong Hill Tracts**: January, 1887, Dr. King's Collector 244 (CAL).

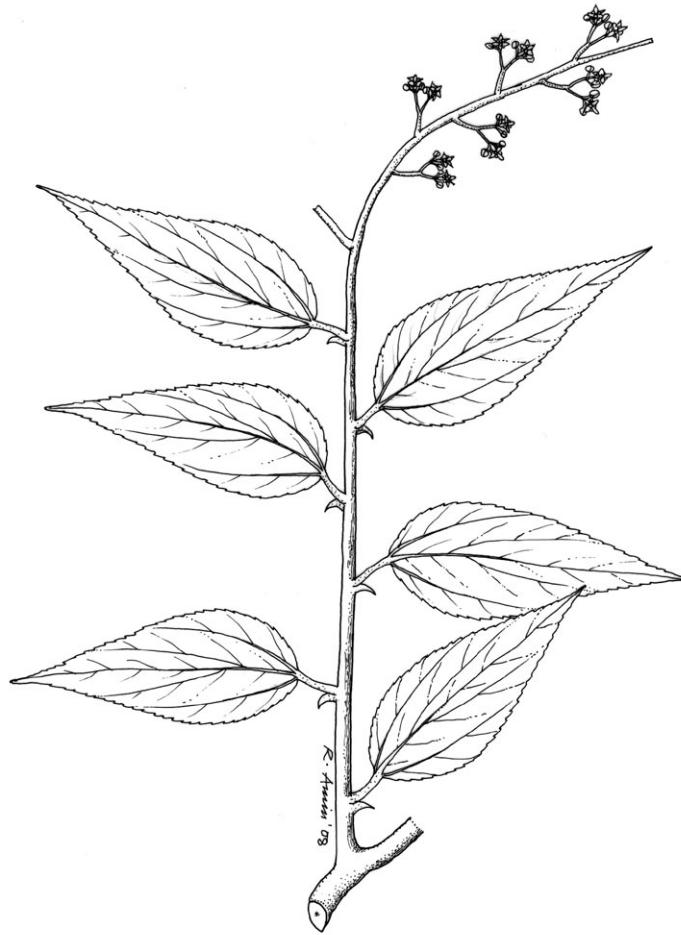


Plate 1. *Ziziphus funiculosa* Buch.- Ham. *ex* Lawson. Habit sketch ($\times 0.4$).

2. ***Ziziphus glabrata*** Heyne *ex* Roth, Nov. Pl. Sp.: 159 (1821). Wight, Ic. Pl. Ind. Or. 1: 15-16, t. 282 (1840); Lawson in Hook. f., Fl. Brit. Ind. 1: 633 (1875-reprint 1973); Sinclair, Bull. Bot. Soc. Beng. 9(2): 89 (1955); Bhandari and Bhansali in M.P. Nayar *et al.*, Fasc. Fl. Ind. 20: 96 (1990); Bhandari and Bhansali in N.P. Singh *et al.* (eds.), Fl. Ind. 5: 229 (2000). *Z. trinervia* Roxb., Fl. Ind. 2: 364 (1824) *et* 1: 614 (1832). *Z. trinervia* var. *glabratus* Heyne *ex* Roth, Nov. Pl. Sp.: 159 (1821). (Plate 2)

English name: Jagged Jujube.

Tree up to 8 m high, unarmed; branchlets glabrous. Leaves 1.8-10.3 \times 1.3-5.2 cm, alternate, lanceolate or ovate-oblong, apex acute, base rounded, crenulate, glabrous, coriaceous, glossy, dark green, basally 3-nerved; petioles 3-9 mm long; stipules filiform, deciduous. Inflorescence axillary fascicles; peduncles 2-3 mm long. Flowers 5-6 mm across, yellowish green, slightly puberulous; pedicels 4-5 mm long. Calyx lobes 2-3 mm

long, glabrous inside. Petals obtriangular with convolute margins, 1-2 mm long, acute or rounded at apex. Stamens about 3 mm long; filaments flattened. Disc faintly 10-lobed, glabrous, fleshy. Ovary 2-celled, glabrous; styles 2, united to the middle, curved. Fruits globose, 10-11 mm in diameter, 1-2-celled with a sweet gelatinous pulp. Seeds soft, brownish. *Fl. & Fr.*: September-January.



Plate 2. *Ziziphus glabrata* Heyne ex Roth. Habit sketch ($\times 0.24$).

Ecology: Grows in foothills or slopes of hills.

Geographical distribution: India and Bhutan.

