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A REVISION OF THE MALESIAN SPECIES OF ZANTHOXYLUM (RUTACEAE)

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THIS STUDY OF THE GENUS *Zanthoxylum* L. is the first of a series of studies on the Rutaceae of Malesia, a family represented by about 30 genera in that area. The geographic delimitation of Malesia as interpreted here (see MAP 1) is the same as that outlined by van Steenis (1950) for *Flora Malesiana* except that the Solomon Islands are included as well.

A genus of about 200 species, *Zanthoxylum* is mainly pantropical in distribution. There are, in addition, several temperate-latitude species in eastern Asia and one in North America. To my knowledge, the range of individual species is restricted so that no single species has a completely pantropical distribution.

The genus is readily recognizable for it is the only Malesian genus of the Rutaceae with the following combination of characteristics: armed, leaves alternate and compound (generally pinnate), carpels entirely or partially distinct. *Geijera*, which occurs in New Guinea, also has alternate leaves and a somewhat similar gynoecium, but is unarmed and the leaves are simple. *Toddalia*, of western Malesia and the Philippines, is similarily armed and has alternate, trifoliolate leaves, but in it the gynoecium is syncarpous.

Since both are present in the area, a treatment of the Malesian species of *Zanthoxylum* involves the problem of whether or not to consider the segregate genus *Fagara* L. (with a biseriate, differentiated perianth) distinct from *Zanthoxylum* L. *sensu stricto* (with a uniseriate, undifferentiated perianth). In general, botanists who favor recognition of the two genera consider the perianth of *Zanthoxylum* to be primitive, with segments homologous to petals, while those who include *Fagara* with *Zanthoxylum* consider the *Zanthoxylum* perianth to be derived from that of *Fagara*. This problem has recently been reviewed and discussed by Brizicky (1962) who concludes that . . . . "the 'simple' perianth of *Zanthoxylum* is most likely a secondary condition, derived by reduction from that of the *Fagara* type by abortion of some or all the sepals." He further states that "The occurrence of species of *Zanthoxylum* which appear in their perianth structure to be transitional to *Fagara* not only

supports this view [of reduction], but also is ample reason to regard *Fagara* as a subgenus of *Zanthoxylum*." I agree with these conclusions, except in the formal recognition of *Fagara* as a subgenus. To the supporting evidence cited by Brizicky I can add that selected specimens of *Zanthoxylum dimorphophyllum* Hemsl., of China, illustrate what appears to be rather complete transition between the *Fagara* and *Zanthoxylum* types of perianth. The following data, taken from three staminate collections of this species in the herbarium of the Arnold Arboretum, serve to demonstrate this:

1. *Fagara* (primitive) type of perianth (*Lau 1870*, Hainan Island). Perianth biseriate; sepals 4, triangular, 0.2–0.5 mm. long; petals 4, clawed, 1.5 mm. long. Stamens 4, opposite the sepals.
2. Intermediate type of perianth (*Wilson 113*, Hupeh Province). Perianth irregularly uniseriate; sepals 1–4, ligulate, about 1.2 mm. long; petals 4–6, slightly clawed, about 2 mm. long. Stamens 5, opposite sepals where sepals are present.
3. *Zanthoxylum* (derived) type of perianth (*Wilson 4770a*, Hupeh Province). Perianth segments irregularly uniseriate, all similar, 7–8, 2–2.5 mm. long. Stamens 5–6, generally opposite 2 or 3 of the segments.

As might be expected, there has been considerable disagreement among authors as to the proper genus for *Z. dimorphophyllum*. Hemsley, in the original description (Ann. Bot. 9: 150. 1895), placed it in *Zanthoxylum*, stating, in regard to the carpellate flowers, ". . . apetali, vel sepala petalis simillima. . . ." Engler (1896) and Reeder and Cheo (1951) assigned it to *Fagara*, whereas Rehder and Wilson (1914) and Huang (1957) placed it in the genus *Zanthoxylum*, section *Euzanthoxylum* Endl. and subgenus *Thylax* (Raf.) Rehd., respectively.

The description of the genus and the synonymy, presented below, applies only to the Malesian species of *Zanthoxylum*. Each of the species is dealt with completely, however, including where applicable, data regarding extra-Malesian as well as Malesian collections and nomenclature.

I was able to study and collect three of the New Guinea species (*Zanthoxylum conspersipunctatum*, *Z. ovalifolium* and *Z. pluviatile*) while employed as a botanist for the Australian Commonwealth Scientific and Industrial Research Organization, Phytochemical Survey of New Guinea, 1961–1965. This study is otherwise based on herbarium specimens. The contributing herbaria are listed below, with abbreviations from Lanjouw and Stafleu's *Index Herbariorum*, Part I. Ed. 5 (Regnum Vegetabile, 31. 1964).

A	Arnold Aboretum of Harvard University, Cambridge
BM	British Museum (Natural History), London
BRI	Botanic Museum and Herbarium, Brisbane
CANB	C.S.I.R.O. Division of Plant Industry, Canberra
GH	Gray Herbarium of Harvard University, Cambridge
G-DC	Herbier DeCandolle, Conservatoire et Jardin Botaniques, Geneva
K	Royal Botanic Gardens, Kew
L	Rijksherbarium, Leiden

M	Botanische Staatssammlung, Munich
MEL	National Herbarium of Victoria, Melbourne
MICH	University Herbarium, University of Michigan, Ann Arbor
NY	New York Botanical Garden, New York
P	Muséum National d'Histoire Naturelle, Paris
PR	Botanical Department of National Museum, Prague
SING	Herbarium of the Botanic Gardens, Singapore
TI	Botanical Institute, Faculty of Science, University of Tokyo
US	U.S. National Museum (Department of Botany), Smithsonian Institution, Washington

I wish to thank the directors and curators of these herbaria for making specimens in their care available to me. Sincere thanks are also extended to Drs. Lily M. Perry and Lorin I. Nevling, Jr., for their cordial assistance in various technical problems.

Zanthoxylum[1] L. Sp. Pl. 1: 270. 1753. Type species: *Xanthoxylum americanum* Mill. (see Fosberg, 1959, and Brizicky, 1962).

Fagara L. Syst. ed. 10. 897. 1759, nom. cons. Type species: *Fagara pterota* L. *Tipalia* Dennst. Schlüss. Hort. Malab. 31. 1818. Type species: *Tipalia limonella* Dennst. [*Zanthoxylum limonella* (Dennst.) Alston].

Scandent or erect shrubs or trees; aromatic, dioecious or rarely monoecious, evergreen or deciduous, armed. Leaves alternate, (occasional leaves unifoliolate) trifoliolate, imparipinnate or paripinnate, to 175 cm. long; rachis terete or winged; leaflets to 15 pairs, opposite to alternate, often inequilateral, with or without scattered and/or marginal oil dots. Inflorescences racemose, paniculate or cymose, axillary and/or terminal. Flowers small, unisexual or rarely bisexual; perianth of 6–8 irregularly uniseriate, undifferentiated segments or differentiated and biseriate with 4–5 sepals and 4–5 petals; stamens 4–6, uniseriate, opposite the sepals, rudimentary or absent in carpellate flowers; disc flat to pulvinate; gynoecium 1–5-carpellate, rudimentary or absent in staminate flowers, ovaries distinct or connate to about the middle, 1-locular, each with 2 collateral, pendulous ovules, styles coherent to divergent, stigmas capitate, coherent to free. Fruits of 1–5 distinct or partially connate, 1-seeded, 2-valved follicles; outer pericarp glandular punctate or pustular, firm to rather fleshy, red to black; endocarp cartilaginous, straw-colored; seeds ovoid to globose, often hanging from the opened follicle by a funiculus at maturity, the testa black or reddish, shining and crustaceous, the endosperm fleshy.

The habit of plants in the genus is variable and five of the seven scandent species are also known as semi-erect or erect shrubs.

A variety of spines and prickles, ranging from broad, corky-based spines to 4 centimeters in diameter to small, scattered or pseudostipular, flattened or terete, recurved, straight or ascending prickles occur in the Malesian species. While all of the species are more or less armed, the presence of spines or prickles on a given part of a plant is quite variable. Thus an

[1] *Xanthoxylum*, *Xanthoxylon* and *Zanthoxylon* are variant spellings.

unarmed herbarium specimen (perhaps chosen by the collector for easier handling!) may often be encountered in a heavily armed species.

Oil dots are found in the leaflets of most species but are seldom consistently present. These glands may be scattered and/or marginal, and, judging from the study of cleared leaflets of *Zanthoxylum conspersipunctatum* and *Z. pluviatile*, may consist of large, oil-filled cavities that are not traversed by the veins, or single cells or small groups of cells that do not interrupt the venation pattern. If these are the same as the "secretory cavities and secretory cells" described by Stern and Brizicky (1960) in a study of the genus *Diomma* (Rutaceae), they seem here to be less significant taxonomically. In *Zanthoxylum conspersipunctatum*, *Z. limonella* and *Z. nitidum*, for example, only occasional specimens have what appear to be the large cavity type of oil dot scattered in the mesophyll. To distinguish them taxonomically, on this basis, would be doing so in the absence of other correlating morphological differences and would necessitate description of several new taxa.

The larger marginal crenations of the leaflets of a number of species are also irregular in occurrence. In *Zanthoxylum limonella* and *Z. nitidum*, for instance, the leaflet margins range from entire to glandular crenate with as many as three or four crenations per centimeter.

The geographic affinities of the Malesian species of *Zanthoxylum* appear to be Asian and Malesian. Nine of the nineteen species occur in both continental Asia and Malesia and an equal number are endemic to single islands or otherwise limited areas in Malesia. *Zanthoxylum parviflorum*, a close relative of the widespread *Z. limonella*, is endemic to the Northern Territory of Australia and adjacent southwestern New Guinea.

The wide and often rather discontinuous distributions of a number of the species is possibly due, in part, to long-distance dispersal of the attractive seeds by birds.

In general the species grow in rain forests and thickets at low and medium altitudes. Three of them, *Zanthoxylum limonella*, *Z. ovalifolium* and *Z. parviflorum*, are most often found in monsoonal areas and one, *Z. conspersipunctatum*, appears to be restricted to montane forests and thickets.

The flowers are fragrant and pollination is apparently by insects.

The following comments concern the citation of collections:

1. The collections are cited in the following geographic sequence: Asia, Malesia and Australia. Within these major areas they are cited in an east to west sequence, following, for Malesia, the sequence outlined in *Flora Malesiana* (Ser. 1. 1: LXXVI – LXXVIII. 1950).

2. The sex of each collection is indicated by the appropriate symbol following the collection number, or, in instances where two or more specimens of a collection from two or more herbaria are of different sex, by the appropriate symbol in parentheses following each herbarium citation. Herbarium sheets with male and female specimens of one collection are indicated by "♂ & ♀." Specimens that are monoecious with unisexual flowers are indicated by "♂ ♀." Specimens with perfect flowers are desig-

nated "♀". Specimens for which I do not give an indication of sex are either sterile or at a stage where the determination could not be made.

3. Following are the abbreviations used for collections numbered in series:

BS	Bureau of Sciences, Manila
BSIP	British Solomon Islands Plants
BW	Boswezan, Forestry Division, Netherlands New Guinea
CCC	Canton Christian College
CP	Ceylon Plants
FB	Forestry Bureau, Manila
HB	Herbarium Bogoriense
LU	Lingnan University
NIFS	Netherlands Indies Forest Service, Forest Research Institute, Buitenzorg. NIFS Ja: Java series. NIFS bb: series bossen buitengewesten — islands outside Java
NGF	New Guinea Forces (now New Guinea Forest Department)
NU	Nanking University
PNH	Philippine National Herbarium
Sar	Sarawak Forestry Service
SB	Species Blancoanae, Philippines
SF	Singapore Field Series
TNSM	Tokyo National Science Museum

KEY TO THE SPECIES

1. Branchlets armed, the prickles mostly flattened and predominantly pseudostipular; leaf rachises usually with conspicuous wings extending to as much as 6 mm. on each side; perianth uniseriate or irregularly biseriate, of 6–8 similar segments ..... 2.
   2. Main veins of leaflets evident, 10–28 on each side of the midrib; inflorescences in the axils of lateral leaves, 0.5–2 cm. long; anthers reddish purple prior to anthesis; gynoecium 2–5-carpellate 18. *Z. acanthopodium.*
   2. Main veins of leaflets generally faint, 7–15 on each side of the midrib; inflorescences terminal on short, lateral branchlets and occasionally in the axils of lateral leaves as well, 1–7 cm. long; anthers yellow prior to anthesis; gynoecium 1–3-carpellate ..... 19. *Z. armatum.*
1. Branchlets armed or unarmed, the prickles terete and usually scattered; leaf rachises terete or with narrow wings extending to not more than 1 mm. on each side; perianth biseriate, of 4–5 sepals and 4–5 petals ..... 3.
   3. Scandent or suberect shrubs; branchlets and/or leaf rachises armed with retrorse prickles; gynoecium 4- or 2-carpellate [2] ..... 4.
      4. Inflorescences mostly in the axils of lateral leaves; gynoecium 4-carpellate ..... 5.
         5. Lateral leaflets subopposite to alternate; terminal leaflet on an extension of the rachis generally less than one-half the width of the blade ..... 1. *Z. scandens.*

[2] The number of carpels in the Malesian species other than *Z. acanthopodium* and *Z. armatum* can be determined in fruiting as well as carpellate flowering material since carpels that do not develop into fruit are persistent.

5. Lateral leaflets opposite; terminal leaflet on an extension of the rachis generally more than one-half the width of the blade ..... 2. *Z. nitidum.*

4. Inflorescences terminal and from upper leaf axils; gynoecium 2-carpellate ..... 6.

6. Inflorescences cymose, the primary branches generally whorled; perianth and androecium 5-merous; follicles 4.5 mm. in diameter ..... 5. *Z. avicennae.*

6. Inflorescences paniculate, the primary branches opposite or alternate; perianth and androecium 4-merous; follicles 6–10 mm. in diameter ..... 7.

7. Leaves ascending, spreading or arching; acuminate apices of leaflets about one-fourth the length of the blade; follicles about 10 mm. in diameter ..... 8. *Z. backeri.*

7. Leaves strongly reflexed at the pulvinate base of the rachis; acuminate apices of leaflets about one-seventh the length of the blade; follicles 6–7 mm. in diameter .... 9. *Z. retroflexum.*

3. Erect shrubs or trees; branchlets with straight or ascending prickles or unarmed; gynoecium 3-, 2- or 1-carpellate (*Zanthoxylum scandens* is occasionally, in Asia, an unarmed, erect shrub, but is always 4-carpellate) 8.

8. Leaves trifoliolate ..... 17. *Z. ovalifolium.*

8. Leaves pinnate ..... 9.

9. Inflorescences cymose, the primary branches generally whorled; leaflets less than 8 cm. long; perianth and androecium 5-merous; gynoecium 2-carpellate ..... 5. *Z. avicennae.*

9. Inflorescences paniculate, the primary branches opposite or alternate; leaflets more than 8 cm. long *or* perianth and androecium 4-merous and gynoecium 1-carpellate ..... 10.

10. Perianth and androecium 5-merous; gynoecium 3-carpellate ..... 11.

11. Leaflets elliptic, broadest at about the middle ..... 3. *Z. myriacanthum.*

11. Leaflets elliptic-lanceolate to lanceolate, broadest near the base ..... 4. *Z. ailanthoides.*

10. Perianth and androecium 4-merous; gynoecium 1- or 2-carpellate ..... 12.

12. Leaves more than 40 cm. long; leaflets 3–5 pairs; gynoecium 2-carpellate ..... 13.

13. Leaves more than 70 cm. long; leaflets 4–5 pairs, the petiolules obsolete to 5 mm. long ..... 6. *Z. megistophyllum*

13. Leaves less than 70 cm. long; leaflets 3–4 pairs, the petiolules 7–10 mm. long ..... 7. *Z. forbesii.*

12. Leaves less than 40 cm. long *or* with more than 5 pairs of leaflets; gynoecium 1-carpellate ..... 14.

14. Branchlets unarmed; leaflets usually obovate, broadest above the middle, the margins entire ..... 16. *Z. integrifoliolum*

14. Branchlets armed or unarmed; leaflets ovate to oblong, broadest at about the middle or below, the margins entire or crenate ..... 15.

15. Deciduous (the flowers appearing before or with the young leaves); acuminate apices of leaflets one-eighth to one-fourth the length of the blade; flowers 1.5–3 mm. long ..... 16.
    16. Leaves 30–40 cm. long; leaflets 7–13 cm. long, the petiolules 3–5 mm. long ..... 10. *Z. limonella.*
    16. Leaves 22–28 cm. long; leaflets 5–8 cm. long, the petiolules 1.5–3 mm. long ..... 11. *Z parviflorum.*
15. Evergreen; acuminate apices of leaflets one-sixteenth to one-ninth the length of the blade; flowers 3–9 mm. long ..... 17.
    17. Leaves 10–30 cm. long; leaflets 2–8 pairs; sepal margins entire or subentire ..... 15. *Z. conspersipunctatum.*
    17. Leaves 30–60 cm. long; leaflets 5–12 pairs; sepal margins ciliate ..... 18.
        18. Inflorescence axes and branches puberulent ..... 12. *Z. celebicum.*
        18. Inflorescence axes and branches glabrate ..... 19.
            19. Leaflet bases subcordate ..... 13. *Z. vinkii.*
            19. Leaflet bases oblique to rounded ..... 14. *Z. pluviatile.*

1. **Zanthoxylum scandens** Bl. Bijdr. Natuurk. Wetens. 249. 1825. Type: *Blume 1603*, Java.

Xanthoxylum cuspidatum Champ. ex Benth. Jour. Bot. Kew Misc. **3**: 329. 1851. Type: *Champion 86*, Hong Kong.

Zanthoxylum khasianum Hook. f. Fl. Brit. Ind. **1**: 494. 1875. Type: *Hooker f. & Thomson 1517*, India, Assam.

Fagara scandens (Bl.) Engl. Nat. Pflanzenfam. III. **4**: 118. 1896.

Fagara cuspidata (Champ. ex Benth.) Engl. *Ibid.*

Fagara khasyana (Hook. f.) Engl. *Ibid.*

Fagara laxifoliolata Hay. Ic. Pl. Formosa **3**: 50. 1913. Type: *Kawakami & Shimada*, 1911, Taiwan.

Fagara cyrtorhachia Hay. *Ibid.* **6**: 8. 1916. Syntypes: *Ito & Hayata*, 1914 and *Hayata*, 1914, Taiwan.

Fagara leiorhachia Hay. *Loc. cit.* 10. Type: *Hayata*, 1913, Taiwan.

Fagara chinensis Merr. Philip. Jour. Sci. Bot. **13**: 141. 1918. Type: *Merrill 10660*, China, Kwangtung Province.

Zanthoxylum chinensis (Merr.) Chung, Mem. Sci. Soc. China **1**: 123. 1924 (*fide* Huang, Acta Phytotax. Sinica **6** (1): 72. 1957).

Fagara kwangsiensis Hand.-Mazz. Sinensia **3**: 186. 1933. Type: *Ching 5401*, China, Kwangsi Province.

Zanthoxylum yunnanense Huang, Acta Phytotax. Sinica **6** (1): 59. 1957. Type: *Tsai 55960*, China, Yunnan Province.

Zanthoxylum laxifoliolatum (Hay.) Huang, *Ibid.* 81.

Zanthoxylum leiorhachium (Hay.) Huang, *Ibid.*
Zanthoxylum cyrtorhachium (Hay.) Huang, *Ibid.*

Scandent and generally climbing or occasionally suberect or erect shrubs; dioecious; evergreen; branchlets and leaf rachises generally armed, the prickles scattered and retrorse. Leaves imparipinnate, 8–37 cm. long; rachis glabrous to short pubescent; petiolules 1–5 mm. long; leaflets (1) 2–12 pairs, subopposite to alternate, chartaceous to subcoriaceous, dark green and glabrous above, paler and glabrous or sparsely pubescent below, generally blackening slightly with drying, ovate to elliptic-lanceolate, 3–9 cm. long, 1–4 cm. wide, base cuneate to obtuse, main veins 4–14 on each side of the midrib, margins, especially in the apical half of the blade, finely glandular crenate with as many as 20 crenations per cm., apex abruptly acuminate to attenuate. Inflorescences axillary or axillary and terminal, paniculate, to 12 cm. long and generally about one-half as wide, the axes and branches glabrous to short pubescent. Staminate flowers 3–6 mm. long; pedicels obsolete to 5 mm. long; sepals 4, triangular to rounded, about 1 mm. long; petals 4, white to pale yellow, occasionally with a purple margin, elliptic-ovate, about 3 mm. long; stamens 5–6 mm. long, anthers about 1 mm. long; disc flat, about 0.3 mm. high; rudimentary carpels 1–4, to 1.5 mm. high. Carpellate flowers about 3 mm. long; pedicels, sepals, petals and disc as in staminate flowers; rudimentary stamens obsolete to 1 mm. long; gynoecium 4-carpellate, 1–1.5 mm. high, styles divergent at anthesis, stigmas globose. Fruiting pedicels 1–6 mm. long; follicles subglobose, 4–5 mm. in diameter, in 4's, 3's, 2's or single with 0, 1, 2, or 3 undeveloped carpels, respectively.

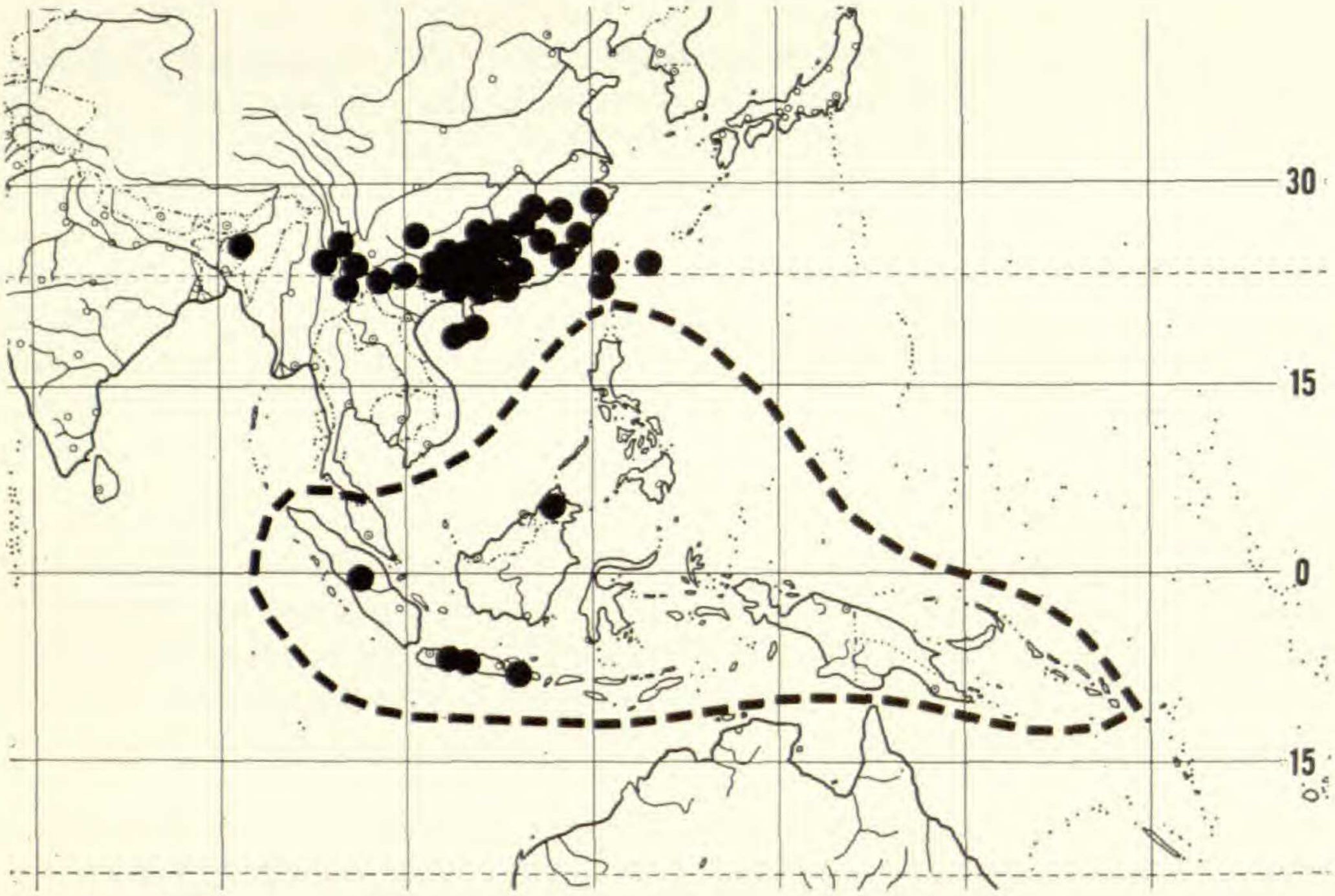
India. ASSAM: Khasia Hills, *Chand 4908* ♀ (MICH), *Hooker f. & Thomson 1517* ♀ (K — holotype of *Zanthoxylum khasianum*; GH — isotype), *Ruse 62* (A), *62A* ♀ (A). **China.** YUNNAN PROVINCE: Sungkwei Range, *Forrest 21554* ♀ (A, US); Mengtsz, *Henry 10421A* ♂ (A), *11163* ♀ (A), *Tsai 52369* ♀ (A); Wen-shan Hsien, *Tsai 51703* ♀ (A), *51764* ♀ (A); O-shan Hsien, *Tsai 53494* ♂ (A); Lan-ping Hsien, *Tsai 54018* ♀ (A); Ping-pien Hsien, *Tsai 55108* ♀ (A), *60072* ♀ (A) *60451* ♀ (A); Lung-ling Hsien, *Tsai 55610* ♂ (A), *55695* ♂ (A); A-tun-tze, Huann-fu-ping, *Wang 69107* ♀ (A); Fo Hai, *Wang 74145* ♀ (A); Kiukiang Valley, *Yu 19463* ♀ (A), *20409* ♀ (A); without definite locality, *Forrest 11922* ♀ (A), *15715* ♂ (A) *17712* ♂ (A), *Tsai 55960* ♀ (A — isotype of *Zanthoxylum yunnanense*), *60269* ♀ (A). KWEICHOW PROVINCE: Fan Ching Shan, *Steward, Chiao & Cheo 757* ♀ (A); Tsingchen, Mou-po, *Teng 90156* ♂ (A), *90174* ♂ (A). KWANGSI PROVINCE: Luchen, Moo Shan, *Ching 5401* ♀ (A — isotype of *Fagara kwangsiensis*); Lau Ha Tung, *Ching 6584* ♀ (A, US); N. Hin Yen, Yeo Mar Shan, *Ching 7130* ♀ (A, US); Tzu Yuen District, *Chung 83584* ♀ (A); Waitsap District, Se Tze Shan, *Tsang 23310* ♀ (A); Shang-sze District, Shap Man Taai Shan, Na Wai Village, *Tsang 23924* ♀ (A); Yao Shan, *Wang 39369* ♀ (A), *40057* ♀ (A); without definite locality, *Wang 41125* ♀ (A). KWANGTUNG PROVINCE: Road to Mahang, *Chun 5952* ♀ (A); Lung Tau Shan, *Kang, W. T. Tsang & U. K. Tsang CCC 12266* ♀ (US), *CCC 12770* ♀ (US), *To & Tsang 12770* ♀ (A); Wung Yuen District, Tsing Wan Shan, *Lau 2463* ♀ (A); Loh Fau Mt., *Levine, McClure & To*, August 31–September 4, 1921 ♀ (A), *Merrill 10660* ♀ (US — isotype of *Fagara chinensis*; A, photo. of holotype from Manila, specimen

