Taxonomic Revision of the Genus *Entada* (Leguminosae) in the Ryukyu Islands, Japan

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Two species of *Entada* are confirmed to occur in the Ryukyu Islands, Japan. One, *E. phaseoloides*, occurs in tropical to subtropical Asia, on Pacific islands and in northeastern Australia. The second species, *E. tonkinensis*, ranges from the Ryukyu Islands through northern Taiwan and southeastern China to northern Vietnam. Descriptions and keys are provided for the two species, as well as for *E. rheedii* and *E. parvifolia* which is sometimes confused with *E. phaseoloides*.

Keywords: *Entada phaseoloides*, *Entada tonkinensis*, leaflet number, Ryukyu Islands, seed morphology

*Entada* Adans. (Leguminosae; Mimosoideae) comprises about 30 species of lianas and scandent shrubs or subshrubs distributed in tropical and subtropical regions (Nielsen 1981, 1992, ILDIS 2005). Although more than half of the species occur only in Africa, three species have a very wide distribution; *Entada rheedii* Spreng. from Africa to the Indo-Pacific, *E. gigas* (L.) Fawc. & Rendle in the New World, and *E. phaseoloides* (L.) Merr. from Southeast Asia to the western Pacific region. These species have seeds that are dispersed by ocean currents, which likely explains their wide distribution. The northernmost limit of distribution of *Entada* is in the Ryukyu Islands at the southwestern tip of the Japanese archipelago.

The first report of *Entada* from the Ryukyu Islands was made by Ito & Matsumura (1899), who identified a specimen from Ishigaki Island, Yaeyama Islands as *E. scandens* Benth. Sakaguchi (1924) followed this treatment. Kanehira (1917), however, assigned these plants to his *Entada formosana* Kaneh., described from Taiwan, and treated plants from Yakushima and Amami-Oshima as the widespread *E. phaseoloides*. Makino & Nemoto (1925, 1931) (Table 1) adopted Kanehira’s (1917) treatment. Later, Takamine (1952) recognized another species, *Entada koshunensis* Hayata & Kaneh., in the Yaeyama Islands. Sonohara et al. (1952) recognized *Entada formosana* from the Yaeyama Islands (Ishigaki, Irionote and Yonaguni islands), and *E. koshunensis* from Ishigaki, Irionote and Okinawa islands. Sonohara (1952), moreover, treated plants of *Entada* on Yakushima and Amami-Oshima Islands as *E. phaseoloides*. In addition to *Entada koshunensis*, Masamune (1955) recognized *E. phaseoloides* from Okinawa Island.

Hatusima (1956) treated *Entada koshunensis* as a synonym of *E. parvifolia* Merr. from the Philippines. His treatment (Hatusima 1956) was...
followed by Hatusima & Amano (1958, 1967), who also recognized *Entada phaseoloides* on Okinawa Island. Hatusima (1971) later treated *Entada parvifolia* as a synonym of *E. phaseoloides*. Walker (1976) also considered *Entada phaseoloides* to be a widely distributed species with large morphological variation, and placed *E. koshunensis*, *E. parvifolia*, and *E. formosana* in its synonymy. Walker’s (1976) treatment was adopted in many floristic works and checklists on the Ryukyu Islands (e.g., Hatusima & Amano 1977, 1994, Shimabuku 1990, 1997). Ohashi’s (1989)