Economic importance: Fruits are well-known for possessing emollient and pectoral properties. Matured fruits are sour but the dried ones are rather sweet. Pulp of the fruits of the cultivated varieties are sweet, aromatic, mealy and white. People eat ripe fruits. The

fruits are also dried in sun, preserved and consumed in off-season. Ripe fruits are also eaten by boiling / stewing / baking with millet or rice. Decoction of the leaves is applied to purify blood; it is also used in venereal diseases (Bhandari and Bhansali 1990).

Specimen examined: Cox's Bazar: Cox's Bazar, Kelatuli forest, 21 iii 1945, Sinclair *s. n.* (mentioned in Sinclair (1955)).

3. **Ziziphus mauritiana** Lam., *Encycl. Meth. Bot.* 3: 318 (1789). Sinclair, *Bull. Bot. Soc. Beng.* 9(2): 89 (1955); Khan and Afza, *Dacca University Studies*, B 16: 38 (1968); Qaiser and Nazimuddin, *Fl. Pakistan* 140: 10 (1981); Deb, *Fl. Tripura State* 1: 407 (1981); Alam, *Pl. Taxon. Series, Bull.* 5: 94 (1988); Bhandari and Bhansali in M.P. Nayar *et al.*, *Fasc. Fl. Ind.* 20: 99 (1990); Long and Rae, *Fl. Bhut.* 2(1): 138 (1991); Rahman and Hassan, *Bangladesh J. Plant Taxon.* 2(1&2): 66 (1995); Bhandari and Bhansali in N.P. Singh *et al.* (eds.), *Fl. Ind.* 5: 233 (2000); Khan and Huq, *Bangladesh J. Plant Taxon.* 8(1): 59 (2001). *Ziziphus jujuba* Lam., *Encycl.* 3: 318 (1789) (non Miller, 1768); Roxb., *Fl. Ind. ed. 2*, 1: 608 (1832); Wight, *Ic. Pl. Ind. Or.* 1: t. 99 (1839); Lawson in Hook. f., *Fl. Brit. Ind.* 1: 632 (1875-reprint 1973); Prain, *Beng. Pl.* 1: 234 (1903-reprint 1963); Brandis, *Ind. Trees*: 169 (1906-reprint 1971); Heining, *List Chittagong*: 13 (1925); Cowan, *Rec. Bot. Surv. Ind.* 11: 208-209 (1928); Kanjilal *et al.*, *Fl. Assam*, 1: 279 (1934-reprint 1982); Datta and Mitra, *Bull. Bot. Soc. Beng.* 7(1&2): 36 (1953). (Plate 3)

Bangla names: Kul, Boroi, Gram-Boroi, Bagri, Bogri.

English names: Chinese date, Indian cherry, Indian jujube, Indian plum.

Large shrubs or trees, evergreen, up to 15 m tall. Young branches densely yellow-gray tomentose; spines solitary or in pairs, straight or one of them recurved. Leaves 2-6 × 1.0-4.5 cm, alternate, variable, broadly elliptic or oblong, rarely subrounded, broadest at middle, base subrounded, slightly oblique, margin serrulate, apex rounded, rarely acute, pubescent or glabrous above, densely yellow or grey-white tomentose beneath, basally 3-nerved; stipules spinescent. Inflorescence short axillary cymes or few to 10-flowered fascicles; peduncles 1-8 mm long. Flowers 4-6 mm across, green-white; pedicels 2-4 mm long in flowers, 5-8 mm in fruits, gray-yellow tomentose. Calyx lobes ovate-triangular, glabrous inside, tomentose outside, tube campanulate. Petals oblong-spatulate, clawed at the base, 1.0-1.5 mm long. Stamens equal to petals. Disk thick, fleshy, 10-lobbed, concave at middle. Ovary globose, bilocular, glabrous; style short, 2-fid or branched to half; stigmatic lobes curved. Drupes 1.0-1.2 × 1.0 cm, globose oblong or ovoid, orange-yellow, turning deep red, pulpy, with persistent tube at base; kernel irregularly furrowed with a hard, thick, boney shell. Seeds 1 or 2, 6-7 × 5-6 mm, shiny, red-brown. *Fl. & Fr.:* August-February.