destroyed); Canton Delta, Heung Shan, Tung Hang, *To CCC 2237* ♂ (A); Sin-fung District, Ngok Shing Shan, *Taam 426* ♂ (A); Tseungshing District, *Tsang 20149* (A); Tsung-fa District, Sam Kok Shan, *Tsang 25017* ♂ (A), *25193* ♀ (A); Hwei-yang District, Lin Fa Shan, *Tsang 25698* ♀ (A); Jen-hua District, Man Chi Shan, *Tsang 26248* ♂ (A); Ho-yuen District, Kwai Shan, *Tsang 28508* ♂ (A); Ying Tak, Tai Tsan, Chung Tung, *Tsang & Wong 3110* ♀ (A); Wai-yeung District, Pak-Wan Cheung, *Tsui 137* ♀ (A, US). HAINAN ISLAND: Po-ting, *How 73154* (A). HONG KONG: *Champion 86* ♂ (K—holotype of *Xanthoxylum cuspidatum*), *Hance 1145* ♂ (GH), *Taam 1111* ♂ (A, US), *1825* ♀ (A, US), *Wright 82* ♂ & ♀ (GH), *s.n.* ♂ (US). HUNAN PROVINCE: Yun-schan prope Wukeng, *Handel-Mazzetti 2563* ♀ (A), *Hui Handel-Mazzetti Expedition 12321* ♂ (A); Yi Chang District, Ping Tou Shan, Pai Mu Village, *Tsang 23387* ♂ (A, US). KIANGSI PROVINCE: Kaling, *Chun 4278* ♀ (A); Swe-chuen Hsien, *Hu 840* ♀ (A); Chung Yih Hsien, *Hu 934* ♀ (A); circa carbonis minas Pinghsiang, *Hui 158* ♀ (A); Lungnan District, Oo Chi Shan, near Lam Uk Tung Village, *Lau 4529* ♀ (A, US). FUKIEN PROVINCE: Hinghwa District, *Chung 1030* ♂ (A); Kuliang, *Chung 6647* ♀ (A), *Norton 1393* ♀ (US). CHEKIANG PROVINCE: Kwanying Tung, Yen Tang Shan, *Chiao NU 14760* ♀ (A, US). **Taiwan.** Mt. Lee-shan, Taichung Hsien, *Feung & Kao 4583* ♀ (A); Mt. Arisan, between Heishana and Funkiko, *Hayata*, April 24, 1913 ♀ (TI—holotype of *Fagara leiorhachia*; A, photo.); Mt. Arisan, between Heishana and Nimandaira, *Hayata*, April 28, 1914 ♀ (TI—syntype of *Fagara cyrtorhachia*; A, photo.); South Cape, *Henry 343* ♀ (US), *1969* ♀ (US); between Funkiko and Taroyen, *Ito & Hayata*, March 29, 1914 ♂ (TI—syntype of *Fagara cyrtorhachia*; A, photo.); Mt. Shichiseitonzan, *Kawakami & Shimada*, April 2, 1911 ♀ (TI—holotype of *Fagara laxifoliata*; A, photo.); Tamsu, *Oldham 59* ♀ (GH); Batakan Tabito, *Tanaka*, October 22, 1930 (A); Nanto Province, Lake Candidius, *Wilson 9973* ♀ (A, US); Taihoki Province, near Hesinbi, *Wilson 10229* ♂ (A, US); without definite locality, *Faurie 8216* (A). **Ryukyu Islands.** Ishigaki Island, *Hatusima 18923* ♀ (US), *Masamune*, March 31, 1935 ♂ (US). **Sumatra.** Sumatra occidentale nel Pandangesche bovenlanden (alto Padang), *Beccari 132* ♀ (K, L, MEL); Westkust, G. Koerinajr, *Bunnemeyer 9574* ♂ (L); Bukit G. Sembilang, Mt. Sago, near Ladang Lawas, *Meijer 4043* ♀ (L). **Java.** WEST JAVA: ad montem Tjerimai Provinciae Cheribon, *Blume 1603* ♀ (L—holotype of *Zanthoxylum scandens*; A—isotype); Tjibodes, *Ooststroom 13255* ♂ (L). CENTRAL JAVA: Dieng (Dijeng Plateau), *Junghuhn* ♀ (L). SOUTHEAST JAVA: *Forbes 1001* ♀ (BM), *s.n.*, 1880–82 ♀ (BM). Without definite locality: *Horsfield 66* ♀ (MEL), *1093* ♀ (K), *s.n.* [GH (♀), K (♂)]. **British North Borneo (Sabah).** Mt. Kinabalu, Tenompok, *J. & M. S. Clemens 29213* [A (♂), K (♂), L (♀), NY (♂)], *29243* ♂ (A, K, L, NY).

DISTRIBUTION. NE India east to Taiwan and Ryukyu Islands; south in Sumatra, Java and British North Borneo; on dry, rocky or sandy slopes and in thickets and mountain forests at altitudes from 1000 to 2000 meters in Malesia and from 300 to 3400 meters in continental Asia. See MAP 1.

ILLUSTRATIONS. HUANG, C. C., Acta Phytotax. Sinica 6(1): *t. XI.* 1957, as *Zanthoxylum yunnanense*. LIU, T. S., Illustrations of native and introduced ligneous plants of Taiwan 2: *t. 728.* 1962, as *Zanthoxylum cuspidatum*.

Acceptance of the extremely variable characters of pubescence, number



MAP 1. Distribution of *Zanthoxylum scandens* Bl. The broken line surrounding the southern stations indicates the geographic area of Malesia as delimited in this paper.

of leaflets, and presence or absence of prickles as being of taxonomic significance would necessitate recognition of an even larger number of taxa than has already been described in this complex. The more conservative delimitation presented here is based on floral characters, arrangement of leaflets, and the type of crenation of the leaflet margin, all of which are relatively constant and, I feel, serve best to show the natural relationship of the various morphological forms involved.

A number of species from continental Asia, including *Zanthoxylum dissitiodes* Huang, *Z. laetum* Drake, *Z. calcicolum* Huang, *Z. chaffanjoni* Levl. and *Z. oxyphyllum* Edgw., show a close relationship to *Z. scandens*.

The following have previously been listed as synonyms of *Zanthoxylum cuspidatum* or *Fagara cuspidata* (= *Zanthoxylum scandens*): *Zanthoxylum khasianum*, by Guillaumin in Flore générale de l'Indo-Chine 1: 640. 1911; *Fagara laxifoliolata, F. cyrtorhachia* and *F. leiorhachia*, by Li, Woody flora of Taiwan, 373. 1963; and *F. chinensis*, by Huang, Acta Phytotax. Sinica 6 (1): 72. 1957.

2. **Zanthoxylum nitidum** (Roxb.) DC. Prodr. 1: 727. 1824.

Fagara nitida Roxb. Fl. Ind. ed. Carey & Wall. 1: 439. 1820. Lectotype: *Roxburgh Icones 2430*, Cult. Bot. Gard. Calcutta.

Nugae sylvarum silvestris Rumph. Herb. Amb. 5: 124. 1747.

Piper pinnatum Lour. Fl. Cochinch. 31. 1790 (nomen illegit.).

Zanthoxylum torvum F. Muell. Frag. Phyt. Austral. **7:** 140. 1871. Type: *Dallachy*, August 21, 1869, Queensland.

Zanthoxylum hamiltonianum Wall. ex Hook. f. Fl. Brit. Ind. **1:** 494. 1875. Type: *Hamilton*, February 12, 1809 (Wallich cat. n. 7117), India.

Fagara torva (F. Muell.) Engl. Nat. Pflanzenfam. III. **4:** 119. 1896.

Fagara warburgii Perk. Fragm. Fl. Philip. 160. 1905. Type: *Warburg 11784*, Philippines, not seen.

Zanthoxylum hirtellum Ridl. Jour. Fed. Malay States **10:** 131. 1920. Type: *Ridley 11291*, Malay Peninsula.

Zanthoxylum collinsae Craib, Kew Bull. **1926:** 165. 1926. Type: *Collins 705*, Thailand.

Fagara hamiltoniana (Wall. ex. Hook. f.) Engl. Nat. Pflanzenfam. ed. 2. **19a:** 221. 1931.

Fagara hirtella (Ridl.) Engl. *Ibid.*

Zanthoxylum scabrum Guill. Bull. Soc. Bot. Fr. **91:** 215. 1944. Type: *Poilane 28200*, North Vietnam.

Fagara oblongifolia Bakh. f. Blumea **6:** 366. 1950. Syntypes: *Blume 1814* and *s.n.*, Java.

Fagara pendjaluensis Bakh. f. *Ibid.* Type: *Koorders & Koorders-Schumacher 47963β*, Java.

Zanthoxylum asperum Huang, Acta Phytotax. Sinica **6** (1): 75. 1957. Type: *Wang 75548*, China, Yunnan Province.

Zanthoxylum asperum var. *glabrum* Huang, *Ibid.* 76. Type: *Wang 77912*, China, Yunnan Province.

Scandent and generally climbing or occasionally suberect or erect shrubs; dioecious or rarely monoecious; evergreen; old stems occasionally with thick, corky spines to 2 cm. long; branchlets, leaf rachises and midribs of leaflets generally armed, the prickles scattered and retrorse. Leaves imparipinnate, 5–40 cm. long; rachis glabrous to short pubescent; petiolules 2–4 mm. long; leaflets (1) 2–4 pairs, opposite, chartaceous to coriaceous, with or without scattered and/or marginal pellucid dots, glabrous to slightly scabrous above, glabrous to short pubescent below, ovate to elliptic, (1.3) 5–12 (16) cm. long, (0.7) 2.5–6 (8.2) cm. wide, base cuneate to truncate, main veins 5–15 on each side of the midrib, margins entire to glandular crenate with as many as 4 crenations per cm., apex acuminate to obtuse. Inflorescences axillary or axillary and terminal, racemose to paniculate, to 15 cm. long and generally less than one-half as broad, the axes and branches glabrous to short pubescent. Staminate flowers 4–5 mm. long; pedicels 1–3 mm. long; sepals 4, broadly triangular, about 1 mm. long; petals 4, white to pale yellow or rarely reddish, elliptic-ovate, 2–3 mm. long; stamens 4, 4–5 mm. long, anthers about 1 mm. long; disc flat, about 0.3 mm. high; rudimentary carpels 2 or 4, about 1 mm. high. Carpellate flowers 2–3 mm. long; pedicels, sepals and petals as in staminate flowers; disc flat to pulvinate, 0.1–0.5 mm. high; gynoecium 4-carpellate, 1.5–2 mm. high, stigmas coherent at anthesis, the combined stigmatic structure peltate. Fruiting pedicels 1–7 mm. long; follicles subglobose, 5–7 mm. in diameter, in 4's, 3's, 2's or single with 0, 1, 2 or 3 undeveloped carpels, respectively.

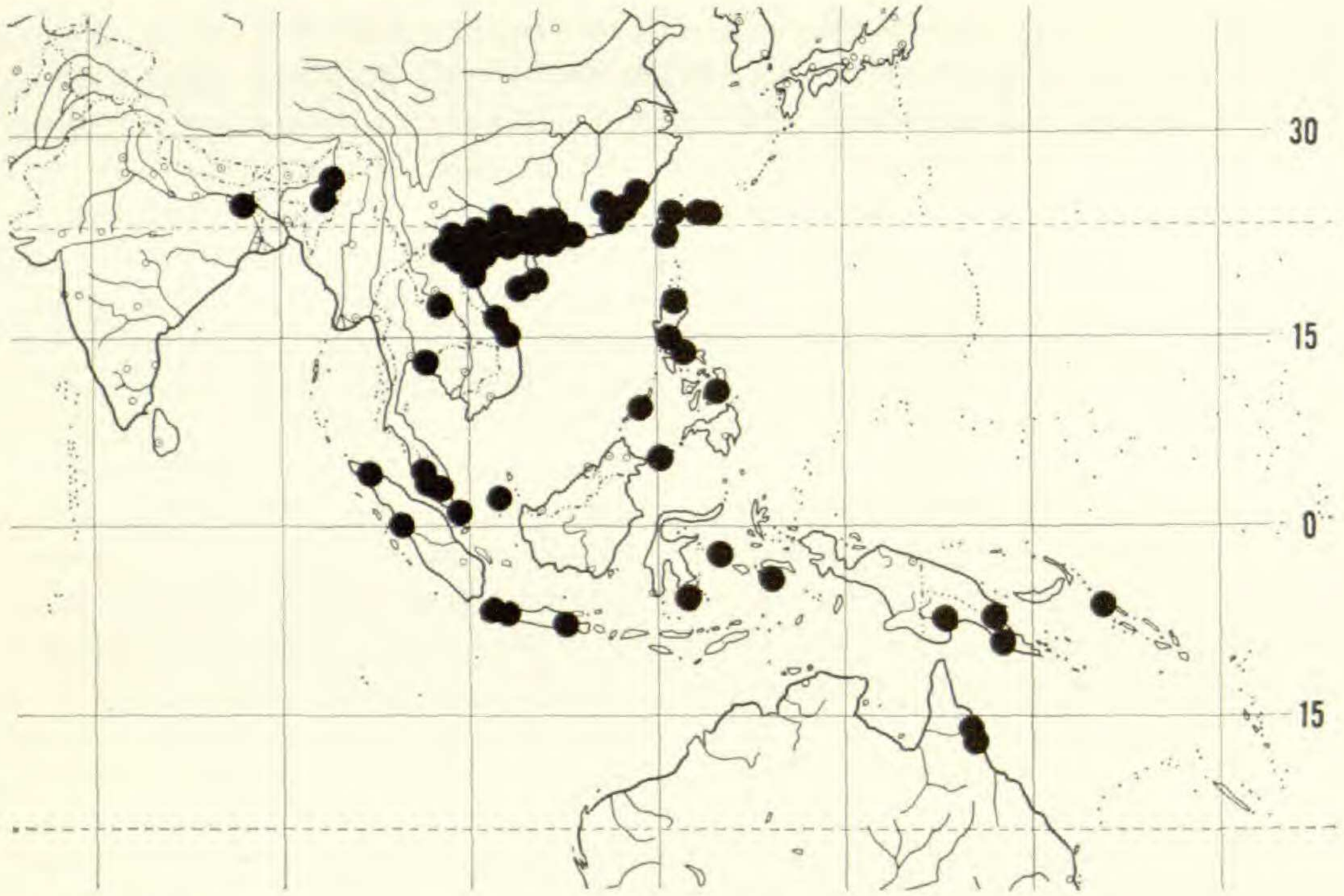
India. BIHAR: Borybari (near Bhagalpur), *Hamilton*, February 12, 1809 (K — holotype of *Zanthoxylum hamiltonianum*, not seen; A, photo.). NORTHERN BENGAL: *Biswas 1707* (A). ASSAM: Naga Hills, *Prain's Collector* 758 (A), 883 ♀ (A), *987* ♀ (A); Mahkoti Dumur, Dullung, *Watt 10441* ♀ (US). Without definite locality: *Kamphovener 169H* ♂ (A). **Thailand.** Sriracha, Tapibut, Lapeboot-tong Kan Forest, *Collins 705* ♂ (K — holotype of *Zanthoxylum collinsae*); Ponpissay, *Kerr 8573* ♂ (SING). **North Vietnam.** Si Ninh Binh Province, *Petelot 875* ♂ (A, US); Lontoy Province, *Petelot 1309* (A); Bhai Nginfen Province, *Petelot 2691* ♀ (A); Than-hoa Province, La-han, *Poilane 1687* (A, photo.); inter Suyut et Cho Bo, *Poilane 28200* (P — holotype of *Zanthoxylum scabrum*, not seen; A, photo.). **South Vietnam.** Mt. Bana, ca. 25 km. W of Tourane (Da Nang), *J. & M. S. Clemens 3996* ♀ (A, US); Hue, *Squires 170* ♀ (A, SING, US). **China.** YUNNAN PROVINCE: Si-chour-hsien, Faa-doon, *Feng 11735* ♀ (A); Fohai, *Wang 74643* ♀ (A); Che-li Hsien, *Wang 75548* ♀ (A — isotype of *Zanthoxylum asperum*), *77546* ♀ (A), *77912* ♀ (A), *79173* ♀ (A). KWANGSI PROVINCE: Lar Pan, W of Hochih, *Ching 6510* ♀ (A); W. Poseh, Bako Shan, *Ching 7685* ♀ (A, US); Pin-lam, *Ko 55674* ♀ (A); Lungchow, *Morse 332* ♂ (US), *382* ♂ (US); Sui-luk, SW of Nanning, *Tsang 21919* ♂ (A); Sun-to District, Po Yam Shan, near Tai Chung Village, *Tsang 22973* ♀ (A). KWANGTUNG PROVINCE: Lofou-shan, *Chun 40435* ♂ (A, SING), *Tsiang 1619* ♂ (A), *1651* ♀ (A, US); vicinity of Yeungkong, *Ferris 11934* ♀ (GH); Canton and vicinity, *Hai 33* ♂ (A), *Levine CCC 201* (A, US), *CCC 236* ♀ (A, US), *CCC 407* ♂ (A, US), *CCC 1130* ♀ (A), *CCC 1625* ♀ (A, US), *Merrill 9940* ♀ (A), *To CCC 407* ♂ (A), *CCC 1130* ♀ (A, US), *Tsiang 17* ♂ (A), *31* ♀ (A); Chung Shan District, Tong Ka Wa Village, *Hom 7–79* ♂ (A); SE of Shangsze, *Tsang 23924A* ♀ (A); Ho-yuen District, Nam Shan, Tsung-shue Village, *Tsang 28864* ♀ (A); Yingtak District, *Tsiang 1927* ♂ (A, SING); Sun-wui District, *Tso & Tsaing 2008* ♀ (A, SING); Yun Fou District, West River, Lou Lu Tsun, *Wang 382* ♂ (A); without definite locality, *Tsoong 1472* ♂ (A). HAINAN ISLAND: Dung Ka, *Chun & Tso 43581* ♀ (A); Fan Maan Tsuen & vicinity, Chim Shan, *Fung 20202* ♀ (A, US); Ta Hau, *Gressitt 965* ♀ (A); Yaichow, *How 70306* ♂ (A, US), *70675* ♀ (A), *Liang 62340* ♀ (US); vicinity of Manning, *How 71366* ♂ (A); Manyun, Tun Shan Ling, *Ko 52130* ♀ (A), *Liang 61515* ♀ (A); Ngai District, Yeung Ling Shan, *Lau 62* ♀ (A, US); Tan District, I Kap Shan & vicinity, *Lau 1079* (A); Kan-en District, Chim Fung Ling, *Lau 3605* ♀ (A), *5523* ♂ (A); Ching Mai District, *Lei 342* (A), *363* ♀ (SING), *800* ♀ (SING); Seven Finger Mt., *Liang 61631* ♀ (A); Taam-chau District, *Tsang 98* ♀ (A, US); *115* ♀ (A, US), *422* ♀ (A, US), *601* ♀ (A, US), *667* ♀ (A, US); without definite locality, *Liang 65076* ♂ (A), *65207* ♂ (US), *65216* ♀ (A), *65318* ♂ (A). HONG KONG: *Chun 4809* ♀ (A), *Taam 1159* ♂ (A, US), *2024* ♀ (US), *Tsang LU 16697* ♂ (A, US), *Wright 81* ♂ & ♀ (GH), *83* ♂ & ♀ (GH), *s.n.* ♀ (US). FUKIEN PROVINCE: Hinghwa District, *Chung 936* ♀ (A, SING); Inghok Hsien, Fang-quang-yen, *Chung 2652* ♀ (A), *7977* ♀ (A); Amoy & vicinity *Chung 4770* (A), *5607* ♀ (A), *5889* ♂ (A), *5892* ♀ (A), *5935* ♂ (A), *6014* ♀ (A), *6252* ♀ (A); Foochow vicinity, *Chung 8417* (A), *Ging 13051* (A), *13531* ♂ (A), *Norton 1394* (US); Kushan, *Dunn 72* ♀ (A); Hok Chiang vicinity, *Ging 15333* ♀ (A); without definite locality, *Chung 6951* ♀ (A), *Dunn's expedition*, April to June, 1905 ♀ (A). **Taiwan.** Tamnii, *Faurie 23* ♀ (A); Hokuto, *Faurie 1268* (A); Kuraru, *Gressitt 478* ♀ (A); South Cape, *Henry 205* two sheets, ♂ & ♀ and ♂ (A); Tchow, *Henry 205A* ♀ (US), *205G* ♀ (US), *1782* [A (♂), US (two sheets, ♂ and ♀)]; Taitung Mts., *Keng & Kao K2674* ♀ (A); Taihoku and vicinity, *Kou & Kae 4496* ♂ (A), *Odashima*, June 22, 1934 ♀ (A, GH, SING, US), *Suzuki*, June 18, 1933 ♀ (A), *Wilson 10161* [A (two sheets, ♂ and ♀), US (♀)]; Tamsuy,

Oldham 60 ♂ (US); Mt. Daiton and vicinity, *Tanaka 1784* ♂ (A, GH); without definite locality, *Faurie 23* ♀ (A), *Henry 464* ♂ (A), *Oldham*, 1864 ♀ (GH). **Ryukyu Islands.** SAKISHIMA GUNTO: Iriomote Island, *Hatusima 18833* ♀ (US); Ishigaki Island, *Smith 85* (US); Yonaguni Island, *Walker & Tawada 6801* (US). **Sumatra.** Middle Patani Valley, *Lorzing 15257* ♀ (L); Sibolangit, *Galoengi 231* ♀ (L). **Malay Peninsula.** PERAK: Padang Rengas, *Haniff SF 14978* (SING); Dindings, *Ridley 10281* ♀ (SING). PAHANG: Manchio, *Haniff SF 16778* (SING); Temerloh, *Ridley*, 1891 ♀ (SING). SINGAPORE: *Ridley 11291* ♀ (SING — holotype of *Zanthoxylum hirtellum*; K, fragments). **Java.** WEST JAVA: Batavia vicinity, *Backer 73* ♀ (L); Lengkong, *Backer 16980* ♂ (L); Res. Batavia, Omgeving Goea si Gadjah, *Backer 31164* ♀ (L); Preanger Regencies, Mt. Megamendoeng, *Blume 1814* ♀ (L — syntype of *Fagara oblongifolia*); Mt. Papandjan, *Blume* ♀ (L — syntype of *Fagara oblongifolia*); Depok, *Hallier*, August 11, 1896 (L); vicinity of Buitenzorg, *Hochreutiner 28* (L); Natuurmonument-eilandje Noesagede in het meer van Pendjaloe, *Koorders & Koorders-Schumacher 47963β* ♀ (L — holotype of *Fagara pendjaluensis*). EAST JAVA: Kediri, *Backer 11717* ♀ (L). **Anambas Islands.** Siantan Island, *Henderson SF 20132* ♀ (SING), *Steenis 748* ♀ (L, SING). **Philippines.** PALAWAN ISLAND: vicinity of Puerto Princesa, *Ebalo 448* (A), *Sulit PNH 12282* ♀ (A, L). LUZON ISLAND: Cagayan Province, Penablanca, *Ramos & Edano BS 46617* ♀ (NY, SING); Nueva Vizcaya Province, *Afalla FB 30213* ♀ (NY, US); Tayabas, *Ramos BS 13261* ♀ (BM). LEYTE ISLAND: Palo, *Elmer 7278* [A, K (♂), L]; without definite locality, *Wenzel 1232* ♀ (GH, NY). TAWITAWI ISLAND: *Ramos & Edano BS 44007* ♀ (A, BM, BRI, K, NY, SING, US). **Celebes.** Kabaena Island, *Elbert 3445* ♀ (A, L, SING). **Moluccas.** Soela Islands, Sanana Island, *Atje* ♀ (L); Amboina Island, *Robinson Plantae Rumph. Amb. 250* ♀ (BM, GH, K, L, NY, SING, US). **Papua.** Western District, Lower Fly River, east bank opposite Stuart Island, *Brass 7983* ♀ (A, BRI, L); Central District, Dieni, Ononge Road, *Brass 3833* ♀ (A, BM, BRI, NY). **Territory of New Guinea.** MOROBE DISTRICT: Wampit River ¾ mile from Lae-Wau Road, *Millar NGF 9997* ♀ (BRI, CANB, K); Bulolo Valley, *Floyd NGF 7471* ♀ (L). **Solomon Islands.** Bougainville Island, Karngu, Bbuin, *Kajewski 2304* ♀ (A). **Australia.** QUEENSLAND: Daintree River, *Brass & White 180* ♀ (A); Rockingham Bay, Herbert's River, *Dallachy*, October 4, 1866 ♀ (BRI, MEL), August 21, 1869 [MEL (two sheets, ♀ and ♂ ♀) — syntypes of *Zanthoxylum torvum*; GH (♂)]; Mossman, *Jones 2060* (CANB); Johnstone River, *Ludbrook 58* ♀ (BRI); Cairns, *Nugent* ♀ (BRI); Tully, Jarra Creek, *Webb 2352* (CANB). **Cultivated.** India: Calcutta, *Roxburgh Icones 2430*, drawn from a plant from Canton, China (K — lectotype of *Fagara nitida*, not seen; A, photo.).

DISTRIBUTION. NE India east to Taiwan and the Ryukyu Islands; south in South Vietnam, Thailand, Sumatra, Malay Peninsula, Java, Anambas Islands, Philippines, Celebes, Moluccas, E New Guinea, Solomon Islands and NE Queensland; in rain forests and thickets at altitudes up to 1100 meters in Malesia and up to 1400 meters in continental Asia. See MAP 2.

