

A Natural Population of *Ficus elastica* Roxb. ex Hornem., in Thailand

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ABSTRACT:- *Ficus elastica* Roxb. ex Hornem. (Indian rubber tree) was previously reported to be distributed in Eastern Himalaya, Khasi hill, Assam, Myanmar and to be absent from Thailand and Malaysia. Whereas in Thailand, it has been recognized as exotic species for many years until the collaborative researcher's team of Natural History Museum of National Science Museum, Thailand and Thungyai Naresuan East Wildlife Sanctuary found a species similar to *F. elastica*, abundant in the deep jungle of Umphang (district). Samples were collected and carefully studied by comparing with type specimens. The results to confirm that the specimens belongs to *F. elastica*. Thus, the species is now claimed to be domestic of Thailand. This is the first report since long of a wild growing population of *F. elastica* showing that the species is not extinct in the wild. Combined with renewed collection of its pollinator in Java, and the colonization by the pollinator of planted trees in Singapore, this suggests that *F. elastica* may still present fertile populations in large parts of its original range.

INTRODUCTION

The name *Ficus elastica* first appeared in Hortus Bengalensis by William Roxburgh (1814) but without description. Five years later Hornemann (1819) published the description under the same name. The species was first reported from a locality named “Garrow Hills” of India by Roxburgh (1814), most probably the Garo Hills in Meghalaya of India today. King (1888) reported the species to be present in Eastern Himalaya, Khasi hill, Assam, Myanmar and the Malayan region. Berg *et al.* (2011) wrote “the natural range of distribution is uncertain; the species is certainly natural in the

foothills of the Himalayas and may be natural in Perak (Malaysia), Sumatra and Java as well. However, fertile specimens with figs containing wasp galls and/or seeds are generally lacking in herbaria and the species has been widely planted throughout Asia”. A pollinating agaonid wasp was collected in the figs of *F. elastica* in the Bogor botanical garden in Java and was described by Mayr (1885) under the name *Blastophaga claviger*, suggesting that *F. elastica* is native to Java. Pollinators of *F. elastica* recently colonized Singapore and their continued presence in Java was documented (Harrison and Rasplus 2014).

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According to Corner (1978) “Certainly *F. elastica* does not occur in the general lowland forest of Malaya and Sumatra, and there are no records of wild trees from Thailand and Indochina. Sukhawattana (1981, in Thai) reported that the species was introduced as an ornamental more than 100 years ago. The first person who introduced this plant remain unclear, but evidence suggests that the first plant was cultivated in the garden of Dr. Thomas Heyward Hays (an American doctor), Silom road, Bangkok, thus suggesting that Dr. Hays was the first person to introduce this species to Thailand. The absence of herbarium specimens of wild growing *F. elastica* from Thailand led to the hypothesis of a disjoint distribution avoiding Thailand. Further, Corner (1985) reported that *F. elastica* “is now so rare in the wild state that there have been no records of it in recent years.” In 2015, a team from the Museum of Natural History of the National Science Museum, Thailand undertook a survey of the flora of the deep jungle of Thung Yai Naresuan East Wildlife Sanctuary, Umphang district. We report here on the discovery by the team of a *F. elastica* population, abundant in natural habitat of dry evergreen forest, on limestone, at an elevation 800-1150 m. Four herbarium collections were made for detailed taxonomic study. Seedlings and saplings were also found developing as epiphytes on other tree species, suggesting effective reproduction of the *Ficus* species in the area.

MATERIALS AND METHODS

The sanctuary patrol road leading from Beki forest station to Thung Nanoi forest station and then Huy Nam Kaew forest station was adopted as a transect line, with a total length of 37 km. All *Indian rubber tree* presenting a DBH of more than 50 cm observed along both sides of the line within a distance of 40 m perpendicular from transect line were recorded. Forest type where specimens were

found was also recorded, GPS coordinates were taken for each plant. Excicata (leafy twig with fruits) were collected for herbarium purpose. Telescope was used to search for seedling and sapling developing as epiphytes on other trees. Morphology of the plant was studied and later described. Species identification followed Berg *et al.* (2011) and Berg and Corner (2005). The specimens were compared to type specimens as well as to other specimens stored in the herbaria of Kew (K), Leiden (L), and Paris (P). The density of the trees was also calculated.