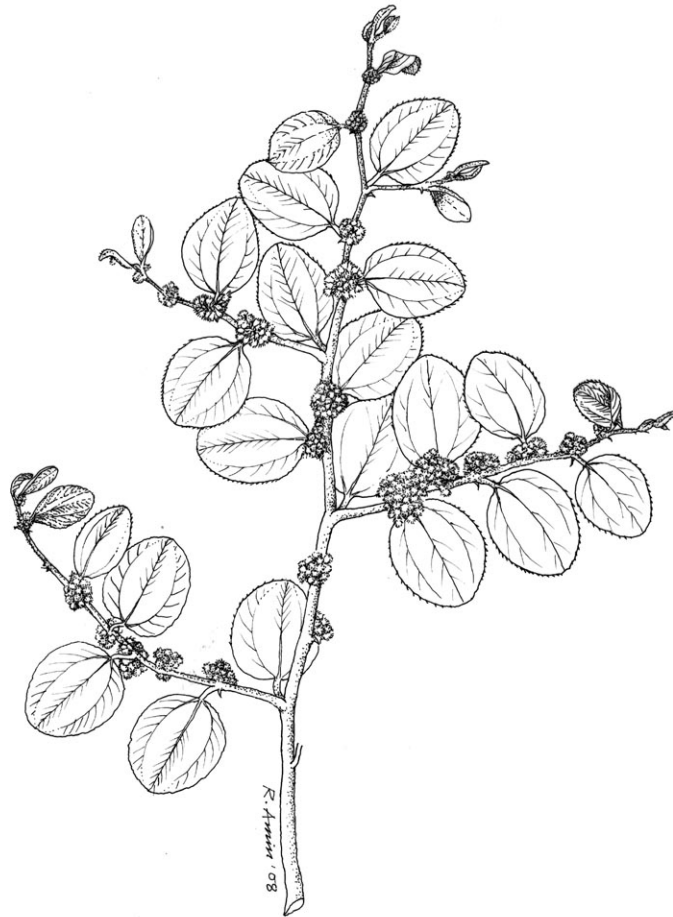


Plate 3. *Ziziphus mauritiana* Lam. Habit sketch ($\times 0.25$).

Chromosome number: $2n = 48$ (Kumar and Subramaniam 1986).

Ecology: Grows well in dry places.

Geographical distribution: India, Pakistan, Sri Lanka, Afghanistan, China, Australia and tropical Africa.

Economic importance: The wood of the tree is reddish in colour and hard in quality. It is used in agricultural implements. It is also used as fuel and charcoal (Bhandari and Bhansali 1990). Fruit acts as a medicine in astringency, stomache, biliousness, digestion, blood purification, laxative, scabies, throat troubles, nausea and vomiting. It also possesses emollient and pectoral properties. Bark is also used in astringency and in diarrhoea. Powder of the bark is used in dressing to wounds. The powder is also an effective medicine in ulcers. Root is helpful in curing fever, delirium, purgative, gout and rheumatism. Tender leaves and twigs cures boils, abscesses and carbuncles (Yusuf *et al.* 1994).

Specimens examined: **Bandarban:** Betchari area, 22 ix 2004, Hosne Ara HA 1190 (DACB). **Chittagong:** Rangapani to Hazarikhil, 31 x 1978, Huq, Rahman & Mia H. 4089 (DACB); Mirsarai, 06 x 1970, Khan & Huq K. 2034 (DACB); Chunati, 26 ix 2005, Hosne Ara HA 2264 (DACB). **Chittagong Hill Tracts:** October, 1887, Dr. King's Collector 606 (CAL); 1886, Dr. King's Collector 105 (CAL). **Cox's Bazar:** Teknaf Upazilla, Nayapara, 08 vi 1988, Mia, Huq & Mahfuz M. 1973 (DACB). **Dhaka:** Tejgaon, 24 ix 1942, Atul (DUH); Abul Ghani Road, 15 x 1963, A.F. Muhammed 18 (DUH); J. N. Hall Campus, 18 vi 1968, Paritosh 188 (DUH). **Dinajpur:** Ramsagor area, 11 x 1980, Huq, Rahman, Mia & Mahbuba H. 4715 (DACB). **Faridpur:** Gaohati on Magura-Faridpur road, 06 x 1976, Huq, Rahman & Mia H. 1965 (DACB). **Habiganj:** Kalenga Beat, Kalenga, 16 v 2005, Hosne Ara HA 1556 (DACB); Satchori, 17 v 2005, Hosne Ara HA 1604 (DACB). **Khulna:** Jamtala, Kotka, Sundarban, 17 ii 2002 (DACB), Sarder Nasir Uddin and Dr. Floris Deodatus N 1290 (DACB). **Mymensing:** Haluaghat thana, Koroitali, 20 vi 2004, Hosne Ara HA 904 (DACB). **Netrokona:** Utrail Bazar, Vabanipur, 18 vi 2004, Hosne Ara HA 844 (DACB). **Patuakhali:** Kolapara thana, Tangragiri, Khan, Huq, Rahman & Mia K. 5842 (DACB). **Rangpur:** Testa near Bridge, 04 xii 1985, Khan, Huq & Mia K. 7511 (DACB). **Sherpur:** Samaschura Beat, 10 x 2003, Hosne Ara 702 (DACB); Rangtia range, Gazni Beat, 21 vi 2004, Hosne Ara HA 948 (DACB). **Sunamganj:** Sunamganj, Maizbari, 12 x 1985, Khan, Huq & Mia K. 7130 (DACB). **Sylhet:** Sarighat-Jainta, 03 x 1983, Huq, Rahman, Mia & Mahbuba H. 6336 (DACB). **Tangail:** Dokhola, 06 x 2003, Hosne Ara HA 532 (DACB).

