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## Short Communication

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# New distribution records of four species of crop wild relatives to India

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**Abstract:** A field survey across various parts of India coupled with an analysis of the literature and an examination of herbarium specimens revealed the presence of four species of crop wild relatives that have not been reported from India, viz., *Dioscorea piscatorum* Prain & Burkill (from Little & Great Nicobar), *Fagopyrum gracilipes* (Hemsl.) Dammer ex Diels (from Arunachal Pradesh), *Rubus praecox* Bertol. (from Jammu & Kashmir), and *Ziziphus subquinquenervia* Miq. (from Great Nicobar). While *Rubus praecox* is naturalised in the Kashmir Valley, *Dioscorea piscatorum* and *Ziziphus subquinquenervia* were found truly wild, and *Fagopyrum gracilipes* occurs as a weed in buckwheat fields and orchards. *Ziziphus subquinquenervia* has been resurrected from the allied *Z. elegans* Wall. of peninsular Malaysia and Singapore owing to the distinct diagnostic characters. Their description, phenology, habitat, and other field observations have been highlighted here.

**Keywords:** Crop wild relatives, *Dioscorea piscatorum*, *Fagopyrum gracilipes*, India, new distribution, *Rubus praecox*, *Ziziphus subquinquenervia*.

During field surveys on plant genetic resources in various remote pockets of India in the past two years, the authors observed the natural distribution of a four species of crop wild relatives, viz., *Dioscorea piscatorum* Prain & Burkill, *Fagopyrum gracilipes* (Hemsl.) Dammer ex Diels, *Rubus praecox* Bertol. and *Ziziphus subquinquenervia* Miq., which have not been reported in Indian floras and allied literature (Kaul 1986; Naithani 1990; Bhandari & Bhansali 2000; Khuroo et al. 2007; Chowdhery et al. 2008; Pradheep et al. 2014; Murugan et al. 2016; Dash & Singh 2017). These plants were studied critically in their natural habitat as well as in the herbaria of London (BM), Edinburgh (E), Kew (K), Leiden (L), Paris (P), and Beijing (PE) including the type specimens and verified with all possible online sources. Germplasm collections of *Dioscorea piscatorum* and *Fagopyrum gracilipes* are being conserved at ICAR-National Bureau of Plant Genetic Resources (ICAR-NBPGR), Thrissur/New Delhi, while herbarium vouchers of all the species are deposited in the National Herbarium of Cultivated Plants (NHCP)

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at ICAR-NBPGR, New Delhi. Distribution-related studies in crop wild relatives not only help in understanding the ecogeography of the species in question, but also serve as a source of germplasm for crop improvement (Pradheep et al. 2011, 2017), which otherwise is to be introduced from adjoining countries under conditions involved in material transfer agreement.

**1. *Dioscorea piscatorum* Prain & Burkill**

Gard. Bull. Str. Settlem. 3: 123. 1924. H.N.Ridley, Fl. Mal. Penins. 4: 319. 1924. Van Steenis, Fl. Males. Ser. 1, 4: 310. 1951. *D. borneensis* R.Knuth in H.G.A.Engler (ed.), Pflanzen., IV, 43: 188. 1924. *D.* sp. Prain & Burkill, J. Roy. Asiat. Soc. Beng. 73: 186. 1904. H.N.Ridley, Mat. Fl. Mal. Penins., Monoc. 2: 84. 1907. [Dioscoreaceae]. (Fig. 1, Images 1 & 4).

Perennial climber. Tubers branched, robust, weigh 12–15 kg, conspicuously spiny throughout, arising from stem base just below soil surface and seated horizontally; juvenile tubers often emerge out of soil, skin brownish-yellow with short fleshy roots, which later become indurated spines; older tubers' spines 2.5–3.0 cm long, skin dark brown, flesh diluted red, fibrous, venenose. Arial parts glabrous; stem 10m or more tall, c. 1cm diameter at base with flat triangular brown prickles (0.6cm wide at base) arranged uninterruptedly in four or five longitudinal rows which get scattered upwards; young twigs twining to left, less prickly. Leaves alternate, glabrous, chartaceous, deeply broad-cordate, conspicuously large, 16–20 x 20–24 cm, basal sinus 1.5–-2 cm deep, nerves nine, abaxially elevated, transverse nervules prominent and numerous; young leaves cordate-acuminate, hairy beneath along nerves which disappear later; petioles 10–13 cm long with scattered small prickles on the back.