### Table 1. Summary of taxonomic history of *Entada* in the Ryukyu Islands.

<table>
<thead>
<tr>
<th>References</th>
<th>Year</th>
<th>Yaeyama</th>
<th>Okinawa</th>
<th>Amami-Oshima</th>
<th>Yakushima</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ito &amp; Matsumura</td>
<td>1899</td>
<td><em>E. scandens</em></td>
<td></td>
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<tr>
<td>Kanehira</td>
<td>1917</td>
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<tr>
<td>Sakaguchi</td>
<td>1924</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Makino &amp; Nemoto</td>
<td>1925</td>
<td><em>E. formosana</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>1931</td>
<td><em>E. formosana</em></td>
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<tr>
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<td>1952</td>
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<td></td>
<td></td>
<td><em>E. koshunensis</em></td>
</tr>
<tr>
<td>Sonohara <em>et al.</em></td>
<td>1952</td>
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<td></td>
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<tr>
<td>Sonohara</td>
<td>1952</td>
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<td><em>E. phaseoloides</em></td>
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<tr>
<td>Masamune</td>
<td>1955</td>
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<td></td>
<td><em>E. phaseoloides</em></td>
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</tr>
<tr>
<td>Hatusima &amp; Amano</td>
<td>1958</td>
<td><em>E. parvifolia</em></td>
<td></td>
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<tr>
<td>Hatusima &amp; Amano</td>
<td>1967</td>
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<td>1977</td>
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<td>1989</td>
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<td>Shimabuku</td>
<td>1990</td>
<td></td>
<td></td>
<td><em>E. phaseoloides</em></td>
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<tr>
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<td></td>
<td><em>E. phaseoloides</em></td>
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<td>Ohashi</td>
<td>2001</td>
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<td></td>
<td><em>E. rheediti</em></td>
<td><em>E. phaseoloides</em></td>
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<td>2005</td>
<td></td>
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<td><em>E. phaseoloides</em></td>
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<td></td>
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<td></td>
<td><em>E. phaseoloides</em></td>
<td><em>E. tonkinensis</em></td>
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treatment was fundamentally the same as Walker’s (1976), but different in suggesting the possible occurrence of *E. parvifolia* on Ishigaki and Iriomote islands. Later, Ohashi (2001) recognized the plants from Yaeyama and Okinawa islands as *E. rheedii*.

In nearly all the treatments above, the species of *Entada* on Yakushima and Amami-Oshima (in the northern Ryukyu islands) has been treated as *E. phaseoloides*. In contrast, the plants of *Entada* on Okinawa and southward have either been considered to be *E. phaseoloides* or a different species. The history of the treatment of *Entada* in the Ryukyu Islands is summarized in Table 1.

Wakita *et al.* (2005) confirmed recently that two species of *Entada* occurred in the Ryukyu Islands. The first, recognized from Okinawa and Yaeyama islands, has small, convex seeds with angular margins (type S seed) and leaves with the second (distal) pinnae consisting of more than two pairs of leaflets. The second species, from Yakushima and Amami-Oshima islands, has large, compressed seeds with rounded margins (type L seed) and leaves with the second pinnae consisting of two pairs of leaflets. SSCP analysis revealed different DNA banding patterns in these species. The molecular difference is a nucleotide substitution and some insertion/deletion differences in the *rps16* intron of the chloroplast DNA. Tentatively, they assigned the plants from Okinawa and Yaeyama to *Entada koshunensis*, and plants from Yakushima and Amami-Oshima to *E. phaseoloides*. Definitive taxonomic decisions were not made because the sampling was limited only to the Ryukyu Islands and no phylogenetic analysis was conducted. Two species have recently been confirmed by phylogenetic analyses of samples from a wider distribution area using chloroplast DNA sequences (Wakita *et al.* 2008), although their taxonomy is still in question.

In this paper, we report the results of a taxonomic study on plants from the Ryukyu Islands, eastern and southeastern Asia, Oceania, and the Pacific islands. Our aim was to clarify the taxonomy of the two species and determine their geographic distribution.

**Material and Methods**

Herbarium specimens preserved in BKF, BO, HN, HNU, HYO, IBSC, KAG, KYO, L, MAK, NH, NOU, NY, P, PDA, PNH, RYU, SING, TAI, TAIF, TI, TNS, TUS, URO, US, and W (see sweetgum.nybg.org/ih/ for the list of herbarium acronyms) were examined. Morphological characters, particularly of the leaf, pod, and seed, and geographical distributions were studied.