ILLUSTRATIONS. HUANG, C. C., Acta Phytotax. Sinica 6(1): *t. XV* (as *Zanthoxylum nitidum*) and *t. XVI* (as *Zanthoxylum asperum*). 1957. LI, H. L., Woody flora of Taiwan 374. 1963. LIU, T. S., Illustrations of native and introduced ligneous plants of Taiwan 2: *t. 729*. 1962. PIERRE, L., Flore forestière de la Cochinchine 4: *t. 291*. 1893.

Occasionally cultivated as a hedge plant in China. In Taiwan the root



MAP 2. Distribution of *Zanthoxylum nitidum* (Roxb.) DC.

is used in making pipe stems. In both the Philippines and China (Hainan Island) collectors have noted that the plant was pounded and placed in pools to stupefy fish. In the Malay Peninsula the bark is used for treatment of toothache.

According to Merrill, Comm. Lour. Fl. Cochinch. 218. 1935, the cultivated material at Calcutta that provided the type for Roxburgh's *Fagara nitida* was originally from Canton, China.

Sealy, Kew Bull. 11: 339. 1956, points out that another Roxburgh drawing at Kew, that of *Elaeagnus arborea* Roxb., bears the same number as *Fagara nitida* Roxb.

Merrill, Interp. Rumph. Herb. Amb. 288. 1917, lists *Nugae sylvarum silvestis* Rumph. as a synonym of *Fagara torva* (F. Muell.) Engl. (= *Zanthoxylum nitidum*).

The name *Piper pinnatum* Lour. is listed as a synonym of *Zanthoxylum nitidum* by Merrill, Comm. Lour. Fl. Cochinch. 218. 1935, who reasoned that Loureiro must have been misled by the peppery taste of the fruit. The epithet *pinnatum* was used earlier to describe a Norfolk Island species, *Blackburnia pinnata* J. R. & G. Forst. [*Zanthoxylum pinnatum* (J. R. & G. Forst.) Druce].

I have not seen the type of *Fagara warburgii* Perk. (*Warburg 11784*), which was apparently lost at Berlin. Merrill, Enum. Philip. Fl. Pl. 2: 327. 1923, cites this Warburg number (apparently from an isotype at Manila, also presumably lost) and lists the name as a synonym of *Zanthoxylum torvum* F. Muell. (= *Zanthoxylum nitidum*).

Vegetatively, *Zanthoxylum nitidum* exhibits a wide range of variation that appears to correspond with ecological differences within its range.

In general, the collections fall into two groups: large-leaved plants of rain forests and small-leaved plants of dryer situations, generally described as thickets. Plants of the first group are high climbing lianas with leaves over 25 cm. (up to 40 cm.) long, leaflets chartaceous or subcoriaceous, dull above and generally with some pubescence on the rachis and lower surface. This form predominates in the Malesian area and is otherwise scattered throughout most of the range of the species. Plants of the second, smaller-leaved group are climbing or semi-erect shrubs with leaves less than 25 cm. (down to 5 cm.) in length, leaflets tending to be coriaceous, shiny above, and glabrous. For the most part this form is restricted to the Asiatic mainland, though there are a few outliers at higher elevations in the islands of Malesia (*Ebalo 448*, from the Philippines; *Elbert 3445*, from the Celebes; and *Galoengi 231,* from Sumatra). There is a great deal of intermingling of the various vegetative features of these two groups, especially on the Asiatic mainland, and while this further complicates the problem by giving rise to several local races that at first appear distinct from either of the two main morphological groups, intergradation is so complete that I have found it impossible to recognize but a single species.

The closest relative of *Zanthoxylum nitidum* appears to be *Z. tetraspermum* Wight & Arn., of southern India and Ceylon, which differs from *Z. nitidum* in having primarily terminal inflorescences, rather fleshy petals, sepals connate basally and leaflets with 15–20 main veins on each side of the midrib. *Z. caudatum* Alston, of Ceylon, is also closely related and is otherwise interesting since it seems to combine some vegetative characters of *Z. scandens*. An isotype examined [*Silva 128* (K)] has leaflets resembling *Z. scandens* in size, shape and color, but with the arrangement and margins of *Z. nitidum*.

3. **Zanthoxylum myriacanthum** Wall. ex Hook. f. Fl. Brit. Ind. **1:** 496. 1875. Type: *Porter* (Wallich cat. n. 1214), Malay Peninsula.

Zanthoxylum rhetsoides Drake, Jour. Bot. Paris **6:** 275. 1892. Syntypes: *Balansa 4044* (not seen) and *4045*, North Vietnam.

Fagara myriacantha (Wall. ex Hook. f.) Engl. Nat. Pflanzenfam. III. **4:** 118. 1896.

Zanthoxylum diabolicum Elmer, Leafl. Philip. Bot. **2:** 477. 1908. Type: *Elmer 10217*, Philippines.

Evodia odorata Levl. Repert. Sp. Nov. **9:** 458. 1911. Type: *Cavalerie 2978*, China, Kweichow Province.

Zanthoxylum odoratum (Levl.) Levl. *Ibid.* **13:** 266. 1914.

Fagara gigantea Hand.-Mazz. Anzeig. Akad. Wiss. Wien. **58:** 64. 1921. Type: *Handel-Mazzetti 12327*, China, Hunan Province.

Zanthoxylum giganteum (Hand.-Mazz.) Rehd. Jour. Arnold Arb. **8:** 151. 1927.

Fagara diabolica (Elmer) Engl. Nat. Pflanzenfam. ed. 2. **19a:** 220. 1931.

Fagara odorata (Levl.) Hand.-Mazz. Symb. Sinica **7:** 623. 1933.

Fagara rhetsoides (Drake) Reeder & Cheo, Jour. Arnold Arb. **32:** 69. 1951.

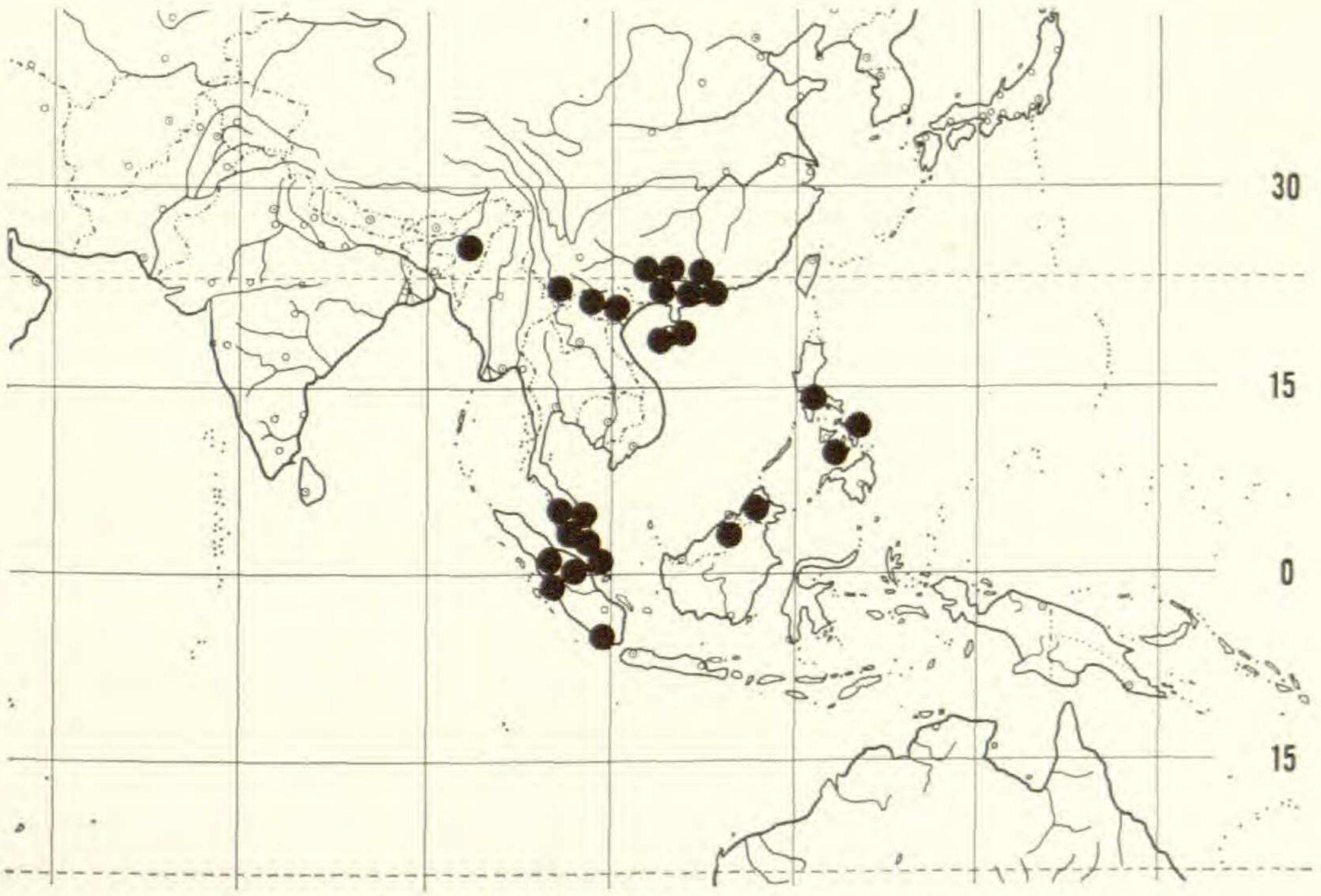
Zanthoxylum rhetsoides Drake var. *pubescens* Huang, Acta Phytotax. Sinica **6** (1): 48. 1957. Type: *Wang 77979*, China, Yunnan Province.

Small to large trees to 25 m.; dioecious; evergreen; main stems prickly or with thick, conical spines to 3 cm. long; branchlets with numerous straight prickles, generally swollen and hollow and apparently housing ants. Leaves imparipinnate, 25–45 (60) cm. long, glabrous or (rarely) short pubescent on the lower surface; petiolules obsolete to 5 mm. long; leaflets 4–9 (11) pairs, opposite or subopposite, chartaceous to coriaceous, dark green and lustrous above, pale green below, pellucid dotted, elliptic, 8–18 cm. long, 2.5–8 cm. wide, base obtuse to subcordate, slightly oblique, main veins 8–18 on each side of the midrib, margins finely (often indistinct) glandular crenate with 6–8 crenations per cm., apex acuminate. Inflorescences terminal and from the upper leaf axils, paniculate, 15–25 cm. long and generally about as wide, the axes and branches glabrous to (rarely) short pubescent. Staminate flowers 3–4 mm. long; pedicels obsolete to 2 mm. long; sepals 5, broadly triangular, about 0.75 mm. long; petals 5, white, pale yellow or occasionally violet, elliptic, 1.5–2.5 mm. long; stamens 5, 3–4 mm. long, anthers 0.5–1 mm. long; disc flat; rudimentary carpels 3, about 1 mm. high. Carpellate flowers 2–3 mm. long; pedicels, sepals, petals and disc as in staminate flowers; rudimentary stamens absent; gynoecium 3-carpellate (occasional flowers 4-carpellate), 1.5–2 mm. high, styles and stigmas coherent, the combined stigmatic structure peltate. Fruiting pedicels obsolete to 2.5 mm. long; follicles subglobose, 3–6 mm. in diameter, in 3's, 2's or single with 0, 1 or 2 undeveloped carpels, respectively.

India. Assam, Naga Hills, *Koelz 25762* ♀ (MICH). **North Vietnam.** Vallei de Lomkok, *Balansa 4045* ♀ (P — syntype of *Zanthoxylum rhetsoides*, not seen; A, photo.; L); Chapa, *Petelot 3569* ♂ (US), *7911* ♀ (A); Tien-yen, Kau Nga Shan, *Tsang 30511* ♀ (A). **China.** YUNNAN PROVINCE: Che-li Hsien, *Wang 77979* ♀ (A — isotype of *Zanthoxylum rhetsoides* var. *pubescens*), *78566* ♂ (A). KWEICHOW PROVINCE: Pin-fa, *Cavalerie 1771* ♂ (A, photo. and fragment); Ma-ho (Ma-jo), *Cavalerie 2978* ♀ (P — holotype of *Evodia odorata*, not seen; A, photo., and fragment); Feng Hsiang Ping, Fan Ching Shan, *Steward, Chiao & Cheo 708* ♀ (A, US). HUNAN PROVINCE: Wukang, Yun-shan, *Handel-Mazzetti 12327* ♂ (A — isotype of *Fagara gigantea*). KWANGSI PROVINCE: S Nanning, Seh-feng Dar Shan, *Ching 8128* ♀ (A); Tzu Yuen District, *Chung 83485* ♂ (A); Pin-lam, *Ko 55597* ♂ (A); San Chiang Hsien, *Steward & Cheo 969* ♀ (A, SING). KWANGTUNG PROVINCE: Wung Yuen District, Fan Shiu Shan, *Lau 2770* ♀ (A); Ying Tak, *Tsang & Wong 2453* ♂ (A). HAINAN ISLAND: Po-ting, *Lau 28166* ♀ (A); Taam-Chau District, Hoi Ta Shan, *Tsang 837* ♀ (A); without definite locality, *Liang 64222* ♀ (A). **Sumatra.** CENTRAL SUMATRA: Padang and Bedagei, *Lorzing 15199* ♀ (L); Gouv. O. kust. ond afd. Simeloengoen, *NIFS bb. 2910* ♀ (L); vicinity of Aek Moente (Aer Moette), Asahan (NE of Tomoean Dolok and W of Salabet, *Rahmat si Boeea 9383* (A, L, MICH). SOUTHERN SUMATRA: Res. Benkoelen ond. afd. Redjang, *Endert NIFS E 1078* ♂ (L). **Malay Peninsula.** PERAK: Goping District, Tohoflow Hills, *King's Collector 8157* ♀ (BM); without definite locality, *Scortechini 275* (L, SING). PAHANG: Fraser's Hill, *Corner SF 33166* ♂ (SING), *Nur SF 11310* ♂ (BM, K, SING); Bukit Suvin, *Henderson SF 21706* (SING); Cameron Highlands, Sg. Ikon, *Jaamat SF 27628* ♂ (SING); Telom, *Ridley 13541* ♀ (BM, K, SING). SELANGOR: Kepong, *Sou & Tachou SF 16893* ♂ (SING). MALACCA: Sg. Udang, *Alvins 36* ♀ (SING), *Derry*

1121 ♀ (SING); Bukit Bruang, *Holmberg 857* ♂ (SING); without definite locality, *Maingay 279* ♂ (A, K, L), *1098* ♀ (K). PENANG: Penang Hill, *Corner*, July 27, 1936 (SING); Govt. Hill, *Curtis 1076* ♂ (BM, SING, US), November, 1890 ♂ (SING); without definite locality, *Porter* ♀ (K — holotype of *Zanthoxylum myriacanthum*; BM — isotype). SINGAPORE: *Ridley* ♂ (BM). **Borneo.** Sarawak, Ulu Lawas, *Omar Sar 00107* ♂ (SING); British North Borneo (Sabah), Mt. Kinabalu, *J. & M. S. Clemens 26344* ♀ (A, BM, L, NY), *26344A* ♀ (L, NY). **Philippines.** Luzon Island, Laguna Province, Mt. Makiling, *Canicosa FB 31197* ♂ (NY); Samar Island, *Ramos BS 1680* ♂ (BM, BRI, GH, L, NY, SING, US), *Rosenbluth FB 12866* ♂ (US); Negros Island, Dumaguete, Cuernos Mts., *Elmer 10217* ♂ (isotypes of *Zanthoxylum diabolicum*: A, BM, K, L, NY, US).

DISTRIBUTION. Assam, North Vietnam, SW China, Sumatra, Malay Peninsula, Borneo and the Philippines; in forests and thickets at altitudes from 100 to 1230 meters in Malesia and from 200 to 2145 meters in continental Asia. See MAP 3.



MAP 3. Distribution of *Zanthoxylum myriacanthum* Wall. ex Hook. f.

The fruit is said to be used as a condiment in Assam.

This species is very closely related to *Zanthoxylum ailanthoides*, which has identical flowers and fruits. *Z. molle* Rehd., a species from Hupeh and Anhwei Provinces, China, is also closely related, differing mainly in having leaves that are white tomentose below.

Reeder & Cheo, Jour. Arnold Arb. 32: 69. 1951, cited *Evodia odorata* and *Fagara gigantea* as synonyms of *Fagara rhetsoides* (= *Zanthoxylum myriacanthum*). Handel-Mazzetti, Symb. Sinica 7: 623. 1933, listed *Fagara gigantea* as a synonym of *F. odorata* (= *Zanthoxylum myriacanthum*).

4. **Zanthoxylum ailanthoides** Sieb. & Zucc. Abh. Akad. München **4** (2): 138. 1846 ("*Zanthoxylon*"). Type: *Siebold*, Japan.

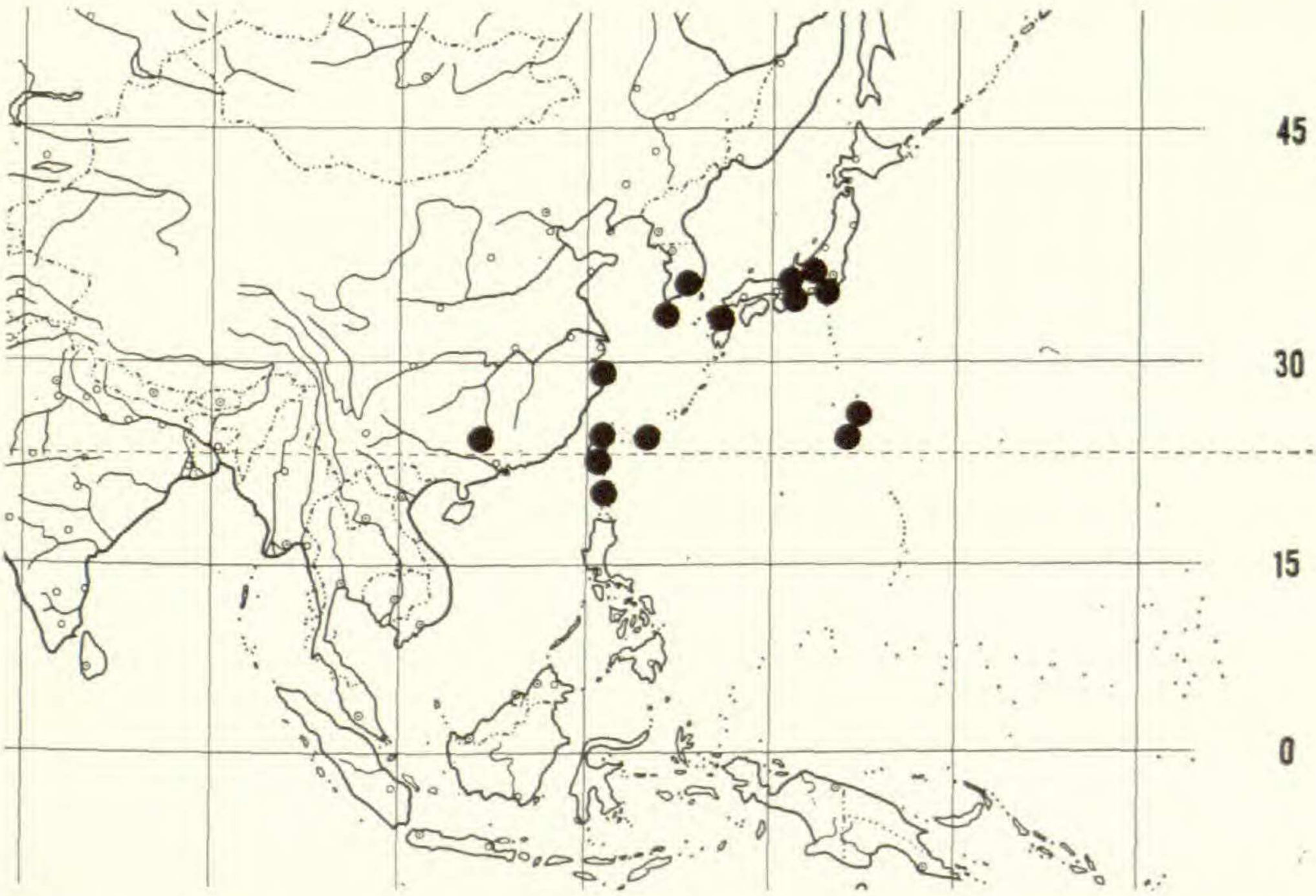
Zanthoxylum emarginellum Miq. Ann. Mus. Lugd.-Bat. **3**: 22. 1867. Type: *Siebold*, Japan.
Fagara ailanthoides (Sieb. & Zucc.) Engl. Nat. Pflanzenfam. III. **4**: 118. 1896.
Fagara emarginella (Miq.) Engl. *Ibid.*
Zanthoxylum hemsleyanum Makino, Bot. Mag. Tokyo **21**: 86. 1907 (*Zanthoxylum emarginellum sensu* Hemsley, Ann. Bot. **9**: 149. 1895). Syntypes: *Cunningham*, Chushan Archipelago (not seen); *Ford*, June, 1884, Taiwan.
Fagara hemsleyana (Makino) Makino, Bot. Mag. Tokyo **21**: 161. 1907.
Zanthoxylum ailanthoides Sieb. & Zucc. var. *inerme* Rehd. & Wils. Jour. Arnold Arb. **1**: 118. 1919. Type: *Wilson 8265*, Bonin Islands.
Zanthoxylon inerme (Rehd. & Wils.) Koidz. Bot. Mag. Tokyo **33**: 218. 1919 (nomen illegit.), *non* Sessé & Mociño.
Fagara boninshimae Koidz. ex Hara, Enum. Spermat. Jap. **3**: 25. 1954 (based on *Zanthoxylum ailanthoides* var. *inerme*).

Medium to large trees to 25 m.; dioecious; apparently evergreen; main stems prickly or with thick, conical spines or rarely unarmed; branchlets generally armed, the prickles straight and scattered. Leaves imparipinnate, 25–80 cm. long, glabrous; petiolules obsolete to 3 mm. long; leaflets 7–15 pairs, opposite, chartaceous to subcoriaceous, medium to dark green above, glaucous below, pellucid dotted, elliptic-lanceolate to lanceolate, broadest near the base, 9–14 cm. long, 2.3–4.7 cm. wide, base rounded to cordate, slightly oblique, main veins 12–20 on each side of the midrib, margins glandular crenate with 4–8 crenations per cm., apex long acuminate to attenuate. Inflorescences terminal and from the upper leaf axils, paniculate, 10–30 cm. long and generally about as wide, the axes and branches glabrous. Staminate flowers 3–4 mm. long; pedicels 1–2 mm. long; sepals 5, broadly triangular, about 0.75 mm. long; petals 5, white or pale yellow, elliptic, 1.5–2.5 mm. long; stamens 5, 3–4 mm. long, anthers 0.5–1 mm. long; disc flat; rudimentary carpels 3, about 1 mm. high. Carpellate flowers 2–3 mm. long; pedicels, sepals, petals and disc as in staminate flowers; rudimentary stamens absent; gynoecium 3-carpellate, 1.5–2 mm. high, styles and stigmas coherent, the combined stigmatic structure peltate. Fruiting pedicels 1–3 (4.5) mm. long; follicles subglobose, about 3.5 mm. in diameter, in 3's, 2's or single with 0, 1 or 2 undeveloped carpels, respectively.

China. KWANGSI PROVINCE: N Hin Yen, Yeo Mar Shan, *Ching 7102* ♂ (A, US). CHEKIANG PROVINCE: Shihpu, *Chiao NU 14130* (A); without definite locality, *Barchet 83* ♀ (US), *84* (US). **Korea.** Circa Hongnu, *Faurie 1632* ♂ (A); Ooryong-too (Dagelet Island), *Wilson 8514* (A); Quelpaert Island, *Faurie 467* ♀ (A), *Moran 5517* ♀ (GH, US), *Taquet 619* ♂ (A), *2713* ♀ (A), *2714* ♀ (A), *4142* ♂ (A), *Wilson 9440* ♀ (A). **Japan.** HONSHU ISLAND: Nakatsugawa, Nojiri, Shinano, *Jack*, September 6, 1905 ♀ (A, GH); Yokohama, *Maximowicz*, 1862 [GH (♂), US (♀)]; Shima, Toba, *Sakurai*, August 2, 1908 (A); Mino, *Shiota 4459* (A); Oshima Island, *Mizushima 573* ♀ (A). KYUSHU ISLAND: Nagasaki, *Maximowicz*, 1863 ♂ (US), *Wilson 6313* ♀ (A). Without definite locality: *Sargent*, August 26, 1892 ♂ (A), *Siebold* (K — sketch of holotype of *Zanthoxy-*

lum emarginellum), *Siebold* (M — isotype of *Zanthoxylum ailanthoides*, not seen; A, photo.). **Bonin Islands.** Chichi-jima, *Gonzales*, 1917 (A), *Otomo*, May 4, 1917 ♂ (A); Haha-jima, *Wilson 8265* ♀ (A — holotype of *Zanthoxylum ailanthoides* var. *inerme*; US — isotype); without definite locality, *Wright 41* ♀ (GH, US). **Ryukyu Islands.** Yaeyama Gunto, Iriomote Island, Funauki Bay, *Walker & Tawada 6762* (US). **Taiwan.** Kelung, *Ford*, June, 1884 (K — syntype of *Zanthoxylum hemsleyanum*, not seen; A, photo.), June 14, 1884 (A, photo.); South Cape, *Henry 1353* ♂ (A); Tamsuy, *Oldham 58* ♀ (GH); Taihoku vicinity, *Shimada 39* ♂ (A), *Wilson 11220* ♀ (A); without definite locality, *Henry 1630* ♀ (A, US). **Philippines.** BATAN ISLAND: Mt. Iraya, *Ramos BS 80273* ♂ (K, NY); Basco, *Ramos BS 80381* ♂ (NY). **Cultivated.** Japan, Tokyo, *Okamoto*, July 25, 1958 ♂ (US), *Terakawa*, June 23, 1946 (US).

DISTRIBUTION. China (Kwangsi and Chekiang Provinces), Korea, Japan, Bonin and the Ryukyu Islands, Taiwan and the Philippines (Batan Island); in lowland forests at altitudes up to 300 meters. See MAP 4.



MAP 4. Distribution of *Zanthoxylum ailanthoides* Sieb. & Zucc.

ILLUSTRATIONS. LIU, T. S., Illustrations of native and introduced ligneous plants of Taiwan 2: *t. 727*. 1962. MAKINO, T., Illustrated flora of Japan, ed. 2. *t. 1173*. 1940, as *Fagara ailanthoides*; revised ed. *t. 1173*. 1949; New illustrated flora of Japan *t. 1328*. 1961.

The wood is used in the Bonin Islands to make canoes.