Distribution & Habitat: Indonesia (Sumatra,

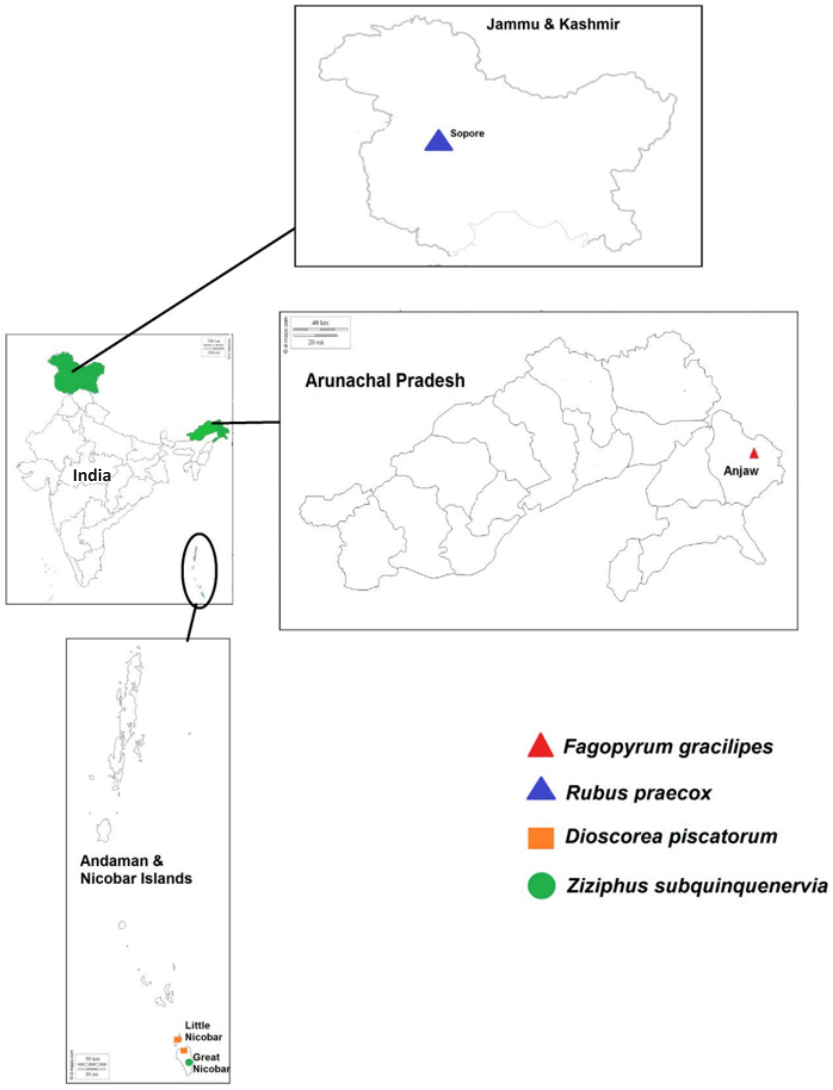


**Figure 1. Distribution of *Dioscorea piscatorum*, *Fagopyrum gracilipes*, *Rubus praecox*, and *Ziziphus subquinquenervia* in India**