Note: *Ziziphus mauritiana* Lam. is often confused with *Z. jujuba* Mill. (*Z. vulgaris* Lam.). *Ziziphus mauritiana* differs from *Z. jujuba* by the leaves velvety tomentose beneath (not glabrescent pubescent) with flowering in August-September (not in May-June). In Bangladesh, *Z. jujuba* does not occur.

4. **Ziziphus oenoplia** (L.) Mill., Gard. Dict. ed. 8: 3 (1768). Roxb., Fl. Ind. 2: 360 (1824) *et* 1: 611 (1832); Lawson in Hook. f., Fl. Brit. Ind. 1: 634 (1875-reprint 1973); Kurz, For. Fl. Brit. Burma 1: 298 (1877); Prain, Beng. Pl. 1: 234 (1903-reprint 1963); Brandis, Ind. Trees: 170 (1906-reprint 1971); Heining, List Chittagong: 13 (1925); Kanjilal *et al.*, Fl. Assam 1: 280 (1934-reprint 1982); Datta and Mitra, Bull. Bot. Soc. Beng. 7(1&2): 36 (1953); Sinclair, Bull. Bot. Soc. Beng. 9(2): 89 (1955); Deb, Fl. Tripura State 1: 408 (1981); Alam, Pl. Taxon. Series, Bull. 5: 94 (1988); Bhandari and Bhansali in M.P. Nayar *et al.*, Fasc. Fl. Ind. 20: 103 (1990); Khan *et al.*, Bangladesh J. Plant Taxon. 1(1): 32 (1994); Rahman and Hassan, Bangladesh J. Plant Taxon. 2(1&2): 66 (1995); Rahman and Uddin, Bangladesh J. Plant Taxon 4(1): 27 (1997); Uddin *et al.*, Bangladesh J. Plant Taxon. 5(1): 29 (1998); Uddin and Rahman, Bangladesh J. Plant Taxon. 6(1): 49 (1999); Rashid *et al.*, Bangladesh J. Plant Taxon. 7(1): 51 (2000); Bhandari and Bhansali in N.P. Singh *et al.* (eds.), Fl. Ind. 5: 236

(2000); Khan and Huq, Bangladesh J. Plant Taxon. 8(1): 59 (2001); Rahman *et al.*, Bangladesh J. Plant Taxon. 8(1): 36 (2001). *Rhamnus oenoplia* L., Sp. Pl.: 194 (1753). **(Plate 4)**

Bangla names: Anor, Banboroi, Bankul, But boroi, Got-Boroi, Jonglikol, Makoh, Makhora, Shealkul, Shiakol, Shyakul.

English name: Jackal jujube.