Zanthoxylum ailanthoides is closely related to both *Z. myriacanthum* and *Z. micranthum* Hemsl. The latter species, known from Hupeh, Hunan, and Szechuan Provinces, China, differs in having more slender branchlets and smaller leaves.

Li, *Woody flora of Taiwan* 372. 1963, has cited *Zanthoxylum emarginellum* and *Z. hemsleyanum*, both based on collections from immature plants, as synonyms of *Fagara ailanthoides*.

5. **Zanthoxylum avicennae** (Lam.) DC. Prodr. 1: 726. 1824.

Fagara avicennae Lam. Encycl. **2:** 445. 1788. Type: *d'Incarville 179*, China (probably Kwangtung Province, *fide* Merrill, Comm. Lour. Fl. Cochinch. 218. 1935).

Xanthoxylum lentiscifolium Champ. ex Benth. Jour. Bot. Kew Misc. **3:** 329. 1851. Type: *Champion*, Hong Kong (not seen).

Zanthoxylum tidorense Miq. Ann. Mus. Lugd.-Bat. **3:** 246. 1867. Type: *Teysmann HB 5167*, Moluccas, Tidore Island.

Zanthoxylum diversifolium Warb. in Engl. Bot. Jahrb. **13:** 339. 1891. Type: *Warburg 20145*, Moluccas, Kai Island.

Fagara diversifolia (Warb.) Engl. Nat. Pflanzenfam. III. **4:** 118. 1896.

Zanthoxylum iwahigense Elmer, Leafl. Philip. Bot. **5:** 1833. 1913. Type: *Elmer 12751*, Philippines, Palawan Island.

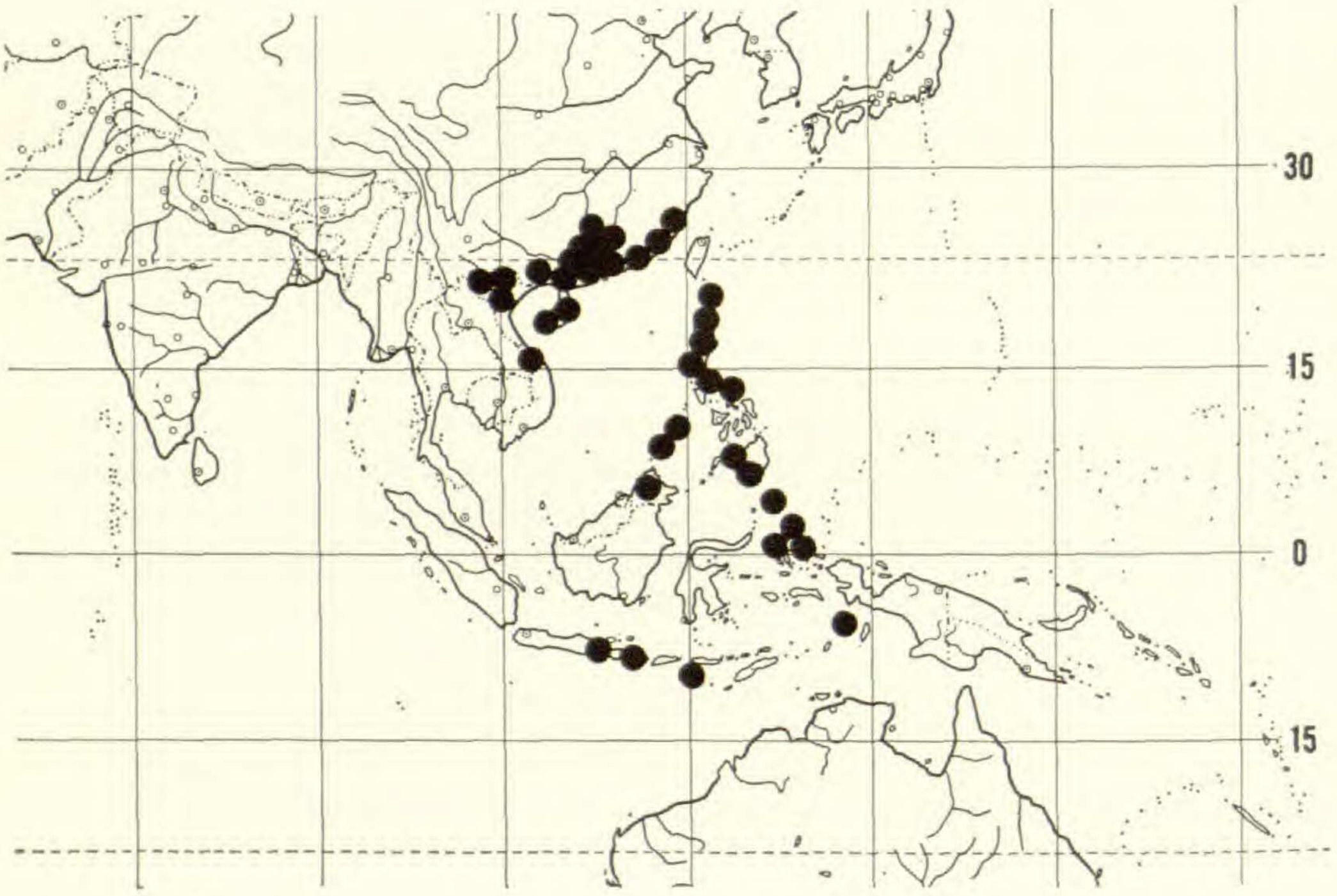
Scandent (rarely) or erect shrubs or small trees to 13 m.; dioecious; evergreen; branchlets generally armed, the prickles straight and scattered or recurved and predominantly pseudostipular. Leaves imparipinnate, 5–30 cm. long, glabrous; rachis often with narrow wings extending to 1 mm. on either side; petiolules 2–5 mm. long; leaflets 2–11 pairs, suboppposite, chartaceous to subcoriaceous, dark green above, pale below, generally blackening somewhat in drying, pellucid dotted, ovate to elliptic-lanceolate, 1–8 cm. long, 0.75–3 cm. wide, base obtuse to cuneate, main veins 4–11 on each side of the midrib, margins subentire to finely glandular crenate with as many as 8 crenations per cm., apex obtuse to acuminate. Inflorescences terminal and occasionally from the upper leaf axils, cymose, the primary branches generally whorled, 5–21 cm. long, flat-topped, glabrous. Staminate flowers 1.5–3 mm. long; pedicels 0.5–3 mm. long; sepals 5, broadly triangular or rounded, 0.5–0.8 mm. long; petals 5, white to greenish yellow, elliptic, 1–2.5 mm. long; stamens 5, about 2 mm. long, anthers about 0.75 mm. long; disc flat; rudimentary carpels 2, about 0.75 mm. high. Carpellate flowers 1.5–3 mm. long; pedicels, sepals and petals as in staminate flowers; rudimentary stamens about 0.5 mm. long; disc pulvinate, about 0.3 mm. high; gynoecium 2-carpellate, about 1 mm. high, styles and stigmas coherent, the combined stigmatic structure peltate. Fruiting pedicels 1–3 mm. long; follicles subglobose, about 4.5 mm. in diameter, in pairs or occasionally single and paired with an undeveloped carpel.

Thailand. Dauang-Quinom, *Smitinand & Abbe 24842* ♀ (L). **North Vietnam.** Ninh Binh Province, Cho Ganh, *Petelot 822* ♀ (A), *1676* ♀ (A); Lontoy Province, *Petelot 2591* ♂ (A); Ha-coi, Taai Wong Mo Shan, *Tsang 27016* ♀ (A), *29377* ♂ (A, SING), *29549* ♂ (A, SING); Tien-yen, Kau Nga Shan, *Tsang 27392* ♀ (A), *30494* ♂ (A, SING); Dam-ha, Sai Wong Mo Shan, *Tsang 30448* ♂ (A, SING). **South Vietnam.** Mt. Bana, 25 km. W of Tourane (Da Nang), *J. & M. S. Clemens 4067* ♂ (A, US), *4445* ♀ (A, US). **China.** KWANGSI PROVINCE: S Nanning, Seh-feng Dar Shan, *Ching 7827* ♀ (A, US); Sun-to District, Po Yam Shan,

Tsang 23022 ♀ (A); Waitsap District, Tou Ngok Shan, near Tung Chung Village, *Tsang 23291* ♀ (A); Shang-sze District, Shap Man Taai Shan, *Tsang 24326* ♀ (A). KWANGTUNG PROVINCE: Canton and vicinity, *Hai 43* ♀ (A), *Levine CCC 170* ♀ (A, GH, US), *CCC 563* ♀ (A, GH, US), *CCC 1298* ♂ (A, GH, US), *CCC 1814* ♀ (A, GH, US), *CCC 3134* ♂ (A, GH), *Merrill BS 10052* ♀ (A); Wung-yuen District, Yung-yun, *Lau 632* ♀ (A); Wong Chuk I, Tsing Wan Shan, *Lau 2495* ♀ (A); Kao-yao District, Ting Woo Shan, *Lau 20292* ♂ (SING); Wah Shau Toi, *Levine & McClure CCC 6913* ♂ (US); Pakhoi, *Playfair*, April, 1883 ♀ (GH); Hwei-yang District, Sam Hang Shek Tau, Lin Fa Shan, *Tsang 25872* ♀ (A); Fang Cheng District, Taan Faan, Kung Ping Shan, *Tsang 26868* ♂ (A); Lofoushan, *Tsiang 1645* ♀ (A, SING, US); Yan Fon District, West River, *Wang 322* ♀ (A). HAINAN ISLAND: Nodoa, *Chun NU 5825* ♀ (US); Dung Ka, *Chun & Tso 43401* ♀ (A); Tai Pin, *Gressitt 1117* ♂ (A); Yaichow, *How 70939* ♂ (A); Nagai District, Yeung Ling Shan, *Lau 133* ♀ (A, US); Chang-kiang District, Ka Chik Shan, *Lau 3085* ♀ (A); Kan-en District, Chim Fung Mt., *Lau 4932* ♀ (A); Loktung, *Lau 27140* ♂ (A); Pak Shik Ling vicinity, Ku Tung Village, *Lei 55* ♀ (SING, US), *876* ♀ (A, SING, US); San Hu, Tin Si, *McClure CCC 7731* ♀ (A); Lam Ko District, Lin Fa Shan, *Tsang 213* ♂ (A, US); Hung Mo Shan, *Tsang 787* ♂ (A); without definite locality, *Liang 62183* ♂ (US), *63604* ♀ (US). MACAO: *Callery 248* ♂ (GH). HONG KONG: *Brigham* ♀ (GH), *Chun 3153* ♀ (A, SING), *6806* ♀ (A), *Ford* ♀ (A), *Sargent* ♀ (A), *Taam 1617* ♂ (US), *1718* ♂ (US), *Tsang 16529* ♀ (A, US), *Wright 84* ♀ (GH), *s.n.* ♀ (US). FUKIEN PROVINCE: Kushan, *Chung 7583* ♂ (A); Kuliang and vicinity, *Tang 6751* ♀ (A); Foochow, *Tang 13119* ♀ (A); Lien-gong and vicinity, *Tang 16040* ♂ (A); Hok-chang, Ling-soik Temple, *Tang 16055* ♂ (A). Without definite locality: *Father d'Incarville 179* ♀ (P — holotype of *Fagara avicennae*, not seen; A, photo.). **Java.** East Java, Madiun Province, Ngebel, *Koorders 23208β* (L). **Lesser Sunda Islands.** Lombok Island, Rindjani-vulkangebirge, *Elbert 1582* [A (♂), CANB (♀), L (♀)]; Soemba Island, *de Voogd 1991* ♀ (L). **British North Borneo (Sabah).** Mt. Kinabalu, Penibukan, *J. & M. S. Clemens 31036* ♂ (A, K, L, NY), *40530* ♀ (A, L); between Ranau and mile 3 on road to Hot Springs, *Darnton 119* ♂ (BM). **Philippines.** PALAWAN ISLAND. Mt. Gantung, *Edano BS 77626* (NY); Mt. Manalsal, *Edano BS 77760* ♂ (NY, SING); Mt. Pulgar, *Elmer 12751* ♀ (isotypes of *Zanthoxylum iwahigense*: A, BM, GH, K, L, NY, US); Victoria Mts., Panacan, Aborlan, *Sulit PNH 12396* (A, L, SING); without definite locality, *Curran FB 3860* ♀ (NY), *Foxworthy BS 905* ♀ (GH, K, NY, US). BATAN ISLAND. Mt. Iraya, *Ramos BS 80214* ♀ (NY, SING). BABUYAN ISLANDS. Dalupiri Island, *Bartlett 15109* [A (♂ & ♀), MICH (♀)], *15133* ♂ (A, MICH), *15827* ♀ (A, MICH). LUZON ISLAND. Benguet Subprovince: Pauai, *Santos BS 32025* ♂ (BRI, NY, SING). Nueva Ecija Province: Mt. Umingan, *Ramos & Edano BS 26303* ♀ (A, BM, US). Zambales Province: *Ramos BS 5090* ♀ (NY, US). Rizal Province: Antipolo, *Ramos BS 20988* ♀ (A, BM, GH, K, L, NY, SING, US); without definite locality, *Loher 14840* ♂ (A), *Merrill SB 1002* (A, BM, GH, L, NY, US), *SB 1060* ♀ (A, BM, GH, L, NY, US). Camarines Province: *Simeon FB 28756* ♀ (A, K, US). Without definite locality: *Loher 241* (K), *Vidal 1445* ♂ (K). MINDANAO ISLAND. Misamis Province: *Caster FB 29749* ♀ (NY), *Cuming 1622* ♂ & ♀ (BM, K), *Klemme FB 22464* ♀ (BM), *Quimpo FB 30149* ♂ (NY, US). Cotabato Province: *Ferraris FB 23044* ♀ (A, BM, US), *Ramos & Edano BS 84843* ♂ (A). **Moluccas.** Taulaud Island, Karakelong, *Lam 3254* ♀ (A, L); Morotai Island, *Kostermans 1481* ♂ (BRI, K, L, SING); Kahatola Island, off Halmaheira, *Fairchild 3484* ♂ (A); Tidore Island, *Teysmann HB 5167* ♂ (isotypes of *Zanthoxylum tidorense*: K, L, MEL), *de Vriese & Teysmann*, 1859–

1860 (L); Ternate Island, *de Vriese*, 1857–1861 ♂ (L), *de Vriese & Teysmann*, 1859–1860 [A (♂), CANB (♀)]; Kai Island, *Beccari*, August, 1873 [A (♂ & ♀), K (♀)], *Jaheri HB 430* ♀ (L), *Warburg 20145* (A — isotype of *Zanthoxylum diversifolium*).

DISTRIBUTION. Thailand east to Fukien Province, China; south in Java, Lesser Sunda Islands, British North Borneo, the Philippines and the Moluccas; in dry forests, thickets and on open slopes at altitudes up to 1630 meters. See MAP 5.



MAP 5. Distribution of *Zanthoxylum avicennae* (Lam.) DC.

ILLUSTRATIONS. PIERRE, L., Flore forestière de la Cochinchine 4: *t. 289*. 1893, as *Zanthoxylum avicennae* vars. *touranense* Pierre and *tonkinense* Pierre.

I have not seen the type of *Xanthoxylum lentiscifolium* which is listed as a synonym of *Xanthoxylum avicennae* by Bentham in *Flora Hongkongensis* 58. 1861.

Plants from dry, open situations and high mountain areas tend to become dwarfed or scandent with considerably reduced leaves and inflorescences, and more or less recurved, predominantly pseudostipular prickles. Some of the extremes of this type, such as *Smitinand & Abbe 24842*, from Thailand, *Koorders 23208β*, from Java, *J. & M. S. Clemens 40530*, from Sabah and *Elmer 12751*, from Palawan Island, look strikingly different from the arborescent form of this species. They are not geographically isolated, however, and there are numerous intergradations. The Elmer collection cited here is the type of *Zanthoxylum iwahigense*, which has already been reduced to synonomy of *Zanthoxylum avicennae*

by Merrill, Enum. Philip. Fl. Pl. 2: 326. 1923. *Fagara anisata* Back. ex Bakh. f., listed as a provisional name by Bakhuizen, Fl. Java 2: 97. 1965, also seems to represent this scandent form. I have not seen the collection cited (*Backer 11431*), but the description fits reasonably well and the author does not include *Zanthoxylum avicennae*.

6. **Zanthoxylum megistophyllum** (Burtt) Hartley, comb. nov.

Fagara megistophylla Burtt, Kew Bull. **1935:** 301. 1935. Type: *Waterhouse B344*, Solomon Islands, Bougainville Island.

Small trees to 8 m.; dioecious. Leaves imparipinnate, 80–175 cm. long, glabrous; petiolules of lateral leaflets obsolete to 5 mm. long; leaflets 4–5 pairs, opposite, chartaceous, dark green above, pale below, pellucid dotted, elliptic, 20–35 cm. long, 9–16.5 cm. wide, base obtuse to rounded, main veins 13–16 on each side of the midrib, margins entire, apex short acuminate. Inflorescences terminal or terminal and from upper leaf axils, paniculate, to 25 cm. long, broadly spreading, the axes and branches glabrate. Staminate flowers 4–5 mm. long; pedicels 2–3 mm. long; sepals 4, connate in the lower half, triangular, about 1 mm. long; petals 4, white, elliptic, 3–4 mm. long; stamens 4, 4–5 mm. long, anthers 0.5 mm. long; disc flat; rudimentary carpel 1, globose, 0.5 mm. high. Carpellate flowers 3–4.5 mm. long; pedicels, sepals, petals, and disc as in staminate flowers; rudimentary stamens about 0.3 mm. long; gynoecium 2-carpellate, about 2 mm. high, styles and stigmas coherent, the combined stigmatic structure peltate. Fruiting pedicels 2–5 mm. long; follicles subglobose, 9–12 mm. in diameter, in pairs or occasionally single and paired with an undeveloped carpel.

Papua. CENTRAL DISTRICT: Kairuku Subdistrict, near Maipa Village, *Darbyshire 934* ♀ (CANB, L), *998* ♂ (CANB, L); Sogeri Region, central position, *Forbes 96* ♀ (BM). **Solomon Islands.** BOUGAINVILLE ISLAND: Kugumaru, Buin, *Kajewski 1835* ♀ (A); Siwai District, *Waterhouse Y167* ♀ (BRI, NY); without definite locality, *Waterhouse B344* ♀ (isotypes: A, BRI). CHOISEUL ISLAND: northern part, *Whitmore's Collectors BSIP 5661* ♀ (L).

DISTRIBUTION. Solomon Islands and Papua; in well drained, primary rain forests at altitudes up to 600 meters.

A very distinctive species with probably the largest leaves of any *Zanthoxylum* in the Australasian-Pacific region. Additional collections are desirable since at present we lack flowering material from the Solomons and fruiting material from Papua.

7. **Zanthoxylum forbesii** Hartley sp. nov.

Arbor magna; foliis paripinnatis, 40–50 cm. longis, glabris; foliolis in paribus 3–4, oppositis, chartaceis, ellipticis, 15–25 cm. longis, 5–9 cm. latis, basi obtusis, apice breviter acuminatis, margine integris, venis primariis utrinsecus 12–15, petiolulis 0.7–1 cm. longis; infructescentiis

terminalibus et axillis superioribus orientibus, paniculatis, 8–14 cm. longis, patentibus, glabris; pedicellis 2–3 mm. longis; sepalis persistentibus 4, late triangularibus, ca. 1 mm. longis; folliculis subglobosis, ca. 1 cm. diametro, in paribus vel interdum folliculo singulo et cum carpello abortivo; floribus non visis. Holotypus: *Forbes 1707* (GH). FIG. 1.

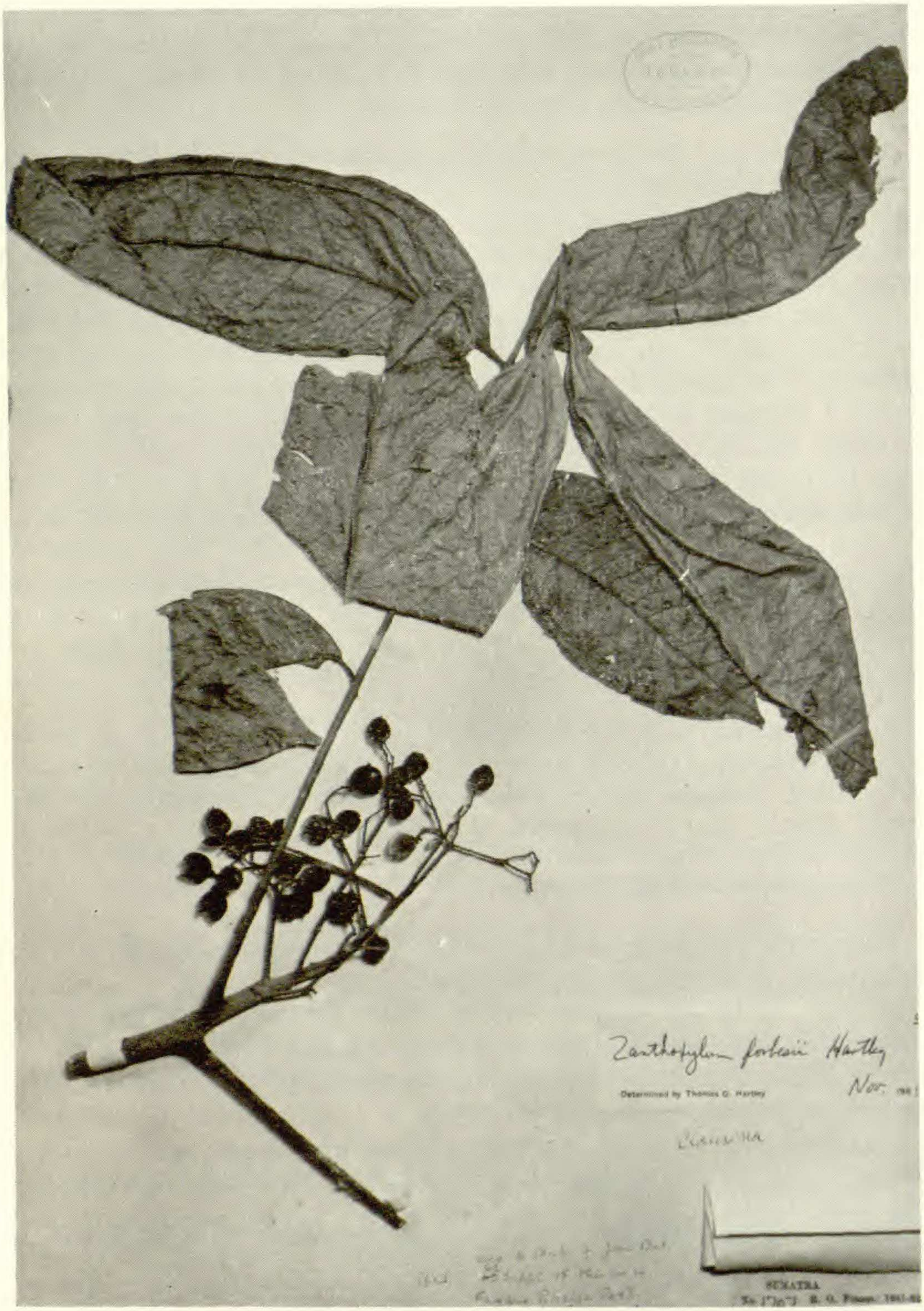


FIG. 1. *Zanthoxylum forbesii* Hartley. Photograph of type (GH), × 3/8.

Sumatra. Penangoengan, Lampongs, altitude 138 m., *Forbes 1707* ♀ (GH — holotype; BM, SING — isotypes).

Apparently allied to *Zanthoxylum megistophyllum* from which it differs in having smaller leaves, fewer leaflets, and longer petiolules.

8. **Zanthoxylum backeri** (Bakh. f.) Hartley, comb. nov.

Fagara backeri Bakh. f. Blumea **6:** 366. 1950. Type: *Backer 17017*, Java.

Liana 15 m.; branchlets sparsely armed with scattered, retrorse prickles. Leaves imparipinnate, to 30 cm. long, glabrous; petiolules about 3 mm. long; leaflets 6–8 pairs, opposite or subopposite, subcoriaceous, elliptic-ovate, 6–8 cm. long, 2.6–3.2 cm. wide, base oblique, main veins 10–12 on each side of the midrib, margins essentially entire, apex acuminate, the acumen about one-fourth the length of the blade. Infructescences terminal and from upper leaf axils, paniculate with opposite branching, 10 cm. (to 30 cm., fide Bakhuizen f.) long and broadly spreading, the axes and branches glabrate. Fruiting pedicels about 1 mm. long; persistent sepals 4, triangular, about 1 mm. long; follicles subglobose, about 1 cm. in diameter, in pairs or single and paired with an undeveloped carpel. Flowers not known.

Java. West Java, Preanger Regencies, Lengkong, in forest at 700 m., *Backer 17017* ♀ (L — isotype).

Although known from only a single collection, this species seems to be closely related to *Zanthoxylum retroflexum* of Sumatra.

9. **Zanthoxylum retroflexum** Hartley sp. nov.

Frutex scandens; ramulis et foliorum rhachibus parce aculeatis, aculeis retrorsis; foliis imparipinnatis, 15–30 cm. longis, glabris, acute reflexis, ad basin rhachibus pulvinatis; foliolis in paribus 4–5, oppositis, subcoriaceis, pellucido-punctatis, elliptico-oblongis, 4–7.5 cm. longis, 1.7–2.5 cm. latis, basi acutis vel leviter obliquis, apice acuminatis, acumine 6–9 mm. longo, ad apicem plerumque leviter emarginato, margine integris vel parce glanduloso-crenatis, venis primariis utrinsecus 12–15, petiolulis 3–5 mm. longis; paniculis fructiferis terminalibus et axillis superioribus orientibus, 10–12 cm. longis, 5–6 cm. latis, ramulis oppositis, axi et ramulis glabratis; pedicellis ca. 1 mm. longis; sepalis persistentibus 4, triangularibus, ca. 1 mm. longis; folliculis subglobosis, 6–7 mm. diametro, in paribus vel interdum singulis cum carpello abortivo; floribus non visis. Holotypus: *Yates 1850* (MICH). FIG. 2.

Sumatra. Asahan, Bandar Poelo, in forest at 250 m., *Yates 1850* ♀ (MICH — holotype; BRI, K — isotypes).

The sharply reflexed leaves of this species are not found in the other

FIG. 2. *Zanthoxylum retroflexum* Hartley. Photograph of type (MICH), × 3/8.

Malesian species of *Zanthoxylum*. *Z. backeri*, of Java, appears to be closely related but also differs in having longer acuminate leaflets with fewer main veins on either side of the midrib and larger follicles.

10. **Zanthoxylum limonella** (Dennst.) Alston, in Trimen, Handb. Fl. Ceylon suppl. 6. 37. 1931.