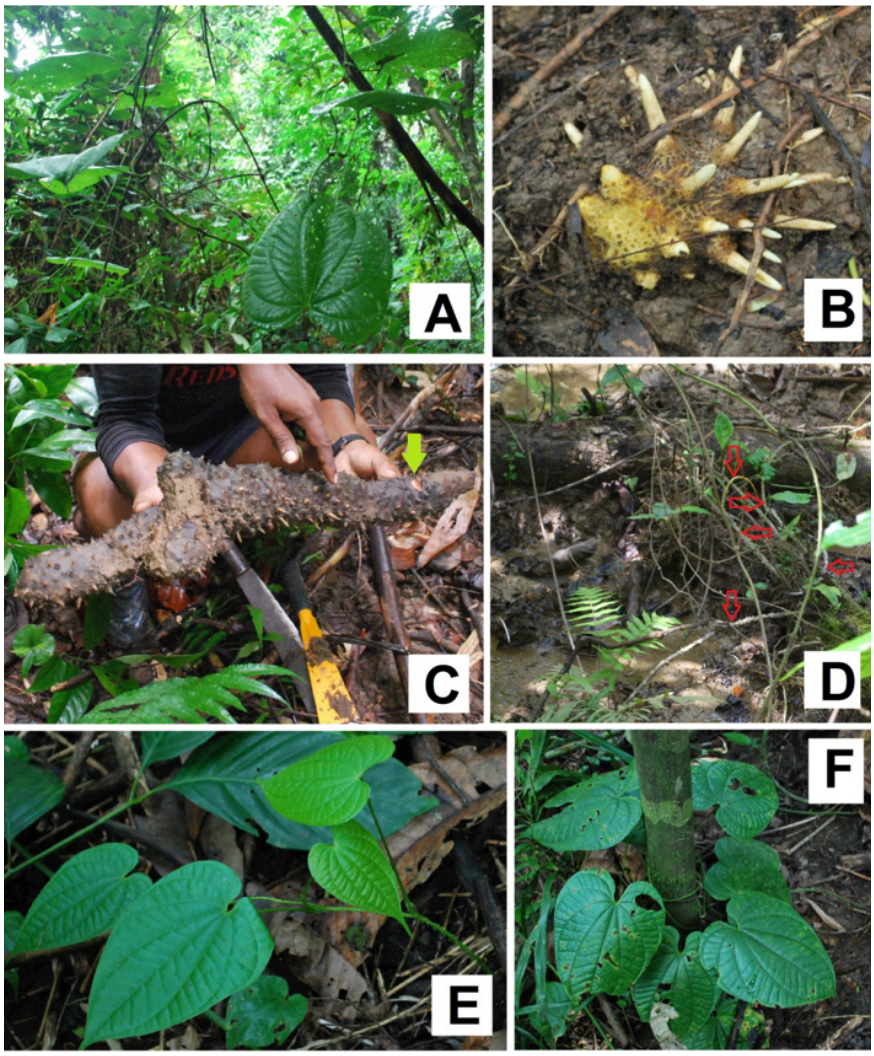


**Image 1. *Dioscorea piscatorum*: A - Habit in forest; B - Young tuber; C - Aged tuber with spines (arrow mark showing diluted red flesh); D - Basal stems (marked) and their swampy habitat; E - Young plant; F - Grown-up plant. © K. Pradheep**

Kalimantan), Malaysia (Peninsular Malaysia, Sabah, Sarawak), India (Little & Great Nicobar in Andaman & Nicobar Islands). Lowland forest, near *Areca*/*Myristica* swamps, 10–50 m.

Specimen examined: 2751, 22.i.2018, Pulopanja, Little Nicobar, Andaman & Nicobar Islands, 7.35$^0$N & 93.74$^0$E, 48m, coll. K. Pradheep, K. Joseph John & I. Jaisankar [NHCP23104]; live collections JPJ/18-70 & JPJ/18-72 conserved at Field Genebank of ICAR-NBPGR, Regional Station, Thrissur.

Notes: Along with three other species (*D. flabellifolia* Prain & Burkill, *D. kjellbergii* R.Knuth, and *D. petelotii* Prain & Burkill), this typical spiny yam was grouped in sect. *Paramecocarpa* Prain & Burkill which accommodates species with left twining stem, pedicelled flowers with tepals borne on a broadened infundibular torus, longer capsules and winged seeds. Discovery of its occurrence in Little & Great Nicobar led to the finding of range extension for the section as well, which is otherwise restricted from Indochina to Palau Islands. Authors could only find about 20 plants of this curious species in two localities in Little Nicobar—Pulopanja (15 plants; 4 in wild, remaining under semi-cultivation) and Pulobhao (3 in wild); and one locality in Great Nicobar—Afra Bay (2 in wild). In wild, it co-occurs with *Dinochloa nicobariana* R.B.Majumdar, *Aglaonema simplex* Blume, *Horsfieldia glabra* (Blume) Warb., *Korthalsia* spp., *Cinnamomum bejolghota* (Buch.-Ham.) Sweet, *Chydenanthus excelsus* Miers, and *Alocasia macrorrhizos* (L.) G.Don. Recently, authors further observed its distribution from Katchal and Teressa islands in central Nicobar.