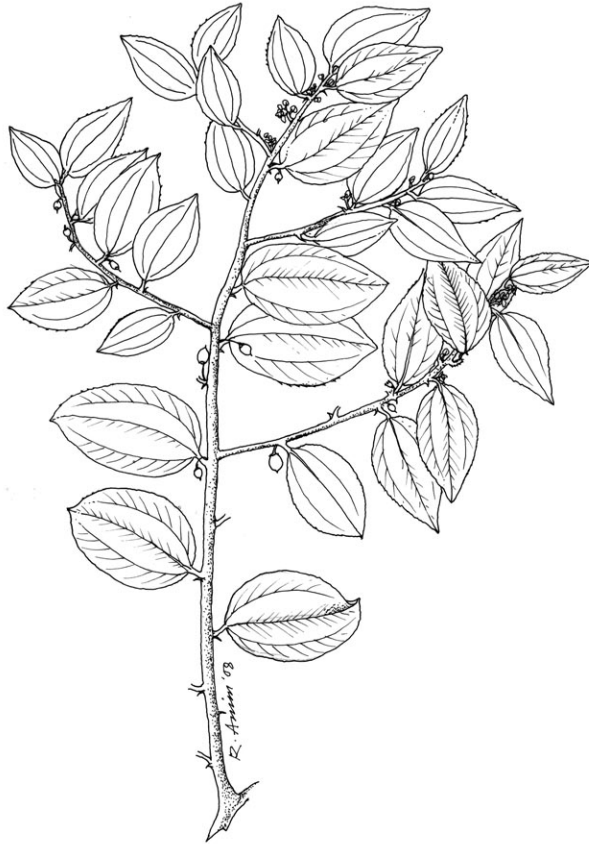


Plate 4. *Ziziphus oenoplia* (L.) Mill. Habit sketch ($\times 0.25$).

Erect, straggling or climbing shrub; branches fasciculate or not, often densely rusty tomentose; nodes slightly enlarged around the leaf scars. Leaves 1-8 \times 2-3 cm, alternate, obliquely ovate or elliptic, crenate or sub-entire, oblique at the base, subrounded, apex acute or acuminate, 3-4 nerved, softly pubescent above, softly pilose beneath; petioles 2-5 mm long, pubescent; stipular spines solitary, recurved. Inflorescence axillary shortly pedunculate cymes. Pedicels about 2 mm long, pilose. Calyx lobes 1.5-2 mm long, ovate-triangular, apex acute, glabrous inside, brownish, apparently hairy outside. Petals 0.8-1.0 mm long, spatulate, clawed, shorter than calyx. Stamens 0.7-0.9 mm long. Disc glabrous,

10-lobed; lobes opposite each calyx lobe, emarginate. Ovary globose, glabrous, 2-celled, immersed in disk; styles 2, united to above the middle; stigma obtuse. Drupe 5-7 × 5-6 mm, globose or ovoid-globose, small, base with persistent calyx tube, apex mucronulate, black and shining when ripe; fruiting pedicel 3-4 mm long, pilose. Seeds 1-2, 1 cm long, shiny, globose. *Fl. & Fr.*: August-January.

Chromosome number: $2n = 20, 24, 48$ (Kumar and Subramaniam 1986).

Ecology: Grows along the roadside forests and thickets.

Geographical distribution: India, Pakistan, Sri Lanka, Malesia and Australia.

Economic importance: The fruit is edible. The bark is used for tanning. The root possesses medicinal properties (Deb 1981).

Specimens examined: **Chittagong**: 03 x 1940, S.K. Sen, N.L. Pal & R. Khan (DUH); Baraiyadhala to Hazarikhil, 14 x 1978, Khan & Huq K. 5185 (DACB); Chunati, 26 ix 2005, Hosne Ara HA 2265 (DACB). **Chittagong Hill Tracts**: Chittagong Hill Tracts, 1876, J.L. Lister 63 (CAL); September 1885, Dr. King's Collector 122 (CAL); 1886, Dr. King's Collector 48 (CAL); October, 1887, Dr. King's Collector 598 (CAL); February 1940, Dr. S.K. Mukerjee 5 (CAL); Kaptai, Sitapahar east, 26 ii 1965, M. S. Khan 1188 (DUH). **Chuadanga**: Darshana, 13 xii 1988, Huq, Rahman & Mia H. 8915 (DACB). **Comilla**: Lalmai hills, Mainamati, 12 xi 1970, Khan & Huq K. 2161 (DACB). **Cox's Bazar**: Kelatuli, 30 xii 1944, James Sinclair 3877 (CAL); Chakoria, 02 xii 1999, Khan, Mia, Rashid & Islam K. 10186 (DACB). **Dhaka**: Tejgaon, 24 ix 1942, Atul (DUH); 13 x 1943, S. K. Sen (DUH); Kurmitolla, 13 xi 1963, Din Mohammad 102 (DUH); Gulshan area, 29 viii 1970, A.M. Huq 120 (DACB); Mirpur Botanical Garden, 15 xii 1979, Huq, Mia & Momtaz M. 216 (DACB). **Dinajpur**: Ramsagor, 11 x 1980, Huq, Rahman, Mia & Mahbuba H. 4717 (DACB); Singra forest, 18 vii 2005, Hosne Ara HA 2094. **Gazipur**: Joydebpur-Sripur, 22 x 1977, Khan, Huq & Rahman K. 4734 (DACB); Joydebpur Railway sides, 20 i 1987, M.K. Mia M 1358 (DACB). **Habiganj**: Kalenga Beat, Kalenga, 06 v 2003, Hosne Ara 295 (DACB); Satchori, 17 v 2005, Hosne Ara 1602 (DACB). **Khagrachhari**: Ramgarh, 31 xii 1985, Huq & Mia H. 7330 (DACB). **Kushtia**: Rajnagar to Amjhupi, 26 ix 1978, Khan & Huq K. 5075 (DACB). **Moulvi Bazar**: Lowachera forest, 19 i 1963, M.S. Khan 478 (DUH). **Mymensingh**: Mirzapur, 27 vi 1965, S. Shaha 65 (DUH); Majra Kura, Karaitala, sal forest, 24 v 1989, Mia, Huq & Rahman M. 2076 (DACB). **Nowabganj**: Nowabganj, 04 ix 2002, Rezia, Momtaz, Bushra & Harun R.K. 3875 (DACB). **Patuakhali**: Kolapara thana, Kuakata, 05 i 1980, Khan, Huq, Rahman & Mia K. 5965 (DACB). **Rajshahi**: Near Nawhati, 13 xii 1972, A.M. Huq 654 (DACB); Mohanpur, 18 xi 1988, Huq, Rezia, Mahfuz & Bushra H. 8763 (DACB). **Sherpur**: Samaschura beat, 10 x 2003, Hosne Ara HA 689 (DACB). **Sylhet**: July 1905, S. Abu Hussain 66 (CAL); Roadside, Asian highway through Satgaon forest, 31 xii 1966, P. Bhattacharjee 110 (DUH); Sylhet M.C. College Compound, 12 x 1973, Khan, Huq &