Tipalia limonella Dennst. Schlüss. Hort. Malab. 31. 1818. Type: plate and description, Rheede, Hort. Malab. **5:** 67. *t. 34.* 1685.
Fagara budrunga Roxb. Fl. Ind. ed. Carey & Wall. **1:** 437. 1820. Lectotype: *Roxburgh Icones 2113*, cult. Bot. Gard. Calcutta.
Fagara rhetsa Roxb. Fl. Ind. ed. Carey & Wall. **1:** 438. 1820. Lectotype: *Roxburgh Icones 185*, cult. Bot. Gard. Calcutta.
Zanthoxylum budrunga (Roxb.) DC. Prodr. **1:** 728. 1824, sub "*species non satis notae.*"
Zanthoxylum rhetsa (Roxb.) DC. Prodr. **1:** 728. 1824.
Zanthoxylum rhetsa var. *budrunga* (Roxb.) Pierre, Fl. Forestière Cochinch. **4:** *t. 290.* 1893.
Zanthoxylum budrunga var. *paucijuga* Koords. & Val. Booms. Java **4:** 224. 1896; Exk. Fl. Java **2:** 418. 1912, pro syn. sub *Zanthoxylum rhetsa* (Roxb.) DC. Syntypes: *Koorders 6983β* & *15353β*, Java (not seen).
Zanthoxylum? minahassae Koords. Fl. N.O. Celebes 639. 1898; Koorders-Schumacher, Syst. Verzeich. **3:** 59. 1914. Syntypes: *Koorders 16258β* (not seen), *18773β*, *18774β* (not seen) and *18775β*, Celebes.

Trees to 35 m.; dioecious; deciduous; rather long bole and spreading crown; main stem generally with broad, conical spines 2–3 cm. long; branchlets usually sparsely armed with straight or ascending prickles, often swollen and hollow and apparently housing ants. Leaves paripinnate or imparipinnate, 30–40 cm. long, glabrous; petiolules of lateral leaflets 3–5 mm. long; leaflets 5–8 pairs, opposite or subopposite, chartaceous, occasionally with scattered pellucid dots, ovate to elliptic, 7–13 cm. long, 3–5 cm. wide, base oblique, main veins 10–15 on each side of the midrib, margins entire to glandular crenate with as many as 3 crenations per cm., apex acuminate, the slender acumen at least one-eighth the length of the blade. Inflorescences terminal and from upper leaf axils, paniculate, 8–14 cm. long and generally about as broad, the axes and branches glabrous or glabrate. Staminate flowers 1.5–2.5 mm. long; pedicels 1–2 mm. long; sepals 4, green, rounded to triangular, 0.5–1 mm. long, connate at about half their length or free to the base, valvate, margins subentire or fimbriate; petals 4, white or yellowish white, elliptic, 1–2 mm. long; stamens 4, about as long as the petals at anthesis, anthers about 1 mm. long; disc pulvinate, irregularly lobed, about 0.5 mm. high; rudimentary carpel about 0.5 mm. high. Carpellate flowers 1.5–2.5 mm. long; pedicels, sepals and petals as in staminate flowers; rudimentary stamens absent; disc pulvinate, about 0.25 mm. high; gynoecium 1-carpellate, about 1 mm. high, style excentric, stigma flattened. Fruiting pedicels 2–4 mm. long; follicles single, globose, 6–7 mm. in diameter.

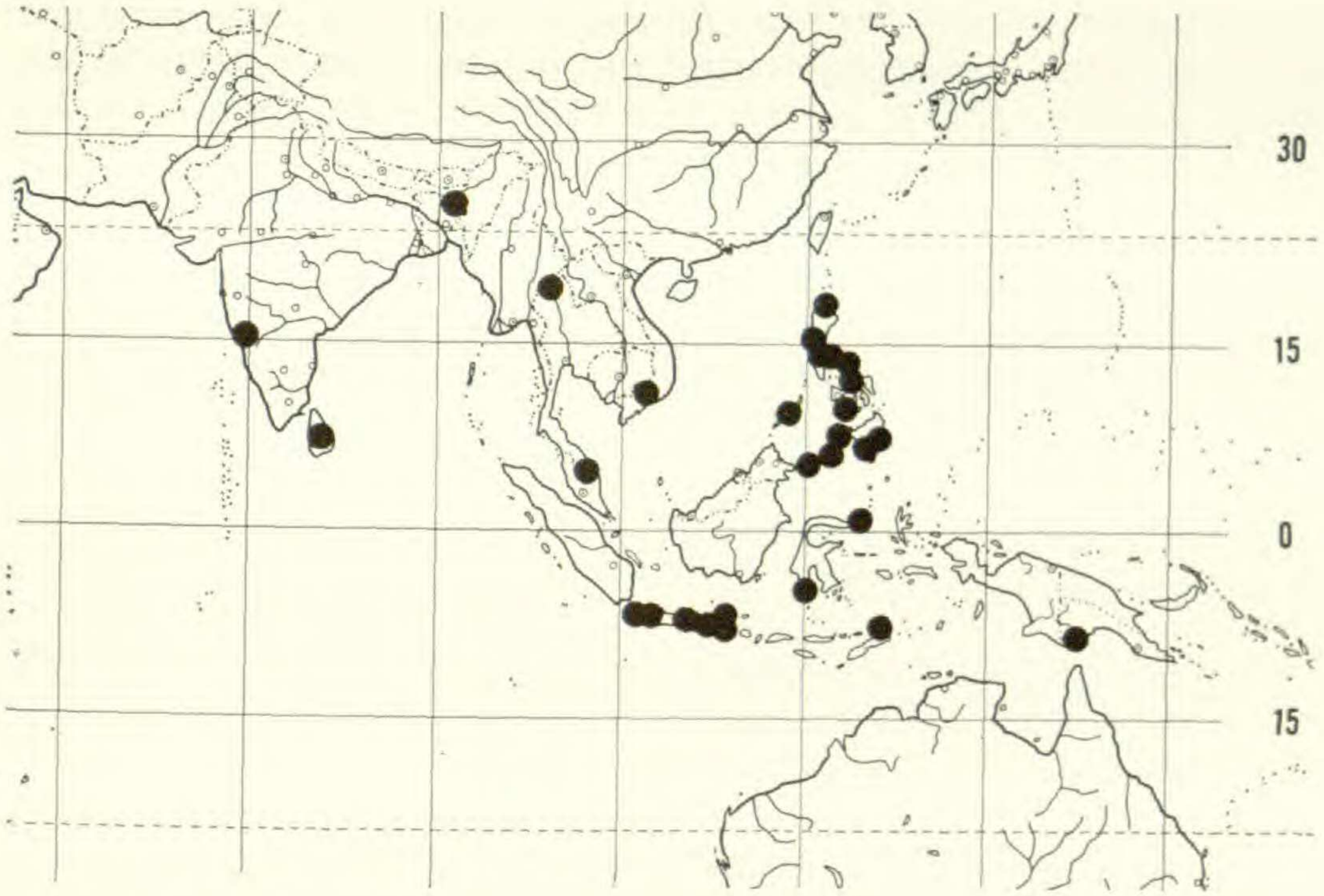
India. Bombay Presidency: region E of Goa boundary, *Fernandes 691* ♀ (A). Assam: Garo Hills, Phulbari, *Chand 3113* ♂ (MICH); Rani, *Koelz 29225* ♀ (MICH); without definite locality, *King's Collector 189* ♂ (A, US). Without definite locality: *Wight 353* ♀ (GH). **Ceylon.** *Thwaites CP 3490* ♀ (GH). **Thailand.** Hue Pang Huang, *Kerr 5473* ♂ (SING). **South Vietnam.** Bien Hoa

Province, Bao Chiang, *Bois 97* ♀ (A), *Pierre*, July, 1877 ♂ (A). **Malay Peninsula.** Kelantan, Kota Bharu, *Corner SF 33458* [A (♂), SING (2 sheets, ♂ and ♀)]. **Java.** WEST JAVA: Samarang Residency, *Koorders*, February 28, 1892 ♀ (L), *1161C* ♂ (L), March 20, 1892 ♀ (L); Cheribon Residency, Kromong Range, Mt. Djaja, *Steenis 12880* ♂ (L). CENTRAL JAVA: Tjilatjap, *NIFS Ja 2933* (A, L). EASTERN JAVA: G. Baloeran, *Backer 24802* ♀ (K, L); Poeger, *Koorders 6995β* (L); Djalipapak, *Koorders 6997β* (L), *6998β* (L); Besoeki, *Koorders 11812β* (L); Banjoemas, *Koorders*, December 8, 1891 ♂ (L); Djember, *Ulbee*, March, 1921 (L); Bodjonegoro, *NIFS Ja 2229* (L). PEUTJANG ISLAND: Udjung Kulon Reserve, *Kostermans*, December 3, 1960 ♂ (A, L). KANGEAN ISLAND: Tjangkramaan, *Backer 27639* ♀ (L). **Philippines.** PALAWAN ISLAND. *Curran FB 3822* ♀ (K, NY). LUZON ISLAND. Ilocos Norte Province: *Addurn FB 22989* ♀ (A, US), *Ramos BS 32711* ♀ (US). Nueva Ecija Province: Bongabon, *Vidal 134* ♂ (A, K, L). Zambales Province: *Curran FB 6920* ♂ (US). Bataan Province: Mt. Mariveles, Lamao River, *Borden FB 1565* ♀ (BM, NY), *FB 3051* ♂ (NY, US); without definite locality, *Ahern's Collector FB 1455* ♀ (NY, US). Rizal Province: Morong, *Loher 5145* ♀ (K, US), *Ramos BS 1421* (NY, US), *Vidal 2269* ♀ (K); Antipolo, *Merrill SB 872* (A, BM, GH, K, L, NY, US), *SB 961* ♂ (A, GH, K, L, NY, US); Bosoboso, *Merrill 2706* ♂ (K, NY, US); San Mateo, *Vidal 1015* ♀ (K, L); without definite locality, *Ahern's Collector FB 3105* ♂ (NY, US). Laguna Province: Los Baños (Mt. Maquiling), *Elmer 18231* ♀ (A). Batangas Province: *Curran FB 7688* ♀ (NY), *Curran & Merritt FB 7715* ♀ (NY, US). Quezon Province: Tayabas, *Ware FB 16* ♀ (BM, K, NY, US). Camarines Province: *Curran FB 10695* ♂ (US), *FB 10726* ♂ & ♀ (US). Albay Province: *Cuming 1218* ♂ (BM, K, L), *1356* ♂ (BM, L). MASBATE ISLAND. *Clark FB 1710* ♀ (K, NY, US). NEGROS ISLAND. *Curran FB 17437* ♀ (US). TAWITAWI ISLAND. *Ramos & Edano BS 44110* ♀ (A, BM, NY, US). BASILAN ISLAND. *Miranda FB 18971* ♀ (BM, K, US). MINDANAO ISLAND. Davao Province, Mt. Pagdaugan, *Ramos & Edano BS 49631* ♂ (A, NY, SING); Cotabato Province, Buayan, *Ramos & Edano BS 85175* ♂ (A); Zamboanga, *Whitford & Hutchinson FB 9067* ♀ (NY). **Celebes.** Minahasa Province, *Koorders 18773β* (L), *18775β* (L) — syntypes of *Zanthoxylum minahassae*; Paria van Longkang naar Giliraeng, *Noerkas 154* ♀ (L). **Moluccas.** Wetar Island, Tara, *NIFS bb 27284* ♀ (K, L, SING). **Papua.** Western District, Mabaduan, *Brass 6491* ♀ (A, BRI, L). **Cultivated.** India, Calcutta, *Roxburgh Icones 185*, drawn from a plant from Sikar, India (K — lectotype of *Fagara rhetsa*, not seen; A, photo.), *Roxburgh Icones 2113*, drawn from a plant from Silhet, India (K — lectotype of *Fagara budrunga*, not seen; A, photo.).

DISTRIBUTION. India, Ceylon, Thailand, South Vietnam, Malay Peninsula, Java, Philippines, Celebes, Moluccas (Wetar Island) and southern Papua; in rather dry, often monsoonal, forests and thickets at altitudes up to 500 meters. See MAP 6.

ILLUSTRATIONS. KOORDERS, S. H., & TH. VALETON, Atlas der baumarten von Java 2: *t. 352*. 1914, as *Fagara rhetsa*. PIERRE, L., Flore forestière de la Cochinchine 4: *t. 290 & 291*. 1893, as *Zanthoxylum rhetsa* var. *budrunga*.

As was pointed out in the discussion of the genus, the leaflets of this species are quite variable in the occurrence of oil dots and marginal crenations. This has been a source of confusion between *Zanthoxylum budrunga*



MAP 6. Distribution of *Zanthoxylum limonella* (Dennst.) Alston.

and *Z. rhetsa* (see Hooker, f., Fl. Brit. Ind. 1: 495. 1875), although the main difference Roxburgh had in mind was the number of leaflets, also a variable character.

Koorders' *Zanthoxylum? minahassae*, based on sterile and apparently juvenile material with prickly leaf rachises and pellucid-dotted, crenate leaflets, is placed here with considerable uncertainty. It could easily be young material of the closely related *Z. celebicum*, which occurs in the same area in the northeast Celebes as *Z. limonella*.

11. **Zanthoxylum parviflorum** Benth. Fl. Austral. 1: 363. 1863. Lectotype: *Armstrong 569*, Australia, Northern Territory.

Fagara parviflora (Benth.) Engl. Nat. Pflanzenfam. III. 4: 119. 1896.

Trees to 20 m.; dioecious; deciduous; main stem with a few scattered prickles; branchlets unarmed or sparsely prickly. Leaves imparipinnate, 22–28 cm. long, glabrous; petiolules of lateral leaflets 1.5–3 mm. long; leaflets 5–8 pairs, opposite, chartaceous, with scattered pellucid dots, elliptic-oblong, 5–8 cm. long, 2–3.5 cm. wide, broadest below the middle, base rounded, main veins 8–11 on each side of the midrib, margins glandular crenate with 2–3 crenations per cm., apex acuminate, the acumen one-fourth to one-fifth the length of the blade. Inflorescences terminal and from upper leaf axils, paniculate, 6–8 cm. long and about as broad, the axes and branches glabrate. Staminate flowers 2–3 mm. long; pedicels 2–4 mm. long; sepals 4, green, rounded to triangular, about 1 mm. long, free to about the base, valvate, margins subentire; petals 4, white, elliptic, 2 mm.

long; stamens 2–3 mm. long, anthers about 1 mm. long; disc pulvinate, 0.5–1 mm. high; rudimentary carpel 0.25–0.5 mm. high, poorly differentiated. Fruiting pedicels 3–5 mm. long; follicles single, globose, about 7 mm. in diameter. Carpellate flowers not seen.

West New Guinea (West Irian). Merauke Area, *Versteeg 1910* ♂ (K, L). **Australia.** NORTHERN TERRITORY: Port Essington, *Armstrong 569* ♂ (MEL — lectotype); Darwin, *Bleeser 532* ♂ (MEL), *Holtze 160* ♂ (MEL); islands in the Gulf of Carpentaria, *Brown 5334* ♀ (BM, MEL); Golburn Island, *Cunningham 181* ♀ (BM, MEL); Arnhem Land, Liverpool River, *Gulliver*, October, 1867 ♂ (MEL); without definite locality, *Schomburgk* (US).

DISTRIBUTION. West New Guinea and Northern Territory of Australia; in monsoon forests at low elevations.

Bentham cited three collections in the original description — *Armstrong 569*, *Brown 5334*, and *Cunningham 181*. The most complete of these, *Armstrong 569*, is designated here as the lectotype.

This species is very similar to *Zanthoxylum limonella*, differing mainly in the smaller leaflets with rounded rather than oblique bases and smaller inflorescences. The New Guinea collection, *Versteeg 1910*, is somewhat intermediate between *Z. parviflorum* and *Z. limonella*.

12. **Zanthoxylum celebicum** Koords. Fl. N.O. Celebes 639. 1898; Koorders-Schumacher, Syst. Verzeich. 3: 59. 1914. Lectotype: *Koorders 18746β*, Celebes.

Trees to 35 m., dioecious; evergreen; branchlets with numerous straight or ascending prickles. Leaves paripinnate or imparipinnate, 40–50 cm. long, glabrous or puberulent on the rachises, petiolules and lower midribs; petiolules of lateral leaflets 3–5 mm. long; leaflets 6–10 pairs, opposite, subcoriaceous, elliptic-oblong, 10–20 cm. long, 4–6 cm. wide, base oblique, main veins 14–20 on each side of the midrib, margins entire or with a few glandular crenations near the apex, apex abruptly acuminate, the acumen about one-twelfth the length of the blade. Inflorescences terminal and from upper leaf axils, paniculate, 15–18 cm. long and about two-thirds as broad, the axes and branches densely puberulent. Staminate flowers (seen only in bud) about 2.5 mm. long; pedicels 1–2 mm. long; sepals 4, broadly rounded, about 1 mm. long, slightly imbricate basally, margins ciliate; petals 4, elliptic-ovate, about 2 mm. long; stamens 4, 1.5 mm. long, anthers about 1 mm. long; disc pulvinate, about 0.5 mm. high; rudimentary carpel about 0.3 mm. high. Fruiting pedicels 0.2–1.2 mm. long; follicles (premature) single, ovoid, about 7 mm. long and 4 mm. wide. Carpellate flowers not seen.

Celebes. Near Manado, Minahasa Province, *Koorders 18746β* (L — lectotype), *18747β* (L), *18772β* (L), *NIFS bb 19450* ♂ (A, L). **Moluccas.** MOROTAI ISLAND: Subdistrict Tobelo, N Tjao, *Tangkilisan NIFS bb 33848* (L, SING); Sangowo River, *Kostermans 1426* ♀ (L, SING).

DISTRIBUTION. NE Celebes and Morotai Island in the Moluccas; in primary rain forests at elevations from 60 to 500 meters.

Koorders' description of this species was based on sterile material and no collections were cited. Later, Koorders-Schumacher (Syst. Verzeich. 3: 59. 1914) cited four Koorders collections for this species, all made in 1895 from the same general locality in the Celebes. I have chosen the lectotype (*Koorders 18746β*) from the three duplicates of these collections at Leiden, each of which bears the name *Zanthoxylum celebicum* in Koorders' handwriting. It consists of a packet of leaflets, a section of a rachis with two leaflets attached and a vegetative stem apex.

The two collections from Morotai Island have a more pronounced pubescence of the inflorescences and more clearly ciliate sepals than the only fertile collection (*NIFS bb 19450*) I have seen from the Celebes. The leaves, however, are a reasonably good match for Koorders' type material of *Zanthoxylum celebicum* and I think there is little doubt that they belong here.

13. **Zanthoxylum vinkii** Hartley sp. nov.

Arbor dioica sempervirens; ramulis parce aculeatis, aculeis rectis, inflatis et cavis et, ut videtur, a formicis inhabitatis; foliis paripinnatis, ca. 60 cm. longis, glabris; foliolis in paribus 10, oppositis, subcoriaceis, elliptico-oblongis, 14–19 cm. longis, 4–6 cm. latis, basi subcordatis, apice abrupte et breviter acuminatis, acumine 6–15 mm. longo, margine integris vel ad apicem parce glanduloso-crenatis, petiolulis 2–3 mm. longis; inflorescentiis paniculatis, terminalibus vel in axillis superioribus orientibus, 15–30 cm. longis latisque, glabris; floribus ♀ 3.2 mm. longis, pedicellis 0–2 mm. longis; sepalis 4, virentibus, late rotundatis, 0.6 mm. longis, margine ciliatis; petalis 4, flavis, ellipticis, 2.7 mm. longis; staminibus rudimentariis 0.1 mm. longis; disco pulvinato, 0.5 mm. alto; gynoeceo 1-carpellato, 1.3 mm. alto, stylo excentrico, stigmate 0.75 mm. lato; floribus ♂ et fructibus non visis. Holotypus: *Vink BW 12065* (A). FIG. 3.

West New Guinea (West Irian). Schouten Islands. BIAK ISLAND: Siabes, primary forest on coral rock with thin clay covering, altitude 75 m., young tree 12 m., common, *Moll BW 7025* (L); Korim Road, old secondary growth forest on rocky soil, altitude 60 m., young tree 12 m., scarce, *Vink BW 12065* ♀ (A — holotype; CANB, L — isotypes).

The subcordate leaflet bases of this species distinguish it from the closely related *Zanthoxylum celebicum* (which also differs in having puberulent rather than glabrate inflorescences) and *Z. pluviatile*.

14. **Zanthoxylum pluviatile** Hartley sp. nov.

Arbor usque ad 35 m. alta, dioica, sempervirens; trunco spinoso vel exarmato, spinis magnis conicis, ramulis exarmatis vel parce aculeatis, aculeis saepe inflatis et cavis et, ut videtur, a formicis inhabitatis; foliis

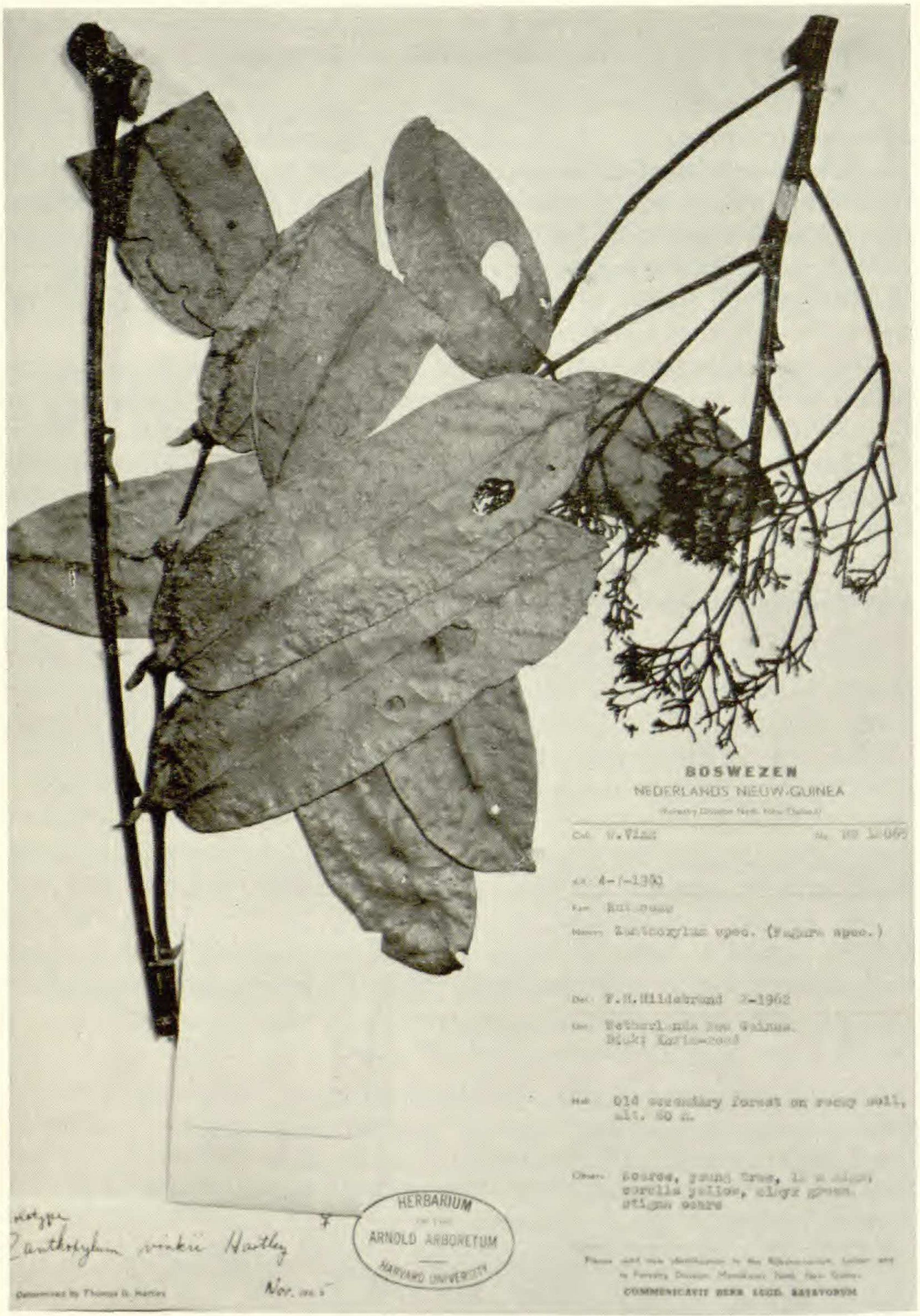


FIG. 3. *Zanthoxylum vinkii* Hartley. Photograph of type (A), × 3/8.

impari- vel paripinnatis, 30–60 cm. longis, glabris; foliolis in paribus 5–12, oppositis, chartaceis, elliptico-oblongis vel anguste oblongis, 9–15 cm. longis, 2–4.5 cm. latis, basi obliquis vel rotundatis, margine integris vel glanduloso-crenatis, crenis 1 cm. distantibus, apice breviter acuminatis, acumine 5–

13 mm. longo, petiolulis 2–5 mm. longis; inflorescentiis terminalibus vel in axillis superioribus orientibus, paniculatis, usque 15 cm. longis, ramis patentibus, axi et ramulis glabratis; floribus ♂ 4–7 mm. longis, pedicellis usque 0.5 mm. longis vel nullis; sepalis 4, viridibus, late rotundatis, 1–2 mm. longis, ad basin leviter imbricatis, margine ciliatis; petalis 4, albis,

FIG. 4. *Zanthoxylum pluviatile* Hartley. Photograph of type (A), × 3/8.

ellipticis, 3–5 mm. longis, plerumque ad anthesin erectis; staminibus 4–6 mm. longis, antheris 1.5–2 mm. longis inclusis; disco pulvinato tenuiter 4-lobato, 0.75–1.5 mm. alto; carpello rudimentario ca. 0.5 mm. alto; pedicellis usque ad 1 mm. longis; folliculo singulo, globoso, 7–8 mm. diametro; floribus ♀ non visis. Holotypus: *Hartley 11349* (A), Territory of New Guinea. FIG. 4.

Papua. NORTHERN DISTRICT: Kakoda, *Carr 16422* ♀ (L). CENTRAL DISTRICT: Mt. Obree, *Lane-Poole 392* (BRI); Kanosia, *Carr 11582* ♂ (L); Boridi, *Carr 13256* ♀ (CANB, K, L). MILNE BAY DISTRICT: Milne Bay Area, *Smith NGF 1287* ♂ (L). **Territory of New Guinea.** MOROBE DISTRICT: 10 miles N of Lae, *Hartley 11349* ♂ (A — holotype; L — isotype); Lae Area, *Vickery NGF 1405* ♀ (L). **Solomon Islands.** SANTA ISABEL ISLAND: Sigana, *Brass 3449* ♂ (A, BRI, L, SING); Tatamba, *Whitmore BSIP 2719* (L). GUADALCANAL: near Point Cruz, *Walker & White BSIP 126* ♀ (A, BRI, CANB, L, US).