**Results and Discussion**

In the survey of herbarium specimens, we tentatively distinguished *Entada phaseoloides* on the basis of the obliquely elliptic and distinctly asymmetric leaves (Fig. 1, Table 2). We then studied a large numbers of specimens of plants identified as *Entada phaseoloides* collected throughout its range of distribution (including the Ryukyu Islands) using seed shape as the primary key character (see Appendix for a list of specimens examined). The specimens examined were divided into two groups corresponding to the two species recognized in the study by Wakita *et al.* (2005). The geographical distributions of the two groups were then compared (Table 2).

We found that the plants with smaller, convex seeds with angular margins (type S seed) occur over a broad swath of tropical to subtropical Asia and the Pacific islands, while plants with large, compressed seeds with rounded margins (type L seed) occur in a smaller area from Vietnam to Japan (Fig. 2). The distribution of the former species coincides with that of *Entada phaseoloides* (Nielsen 1992). *Entada phaseoloides* was originally described as *Lens phaseoloides*
L. Merrill (1917) and Johnston (1949) chose as the type the plate of *Faba marina* by Rumphius in his Herbarium Amboinense 5: tab. 4 (1747). The plate had probably been drawn from a plant growing in Ambon, or an adjacent area (Scheffer 1871), which is within the range of distribution of plants with type S seeds. Based on Rumphius’s *Faba marina*, Scheffer (1871) described *E. rumphii*, a name that has been treated as a synonym for *E. phaseoloides*. The two critically drawn plates attached to the original description of *Entada rumphii* show a convex seed with a lateral swelling (tab. 18 of Scheffer 1871), which can be regarded as a type S seed. From the above observations, we conclude that plants with type S seeds should be treated as *Entada phaseoloides*.

We also conclude that plants with type L seed should be assigned to *Entada tonkinensis* Gagnep. *Entada tonkinensis* was originally described from northern Vietnam (Gagnepain 1911), but has been treated as a synonym of *E. phaseoloides* (Nielsen 1980, 1981, Lock & Heald 1994), and has never been recorded outside Vietnam. According to the original description (Gagnepain 1911), the seeds of *E. tonkinensis* are 6 cm long, 5 cm wide, and compressed. These features are consistent with type L seeds. We also confirmed that the type specimen (*Balansa 2130*) of *Entada tonkinensis* at P is identical with specimens from the Ryukyus, Taiwan, and China. The monophyly of these samples has also been confirmed by phylogenetic analyses (Wakita et al. 2008). The redefined diagnostic characters of *Entada tonkinensis* and its distribution are given in the following key and taxonomic treatment (Table 2 and Fig. 1).

Wakita et al. (2005), assigned plants from the Ryukyu Islands with type L seeds to *Entada phaseoloides*, and plants with type S seeds to *E. koshunensis*. They followed the treatment of Ho (1985) for *Entada* in Taiwan, which was based on seed characters and leaflet numbers. In contrast with Wakita et al. (2005), we concluded that the plants with type S seeds are *Entada phaseoloides*, and those with type L seeds are *E. tonkinensis*. Although Wakita et al. (2005) recognized *Entada koshunensis*, we considered it to be a synonym of *E. phaseoloides*. In works recognizing *Entada koshunensis* as a separate species, the diagnostic character was given as the 3 or 4 pairs of leaflets (Hayata 1921, Makino & Nemoto 1925, 1931, Nemoto 1936 as *E. parvifolia*, Ho 1985, Huang & Ohashi 1993). Our herbarium study revealed that 3 or 4 pairs of leaflets appear predominantly in plants from the Philippines through southern Taiwan to the southern Ryukyu Islands, and sporadically over the entire area of distribution of *Entada phaseoloides* (see Appendix). Plants with 3 pairs of leaflets were also reported from the Solomon (Verdcourt 1979) and Bismark islands (Nielsen 1992). Other features of *Entada koshunensis*, for example the distinctly asymmetrical leaflets (Fig 1b) and pods with rather thin parchment-like endocarps, are indistinguishable from *E. phaseoloides*.