RESULT

Taxonomic study

The collected specimens fitted the description of *F. elastica* and agreed with the examined reference herbarium samples. We complement here the description by Berg and Corner (2005) by adding the description of the flowers.

Ficus elastica Roxb. [Hort. Bengal.: 65. 1814, nom. nud.] ex Hornem., Hort. Bot. Hafn. Suppl.: 7. 1819; Link, Enum. Hort. Berol. 2: 448. 1822; Blume, Bijdr.: 446. 1825; Roxb., Fl. Ind. Ed. 3: 541. 1832; Wight, Icon. Pl. Ind. Orient. 2: t. 663. 1843; Kunth, Ann. Sci. Nat. Bot., Sér. 3, 7: 233. 1847; Griff., Icon. Pl. Asiat. 4: t. 552. 1854; Miq., Ann. Mus. Bot. Lugd.-Bat. 3: 265, 287. 1867; Kurz, Forest Fl. Burma 2: 444. 1877; King, Ann. Roy. Bot. Gard. (Calcutta) 1(1): 45, t. 54. 1887; Ridl., Fl. Malay Penins. 3: 334. 1924; Gagnep. in Lecomte, Fl. Indo-Chine 5: 777. 1928; Kochummen, Tree Fl. Malaya 3: 146. 1978; C.C. Berg & Corner, Fl. Males., Ser. 1, 17(2): 691. 2005. –*Visiania elastica* (Roxb. ex Hornem.) Gasp., Giorn. Bot. Ital. 2: 216. 1844. –*Macrophthalmia elastica* (Roxb. ex Hornem.) Gasp., Rendiconti Reale Accad. Sci. Fis. 25: 83. 1845. –*Urostigma elasticum* (Roxb. ex Hornem.) Miq.,

- London J. Bot. 6: 578. 1847. – *Stilpnophyllum elasticum* (Roxb. ex Hornem.) Drury, Handb. Ind. Fl. 3: 225. 1869. – TYPE: India, Garrow hill, Smith (not found yet)
- Ficus elastica* Roxb. ex Hornem. var. *bengalica* Blume, Bijdr. 446. 1471. – TYPE: Indonesia, Java, Blume s.n. (Holotype: L)
- Ficus taeda* Kunth and C.D. Bouché, Ind. Sem. Hort. Berol. 14: 1846. 1847. Nom. Inval. In synon.
- Ficus cordata* Kunth and C.D. Bouché, Ind. Sem. Hort. Berol. 14: 1846. 1847. Nom. Inval. In synon., non Thunb. 1786.
- Urostigma elasticum* (Roxb. ex Hornem.) Miq. var. *latifolium* Miq., London J. Bot. 6: 578. 1847. – TYPE: Assam, Hooker s.n. (Not found yet)
- Urostigma odoratum* Miq., Pl. Jungh. 49. 1851; Fl. Ind. Bat. 1,2: 348, t. 24B. 1859. – *Ficus elastica* Roxb. ex Hornem. var. *odorata* (Miq.) Miq., Ann. Mus. Bot. Lugd.-Bat. 3: 265, 287. 1867. – TYPE: Indonesia, Junghuhn s.n. (isotype: L)
- Urostigma circumscissum* Miq., Pl. Jungh.: 292. 1854; Fl. Ind. Bat. 1,2: 344. 1859. – *Ficus elastic* Roxb. ex Hornem. var. *minor* Miq., Ann. Mus. Bot. Lugd.-Bat. 3: 287. 1867. – TYPE: Indonesia, Java, Junghuhn s.n. (isotype: L)
- Urostigma karet* Miq., Fl. Ind. Bat. 1,2: 348. 1859. – *Ficus elastica* Roxb. ex Hornem. var. *karet* (Miq.) Miq., Ann. Mus. Bot. Lugd.-Bat. 3: 265. 1867. – *Ficus karet* (Miq.) King, Ann. Roy. Bot. Gard. (Calcutta) 1(1). Index 3. 1888.
- Ficus clusifolia* Summerh., J. Arnold Arbor. 10: 152. 1929, non Schott in Spreng. 1827. – *Ficus skytinoderma* Summerh., J. Arnold Arbor. 14: 62. 1933; Diels, Bot. Jahrb. Syst. 67: 182. 1935. – TYPE: Papua New Guinea, Sogeri, Brass 641 (holotype: K)
- Ficus elastica* Roxb. ex Hornem. var. *belgica* L.H. Bailey & E.Z. Bailey, Hort. Sec.: 308. 1941. Nom. Inval., in synon.
- Ficus elastica* Roxb. ex Hornem. var. *rubra* L.H. Bailey & E.Z. Bailey, Hort. Sec.:

308. 1941. Nom. Inval., in synon.