DISTRIBUTION. Eastern New Guinea and the Solomon Islands; in well-drained, primary rain forests at altitudes up to 2100 meters.

A flowering collection from the Solomon Islands (*Brass 3449*) seems to indicate a tendency of this species to grade into *Zanthoxylum limonella*. In this collection the flowers are smaller and have less exserted stamens and more spreading petals than the New Guinea material of *Z. pluviatile*.

Collections from elevations of 1500 and 2100 meters in Papua (*Lane-Poole 392* and *Carr 13256*) differ from the lowland material in having smaller, more narrowly oblong leaflets and sparsely prickly branchlets. They may indicate a close relationship with *Zanthoxylum conspersipunctatum* of which there is a similar narrow-leaved form (*Brass 22553* and *22919* from Mt. Dayman, Milne Bay District, Papua).

15. **Zanthoxylum conspersipunctatum** Merr. & Perry, Jour. Arnold Arb. 22: 33. 1941. Type: *Brass 11579*, West New Guinea.

Trees to 25 m.; dioecious; evergreen; rather long bole and spreading crown; main stem prickly, becoming smooth with age; outer bark gray-brown, longitudinally fissured; inner bark yellow or yellowish brown; wood yellow; branchlets with straight or ascending prickles, often swollen and hollow and apparently housing ants. Leaves paripinnate or imparipinnate, 10–30 cm. long, glabrous; petiolules 3–5 mm. long; leaflets 2–8 pairs, opposite, subcoriaceous to coriaceous, generally lustrous above, with scattered and/or marginal pellucid dots, ovate to elliptic, 5–13 cm. long, 2–5 cm. wide, base oblique to obtuse, main veins 12–18 on each side of the midrib, margins subentire to glandular crenate with as many as 2 crenations per cm., apex acuminate, the acumen about one-tenth the length of the blade. Inflorescences terminal and from upper leaf axils, paniculate, 6–10 cm. long and generally about as wide, the axes and branches glabrate. Staminate flowers 3.5–7 mm. long; pedicels obsolete to 1 mm. long; sepals 4, green to pink, broadly rounded, 1–1.3 mm. long, free to about the base, valvate or slightly imbricate basally, margins entire or slightly fimbriate;

petals 4, white to pink, elliptic, 3–5 mm. long; stamens 4, about as long as the petals at anthesis, anthers 1.3–2.5 mm. long; disc pulvinate, 4–lobed, 0.5–1 mm. high; rudimentary carpel 0.2–2 mm. high, well differentiated. Carpellate flowers 3.5–7 mm. long; pedicels, sepals and petals as in staminate flowers; rudimentary stamens 0.2–2 mm. long; disc pulvinate, slightly lobed, about 0.5 mm. high; gynoecium 1-carpellate, 1.5–2.5 mm. high, style excentric, stigma flattened, 0.5–1 mm. broad. Fruiting pedicels 1–2 mm. long; follicles single, globose to ovoid, 6–10 mm. in diameter.

West New Guinea (West Irian). Bele River, 18 km. NE of Lake Habbema, *Brass 11579* ♂ (A — holotype; L — isotype). **Papua.** Milne Bay District, Maneau Range, N slopes of Mt. Dayman, *Brass 22553* ♀ (A), *22919* ♂ (A). **Territory of New Guinea.** WESTERN HIGHLANDS DISTRICT: Mt. Hagen Range, Tomba Village, *Hoogland & Pullen 6116* ♀ (A, BRI, K, L, US); Mt. Kum, near Mt. Hagen, *Womersley NGF 9418* ♂ (A, BRI, K, L). EASTERN HIGHLANDS DISTRICT: Mt. Wilhelm, E slopes, *Brass 30345* ♀ (CANB, K, L, US), *30496* ♂ (A, K, L, US), *30614* ♂ (A, K, L, NY, US); about 1 mile S of Akuna, *Hartley 12027* ♀ (A, L); Marafunga, about 20 miles NW of Goroka, *Hartley 13270* ♀ (A), *Womersley & Sleumer NGF 14011* ♂ & ♀ (CANB); Asaro-Mairi Divide, near Daulo camp, *Hoogland & Pullen 5471* ♀ (CANB), *5475* ♂ (A, BRI, K, L, US), *Saunders 892* (CANB, L); ridge above Toromambuno Mission, *Pullen 309* ♂ (A, BRI, K, L, US); about 5 miles W of Keglsugl airstrip, *Saunders 770* (A, L); Wonatabe, 15 miles S of Okapa, *Womersley NGF 17629* ♂ (BRI, CANB). MOROBE DISTRICT: Yunzaing, *J. & M. S. Clemens 3574* ♀ (A), *4060* ♀ (A); Sambanga, *Clemens 6813* ♂ (A, L).

DISTRIBUTION. New Guinea; in mountain forests from 1500 to 2000 meters.

A highly variable species with four morphological extremes possibly representing incipient species. Apparently closely related to *Zanthoxylum pluviatile* and also to *Z. veneficum* F. M. Bailey and *Z. brachyacanthum* F. Muell. (distinct?) of eastern Australia.

The type collection of *Zanthoxylum conspersipunctatum, Brass 11579,* has much more conspicuous pellucid dots in the leaflets than any of the other collections cited for this species. Examination of cleared leaflets of this collection revealed that the dots are actually cavities in the mesophyll not traversed by the veins. The oil dots in the mesophyll of the other collections of this species examined proved to be small groups of cells not altering the venation pattern, though marginal dots in some of these were of the cavity type. As I have noted in the discussion of the genus, the presence and type of oil dots seem to be variable characters in the Malesian species of *Zanthoxylum*, and, without other morphological differences, I prefer not to make taxonomic distinctions.

Of the species of *Zanthoxylum* in New Guinea, *Z. conspersipunctatum* is by far the most frequent, being especially common in the mountain forests of the Eastern Highlands District.

16. **Zanthoxylum integrifoliolum** (Merr.) Merr. Enum. Philip. Fl. Pl. 2: 327. 1923.

Fagara integrifoliola Merr. Philip. Jour. Sci. Bot. **1**(suppl.): 68. 1906. Lectotype: *Barnes FB 88*, Philippines.

Trees to 20 m.; dioecious; evergreen; older, apparently exposed roots sometimes (always?) covered with dense, soft, yellowish fibers that appear to be phelloderm tissue; main stems with short, scattered prickles when young, becoming smooth with age; branches relatively few, widely spaced, horizontal with ascending tips; branchlets unarmed. Leaves paripinnate or imparipinnate, 20–60 cm. long, glabrous, crowded toward tips of branchlets; petiolules of lateral leaflets 7–13 mm. long; leaflets 4–12 pairs, opposite, chartaceous to coriaceous, bright green above, much paler below, obovate to elliptic, generally broadest above the middle, 6–15 cm. long, 4–6 cm. wide, base obtuse to cuneate, often rather oblique, main veins 9–15 on each side of the midrib, margins entire, becoming cartilaginous with age, apex abruptly acuminate, the acumen usually about one-twelfth the length of the blade. Inflorescences terminal and from the upper leaf axils, paniculate, 12–46 cm. long and one-third to one-half as broad, the axes and branches glabrous or glabrate. Staminate flowers 4–5 mm. long; pedicels 2–4 mm. long; sepals 4, green, broadly triangular, about 1 mm. long, the margins entire; petals 4, white, elliptic-ovate, 2.5–3.5 mm. long; stamens 4, slightly exceeding the petals at anthesis, anthers about 1 mm. long; disc pulvinate, about 0.5 mm. high; rudimentary carpel conical, to 0.2 mm. high. Carpellate flowers 3–4 mm. long; pedicels, sepals, petals and disc as in staminate flowers; rudimentary stamens absent; gynoecium 1-carpellate, about 1 mm. high, style excentric, stigma flattened, about 0.5 mm. broad. Fruiting pedicels 3–5 mm. long; follicles single, subglobose, 6–9 mm. in diameter, with numerous, large oil glands.

Philippines. MINDORO ISLAND. Mt. Yagaw, S slope, *Conklin PNH 19019* (A, L); Bongabong River, *Merritt FB 3659* ♀ (NY), *Whitford 1464* ♀ (NY, US); Paluan, *Ramos BS 39551* ♀ (A, BM, GH). BATANES ISLANDS. Batan Island, Mt. Iraya, *Ramos BS 79957* ♀ (K, NY); without definite locality, *Fenix BS 3584* ♀ (NY). BABUYAN ISLANDS. Calayan Island, *Penas FB 26698* ♀ (US). LUZON ISLAND. Bataan Province: Mt. Mariveles, Lamao River, *Barnes FB 88* ♂ (US — lectotype of *Fagara integrifoliola*; BM, K, NY, SING), *Borden FB 2351* ♂ (NY, SING, US), *FB 2484* [NY, US (♀)], *FB 2740* ♀ (NY, SING, US), *Foxworthy BS 1567* (US), *Meyer FB 2307* ♂ (K, NY, SING, US), *Whitford 1044* ♀ (NY, US), *1295* ♀ (K, NY, US), *Williams 575* ♀ (GH, NY, US); Mamac River, *Barnes FB 336* ♀ (BM, K, NY, SING, US); without definite locality, *Curran FB 17578* ♂ (L). Rizal Province: Montalban, *Loher 6058* ♀ (K, US); without definite locality, *Ramos BS 22465* ♀ (A, BM, BRI, L, US). Camarines Norte Province: Paracale, *Ramos & Edano BS 33770* ♂ (A, K). Sorsogon Province: Irosin (Mt. Bulusan), *Elmer 15566* ♀ (A, BM, GH, NY, L, US); without definite locality, *Ramos BS 23421* ♂ (US). SAMAR ISLAND. Catubig River, *Ramos BS 24171* ♀ (A, K, US), *BS 24522* ♂ (L, US); Oquendo, Mt. Mahagna, *Sulit PNH 14512* ♀ (A, K, L); without definite locality, *Lasquety FB 23569* ♂ (A, US), *Ramos BS 1629* ♀ (BM, GH, L, SING). LEYTE ISLAND. Cabalian, *Ramos BS 41586* ♀ (A, L). PANAY ISLAND. Capiz Province: Magallanes (Mt. Giting-Giting), *Elmer 12063* ♀ (A, BM, GH, K, L, NY, US); without definite locality, *Edano BS 46165* ♂ (A, NY). MINDANAO ISLAND. Surigao Province, Mt. Cantugas, *Ramos & Convocar*

BS 83490 ♂ (NY); Davao Province, *de Mesa FB 27604* ♀ (SING); Zamboanga Province, *Quezon FB 30252* (BRI). DINAGAT ISLAND. *Ramos & Pascasio BS 35248* ♀ (BM, L), *Ramos & Convocar BS 83892* ♀ (NY).

DISTRIBUTION. Widespread in the Philippines in well-drained rain forests and thickets up to 640 meters elevation. Otherwise known from Lanyu Island (Botel Tobago) off the SE coast of Taiwan, *fide* Li, H. L., *Woody flora of Taiwan*, 373. 1963.

ILLUSTRATION. ITO, T., Illustrated flora of Formosa, *t. 13*. 1928.

Closely related to *Zanthoxylum limonella*, *Z. integrifoliolum* is distinguished by its obovate leaflets with entire, cartilaginous margins and unarmed branchlets.

The soft, fibrous material from the roots has reportedly been used by the natives of Lanyu Island to calk canoes.

17. **Zanthoxylum ovalifolium** Wight, Illus. Ind. Bot. 1: 169. 1839 ("*Zanthoxylon*"). Type: *Wight 356*, India, Madras.

Zanthoxylon sepearium Wight, Illus. Ind. Bot. 1: 169. 1839. Type: *Wight 355*, India, Madras.

Zanthoxylum ovalifolium var. *sepearium* (Wight) Hook. f. Fl. Brit. Ind. 1: 493. 1875.

Fagara ovalifolia (Wight) Engl. Nat. Pflanzenfam. III. 4: 118. 1896.

Zanthoxylum inerme White & Francis Bot. Bull. (Dept. Agr. Brisbane) 22: 6. 1920 (nomen illegit.) non Sessé & Mociño, nec Koidz. Type: *White*, January, 1918, Australia, Queensland.

Fagara varians Domin Bibliot. Bot. 22 (894): 846. 1927 (nomen illegit.) non Benth. Type: *Domin 5657*, Australia, Queensland.

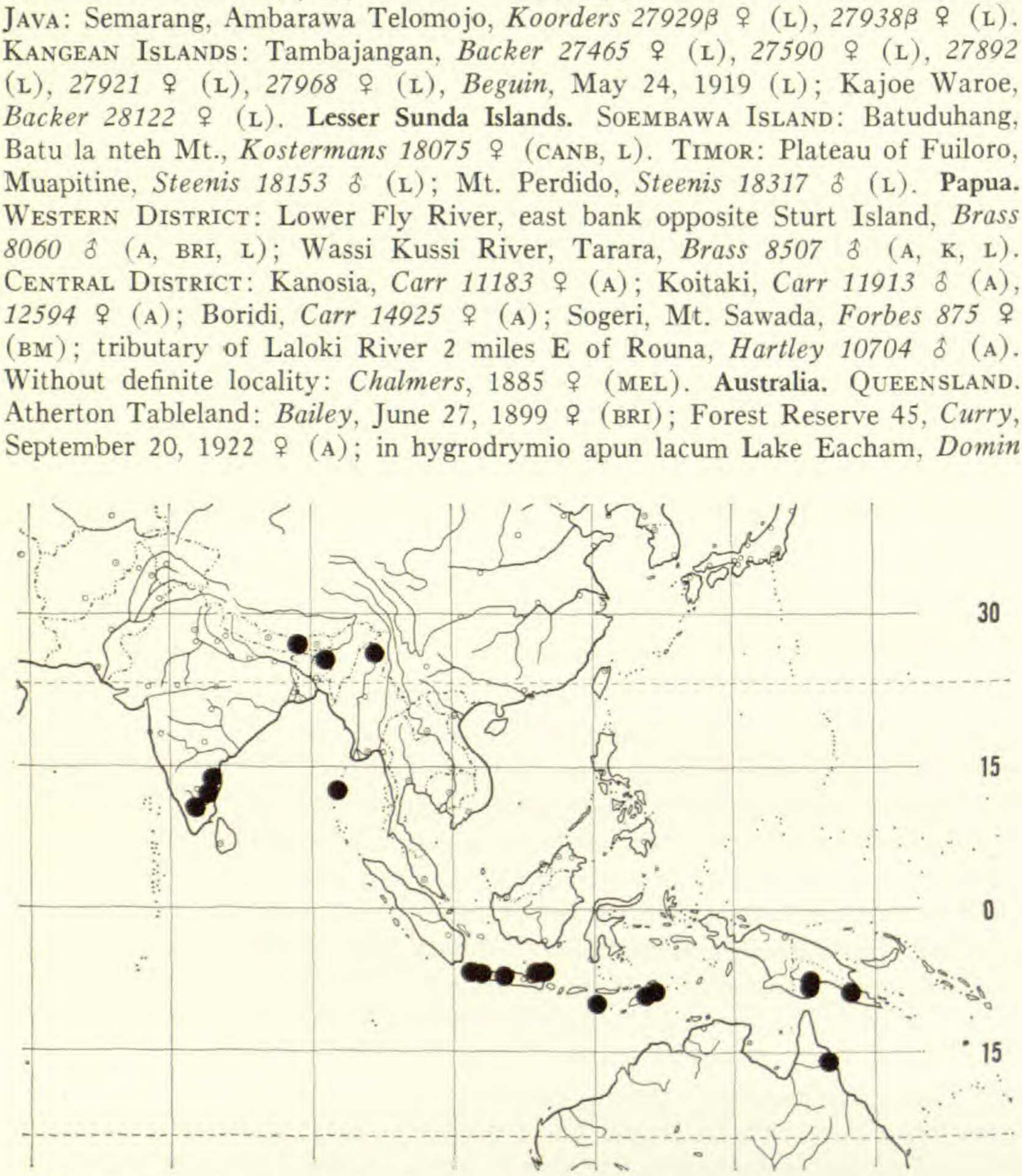
Zanthoxylum dominianum Merr. & Perry, Jour. Arnold Arb. 22: 32. 1941 (based on *Fagara varians* Domin).

Zanthoxylum suberosum White, Proc. Roy. Soc. Queensland, 53: 208. 1942 (based on *Z. inerme* White & Francis).

Erect shrubs or small trees to 8 m.; branchlets unarmed or rarely with a few straight, scattered prickles. Leaves trifoliolate (occasional leaves bi- or unifoliolate), 8–28 cm. long, glabrous; leaflets chartaceous to subcoriaceous, with scattered pellucid dots, ovate to elliptic, 3–19 cm. long, sessile or subsessile, base cuneate, main veins 7–20 on each side of the midrib, margins subentire to doubly crenate with about 5 crenations per cm., apex acute to short acuminate. Inflorescences axillary and terminal, paniculate, 3–12 cm. long and about half as broad, more or less flexuous, the axes and branches glabrate. Staminate flowers 2–3 mm. long; pedicels 1–3 mm. long; sepals 4, green, narrowly triangular, about 1 mm. long; petals 4, white, elliptic, about 2.5 mm. long; stamens 4 (in occasional pentamerous flowers, 5), 2–3 mm. long, anthers about 0.75 mm. long; disc pulvinate, about 0.75 mm. high; rudimentary carpel narrowly conical, about 0.5 mm. high. Carpellate flowers about 3 mm. long; pedicels, sepals and petals as in staminate flowers; rudimentary stamens 4, about 1 mm. long; disc pulvinate, about 0.5 mm. high; gynoecium 1-carpellate, about 1.5 mm. high, style

excentric, stigma globose. Fruiting pedicels 2–4 mm. long; follicles single, subglobose, 6–7 mm. in diameter.

Sikkim. *Brandis 856* (A). **India.** ASSAM: Khasi Hills, *Chand 6328* ♀ (MICH), *Hooker f. & Thomson* ♀ (GH), *Koelz 30380* ♀ (MICH), *30809* ♀ (MICH), *31105* ♀ (MICH), *Ruse 122* ♂ (A). MADRAS: Nilghiri Mts., *Hooker f. & Thomson* ♂ & ♀ (GH); Pulicat Hills, *Wight 355* ♂ (K—holotype of *Zanthoxylon sepearium*; GH); Shevagherry Hills, *Wight 356* ♂ & ♀ (K—holotype of *Zanthoxylon ovalifolium*; GH). Without definite locality: *Blinkworth* (Wall Cat. n. 7469) ♀ (K), *Griffith* ♂ (GH). **Burma.** Kachin Hills, *Mokim*, 1897 ♂ (A), *s.n.*, 1898 ♀ (A). **Andaman Islands.** *Heinig*, December 12, 1900 ♀ (A), *King*, December 13, 1890 ♂ (SING), *King's Collector 102* ♀ (SING), October 1, 1892 ♀ (SING), *Prain's Collector*, October, 1900 ♀ (GH). **Java.** WESTERN JAVA: Goenoeng Poetjah Tjatjing, *Forbes 838* ♂ (BM, GH, SING); Bandoeng Tjigenteng, *Koorders 26284β* ♀ (A, L), *26333β* ♀ (L); Kjaja, *Lam 299* ♂ (L). CENTRAL JAVA: Semarang, Ambarawa Telomojo, *Koorders 27929β* ♀ (L), *27938β* ♀ (L). KANGEAN ISLANDS: Tambajangan, *Backer 27465* ♀ (L), *27590* ♀ (L), *27892* (L), *27921* ♀ (L), *27968* ♀ (L), *Beguin*, May 24, 1919 (L); Kajoe Waroe, *Backer 28122* ♀ (L). **Lesser Sunda Islands.** SOEMBAWA ISLAND: Batuduhang, Batu la nteh Mt., *Kostermans 18075* ♀ (CANB, L). TIMOR: Plateau of Fuiloro, Muapitine, *Steenis 18153* ♂ (L); Mt. Perdido, *Steenis 18317* ♂ (L). **Papua.** WESTERN DISTRICT: Lower Fly River, east bank opposite Sturt Island, *Brass 8060* ♂ (A, BRI, L); Wassi Kussi River, Tarara, *Brass 8507* ♂ (A, K, L). CENTRAL DISTRICT: Kanosia, *Carr 11183* ♀ (A); Koitaki, *Carr 11913* ♂ (A), *12594* ♀ (A); Boridi, *Carr 14925* ♀ (A); Sogeri, Mt. Sawada, *Forbes 875* ♀ (BM); tributary of Laloki River 2 miles E of Rouna, *Hartley 10704* ♂ (A). Without definite locality: *Chalmers*, 1885 ♀ (MEL). **Australia.** QUEENSLAND. Atherton Tableland: *Bailey*, June 27, 1899 ♀ (BRI); Forest Reserve 45, *Curry*, September 20, 1922 ♀ (A); in hygrodrymio apun lacum Lake Eacham, *Domin*



MAP 7. Distribution of *Zanthoxylum ovalifolium* Wight.

5657 ♀ (PR — holotype of *Fagara varians* Domin); Dunbella, *Forest Officer F71* (BRI); Herberton, *Kajewski 1358* ♀ (A, BRI); Tolga, *McKee 9296* ♀ (CANB); Ravenshoe, Millet Farm, *Samundsett 22* ♀ (BRI); near Atherton, *White*, January, 1918 ♀ (BRI — holotype of *Zanthoxylum inerme* White & Francis; MEL). Cairns: Trinity Bay, *Fitzalan*, 1882 ♀ (MEL).

DISTRIBUTION. Sikkim and India southeast to Queensland; in monsoon forests and thickets at elevations up to 1750 meters in Malesia and from 1000 to 2000 meters in continental Asia. See MAP 7.

ILLUSTRATION. WHITE, C. T., & W. D. FRANCIS (descr. of *Zanthoxylum inerme*), Bot. Bull. (Dept. Agr. Brisbane) 22: 6. 1920.

Zanthoxylum ovalifolium is markedly different from the other Malesian species and is apparently most closely related to two species of southwestern China, *Z. dimorphophyllum* Hemsl. and *Z. robiginosum* (Reeder & Cheo) Huang. The first of these, as I have pointed out in the introductory part of this paper, appears to be transitional between *Fagara* and *Zanthoxylum*, sensu stricto.

18. **Zanthoxylum acanthopodium** DC. Prodr. 1: 727. 1824. Type: *Wallich*, 1821, Nepal.

Scandent or erect shrubs or small trees to 6 m.; dioecious or (in Sumatra) with perfect flowers; apparently both deciduous and evergreen; branchlets villous with ferruginous hairs to glabrate, generally armed, the prickles flattened, predominantly pseudostipular, to 1.2 cm. long. Leaves trifoliolate or imparipinnate, 2–25 cm. long; rachis villous to glabrate, often with flattened prickles, narrowly to broadly (to 3 mm. on either side) winged; petiolules obsolete to 3 mm. long; leaflets 1–6 pairs, opposite, chartaceous, villous to sparsely hairy on the main veins below, with appressed hairs or glabrous above, often with flattened prickles along the midrib above and below, ovate to elliptic-lanceolate, 1–12 cm. long, 0.5–4.5 cm. wide, base obtuse, main veins generally conspicuous, 10–28 on each side of the midrib, margins subentire to glandular crenate with as many as 8 crenations per cm., apex acute to acuminate. Inflorescences axillary, paniculate to racemose, 0.5–2 cm. long and generally glomerate. Staminate flowers about 3 mm. long; pedicels obsolete to 2 mm. long; perianth segments 6–8, undifferentiated although occasionally slightly unequal in size, uniseriate to irregularly biseriate, green or yellowish green elliptic to ligulate, 1–2 mm. long, sparsely hairy to glabrous; stamens 6, about 2 mm. long, anthers about 1 mm. long and reddish purple prior to anthesis; disc pulvinate, about 0.75 mm. high; rudimentary carpels 2–5. Carpellate flowers about 2 mm. long; pedicels and perianth segments as in staminate flowers; rudimentary stamens none; disc pulvinate, 0.5–0.75 mm. high; gynoecium 2–5-carpellate, sparsely hirsute to glabrous, about 1.5 mm. high, styles about 0.75 mm. long, divergent, articulating about 0.3 mm. below the globose stigma. Perfect flowers (only in Sumatran specimens) about 3 mm. long; pedicels and perianth segments as in staminate

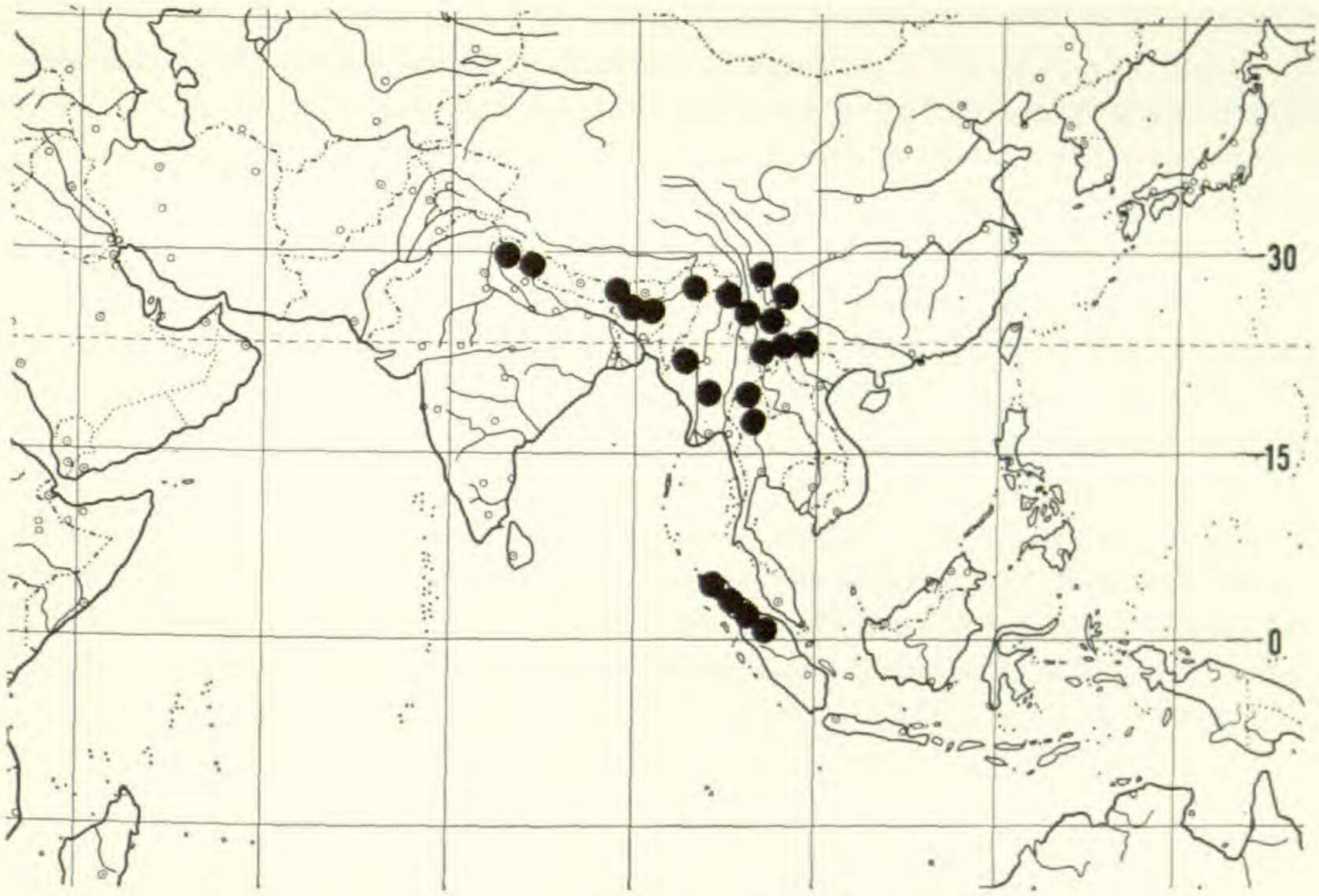
flowers; stamens 3–6, about 3 mm. long, otherwise as in staminate flowers; gynoecium 2–4-carpellate, sparsely hirsute, otherwise as in carpellate flowers. Fruiting pedicels 0.5–1.5 mm. long; follicles generally reddish, subglobose, about 4 mm. in diameter, in 2's to 5's, the undeveloped carpels caducous.