Hassan K. 3239 (DACB). **Tangail:** Dokhola, Madhupur forest, 06 x 2003, Hosne Ara HA. 533 (DACB).

5. ***Ziziphus rugosa*** Lam., *Encycl.* 3: 319 (1789). Lawson in Hook. f., *Fl. Brit. Ind.* 1: 636 (1875-reprint 1973); Kurz, *For. Fl. Brit. Burma* 1: 265 (1877); Prain, *Beng. Pl.* 1: 234 (1903-reprint 1963); Brandis, *Ind. Trees*: 171 (1906-reprint 1971); Heinig, *List Chittagong*: 13 (1925); Kanjilal *et al.*, *Fl. Assam*, 1: 281 (1934-reprint 1982); Qaiser and Nazimuddin, *Fl. Pakistan* 140: 11 (1981); Deb, *Fl. Tripura State* 1: 408 (1981); Alam, *Pl. Taxon. Series, Bull.* 5: 94 (1988); Bhandari and Bhansali in M.P. Nayar *et al.*, *Fasc. Fl. Ind.* 20: 108 (1990); Long and Rae, *Fl. Bhut.* 2(1): 140 (1991); Khan *et al.*, *Bangladesh J. Plant Taxon.* 1(1): 32 (1994); Rahman and Hassan, *Bangladesh J. Plant Taxon.* 2(1&2): 66 (1995); Bhandari and Bhansali in N.P. Singh *et al.*, *Fl. Ind.* 5: 240 (2000). *Z. latifolia* Roxb., *Fl. Ind.* 2: 355 (1824); ed 2, 1: 607 (1832). *Z. glabra* Roxb., *Fl. Ind.*, ed. 2, 1: 614 (1832); Heinig, *List Chittagong*: 13 (1925). (Plate 5)
Bangla names: Anai, Jangli boroi, Banboroi.