Trees, up to 30 m tall, terrestrial or hemi-epiphytic. Leafy twigs 3-5 mm thick, angular, glabrous or (minutely) white puberulous. Leaves spirally arranged; lamina elliptic to oblong, 8-21(-40) by 4-12(-22) cm, coriaceous, apex acuminate, base cuneate to obtuse (to rounded); both surfaces glabrous; cystoliths on both sides; lateral veins (10-)15-22 pairs, the basal lateral veins not or hardly distinct, tertiary venation parallel to the lateral veins; waxy gland at the base of the midrib (often faint); petiole 2-5(-10) cm long, glabrous; stipules 1.5-15(-25) cm long, glabrous or white puberulous, caducous. Figs axillary or just below the leaves, in pairs (or solitary); peduncle 0.2-0.5(-0.8) mm long, the apex dilated; basal bracts 3, ca. 3-10 mm long, early caducous; receptacle ellipsoid to cylindrical, 0.5-0.8 cm diam. when dry, glabrous, yellow at maturity, apex slightly umbonate, ostiole circular, ca. 2 mm in diameter, covered with 3 bracts, glabrous. Staminate flowers dispersed, sessile or pedicellate, stamen 1, tepals (2) 3-4, ovate to lanceolate, free. Pistillate flowers sessile or pedicellate, ovary white, tepals 3-4, ovate to lanceolate, free. (Figure 1)

Distribution: India (Assam, Sikkim), Nepal, Bhutan, Myanmar, Thailand, Peninsular Malaysia (Perak), Indonesia (Sumatra, Java).

Distribution in Thailand: Tak, Umphang, 17 Feb 2015, Chantarasuwan 170215-5 (THN HM); Chantarasuwan 170215-6 (THNHM); 18 Feb 2015, Chantarasuwan 180215-2 (THNHM); Chantarasuwan 180215-6 (THNHM).

Vernacular: Yanglop (ยางลบ) (Central); yang india (ยางอินเดีย) (Bangkok); lung (ลุง) (Northern).

Representative Specimens Examined: INDIA. Assam, Cherrapunjee, Khasi Hills, 18 Jul 1952, Walter N. Koelz 30639 (L); Assam, Tura, Garo Hills, 4 Jan 1950, Walter N. Koelz 24999(L); Sikkim, Hooker s.n. (K). BHUTAN. Griffith 2605 (K). MYANMAR. Sagain, 1826, Wallich 4557B (P), Wallich 4557C

(K). MALAY PENINSULAR. Johore, Mawai, 1 May 1932, Corner 21187 (L). INDONESIA. Sumatra, 1857 – 1861, de Vriese s.n. (L), Sumatra, 1881-82, Forbes 1681 (L); Java, Preanger (Parahyangan), 9 Jun 1890, Koorders 9138B (L). PAPUA NEW GUINEA. Sogeri, Brass 641(K).

Habitat and Density of Species

In the area of Thung Yai Naresuan East Wildlife Sanctuary, *Ficus elastica* was only found in dry evergreen forest on limestone at an elevation 800 – 1150 m. Within the area 2.96 km² a total of fifty-eight trees were recorded (Table 1) corresponding to a density of the species of 20 trees/km².

Seedlings and Saplings recorded

Along the 37 km long road, we recorded 7 trees presenting seedlings or saplings of *F. elastica* to identify most of the host-species (Table 2).