Roots arising on the surface of the tuber get modified as broad-based sharp spines; thus wears armour against predating wild boars. Known in English as ‘Fish-poison yam’, Nicobarees call it ‘okavu’, and excavate the young tubers from the wild for edible use. The flesh colour

of young tubers is creamy yellow when cut; thereafter turns pinkish-red. The de-skinned tubers are first cut into small pieces and boiled in water twice or three times and drained to remove bitter/poisonous substances, then consumed with fish or roasted. During monsoon, it forms an important article of food owing to disruptive transport and food supply system in Little Nicobar. Nicobarees protect this species in the wild and cultivate it in their cleared uplands. They dig up small pits in the cleared uplands, and put pieces of matured tuber as planting material and cover with soil. Burkill (1935) also mentioned its edible use after roasting by the Sahai in Malaya. Tubers are variously called and used across the regions of distribution – 'tuba ubi' in Sumatra (Indonesia) and peninsular Malaysia, and used as a piscicide; 'tuba gunjo' by Bataks of Tapanuli (Indonesia), and used as biopesticide against rice pests; 'tubah podeh gantung' in Borneo (PlantUse English contributors 2016).

**2. *Fagopyrum gracilipes* (Hemsl.) Dammer ex Diels**

Bot. Jahrb. Syst. 29: 315. 1900. Li Anjen & Suk-pyo Hong, Fl. China 5: 322. 2003. *Polygonum gracilipes* Hemsl., J. Linn. Soc., Bot. 26: 340. 1891. [Polygonaceae]. (Fig. 1, Images 2 & 5).

Herbs annual, with or without pigmentation. Stems sprawling or erect, 25–45 cm tall, branched profusely at base, striate, sparsely short-strigose. Leaves petiolate, petiole 0.7–1.1 cm, short-strigose; leaf blade ovate-triangular, 2.4–3.3 × 1.8–2.5 cm, sparsely short-strigose adaxially and abaxially, cordate to hastate at base, long-acuminate at apex; ochrea 4.5–5 mm, membranous, pubescent. Inflorescence axillary, racemose, long-interrupted, suberect, very lax, slender, peduncles 3–5 cm long; bracts green or pale pink, funnel-shaped, each 2- or 3-flowered; flowers white or pale pink, 3mm across. Pedicels longer than bracts, slender. Perianth pinkish, tepals elliptic, unequal, c. 2mm. Stamens included. Stigmas capitate. Achenes exceeding persistent perianth, greyish, shiny, sticky, broadly ovoid, ca. 3mm, sharply trigonous.

Flowering & Fruiting: June–October & July–Nov.