India. UTTAR PRADESH: Kumaun, Jagesar, *Strachey & Winterbottom 2* ♂ & ♀ (GH). West Bengal: Darjeeling District, *Smith*, April 20, 1908 ♀ (A). ASSAM: Naga Hills, *Chand 3376* ♀ (MICH); Khasia, *Hooker f. & Thomson* ♀ (GH, US); Mawphlang, *Koelz 31303* ♀ (MICH); without definite locality, *Simons 620* ♂ (L). **Nepal.** Doti District, *Ram*, May 15, 1929 ♀ (A); without definite locality, *Wallich*, 1821 (G-DC — holotype of *Zanthoxylum acanthopodium*, not seen; A, photo. and fragment). **Sikkim.** Sureil, *Smith 702* (A); without definite locality, *Hooker f. & Thomson* ♀ (GH). **East Pakistan (East Bengal).** *Griffith 1186/2* ♂ (GH). **Burma.** Thandaung, *Dickason 5273* ♂ (A), *6718* ♂ (A); Haka, *Dickason 7563* ♀ (A); North Triangle, *Kingdon-Ward 20736* ♀ (A). **Thailand.** Doi Sootep Mt. range, summit of Doi Chom Cheng, *Rock 1166* ♂ (US); Doi Chang Mt. near Hue San, *Rock 1726* ♀ (A, US). **China.** YUNNAN PROVINCE: Likiang & vicinity, *Ching 21045* ♂ (A), *21882* ♀ (A), *Schneider 2877* ♂ (GH, US); S. Chungtien, Chiao-tou on Yangtze, *Feng 3067* ♀ (A); Si-Chour Hsien, Faa-doon, *Feng 11687* ♀ (A), *11807* ♂ (A); S of Red River from Manmei, *Henry 9758* ♂ (A); Mengtsz, *Henry 10150* [A (♂), US (2 sheets, ♂ & ♀ and ♂)], *10150B* ♀ (A, US), *11413* ♀ (A); Szemao, *Henry 12451* ♂ (A); Yunnanfu, *Schoch 268* ♂ (A, US); Peyen-tsien, *Ten 502* ♂ (A, US); Wen-shan Hsien, *Tsai 51691* ♀ (A); Kien-shuei Hsien, *Tsai 53113* ♀ (A); Pin-chuan Hsien, *Tsai 53686* ♂ (A); Lung-ling Hsien, *Tsai 55526* ♀ (A); Lan-ping Hsien, *Tsai 56103* ♀ (A); Lu-se, *Tsai 56423* ♀ (A); Che-tse-lo, *Tsai 58566* ♀ (A); Wei-si Hsien, *Tsai 59989* ♀ (A); Ping-pien Hsien, *Tsai 60761* ♀ (A), *61922* ♂ (A); W of Champutung, *Wang 67388* ♂ (A); Shunning, *Yu 16576* ♂ (A); Mienning, Poshang, *Yu 17849* ♂ (A); Kuikiang Valley, N of Mon-ting, *Yu 20391* ♀ (A); Muchietu, *Yu 21009* ♂ (A); without definite locality, *Forrest 7881* ♂ (A), *8846* ♂ (A), *11790* ♂ (A), *15914* ♂ (A), *Tsai 57118* ♀ (A), *57245* ♂ (A), *60092* ♀ (A). SZECHWAN PROVINCE: Yalung, *Handel-Mazzetti 482* ♀ (A); zwischen Ruapie und Takaioko, *Schneider 1353* ♀ (A), *1373* (A); Huei-li Hsien, *Yu 1607* ♀ (A). **Sumatra.** Gajo Loeas, Wenareh, *Pringgo Atmodjo* 55 ☿ (L); Karo Highlands, Berastagi, *Hamel & Rahmat Si Boeea 630* ☿ (A, MICH), *Lorzing 6100* ☿ (L), *Yates 1548* ☿ (A, BM, MICH); Karo Highlands, Kabandjahe, *Lorzing 13687* ☿ (L); Asahan, *Rahmat Si Boeea 10558* ☿ (A, L); Atjeh, Boer ni Telong, *Steenis 6342* ☿ (A, L).

DISTRIBUTION. N India, Nepal, Sikkim, East Pakistan, Burma, Thailand, SW China and Sumatra; in mountain forests and thickets at elevations of 1200 to 1400 meters in Sumatra and up to 2900 meters in SW China. See MAP 8.

ILLUSTRATION. PIERRE, L., Flore Forestière de la Cochinchine 4: *t. 290.* 1893.

Similar to *Zanthoxylum armatum* but with relatively constant differences in the size and position of the inflorescence, number of lateral veins in the leaflets and the color of the anthers prior to anthesis. These are maintained even though the two species apparently grow together in Kumaun, Nepal,



MAP 8. Distribution of *Zanthoxylum acanthopodium* DC.

Assam, and Yunnan. Perfect flowers were noted only in material from Sumatra where the unisexual condition seems to be lacking entirely. This may indicate that the population of that island is a relict, particularly since there appears to be a considerable geographic discontinuity with the unisexual material of the Asiatic mainland. Aside from this, however, the Sumatran material matches the Asian very closely.

Two collections from Szechuan Province, China (*Schneider 1353* and *Handel-Mazzetti 2524*), with dwarf leaves 2–3 cm. long and very short, compact inflorescences have been designated in error as *Zanthoxylum acanthopodium* var. *diminutum* (Rehd.) Reeder & Cheo, Jour. Arnold Arb. 32: 71. 1951. I have seen the holotype of *Z. dimorphophyllum* Hemsl. var. *diminutum* Rehd. (Jour. Arnold Arb. 22: 577. 1941) which clearly is most closely allied to *Z. dimorphophyllum*, a distinctive species restricted to China. This misjudgement by Reeder and Cheo apparently occurred because Rehder cited *Schneider 1353* as a paratype of *Z. dimorphophyllum* var. *diminutum*.

19. **Zanthoxylum armatum** DC. Prodr. 1: 727. 1824. Lectotype: *Lambert*, 1816, India, non *Z. armatum* (Thunb.) Druce, 1917.

Zanthoxylum alatum Roxb. Hort. Beng. 72. 1814, nomen nudum; Roxb. Fl. Ind. 3: 768. 1832. Lectotype: *Roxburgh Icones 1916*, cult. Bot. Gard. Calcutta.

Zanthoxylon planispinum Sieb. & Zucc. Abh. Akad. München 4 (2): 138. 1846. Type: *Siebold*, Japan.

Zanthoxylum alatum Roxb. var. *planispinum* (Sieb. & Zucc.) Rehd. & Wils. Pl. Wils. 2: 125. 1914.

Scandent or erect shrubs or small trees to 6 m.; dioecious; apparently deciduous or evergreen; branchlets glabrous to short pubescent, generally armed, the prickles flattened, predominantly pseudostipular, to 2 cm. long. Leaves trifoliolate or imparipinnate, 5–23 cm. long; rachis glabrous, often with flattened prickles, narrowly to broadly winged (to 6 mm. on either side); petiolules obsolete to 3 mm. long; leaflets 1–5 pairs, opposite, chartaceous to subcoriaceous, glabrous or occasionally with a few hairs along the midrib below, often with flattened prickles along the midrib above and below, ovate to lanceolate, 1.5–13 cm. long, 0.5–4.7 cm. wide, base cuneate to acute, main veins generally faint, 7–15 on each side of the midrib, margins entire to glandular crenate with as many as 8 crenations per cm., apex acute to acuminate. Inflorescences terminal on short lateral branchlets and occasionally axillary, paniculate, 1–7 cm. long and generally about as wide. Staminate flowers about 2 mm. long; pedicels 0.2–1.5 mm. long; perianth segments 6–7, undifferentiated, uniseriate to irregularly biseriate, green to yellow, elliptic to ligulate, 0.3–1 mm. long, glabrous, stamens 4–6, 1–2 mm. long, anthers about 1 mm. long and yellow prior to anthesis; disc pulvinate, about 0.5 mm. high; rudimentary carpels none. Carpellate flowers about 2 mm. long; pedicels and perianth segments as in staminate flowers; rudimentary stamens none; disc pulvinate, 0.5–0.75 mm. high; gynoecium 1–3-carpellate, glabrous, about 1.5 mm. high, styles about 0.75 mm. long, divergent, articulating about 0.3 mm. below the globose stigma. Fruiting pedicels 1–2.5 mm. long; follicles generally reddish, subglobose, 4–5 mm. in diameter, single or in 2's or 3's, the undeveloped carpels caducous.

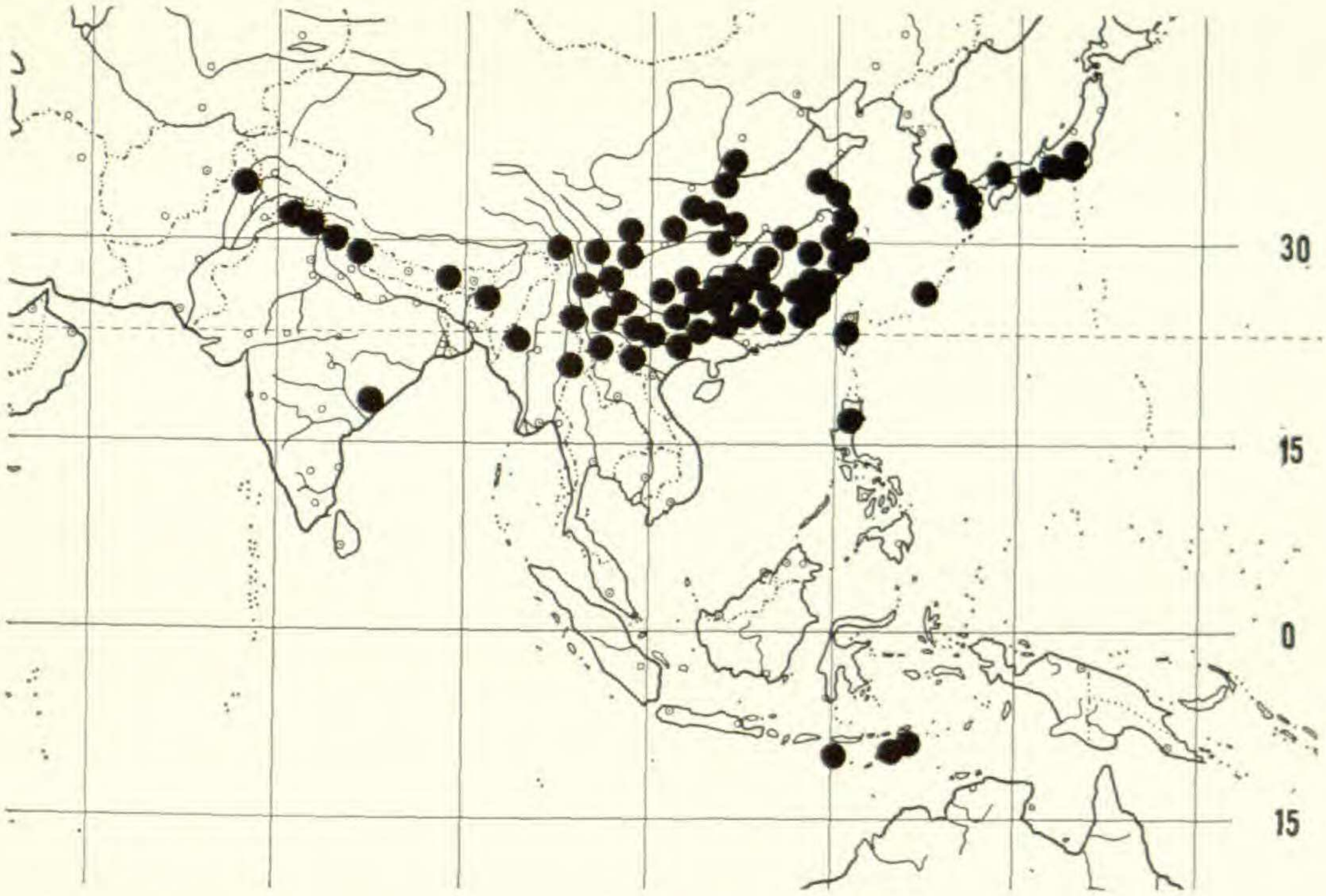
West Pakistan. Hazara (Abbottabad) District, Massar Reserve, Sirau Range, *Parker*, May, 1910 ♂ (A). **India.** PUNJAB: Kangra, Baijnath, *Koelz 4516* ♀ (US); Kulu Kulu, *Koelz 8315* ♀ (A), *10274* ♂ (A); Shahpur, Dharmsola Road, *Stewart 1823* ♀ (A). HIMACHAL PRADESH: Simla District, *Parker 3019* ♀ (A); Jaranda Range, between Sarahair & Gohoilhur, *Selhi*, July, 1953 ♀ (A). UTTAR PRADESH: near Mussoorie, *King*, 1869 ♀ (US); Dehra Dun, Siwalik & Jaunsar, *Singh 22* ♂ (US), May & June, 1912 ♂ & ♀ (A); Kumaun Division, *Strachey & Winterbottom 3* ♀ (GH), *4* ♀ (GH). ORISSA: Koraput District, near Pottangi, Sirimanda Parbat, *Mooney*, July 10, 1950 (A). ASSAM: Khasia & Jaintia Hills, *Bor 16083* ♂ (A), *Hooker f. & Thomson* ♀ (GH), *Koelz 22785* ♀ (MICH), *Ruse 73* ♂ (A). Without definite locality: *Lambert*, 1816 ♀ (G-DC — lectotype of *Zanthoxylum armatum*, not seen; A, photo.), *Thomson* ♀ (GH). **Nepal.** West Nepal, Doti District, Rikhar, *Ram 398* ♀ (A); without definite locality, *Ram 181* ♀ (A), *Wallich*, 1821 (A, photo.), *Wallich* ♀ (SING). **Sikkim.** *Hooker f.* ♀ (GH). **Burma.** Kalewa, *Dickason 6148* ♀ (A); Southern Shan State, *Khalil*, 1893 ♀ (A). **North Vietnam.** Chapa, *Petelot 5815* ♀ (A, SING). **Tibet.** Sikang Province, Dzer-nar, Tsa-wa-rung, *Wang 66378* ♀ (A). **China.** YUNNAN PROVINCE: Likiang City, *Ching 21062* ♀ (A); Tapintze, *Delavay 777* ♀ (A, photo. and fragment); NE. Likiang, between Min-ing and Hung-mun-kow, *Feng 2549* ♀ (A); W. Likiang, Kai-tze on Yangtze bank, *Feng 2647* ♀ (A); S. Chungtien, Chiao-tou on Yangtze bank, *Feng 3125* (A); Wen-shan-hsien, Maa-luh-tarng, *Feng 11245* ♀ (A); Mengtsz, *Henry 9366* ♀ (A, US), *9366A* [A (2 sheets, ♂ and ♀), US (♂)], *9366C* ♀ (A), *9366D* ♀ (A, US), *9366F* ♂ (A); Szemao, *Henry 11908* ♂ (A), *12249* ♀ (A, US); Kun-ming, Miao-kao-szu, Ta-pu-chi, *Ko 56310*

♀ (A); W of Mekong en route from Pingpo to Youngchang and Tengyueh, *Rock 6994* ♀ (A, US); Shweli River drainage basin & environs of Tengyueh, *Rock 8031* ♂ (A, US); zwischen Yunnanfu und Sah-ying-pan, *Schneider 281* (A); Talifu, *Schneider 2803* ♀ (A, GH, US); prope Yang Lin, *Schoch 351* ♀ (A, US); Kienshuei Hsien, *Tsai 53132* ♂ & ♀ (A); Shang-pa Hsien, *Tsai 54638* ♀ (A), *54984* ♀ (A); Ping-pien Hsien, *Tsai 55163* ♀ (A); Chenkang, near Feng-tai-szu, *Tsiang & Wang 16258* ♀ (A); Wei-si Hsien, Kang-pu, *Wang 64191* ♀ (A); Chen-kang Hsien, Wang *72187* ♀ (A); Fo-hai, *Wang 74490* ♀ (A); Che-li Hsien, Kuen-ger, *Wang 79257* ♀ (A); Saluen Valley, NW of Champutong, *Yu 19171* ♀ (A); without definite locality, *Forrest 7535* ♀ (A), *Schneider 3887* ♀ (A), *Tsai 57272* ♀ (A). SZECHWAN PROVINCE: Mt. Omei, *Chien 5565* ♂ (A), *Fang 3913* ♀ (A), *12666* ♀ (A), *Lee 2715* ♀ (US), *Liu 1032* ♀ (A), *1650* ♀ (A), *Wang 23192* ♀ (A), *Wilson 4769* ♂ (A), *Yu 254* ♀ (A), *325* ♂ (GH), *341* ♂ (A); Kuan Hsien, *Chien 5596* ♀ (A), *Fang 2026* ♀ (A), *Wang 20542* ♂ (A); Huili, *Handel-Mazzetti 248* ♀ (A); Mili Kingdom, Mili & Litang River Valley, near Mili Gomba, *Rock 16129* ♀ (A, US); Ningyuanfu, Lu-shan, *Smith 1790* ♀ (A); zwischen Mo-so-ying und Kung-mu-ying, *Schneider 645* ♀ (A); Yun-ching-hsien, *Sun 1287* ♀ (US); Mao Hsien, *Wang 21856* ♀ (A); Ping-shan Hsien, *Wang 22697* ♀ (A); Lo-shan Hsien, *Wang 23556C* ♀ (A); Wen Chuan Hsien, *Wilson 2693*, July, 1908 ♀ (A); He-chang Hsien, *Yu 1120* ♀ (A). KWEICHOW PROVINCE: Tsunyi Hsien, Liang Feng Yah, *Steward, Chiao & Cheo 34* ♀ (A, US); Ta Ho Yen, Fan Ching Shan, *Steward, Chiao & Cheo 696* ♀ (US); Tsingchen, Ju-long-san, *Teng 90201* ♂ (A). KWANGSI PROVINCE: Luchen, Tia Lian Shan, *Ching 5295* ♀ (A); E. Hin Yen, Bian Chen, *Ching 6710* ♀ (A, US); Hin Yen, Spring Cave, *Ching 6741* ♀ (A, US); Shuen-yuen, *Chung 81695* ♀ (A); Hing On District, Sai On Village, *Chung 83615* ♀ (A); Yang-so, Ching-o-ken, *Fung 21106* ♀ (A); Ling Yun District, *Lau 28557* ♀ (A); Ling Yun Hsien, Loh Hoh Tsuen, *Steward & Cheo 56* ♂ (A, SING); Yung Hsien, Ta Tseh Tsuen, *Steward & Cheo 795* ♀ (A, SING); Yung Hsien, Chang An, *Steward & Cheo 1188* ♀ (A); Mts. surrounding Pa Lau Village near Sui-luk, *Tsang 21871* ♂ (A); Ling-chuan District, Ling-chai-miao, Hai-yang Shan, *Tsang 27829* ♀ (A, US); Kwei-lin District, San-min Village, *Tsang 28021* ♀ (A, US); Nam Tanyuen, *Wang 40895* ♀ (A); without definite locality, *Wang 41127* ♀ (A). KWANGTUNG PROVINCE: Nan Shung, *Chun 5704* ♀ (A); Yim Na San, *Gressitt 1395* ♀ (A); Lung Tau Mt., *Kang, W. T. Tsang & U. K. Tsang CCC 12709* ♀ (US); North River Region, near Fung-wan, *Kang, W. T. Tsang & U. K. Tsang CCC 12857* ♀ (US); Sin-fung District, Hau Tong Shan, Fuk Lung Monastery, *Taam 757* ♀ (A); Jen-hua District, Man Chi Shan, Shek Pik Ha Village, *Tsang 26136* ♀ (A); Ying Tak District, Wan Tong Shan, *Tsui 302* ♀ (A, US); Yang Shan District, Yang Shan, *Tsui 458* ♀ (A, US), 665 ♀ (US). HUNAN PROVINCE: Sinning Hsien, Ma-ling-tung, *Fan & Li 481* ♀ (A); Tschang-scha, *Handel-Mazzetti 2347* ♂ (A); Yi Chang District, Ping Tou Shan, Pai Mu Village, *Tsang 23406* ♂ (A, US); Wukang, Yun-shan, *Wang 15* ♂ (A). HUPEH PROVINCE: Yangtze-Hwaiho Divide on Hupeh-Honan border, Chikungshan, *Bailey*, June 29, 1917 (A); Ichang, *Chien NU 8034* ♀ (US), *Chun 3831* ♀ (US), *Tsung 3486* ♀ (A); Gran Gra Kon, *Ching 3560* ♀ (A); Patung Hsien, *Chow 349* ♀ (A); Enshih Hsien, *Chow*, June 14, 1934 ♀ (A); Kwan Ying Tong, *Chun 3686* ♀ (A), *NU 4028* ♀ (US); Liang-sun-yon, *Chun 3849* ♀ (A); Wuchang, Lokiashan, *Chung 9176* (A), *Sun 19* ♀ (A), *775* ♀ (A), *848* ♀ (A); U-tan Hsien, *Silvestri 4849* ♂ (A); Hoing-shan Hsien, *Wilson 138* [A (2 sheets, ♂ & ♀ and ♀), GH (♂ & ♀), US (♂ & ♀)]; Chang-to Hsien, *Wilson 2693*, April, 1907 [A (2 sheets, ♂ & ♀ and ♀), US (♀)]; without definite locality, *Henry 3584* ♀ (US), *7687* ♀ (A, GH), *Wilson 338* ♀ (US). HONAN PROVINCE: Sung Hsien,

Shih Tze Miao, *Hers 594* ♀ (A); Yungning, Tieh-lu-ping, *Hers 1001* ♀ (A). KIANGSI PROVINCE: Lu Shan, *Chiao NU 18767* ♀ (US); Nanchang, *Chung 10* ♀ (A); Kiennan District, Sai Hang Cheung, near Tung Lei, *Lau 4183* ♀ (US); Lungnan District, Oo Chi Shan, Lam Uk Tung Village, *Lau 4480* ♀ (A, US); Farr-yung, *Sing NU 7892* ♀ (A). FUKIEN PROVINCE: Foochow: Nantai Island, *Chang 4250* ♀ (A); Nanshan Monastery, *Chung 2802* ♀ (A, SING); Kushan, *Chung 8355* ♀ (A); Kuliang Hills, *Norton 1395* ♀ (US). Diong Loh Hsien, *Chung 1238* ♀ (A, SING); Diong Loh, Muoi Hua, on the seacoast, *Ging 13651* ♀ (A); Yeuping, Buong Kang, *Chung 3390* ♀ (A); N. Mountain, *Chung 8597* ♀ (A); Baekliang, *Ging 15596* ♀ (A), *15652* ♀ (A); without definite locality, *Dunn 845* ♀ (A). CHEKIANG PROVINCE: Shihpu, *Chiao NU 14139* ♀ (A, US), *NU 14152* ♀ (A, US); Sizchu, *Ching 1659* ♀ (A, GH, US); Tsing-tien, *Keng 56* ♀ (A); vicinity of Ningpo, *Macgregor, 1908* ♀ (A); Hangchow, *Tang & Hsia 79* ♀ (A); without definite locality, *Barchet 85* ♀ (US), *s.n.* ♀ (US). ANHWEI PROVINCE: Tien Chu Shan, Chien Shan Hsien, *Fan & Li 115* ♀ (A); Chuchow, *Zee NU 1298* ♂ (US). KIANGSU PROVINCE: Nanking and vicinity, *Chen 8664* ♀ (A), *Merrill 11394* ♀ (A), *Steward NU 2169* ♀ (A), *Tso 1021* ♀ (A); Ih-shing, *Ching 4883* ♀ (A); Chiu-yong, *Ling NU 12192* ♀ (GH); Chankiang, Chin Shan, *Tso 254* ♀ (A); Ma An Shan, Quin Shan, *Tso 1633* ♀ (A). **Taiwan.** Maruyama, *Faurie 22* ♀ (A). **Korea.** Fusan, *Faurie 465* ♀ (A); Namtijoukak, *Taquet 820* ♀ (A); Hokeum, *Taquet 2707* ♀ (A); Nokan, *Taquet 2708* ♀ (A); Quelpart Island, *Faurie 1627* ♀ (A), *Wilson 9397* ♀ (A). **Japan.** TSUSHIMA ISLAND: *Wilford*, 1859 ♀ (GH). HONSHU ISLAND: Fuji san, *Faurie 2427* ♀ (A); Kasugayama, *Kume*, June 21, 1925 ♀ (A); Yokohama, *Maximowicz*, 1862 ♀ (GH, US); Musashi Province, Mt. Takao, *Mizushima TNSM 1080* ♀ (US), *11094* ♀ (A), *11437* (A); Mt. Setsuhiko, *Muroi 20* ♀ (A); Mt. Ruridera, *Muroi 914* ♀ (A); Owari Province, *Shiota 4462* ♀ (A); Kariyose-yama, *Suzuki 106* ♀ (US), *336–1* ♀ (A), *336–2* ♀ (A); Mt. Kogane, *Uno 2599* ♀ (A). KYUSHU ISLAND: Fukuoka, *Ichikawa 138* ♀ (A); Mt. Kirishima, *Tashiro*, September 23, 1917 ♀ (A); Kiushiu, Shiraishi, *Uno 2611* ♀ (A). Without definite locality: *Siebold* ♀ (M — isotype of *Zanthoxylum planispinum*, not seen; A, photo.). **Ryukyu Islands.** Kume-jima, *Amano 7074* (US). **Lesser Sunda Islands.** SOEMBA: Kanangar, *Iboet 559* ♀ (L). TIMOR: near Kapan, *Bloomborgon 3478* ♀ (A, L); en Ond. Z. midden Timor, *Steenis NIFS bb 17584* (A, L); Mt. Perdido, ascent of Ossu, *Steenis 18324* ♂ (L); Mt. Moetis, *DeVoogd 2283* ♀ (L); Kot Olim, *Walsh 252* ♀ (BM); without definite locality, *Forbes 3653* ♀ (BM, GH, L). **Philippines.** LUZON ISLAND: Benguet Subprovince, *Loher 243* (K), *Merrill 774* ♀ (US), *Sinclair & Edano 9765* ♀ (SING). **Cultivated.** India: Calcutta, *Roxburgh Icones 1916*, drawn from a plant from northern India (K — lectotype of *Zanthoxylum alatum*, not seen; A, photo.). Japan: Fukuoka, *Ichikawa 247* ♀ (GH); Tokyo, *Mizushima TNSM 1398* ♀ (US), *Sargent*, August, 1892 ♀ (A).