DISCUSSION

The morphological study shows that all four samples we collected for thorough investigation corresponded to *F. elastica*. The dominant characters are described as follows. Lamina elliptic to oblong, coriaceous, lateral veins normally 15-22 pairs, the basal lateral veins not or hardly distinct, tertiary venation parallel to the lateral veins. Figs axillary or just below the leaves, in pairs (or solitary); peduncle 0.2-0.5(-0.8) mm long, basal bracts 3, early caduceus. Receptacle ellipsoid to cylindrical, 0.5-0.8 cm diam. when dry, glabrous, yellow at maturity. Staminate flowers disperse, sessile or pedicellate, stamen 1. Pistillate flowers sessile or pedicellate, ovary white. The comparison of all character of the four samples are consistent with previous descriptions by Berg *et. al* (2011) and Berg and Corner (2005). The samples are also

consistent with the specimens stored in Leiden, Kew, and Paris herbaria that we observed. The flowers characters which were not previously described in Berg *et al.* (2011) and Berg and Corner (2005) were added in the description here.

The habitat of the species is only known now in dry evergreen forest of Thung Yai Naresuan East Wildlife Sanctuary. The population density was 20 trees/km² which is rather abundant for a *Ficus* species of that size. Although few in number, seedlings and saplings were recorded confirming natural reproduction in the locality. It is surprising that such a large and easily identified tree species had escaped notice from botanists. It is likely that the species was not reported before because Thung Yai Naresuan East Wildlife Sanctuary is not a prized destination for plant collectors and the habitat of *F. elastica* is located in the deep jungle, and can only be reached during dry season.

Reports on the former distribution of *F. elastica* by Corner (1978), Starr *et al.* (2003) and Berg *et al.* (2011), agree on a disjoint distribution with presence in Eastern Himalaya foothills, Khasi hill, Assam, Myanmar and then a gap throughout Thailand and Indochina, and then presence in Perak in peninsular Malaysia, Sumatra and Java of Indonesia. However, our discovery has filled part of that gap and thus the current distribution of the species should range from the foothills of the Himalayas to Myanmar, Thailand (western), Peninsular Malaysia (Perak), and Indonesia (Sumatra, Java). Our observations also confirm previous observations suggesting that *F. elastica* is associated with limestone hills. Berg and Corner (2005) proposed that *F. elastica* was restricted to low altitudes while we document here occurrence at 1000 m elevation.

Our observations show that *F. elastica* is still

thriving in natural populations in Thailand. One can only hope that other surviving wild populations will be reported from other parts of the range, in a context where its species specific pollinator has been rediscovered in figs of planted trees in the Bogor botanical garden and the pollinators have also established on planted *F. elastica* trees in Singapore (Harrison *et al.* 2014).

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Table 1. Elevation and coordinate of all 58 Indian rubber trees

Code	Elevation (m)	GPS coordinate recorded	
		N	E
Ficus elastica 1	1024	15° 26' 23.58"	099° 03' 11.30"
Ficus elastica 2	1017	15° 26' 31.03"	099° 03' 05.31"
Ficus elastica 3	1018	15° 26' 30.19"	099° 03' 05.37"
Ficus elastica 4	1062	15° 24' 14.66"	099° 03' 23.33"
Ficus elastica 5	1044	15° 26' 00.50"	099° 03' 01.77"
Ficus elastica 6	1063	15° 24' 02.18"	099° 03' 24.51"
Ficus elastica 7	997	15° 26' 52.37"	099° 02' 51.17"
Ficus elastica 8	1059	15° 24' 05.68"	099° 03' 22.75"
Ficus elastica 9	1062	15° 24' 00.01"	099° 03' 23.82"
Ficus elastica 10	1047	15° 25' 58.34"	099° 02' 59.24"
Ficus elastica 11	975	15° 30' 19.32"	099° 02' 08.18"
Ficus elastica 12	976	15° 30' 19.12"	099° 02' 08.18"
Ficus elastica 13	987	15° 29' 35.95"	099° 02' 11.37"
Ficus elastica 14	977	15° 30' 24.95"	099° 02' 02.42"
Ficus elastica 15	982	15° 30' 24.35"	099° 02' 02.25"
Ficus elastica 16	1043	15° 25' 48.61"	099° 02' 48.20"
Ficus elastica 17	1054	15° 24' 11.39"	099° 03' 04.95"
Ficus elastica 18	1054	15° 24' 12.10"	099° 03' 04.49"
Ficus elastica 19	1055	15° 24' 10.80"	099° 03' 04.21"
Ficus elastica 20	1056	15° 23' 43.14"	099° 03' 08.75"
Ficus elastica 21	1112	15° 23' 38.86"	099° 03' 06.44"
Ficus elastica 22	1109	15° 23' 38.85"	099° 03' 06.33"
Ficus elastica 23	976	15° 27' 46.79"	099° 02' 19.80"
Ficus elastica 24	1103	15° 23' 37.05"	099° 03' 06.52"
Ficus elastica 25	1097	15° 23' 37.89"	099° 03' 06.30"
Ficus elastica 26	1106	15° 23' 33.57"	099° 03' 07.15"
Ficus elastica 27	1096	15° 23' 36.34"	099° 03' 06.55"
Ficus elastica 28	1101	15° 23' 37.72"	099° 03' 06.27"
Ficus elastica 29	1099	15° 23' 35.73"	099° 03' 06.63"
Ficus elastica 30	1062	15° 23' 33.71"	099° 03' 00.56"
Ficus elastica 31	1059	15° 23' 40.51"	099° 02' 55.31"
Ficus elastica 32	1056	15° 23' 54.52"	099° 02' 48.86"
Ficus elastica 33	958	15° 31' 04.28"	099° 01' 31.57"
Ficus elastica 34	1056	15° 23' 50.74"	099° 02' 45.40"
Ficus elastica 35	954	15° 31' 35.10"	099° 01' 15.86"