Distribution & Habitat: China (southern Gansu,

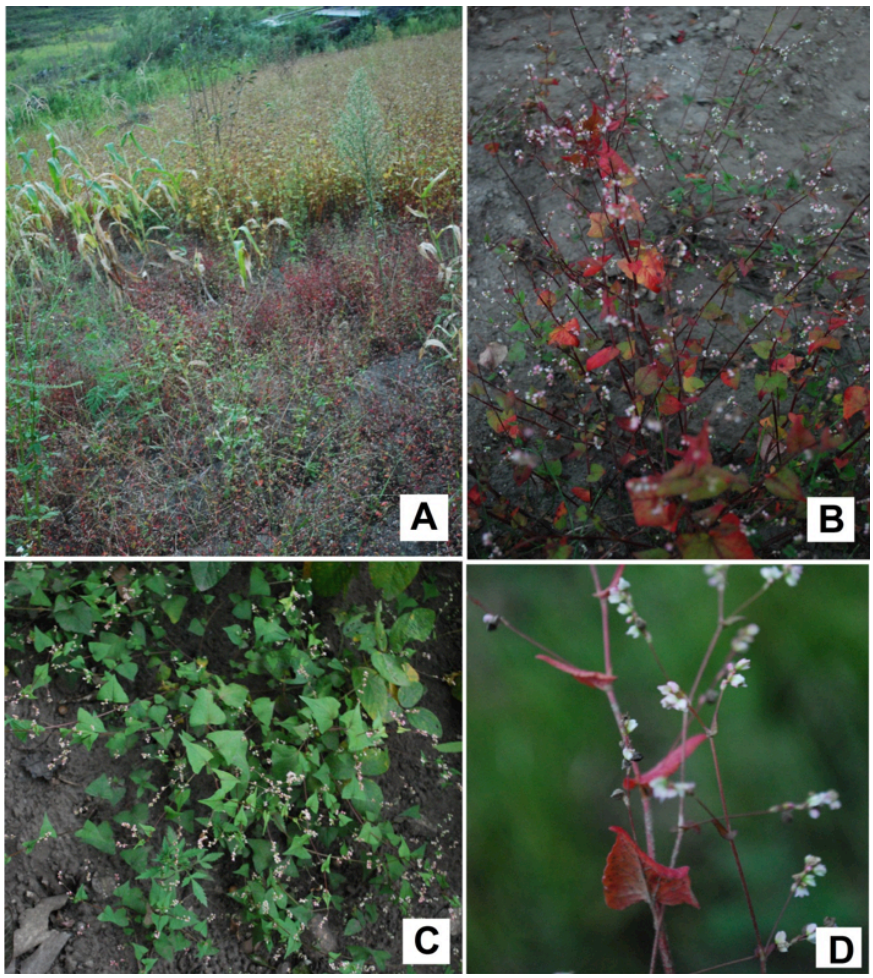


**Image 2. *Fagopyrum gracilipes*: A - As weed in a buckwheat field at Sapkum village; B - Population with pigmented plants; C - Population with unpigmented plants; D - Close-up of flowering shoot. © K. Pradheep**

Guizhou, Henan, Hubei, Shaanxi, Sichuan, Xizang (Tsuji et al. 1999), Yunnan); Bhutan (Ohnishi 1992; Parker 1992); India (Arunachal Pradesh (now)). Found as a locally abundant weed in upland fields of buckwheat crops and orchards from 1100–1500 m. Its weediness, aided through sticky nature of seeds, might have contributed to the fast dispersal adjacent to its native range.

Specimen examined: 2366, 22.x.2016, Sapkum, Anjaw District, Arunachal Pradesh, India, 28.16$^0$N & 97.04$^0$E, 1,187m, coll. K. Pradheep, G.D. Harish & K. Naveen [NHCP22855]; live collection PHN-2320 (IC622179) conserved at National Genebank of ICAR-NBPGR, New Delhi.

Notes: At Sapkum, it is known as 'therthek', and the local tribals informed that they use its leaves as vegetable. Further they informed that it is quite common in other villages of the Walong block, which lies adjacent to China (Tibet)/Myanmar border. We found both the pigmented and non pigmented plant forms co-occurring in the same field. This species is reported to be a homostylous, tetraploid, self-fertilizing with 2n=4x=32 (Yang et al. 2010). It is closely related to the diploid outcrossing species *F. capillatum* Ohnishi, and only distantly related to the cultivated species, *F. esculentum* Moench and *F. tataricum* (L.) Gaertn.

### 3. *Rubus praecox* Bertol.

Fl. ital. [Bertolini] 5: 220. 1842. Weihe ex H. G. L. Reichenbach, Fl. Germ. Excurs. 2: 600. 1832. *R. procerus* P.J.Müll. ex Boulay, Ronces vosg. 1: 7. 1864. *R. macrostemon* Focke, Syn. Rub. Germ. 193. 1877. *R. anglocandicans* A.Newton, Watsonia 11(3): 243. 1977. [Rosaceae]. (Fig. 1, Images 3 A,B & 6).

Robust semievergreen straggler, 3–4 m tall, with long arching stems up to 6m long. Stems biennial, twings c. 1cm in diameter, angled, channelled, glabrescent to glabrous, prickles curved, retrorse, moderately dense. Leaves alternate, 7–13 x 8–15 cm, leaflets five in primocanes, and 3(-5) in floricanes, ± elliptic, apex acute to short acuminate, terminal leaflet larger, 6–7 x 5–5.5 cm, adaxially green, smooth, abaxially grey-green, woolly beneath with hooked prickles on the largest vein, margin coarsely serrate-laciniate; petiole 5cm long, stipules linear, c. 7mm long. Infructescence terminal, sometimes also axillary, medium-sized, more compact, 5–10 fruited, densely hairy, prickles almost curved. Fruits black, smooth, globose to subcyclindric, 1–1.5 cm, drupelets 15–20, strongly coherent, separating with the torus attached.

Flowering & Fruiting: Flowering during April-May, fruiting during July–August.

Distribution & Habitat: Native to Europe (Ukraine, Austria, Belgium, Germany, Hungary, The Netherlands, Switzerland, Bulgaria, Italy, Romania, France, Portugal, and Spain) (USDA, Agricultural Research Service, National Plant Germplasm System 2018), naturalised and became serious weed in Australia (Evans & Weber 2003), Chile (Rejmánek 2015), Luxembourg (Helminger 2009), and Oregon (USA) (Bruckart et al. 2017); India (Jammu & Kashmir (Kashmir Valley)). Its actual distribution was marred by misidentification and lumping with the closely related species. It was found occasionally in roadside thickets from Bandipora to Kupwara with another *Rubus* species, *R. ulmifolius* Schott.