DISTRIBUTION. West Pakistan and northern India east to Japan and Taiwan; south only in the Philippines and Lesser Sunda Islands; in rain forests, thickets and, at higher elevations, often on open slopes and rock ledges; at elevations from 50–1750 meters in Malesia and up to 2400 meters in continental Asia. See MAP 9.

ILLUSTRATIONS. HUANG, C. C., Acta Phytotax. Sinica 6 (1) : *t. 3.* 1957, as *Zanthoxylum planispinum*. LIU, T. S., Illustrations of native and introduced plants of Taiwan 2: *t. 730.* 1962, as *Z. planispinum*. MAKINO, T., Illustrated flora of Japan, 2nd. ed. *t. 1175.* 1940, as *Xanthoxylum*



MAP 9. Distribution of *Zanthoxylum armatum* DC.

planispinum; revised ed. *t. 1175.* 1949, as *Zanthoxylum alatum* var. *planispinum*; New illustrated flora of Japan *t. 1326.* 1961, as *Z. alatum* var. *planispinum.*

Occasionally cultivated as a hedge plant in China. The bark is pungent and several collectors noted that it is used to clean teeth. It also has been used, in China, to repel insects from furs. Indian collectors noted that the leaves, bark, and fruits were used in treatment of smallpox and cholera. Various parts of the plant are used to season food in China and India.

This is apparently the first use of the epithet *armatum* for this species since DeCandolle substituted it for Roxburgh's *alatum* in 1824. That *Zanthoxylum alatum* has so long been the accepted name may probably be accounted for by the fact that the DeCandolle name is listed as a misspelling in *Index Kewensis.* It is clear, however, that the spelling was intended since the Lambert collection (which is cited by DeCandolle) in the Prodromus Herbarium bears the annotation "*Zanthoxylum armatum* Roxb." in A. P. DeCandolle's handwriting. This collection is mounted on a sheet with a Wallich collection from Nepal and consists of two branchlets (both collected in 1816). I have chosen the larger of the two, in the lower right corner of the sheet, as the lectotype.

"*Zanthoxylum planispinum*" differs in having fewer leaflets — generally 3–5, compared to 5–11 in typical Indian material of *Zanthoxylum armatum.* The number of leaflets is extremely variable in this species, especially in specimens from China.

EXCLUDED SPECIES

The following species, described from Malesia, apparently belong to genera other than *Zanthoxylum*.

FAGARA DECANDRA Blanco, Fl. Filip. (ed. 1) 66. 1837 = **Buchanania arborescens** Bl. (Anacardiaceae) according to Merrill, Enum. Philip. Fl. Pl. **2:** 465. 1923.

FAGARA GLABRA Bl. Cat. Gew. Buitenz. 40. 1823 = **Evodia glabra** (Bl.) Bl. Bijdr. Natuurk. Wetens. 245. 1825.

FAGARA MONTANA (Bl.) Engl. Nat. Pflanzenfam. III **4:** 118. 1896 = **Turpinia montana** (Bl.) Kurz (Staphyleaceae), Jour. Asiat. Soc. Beng. **44:** 182. 1875.

?FAGARA PAPUANA Laut. Nova Guinea **8** (4): 823. 1912 = **Melicope papuana** (Laut.) Laut. in Engl. Bot. Jahrb. **55:** 241. 1918.

FAGARA SERRULATA (Bl.) Engl. Nat. Pflanzenfam. III. **4:** 118. 1896 = **Turpinia montana** (Bl.) Kurz (Staphyleaceae) according to Koorders, Exk. Fl. Java **2:** 528. 1912.

FAGARA TRIPHYLLA Lam. Encycl. **2:** 447. 1788 = **Melicope triphylla** (Lam.) Merr. Philip. Jour. Sci. Bot. **7:** 375. 1912.

ZANTHOXYLON ACCEDENS (Bl.) Miq. Fl. Ind. Bat. **1** (2): 671. 1859 (based on *Evodia accedens* Bl. Bijdr. Natuurk. Wetens. 246. 1825) = **Evodia accedens** Bl. according to Miquel, Ann. Mus. Lugd.-Bat. **3:** 242. 1867.

ZANTHOXYLON AROMATICUM (Bl.) Miq. Fl. Ind. Bat. **1** (2): 670. 1859 (based on *Evodia aromatica* Bl. Bijdr. Natuurk. Wetens. 246. 1825) = **Evodia glabra** (Bl.) Bl. according to Miquel, Ann. Mus. Lugd.-Bat. **3:** 243. 1867.

ZANTHOXYLON EUNEURON Miq. Fl. Ind. Bat. (suppl.) 532. 1860 = **Evodia euneura** (Miq.) Miq. Ann. Mus. Lugd.-Bat. **3:** 243. 1867.

ZANTHOXYLON MACROPHYLLUM (Bl.) Miq. Fl. Ind. Bat. **1** (2): 670. 1859 (based on *Evodia macrophylla* Bl. Bijdr. Natuurk. Wetens. 246. 1825) = **Evodia accedens** Bl. according to Miquel, Ann. Mus. Lugd.-Bat. **3:** 242. 1867.

ZANTHOXYLON MARAMBONG Miq. Fl. Ind. Bat. (suppl.) 533. 1860 = **Evodia marambong** (Miq.) Miq. Ann. Mus. Lugd.-Bat. **3:** 244. 1867.

ZANTHOXYLUM HORSFIELDII Turcz. Bull. Soc. Nat. Moscou **36** (2): 597. 1863. I have not seen type material but from the description — the leaves are described as opposite — it is clearly not a *Zanthoxylum*.

ZANTHOXYLUM JAVANICUM (Bl.) Walp. Repert. Bot. Syst. **1:** 519. 1842 = **Picrasma javanica** Bl. (Simaroubaceae) Bijdr. Natuurk. Wetens. 248. 1825.

ZANTHOXYLUM LAMARKIANUM Cham. Linnaea **5:** 58. 1830 = **Melicope triphylla** (Lam.) Merr. according to Merrill, Philip. Jour. Sci. Bot. **7:** 375. 1912.

ZANTHOXYLUM LATIFOLIUM (DC.) G. Don, Gen. Syst. **1:** 804. 1831 (based on *Ampacus latifolia* Rumph. Herb. Amb. **2:** 186. 1741) = **Evodia latifolia** DC. according to Merrill, Interpret. Rumph. Herb. Amb. 289. 1917.

ZANTHOXYLUM LUCIDUM Miq. Fl. Ind. Bat. (suppl.) 532. 1860 = **Evodia lucida** (Miq.) Miq. Ann. Mus. Lugd.-Bat. **3:** 244. 1867.

ZANTHOXYLUM MONTANUM Bl. Bijdr. Natuurk. Wetens. 248. 1825 = **Turpinia montana** (Bl.) Kurz (Staphyleaceae), Jour. Asiat. Soc. Beng. **44:** 182. 1875.

ZANTHOXYLUM RHIZINOIDES Bl. Bijdr. Natuurk. Wetens. 248. 1825. According to the description the leaves are simple and the calyx 3-parted, a combination not found in any of the known Malesian species of *Zanthoxylum*. Miquel (Fl. Ind. Bat. **1** (2): 669. 1859) and Koorders (Exk. Fl. Java **2:** 418. 1912) also express the opinion that the generic designation may be incorrect.

ZANTHOXYLUM ROXBURGHIANUM Cham. Linnaea **5:** 58. 1830 = **Evodia lunur-ankenda** (Gaertn.) Merr. according to Merrill, Philip. Jour. Sci. Bot. **7:** 378. 1912.

ZANTHOXYLUM RUMPHIANUM Cham. Linnaea **5:** 58. 1830 = **Evodia latifolia** DC. according to Merrill, Interpret. Rumph. Herb. Amb. 289. 1917.

ZANTHOXYLUM SERRULATUM Bl. Bijdr. Natuurk. Wetens. 249. 1825 = **Turpinia montana** (Bl.) Kurz (Staphyleaceae) according to Koorders, Exk. Fl. Java **2:** 528. 1912.

ZANTHOXYLUM TIMORIENSE Span. Linnaea **15:** 185. 1841. I have not seen type material of this but from the description it seems closer to *Toddalia* than *Zanthoxylum*.

ZANTHOXYLUM? TRIPLINERVE Turcz. Bull. Soc. Nat. Moscou **36:** 597. 1863. Reported from "Insula Lucon, in provincia North Hows." The leaves are described as simple, so this is probably not a *Zanthoxylum*. Perkins, Frag. Fl. Philip. 161. 1905, states that the type has not been accounted for and that the locality given is not clearly a Philippine one.

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INDEX TO EXSICCATAE

The numbers in parentheses refer to the corresponding species in the text.

Brandis *856* (17)
Brass *3449* (14); *3833* (2); *6491* (10); *7983* (2); *8060, 8507* (17); *11579, 22553, 22919, 30345, 30496, 30614* (15)
Brass & White *180* (2)
Brown *5334* (11)
Bunnemeyer *9574* (1)
Burkill *SF 16330* (18)
Canicosa *FB 31197* (3)
Carr *11183* (17); *11582* (14); *11913, 12594* (17); *13256* (14); *14925* (17); *16422* (14)
Caster *FB 29749* (5)
Cavalerie *1771, 2978* (3)
Champion *86* (1)
Chand *3113* (10); *3376* (18); *4908* (1); *6328* (17)
Chang *4250* (19)
Chen *8664* (19)
Chiao *NU 14130* (4); *NU 14139, NU 14152* (19); *NU 14760* (1); *NU 18767* (19)
Chien *5565, 5596, NU 8034* (19)
Ching *1659, 3560, 4883, 5295* (19); *5401* (1); *6510* (2); *6584* (1); *6710, 6741* (19); *7102* (4); *7130* (1); *7685* (2); *7827* (5); *8128* (3); *21045* (18); *21062* (19); *21882* (18)
Chow *349* (19)
Chun, N. K., *40435* (2)
Chun, N. K., & Tso *43401* (5); *43581* (2)
Chun, W. Y., *3153* (5); *3686, 3831, 3849, NU 4028* (19); *4278* (1); *4809* (2); *5052, 5704* (19); *NU 5825* (5); *5952* (1); *6806* (5)
Chung, H. H., *10* (19); *936* (2); *1030* (1); *1238* (19); *2652* (2); *2802, 3390* (19); *4770, 5607, 5889, 5892, 5935, 6014, 6252* (2); *6647* (1); *6951* (2); *7583* (5); *7977* (2); *8355* (19); *8417* (2); *8597, 9176* (19)
Chung, Z. S., *81695* (19); *83485* (3); *83584* (1); *83615* (19)
Clark *FB 1710* (10)
Clemens, J., & M. S., *3574* (15); *3996* (2); *4060* (15); *4067, 4445* (5); *26344, 26344a* (3); *29213, 29243* (1); *31036, 40530* (5)
Clemens, M. S., *6813* (15)
Collins *705* (2)
Conklin *PNH 19019* (16)
Corner *SF 33166* (3); *SF 33458* (10)
Cuming *1218, 1356* (10); *1622* (5)
Cunningham *181* (11)
Curran *FB 3822* (10); *FB 3860* (5); *FB 6920, FB 7688, FB 10695, FB 10726, FB 17437* (10); *FB 17578* (16)
Curran & Merritt *FB 7715* (10)
Curtis *1076* (3)
Darbyshire *934, 998* (6)
Darnton *119* (5)
Delavay *777* (19)
Derry *1121* (3)
Dickason *5273* (18); *6148* (19); *6718, 7563* (18)
Domin *5657* (17)
Dunn *72* (2); *845* (19)
Ebalo *448* (2)
Edano *BS 46165* (16); *BS 77626, BS 77760* (5)
Elbert *1582* (5); *3445* (2)
Elmer *7278* (2); *10217* (3); *12063* (16); *12751* (5); *15566* (16); *18231* (10)
Endert *NIFS E 1078* (3)
Fairchild *3484* (5)
Fan & Li *115, 481* (19)
Fang *2026, 3913, 12666* (19)
Faurie *22* (19); *23* (2); *465* (19); *467* (4); *1268* (2); *1627* (19); *1632* (4); *2427* (19); *8216* (1)
Feng *2549, 2647* (19); *3067* (18); *3125, 11245* (19); *11687* (18); *11735* (2); *11807* (18)
Fenix *BS 3584* (16)
Fernandes *691* (10)
Ferraris *FB 23044* (5)
Ferris *11934* (2)
Feung & Kao *4583* (1)
Floyd *NGF 7471* (2)
Forbes *96* (6); *838, 875* (17); *1001* (1); *1707* (7); *3653* (19)
Forrest *7535* (19); *7881, 8846, 11790* (18); *11922, 15715* (1); *15914* (18); *17712, 21554* (1)
Foxworthy *BS 905* (5); *BS 1567* (16)
Fung *7–79, 20202* (2); *21106* (19)
Galoengi *231* (2)

Gressitt *478, 965* (2); *1117* (5); *1395* (19)
Griffith *1186/2* (18)
Hai *33* (2); *43* (5)
Hamel & Rahmat si Toroes (Rahmat si Boeea) *630* (18)
Hamilton *Wall. cat. n. 7117* (2)
Hance *1145* (1)
Handel-Mazzetti *248* (19); *482* (18); *2347* (19); *2563* (1); *12327* (3)
Haniff *SF 14978, SF 16778* (2)
Hartley *10704* (17); *11349* (14); *12027, 13270* (15)
Hatusima *18833* (2); *18923* (1)
Henderson *SF 20132* (2); *SF 21706* (3)
Henry *205, 205A, 205G* (2); *343* (1); *464* (2); *1353, 1630* (4); *1655, 1782* (2); *1969* (1); *3584, 7687, 9366, 9366A, 9366C, 9366D, 9366F* (19); *9758, 10150, 10150B* (18); *10421A, 11163* (1); *11413* (18); *11908, 12249* (19); *12451* (18)
Hers *594, 1001* (19)
Hochreutiner *28* (2)
Holmberg *857* (3)
Holtze *160* (11)
Hoogland & Pullen *5471, 5475, 6116* (15)
Hooker f. & Thomson *1517* (1)
Horsfield *66, 1093* (1)
How *70306, 70675* (2); *70939* (5); *71366* (2); *73154* (1)
Hu *840, 934* (1)
Hui *158, 12321* (1)
Iboet *559* (19)
Ichikawa *138, 247* (19)
d'Incarville *179* (5)
Jaamat *SF 27628* (3)
Jaheri *HB 430* (5)
Jones *2060* (2)
Kajewski *1358* (17); *1835* (6); *2304* (2)
Kamphovener *169h* (2)
Kang, Tsang & Tsang *CCC 709* (19); *CCC 12266, CCC 12770* (1); *CCC 12857* (19)
Keng, H., & Kao *K 2674* (2)
Keng, Y. L., *56* (19)
Kerr *5473* (10); *8573* (2)
Kingdon-Ward *20736* (18)
King's Collector *102* (17); *189* (10); *8157* (3)
Klemme *FB 22464* (5)
Ko *52130* (2); *55597* (3); *55674* (2); *56310* (19)
Koelz *4516, 8315, 10274, 22785* (19); *25762* (3); *29225* (10); *30380, 30809, 31105* (17); *31303* (18)
Koorders *1161C, 6995β, 6997β, 6998β, 11812β* (10); *18746β, 18747β, 18772β* (12); *18773β, 18775β* (10); *23208β* (5); *26284β, 26333β, 27929β, 27938β* (17)
Koorders & Koorders-Schumacher *47963β* (2)
Kostermans *1426* (12); *1481* (5); *18075* (17)
Kou & Kae *4496* (2)
Lam *299* (17); *3254* (5)
Lane-Poole *392* (14)
Lasquety *FB 23569* (16)
Lau, S. K., *62* (2); *133, 632* (5); *1079* (2); *2463* (1); *2495* (5); *2770* (3); *3085* (5); *3605* (2); *4183, 4480* (19); *4529* (1); *4932* (5); *5523* (2); *27140* (5); *28166* (3); *28307* (1); *28557* (19)
Lau, S. Y., *20292* (5)
Lee *2715* (19)
Lei *55* (5); *342, 363, 800* (2); *876* (5)
Levine *CCC 170* (5); *CCC 201, CCC 236, CCC 407* (2); *CCC 563* (5); *CCC 1130* (2); *CCC 1298* (5); *CCC 1625* (2); *CCC 1814, CCC 3134* (5)
Levine & McClure *CCC 6913* (5)
Liang *61515, 61631* (2); *62183* (5); *62340* (2); *63604* (5); *64222* (3); *65076, 65207, 65216, 65318* (2)
Ling *NU 12192* (19)
Liu *1032, 1650* (19)
Loher *241* (5); *243* (19); *5145* (10); *6058* (16); *14840* (5)
Lorzing *6100, 13687* (18); *15199* (3); *15257* (2)
Ludbrook *58* (2)
Maingay *279, 1098* (3)
McKee *9296* (17)
Meijer *4043* (1)
Merrill *774* (19); *SB 872, SB 961* (10); *SB 1002, SB 1060* (5); *2706*

(10); *9940* (2); *BS 10052* (5); *10660* (1); *11394* (19)
Merritt *FB 3659* (16)
de Mesa *FB 27604* (16)
Meyer *FB 2307* (16)
Millar *NGF 9997* (2)
Miranda *FB 18971* (10)
Mizushima *573* (4); *TNSM 1080, TNSM 1398, 11094, 11437* (19)
Moll *BW 7025* (13)
Moran *5517* (4)
Morse *332, 382* (2)
Muroi *20, 914* (19)
Netherlands Indies Forest Service (NIFS), the following by anonymous collectors: *Ja 2229* (10); *bb 2910* (3); *Ja 2933* (10); *bb 19450* (12); *bb 27284* (10)
Noerkas *154* (10)
Norton *1393* (1); *1394* (2); *1395* (19)
Nur *SF 11310* (3)
Oldham *58* (4); *59* (1); *60* (2)
Omar *Sar 00107* (3)
van Ooststroom *13255* (1)
Parker *3019* (19)
Penas *FB 26698* (16)
Petelot *822* (5); *875, 1309* (2); *1676, 2591* (5); *2691* (2); *3569* (3); *5815* (19); *7911* (3)
Poilane *1687, 28200* (2)
Porter *Wall. cat. n. 1214* (3)
Prain's Collector *758, 883, 987* (2)
Pringo Atmodjo *55* (18)
Pullen *309* (15)
Quezon *FB 30252* (16)
Quimpo *FB 30149* (5)
Rahmat si Boeea *9383* (3); *10558* (18)
Ram *181, 398* (19)
Ramos *BS 1421* (10); *BS 1629* (16); *BS 1680* (3); *BS 5090* (5); *BS 13261* (2); *BS 20988* (5); *BS 22465, BS 23421, BS 24171, BS 24522* (16); *BS 32711* (10); *BS 39551, BS 41586, BS 79957* (16); *BS 80214* (5); *BS 80273, BS 80381* (4)
Ramos & Convocar *BS 83490, BS 83892* (16)
Ramos & Edano *BS 26303* (5); *BS 33770* (16); *BS 44007* (2); *BS 44110* (10); *BS 49631* (10); *BS 84843* (5); *BS 85175* (10)
Ramos & Pascasio *BS 35248* (16)
Ridley *10281, 11291* (2); *13541* (3)
Rock *1166, 1726* (18); *6994, 8031, 16129* (19)
Rosenbluth *FB 12866* (3)
Roxburgh Icones *185* (10); *1916* (19); *2113* (10); *2430* (2)
Ruse *62, 62A* (1); *73* (19); *122* (17)
Samundsett *22* (17)
Santos *BS 32025* (5)
Saunders *770, 892* (15)
Schneider *281, 645* (19); *1353, 1373* (18); *2803* (19); *2877* (18); *3887* (19)
Schoch *268* (18); *351* (19)
Scortechini *275* (3)
Shiota *4459* (4); *4462* (19)
Silvestri *4849* (19)
Shimada *39* (4)
Simeon *FB 28756* (5)
Simons *620* (18)
Sinclair & Edano *9765* (19)
Singh *22* (19)
Smith, H., *1790* (19)
Smith, L. S., *NGF 1287* (14)
Smith, R., *85* (2)
Smith, W. W., *702* (18)
Smitinand & Abbe *24842* (5)
Sou & Tachou *SF 16893* (3)
Squires *170* (2)
van Steenis *748* (2); *6342* (18); *12880* (10); *NIFS bb 17584* (19); *18153, 18317* (17); *18324* (19)
Steward *NU 2169* (19)
Steward & Cheo *56, 795* (19); *969* (3); *1188* (19)
Steward, Chiao & Cheo *34, 696* (19); *708* (3); *757* (1)
Stewart *1823* (19)
Strachey & Winterbottom *2* (18); *3, 4* (19)
Sulit *PNH 12282* (2); *PNH 12396* (5); *PNH 14512* (16)
Sun *19, 775, 848, 1287* (19)
Suzuki *106, 336–1, 336–2* (19)
Taam *426* (1); *757* (19); *1111* (1); *1159* (2); *1617, 1718* (5); *1825* (1); *2024* (2)
Tanaka *1784* (2)
Tang, S. G., *6751* (5); *13051* (2);

13119 (5); *13531* (2); *13651* (19); *15333* (2); *15596*, *15652* (19); *16040*, *16055* (5)
Tang, T., & Hsia *79* (19)
Tangkilisan *NIFS bb 33848* (12)
Taquet *619* (4); *820*, *2707*, *2708* (19); *2713*, *2714*, *4142* (4)
Ten *502* (18)
Teng *90156*, *90174* (1); *90201* (19)
Thwaites *CP 3490* (10)
To *CCC 407*, *CCC 1130* (2); *CCC 2237* (1)
To & Tsang *12770* (1)
Tsai *51691* (18); *51703*, *51764*, *52369* (1); *53113* (18); *53132* (19); *53494* (1); *53686* (18); *54018* (1); *54638*, *54984* (19); *55108* (1); *55163* (19); *55526* (18); *55610*, *55695*, *55960* (1); *56103*, *56423*, *57118*, *57245* (18); *57272* (19); *58566*, *59989* (18); *60072* (1); *60092* (18); *60269*, *60451* (1); *60761*, *61922* (18)
Tsang *98*, *115* (2); *213* (5); *422*, *601*, *667* (2); *787* (5); *837* (3); *16529* (5); *LU 16697* (2); *20149* (1); *21871* (19); *21919*, *22973* (2); *23022*, *23291* (5); *23310*, *23387* (1); *23406* (19); *23924* (1); *23924a* (2); *24326* (5); *25017*, *25193*, *25698* (1); *25872* (5); *26136* (19); *26248* (1); *26868*, *27016*, *27392* (5); *27829*, *28021* (19); *28508* (1); *28864* (2); *29377*, *29549*, *30448*, *30494* (5); *30511* (3)
Tsang & Wong *2453* (3); *3110* (1)
Tsiang *17*, *31*, *1619* (2); *1645* (5); *1651*, *1927* (2)
Tsiang & Wang *16258* (19)
Tso *254*, *1021*, *1633* (19)
Tso & Tsaing *2008* (2)
Tsoong *1472* (2)
Tsui *137* (1); *302*, *458*, *665* (19)
Tsung *3486* (19)
Uno *2599*, *2611* (19)
Versteeg *1910* (11)
Vickery *NGF 1405* (14)
Vidal *134*, *1015* (10); *1445* (5); *2269* (10)
Vink *BW 12065* (13)
de Voogd *1991* (5); *2283* (19)
Walker & Tawada *6762* (4); *6801* (2)
Walker & White *BSIP 126* (14)
Walsh *252* (19)
Wang, C. W., *15* (19), *322* (5); *382* (2); *39369*, *40057* (1); *40895* (19); *41125* (1); *41127*, *64191*, *66378* (19); *67388* (18); *69107* (1); *72187* (19); *74145* (1); *74490* (19); *74643*, *75548*, *77546*, *77912* (2); *77979*, *78566* (3); *79173* (2); *79257* (19)
Wang, F. T., *20542*, *21856*, *22697*, *23192*, *23556c* (19)
Warburg *20145* (5)
Ware *FB 16* (10)
Waterhouse *Y 167*, *B 344* (6)
Watt *10441* (2)
Webb *2352* (2)
Wenzel *1232* (2)
Whitford *1044*, *1295*, *1464* (16)
Whitford & Hutchinson *FB 9067* (10)
Whitmore *BSIP 2719* (14)
Whitmore's Collectors *BSIP 5661* (6)
Wight *353* (10); *355*, *356* (17)
Williams *575* (16)
Wilson *138*, *338*, *2693*, *4769* (19); *6313*, *8265*, *8514* (4); *9397* (19); *9440* (4); *9973* (1); *10161* (2); *10229* (1); *11220* (4)
Womersley *NGF 9418*, *NGF 17629* (15)
Womersley & Sleumer *NGF 14011* (15)
Wright *41* (4); *81* (2); *82* (1); *83* (2); *84* (5)
Yates *1548* (18); *1850* (9)
Yu *254*, *325*, *341*, *1120* (19); *1607*, *16576*, *17849* (18); *19171* (19); *19463* (1); *20391* (18); *20409* (1); *21009* (18)
Zee *NU 1298* (19)