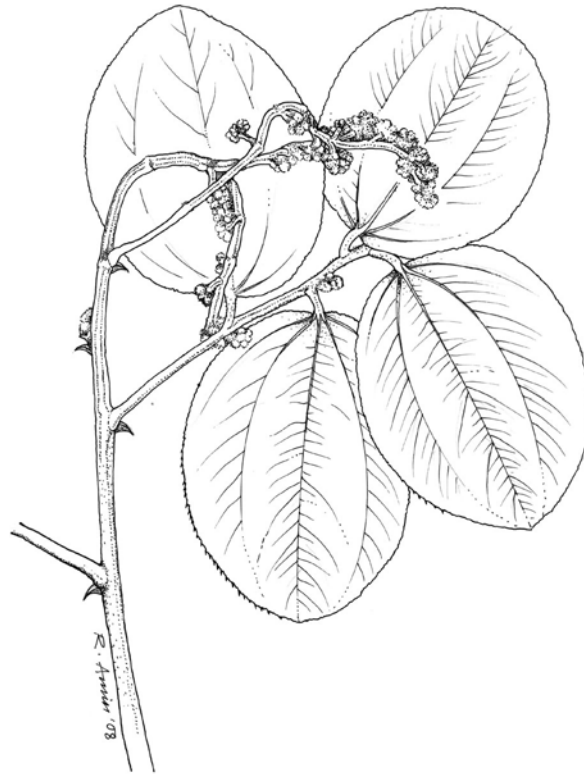


Plate 5. *Ziziphus rugosa* Lam. Habit sketch ($\times 0.27$).

Evergreen straggling shrub or small tree, 3-6 m tall, young branches rusty tomentose; bark dark grey or nearly black; spine 1, recurved, purple-red, 3-6 mm long. Leaves 5-14 × 3-8 cm, alternate, dark-green, broadly ovate or broadly elliptic, serrate, oblique or subcordate or rounded at the base, acute or bluntly apiculate, glabrous above, rusty tomentose beneath, basally 3-5 nerved; petioles 5-7 mm long, tomentose. Cymes on very long axillary or terminal rusty tomentose panicles. Flowers minute, pale green; pedicels 3-4 mm long, densely tomentose. Calyx lobes triangular, 1.5-2.5 mm long, tomentose outside. Petals absent. Stamens 1-2 mm long; anther lobes broadly ovate. Disc 5-lobed, glabrous. Ovary globose, immersed in the disc, 2-celled, villous or glabrous; style 2-lobed, divided to middle, curved. Drupes 6-12 × 8-10 mm, fleshy, obovoid-globose; fruiting pedicels 7-10 mm long, tomentose. Seeds 2, black. *Fl. & Fr.*: January-June.

Chromosome number: $2n = 24$ (Kumar and Subramaniam 1986).

Ecology: Grows in hill slope and top of the hill.

Geographical distribution: India, Pakistan, Laos, Myanmar, Sri Lanka, Thailand and Vietnam.

Economic importance: The wood of the tree is reddish in colour and moderately hard in quality. The wood is susceptible to insect attack. Main use of the wood is fuel. The fruits are consumed by people. The leaves are used as fodder. The bark is used as medicine in swelling in cheek and ulcer in mouth in powder form mixing with ghee (Bhandari and Bhansali 1990).

Specimens examined: **Chittagong Hill Tracts**: 1876, J.L. Lister (CAL); February, 1887, Dr. King's Collector 287, 369, 521 (CAL); Kaptai, Sita Pahar east, 26 ii 1965, M.S. Khan 1188 (DUH). **Dhaka**: Kurmitolla, 27 ii 1938, N.K. Chatterji & S.K. Sen (DUH); Ramna, 20 iii 1964, Din Mohammad 258 (DUH); Mirpur, 24 iii 1968, Paritosh 52 (DUH); Savar, 13 iv 1969, Panna 118 (DUH). **Dinajpur**: Singhra forest, 15 i 1974, Khan & Huq K. 3604 (DACB); 18 viii 2005, Hosne Ara HA 2092 (DACB). **Gazipur**: Salna forest, 24 i 1968, N. Begum 89 (DUH). **Habiganj**: Chunarughat, Chanbari beat, Chanbari, 02 iv 1997, A.M. Huq & A.I. H 10412 (DACB). **Mymensingh**: Rasulpur, 12 v 1983, Huq, Hassan & Islam H. 5718 (DACB); Madhupur forest; 28 ii 1987, Huq, Mia & Habib H. 8189 (DACB). **Sherpur**: Gazni forest area, 05 v 1982, Mia *et al.* M. 700b (DACB); 10 ii 1985, Khan Huq & Mia K. 7112 (DACB); Samaschura Beat, 10 x 2003, Hosne Ara HA 652 (DACB). **Sylhet**: Satgaon forest road side, 14 iv 1967, P. Bhattacharjee 240 (DUH).