Specimen examined: 2598, 16.vii.2017, Sopore, Baramulla district, Jammu & Kashmir, India, 34.29$^0$N & 74.46$^0$E, 1,580m, coll. K. Pradheep & Sheikh M. Sultan [NHCP23028].

Notes: Although popularly known as 'Himalayan giant blackberry' or 'Himalayan blackberry', there is no evidence to show that this clonal species is native to the Himalayan region. *Rubus praecox* is very closely related to or often confused or lumped with *R. armeniacus* Focke; however notably different by the smaller terminal leaflet and petals, narrow-elliptic to elliptic leaflets (vs larger, broad-elliptic to rotund), mostly with curved prickles (vs. mostly with straight) in inflorescence axis, and moderate sized more compact inflorescence (vs large and loose) (Trávníček & Zázvorka 2005; Bruckart et al. 2017). The authors observed moderate laciniations in leaf margin in the Kashmir-naturalised species, while *R. armeniacus* has only serrulate to double serrate leaf margin. Ahmad et al. (2016) listed *R. armeniacus* in Kandi Forest Range in the Kamraj Forest Division of Kashmir, without any herbarium details.

*Rubus discolor* Weihe & Nees (kept under *R. fruticosus* L. by J.D. Hooker in Fl. Brit. India 2: 337. 1878), is currently recognised as the synonym of *R. ulmifolius*; the latter is a predominant weedy species occurring throughout the Kashmir Valley and flowers from June to September. *Rubus praecox* is easily distinguished from it by the absence of a pruinose stem, stems with large thorns, 5-leaflets in primocanes (vs. mostly 3) and whitish petal colour (vs. pink). Both the species are kept under sect. *Rubus*, which comprises closely allied blackberry (*R. fruticosus* L. agg.), hence useful in crop improvement programmes.

### 4. *Ziziphus subquinquenervia* Miq.

Fl. Ind. Bat., Suppl. 330. 1861. *Z. elegans* auct. non Wall.: King p.p. in J. Roy. Asiat. Soc. Beng. 65(3): 374. 1896. [Rhamnaceae]. (Fig. 1, Images 3 C,D,E & 7).

Scandent armed shrub, up to 5m tall. Main branches yellowish-brown; young twigs slender, softly brown tomentose, later becoming ashy nigrescent. Leaves bifarious, subcoriaceous, broad ovate, 6.8–7.3 x 4.1–-4.3 cm, apiculate, base oblique, sub-cordate, margin serrulate-crenulate, upper surface glabrous, lower surface brown-pubescent, especially along nerves; main longitudinal nerves three, running through central areas, leaving large width between lateral nerves and margin; lateral nerves 5(–7), prominent, arcuate, almost reaching the margin, the lower one originates at the point of origin of main nerves; petioles brown-tomentose, 0.5–0.6 cm long. Fruits pedicel brown-tomentose, 3.0–3.5 mm long, arising from subsessile peduncle (c.2 mm long); drupe obovoid, not compressed, 9.5–11 x 8.3–9.2 mm, base with conspicuous calyx ring scar, dark red upon ripening, endocarp leathery, pulp very thin, whitish; pyrene ovoid, c. 8.5 x 7.5 mm, reddish-brown.

Flowering & Fruiting: Flowering from October–December, fruiting from December–February.

Distribution: Indonesia (Sumatra), India (Great Nicobar).

Specimen examined: 2750, 19.i.2018, 13km from Campbell Bay in East-West Road, Great Nicobar, Andaman & Nicobar Islands, India, 6.99$^0$N & 93.86$^0$E, 133m, coll. K. Pradheep, K. Joseph John & I. Jaisankar [NHCP23103].

Notes: Dagar & Singh (1999) in their enumeration of the plant wealth of the Andaman & Nicobar Islands mentioned its occurrence in Central Nicobar Islands, without any herbarium details. We found only five plants (4-adult, 1-juvenile) of this extremely rare species within a four kilometer-stretch in the East-West Road connecting Campbell Bay to Koppenheat. Commonly associated species include *Piper miniatum* Blume, *Ziziphus horsfiedii* Miq., *Fagraea racemosa* Jack, *Alocasia macrorrhizos* (L.) G.Don, and *Amischotolype* sp.