Table 1. Continue

Code	Elevation (m)	GPS coordinate recorded	
		N	E
Ficus elastica 36	969	15° 28' 57.52"	099° 01' 39.18"
Ficus elastica 37	970	15° 28' 57.60"	099° 01' 38.11"
Ficus elastica 38	971	15° 28' 56.42"	099° 01' 37.64"
Ficus elastica 39	970	15° 28' 54.80"	099° 01' 18.06"
Ficus elastica 40	974	15° 28' 55.46"	099° 01' 16.74"
Ficus elastica 41	979	15° 28' 54.73"	099° 01' 15.20"
Ficus elastica 42	993	15° 28' 51.26"	099° 01' 05.97"
Ficus elastica 43	959	15° 28' 32.62"	099° 00' 50.81"
Ficus elastica 44	961	15° 28' 16.04"	099° 00' 14.64"
Ficus elastica 45	959	15° 28' 07.72"	099° 00' 05.47"
Ficus elastica 46	958	15° 28' 07.22"	099° 00' 04.92"
Ficus elastica 47	959	15° 28' 06.03"	099° 00' 04.23"
Ficus elastica 48	856	15° 28' 25.79"	098° 57' 41.85"
Ficus elastica 49	876	15° 28' 25.79"	098° 57' 39.98"
Ficus elastica 50	867	15° 28' 37.69"	098° 57' 36.74"
Ficus elastica 51	820	15° 30' 24.49"	098° 57' 13.50"
Ficus elastica 52	869	15° 28' 46.19"	098° 57' 27.95"
Ficus elastica 53	811	15° 30' 21.88"	098° 57' 12.71"
Ficus elastica 54	822	15° 30' 09.46"	098° 57' 10.76"
Ficus elastica 55	869	15° 29' 06.34"	098° 57' 19.60"
Ficus elastica 56	816	15° 30' 15.23"	098° 57' 08.56"
Ficus elastica 57	877	15° 30' 0.10"	098° 57' 03.02"
Ficus elastica 58	846	15° 29' 45.82"	098° 57' 01.87"

Table 2. Seedling or sapling of *F. elastica* with coordinate of host trees

Code	N	E	Host
Ficus elastica1	15°29'25.63"	099° 02'8.75"	dead tree
Ficus elastica2	15°30'14.03"	098°57'11.56"	unknown
Ficus elastica3	15°30'15.97"	098°57'12.36"	Jack fruit
Ficus elastica4	15°28'40.32"	098°57'35.27"	unknown
Ficus elastica5	15°28'25.32"	099° 02'10.26"	unknown
Ficus elastica6	15°23'34.81"	099° 03'6.50"	unknown
Ficus elastica7	15°23'34.21"	099° 03'6.55"	unknown