6. **Ziziphus xylopyrus** (Retz.) Willd., Sp. Pl. 1: 1104 (1789). Lawson in Hook. f., Fl. Brit. Ind. 1: 634 (1875-reprint 1973); Prain, Beng. Pl. 234 (1903-reprint 1963); Brandis, Ind. Trees: 171 (1906-reprint 1971); Deb, Fl. Tripura State, 1: 409 (1981); Bhandari and Bhansali in M.P. Nayar *et al.*, Fasc. Fl. Ind. 20: 112 (1990); Bhandari

and Bhansali in N.P. Singh *et al.*, (eds.), Fl. Ind. 5: 243 (2000); Uddin *et al.*, Bangladesh J. Plant Taxon. 7(2): 77-79 (2000). *Rhamnus xylopyrus* Retz., Obs. B. 2: 11 (1781). *Zizyphus caracutta* Roxb., Fl. Ind., ed. 2, 1: 612 (1832). (Plate 6)

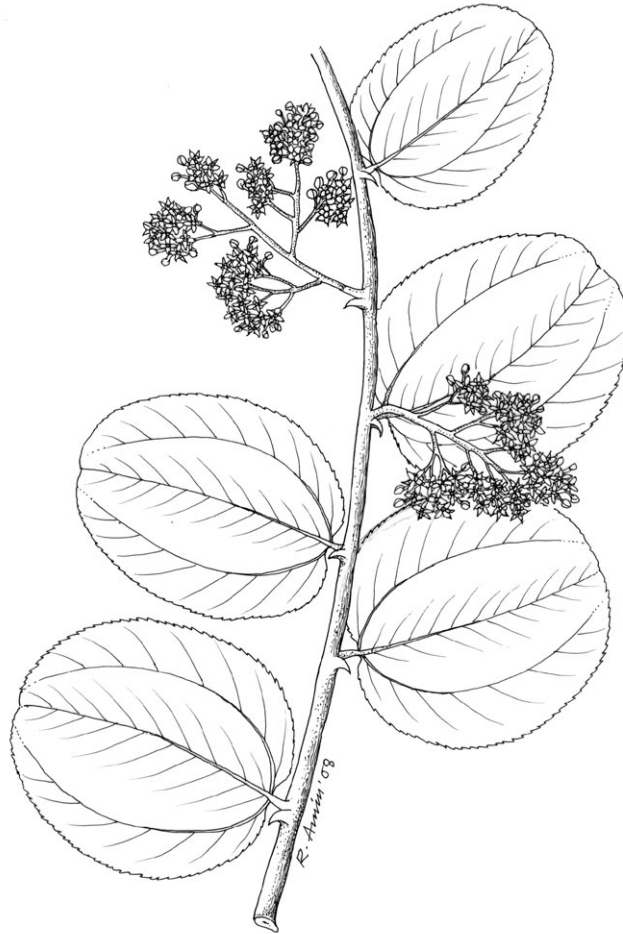


Plate 6. *Zizyphus xylopyrus* (Retz.) Willd. Habit sketch ($\times 0.39$).

Large, straggling shrub or small tree, 6-10 m tall; young shoots rusty tomentose, spines in pairs on younger branches, one straight, the other curved; nodes swollen at the leaf scars. Leaves 2.5-9.0 \times 1.5-8.0 cm, alternate, broadly elliptic or orbiculate, rarely ovate, crenate-serrate, rounded at apex, slightly oblique, subcordate at the base, 3-4 nerved; petioles 2-7 mm long, tomentose. Inflorescence axillary, dense, dichotomous cymes; peduncles up to 15 cm long, branched, reddish to yellowish tomentose. Flowers 4-6 mm across, yellowish green, buds ovoids, densely pubescent; pedicels 3-4 mm long, tomentose. Calyx lobes 2.0-2.5 mm long, keeled up to the middle, glabrous inside, pubescent outside. Petals 1.5-2 mm long, obovate. Stamens 5, equal to petals. Disc 10-

lobed, rarely 5-lobed, glabrous. Ovary globose, glabrous, 3-celled, 1×1 mm; styles 2-3, 2 mm long, hairy; stigma papillate. Drupes globose, about 2×1 cm, white when ripe. Seeds 3, $1-2 \times 1.0-1.5$ mm, black. *Fl. & Fr.*: March-January.

Chromosome number: $2n = 24$ (Kumar and Subramaniam 1986).

Ecology: Grows in deciduous forests.

Geographical distribution: India, Nepal and Sri Lanka.

Economic importance: The wood of the tree is yellowish-brown in colour, hard and durable in quality. It is mainly used as fuel. The fruits and bark are used in tanning. The leaves are used as fodder. The kernel, not the pulp, of the fruit is consumed by people (Bhandari and Bhansali 1990).

Specimens examined: **Habiganj**: Chunarughat thana, Kalenga Forest Range, Kalenga Beat area, 07 iv 2000, Zashim 756 (DUH); 06 v 2003, Hosne Ara HA 293 (DACB).

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