Earlier, this Sumatran species was placed under the peninsular Malayan species *Z. elegans* Wall. by King (1896), since then it was left unnoticed in literature during the 20$^{th}$ Century (e.g., Laumonier 1997), probably because the treatment of the family Rhamnaceae in the Flora Malesiana is yet to be published. Our specimen exactly matches the type specimen (U0005768) of

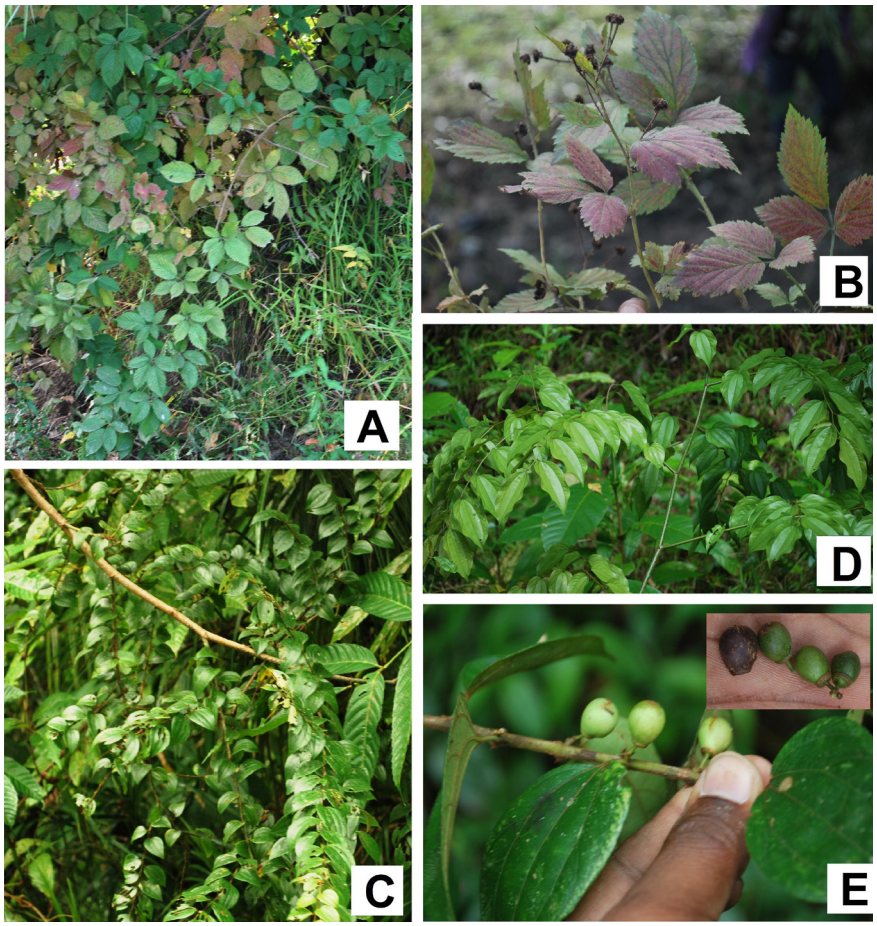


**Image 3. *Rubus praecox***
**A - Habit; B - Floricane shoot.**
***Ziziphus subquinquenervia***
**C - Habit; D - Young sapling; E - Twig with fruit (inset: unripe and ripe fruits).**
**© K. Pradheep**

**Table 1. Comparative morphological traits of two allied *Ziziphus* species from Southeast Asia**

| | Characters | *Z. subquinquenervia* | *Z. elegans* |
|---|---|---|---|
| 1. | Twig nature | Armed with small recurved spines in almost every node | Nearly unarmed |
| 2. | Leaf shape | (Broad-)ovate | Lanceolate |
| 3. | Leaf apex | Apiculate | Long tail-like tip (retuse) |
| 4. | Leaf longitudinal (main) nerves | Running through central areas | Distanced equally between and from margin |
| 5. | Leaf transverse nerves (from lateral longitudinal nerves) | Prominent, 5–7 in number | Insignificant |
| 6. | Drupe nature | Obovoid, not compressed | Sub-globular, compressed |