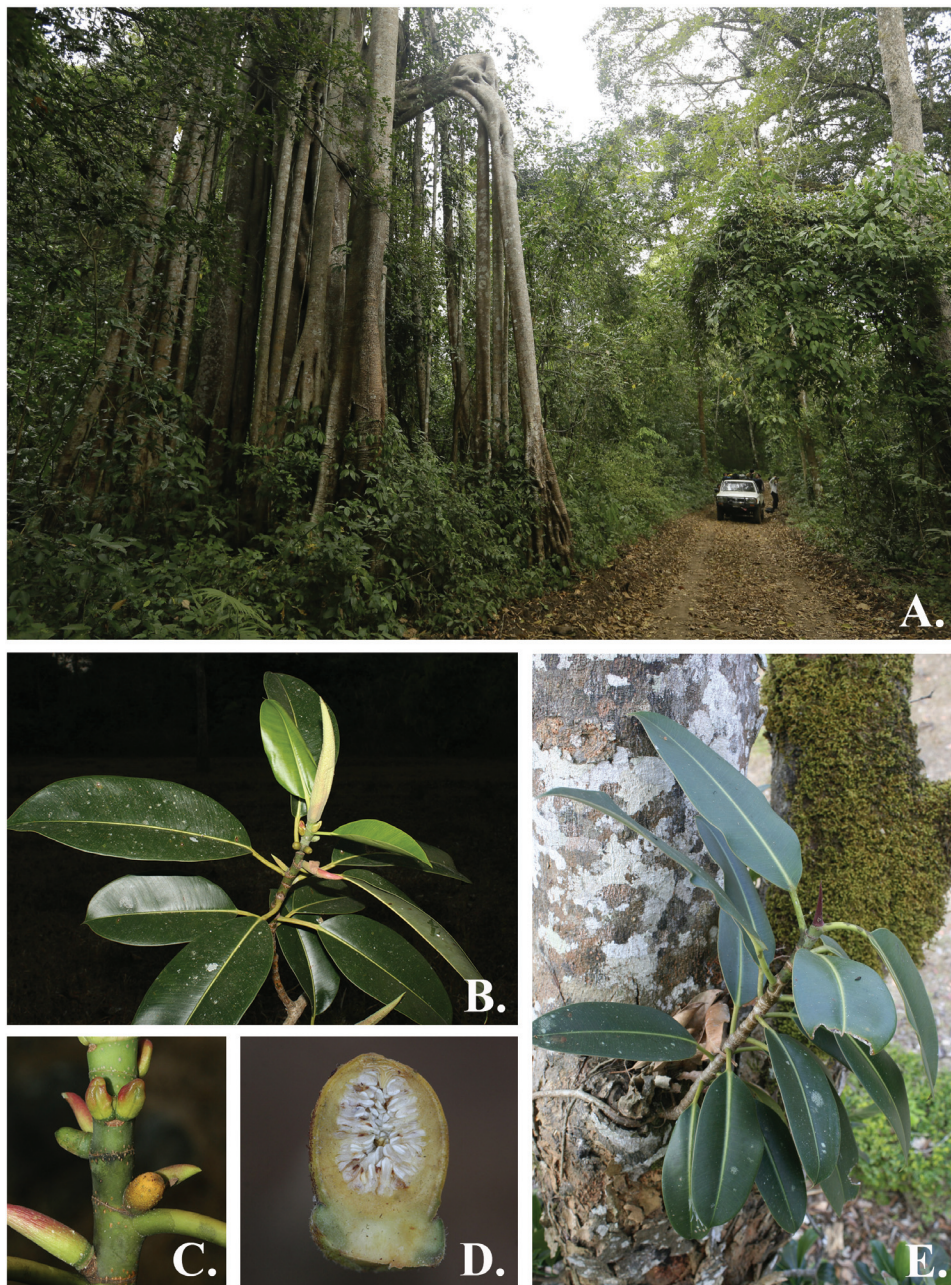


Figure 1. A, prop root of *Ficus elastica* in the wild. B, a branch with leaves and figs. C, yellow ripe fig in leaf axil. D, fig in longitudinal section, showing the staminate flowers. E, Sapling of *Ficus elastica* epiphytic on another tree.