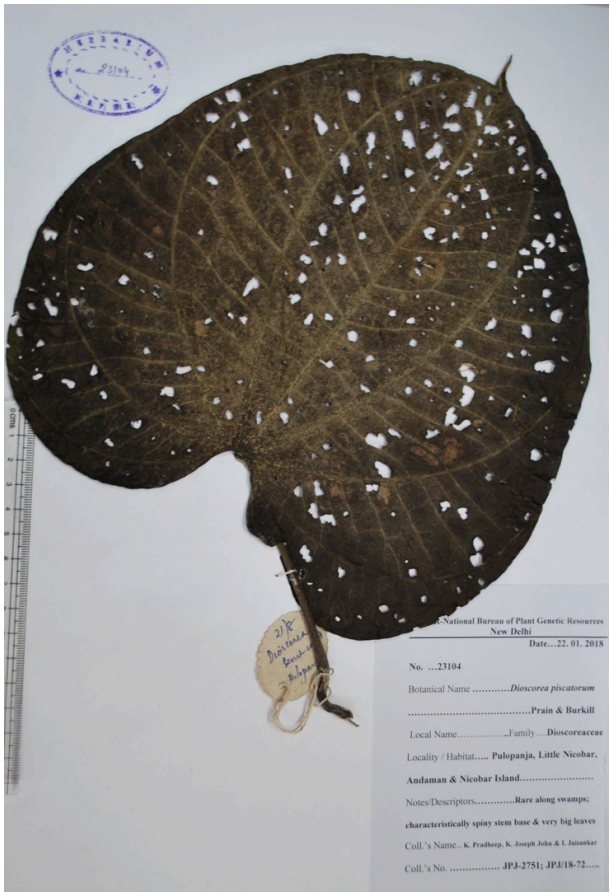


**Image 4. Herbarium of *Dioscorea piscatorum* deposited in NHCP, New Delhi. © NHCP, ICAR-NBPGR**

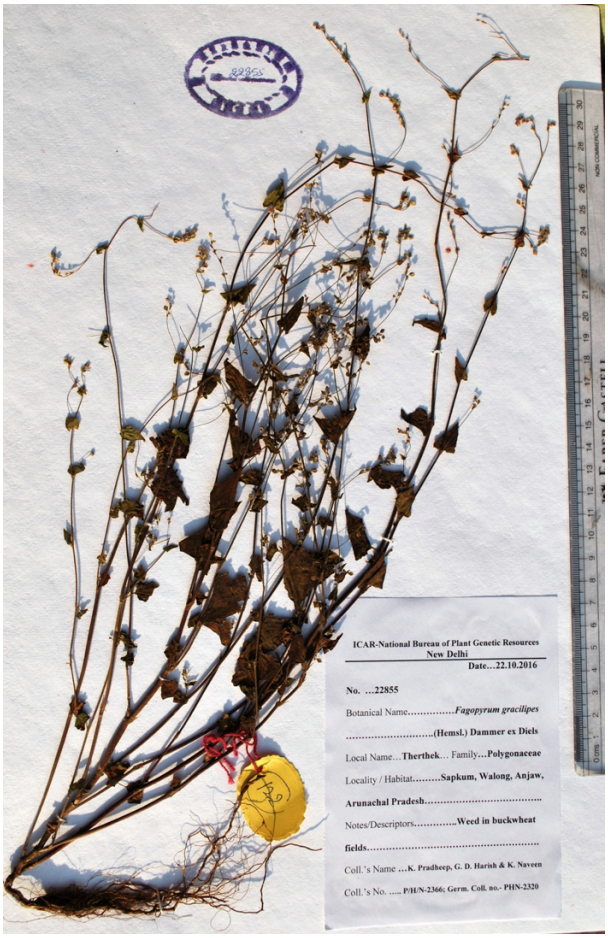


**Image 5. Herbarium of *Fagopyrum gracilipes* deposited in NHCP, New Delhi. © NHCP, ICAR-NBPGR**

*Z. subquinquenervia* housed at Leiden Herbarium (Naturalis Biodiversity Center 2018). This good species is resurrected here, based on the characters that distinguish it from *Z. elegans* (Table 1). King (1896) mentioned that the cyme of *Z. elegans* was dichotomous in nature, with 20–30 flowers. Although authors have not noticed inflorescence, examination of infructescence indicated simple axillary cyme with a possibility of not more than 4 or 5 flowers. Global Biodiversity Information Facility (GBIF Secretariat 2018) has many specimens kept under *Z. elegans*, of which only two (P06791814, P06791813; both from the Paris herbarium) are identical with the type [*Wallich* Cat. No. 4233 (K001038450) at Kew], while others represent different species.


Image 6. Herbarium of *Rubus praecox* deposited in NHCP, New Delhi. © NHCP, ICAR-NBPGR


Image 7. Herbarium of *Ziziphus subquinquenervia* deposited in NHCP, New Delhi. © NHCP, ICAR-NBPGR

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