Two other species, *Entada parvifolia* and *E. rheedii*, have sometimes been confused with *E. phaseoloides* in the Ryukyu Islands (Table 1). *Entada parvifolia* Merr., from the Philippines, has sometimes been applied to plants of *E. phaseoloides* from the southern Ryukyu Islands and southern Taiwan (Hatusima 1956, Hatusima & Amano 1958, 1967, Ho 1985, Huang & Ohashi 1993). The type specimen (*Ramos 5067, NY. http://sciwcl.nybg.org/science2/VirtualHerbarium.asp*) and the original description of *Entada parvifolia* (Merrill 1908), however, show that it is difficult to confuse *E. parvifolia* with *E. phaseoloides*. As summarized in Table 2 and in the key, *Entada parvifolia* is not a gigantic liana, but rather a trailing or scandent shrub whose leaves have 8–11 pairs of small, almost symmetrical leaflets (Fig. 1), small pods 15–30 cm long, and 4–5.5 cm wide, a thin parchment-like endocarp, and small seeds 1.8–2 × 1.6–1.9 cm. *Entada parv-
ifolia is placed in a different subsection, subsect. Sphaerospermae Brenan, from subsection Entada in which E. phaseoloides belongs (Brenan 1967, Nielsen 1992).

Early in the history of taxonomy on Entada in the Ryukyu Islands, the name E. formosana, a synonym of E. rheedii, was sometimes applied to plants on Yaeyama (Table 1). In the most recent comprehensive flora of Japan, Ohashi (2001) recognized Entada rheedii in the southern Ryukyu Islands and treated E. phaseoloides as its synonym. These two species, however, are clearly different in shape, size, and number of leaflets (Fig. 1), texture of the pod endocarp, and thickness of seeds (Table 2).

In this study, we show that two Entada species occurred in the Ryukyu Islands of Japan are E. phaseoloides and E. tonkinensis. In the recent

<table>
<thead>
<tr>
<th>Character</th>
<th>E. phaseoloides</th>
<th>E. tonkinensis</th>
<th>E. rheedii</th>
<th>E. parvifolia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habit</td>
<td>giant woody climber</td>
<td>giant woody climber</td>
<td>giant woody climber</td>
<td>trailing or scandent shrub</td>
</tr>
<tr>
<td>Leaflet outline</td>
<td>obliquely oblong to obliquely elliptic or obliquely obvolutely elliptic, distinctly asymmetrical</td>
<td>obliquely elliptic or obliquely obvolutely elliptic, distinctly asymmetrical</td>
<td>obovate to elliptic, or lanceolate, usually nearly symmetrical</td>
<td>oblong or obliquely oblong, nearly symmetrical</td>
</tr>
<tr>
<td>apex</td>
<td>acute to obtuse</td>
<td>acute to rounded</td>
<td>obtuse to rounded</td>
<td>rounded, truncate or slightly emarginate</td>
</tr>
<tr>
<td>no. per 2nd pinna</td>
<td>(1-)2–4 pairs</td>
<td>2–3(-4) pairs</td>
<td>4–5(-6) pairs</td>
<td>8–11 pairs</td>
</tr>
<tr>
<td>size of the distal ones on 2nd pinna</td>
<td>7–11 cm long, 3.5–5.5 cm wide</td>
<td>8.5–12 cm long, 4.4–6 cm wide</td>
<td>6–9 cm long, 2.5–4 cm wide</td>
<td>1.5–3 cm long, 0.6–1.1 cm wide</td>
</tr>
<tr>
<td>Pod endocarp</td>
<td>parchment-like</td>
<td>parchment-like</td>
<td>woody</td>
<td>thinly parchment-like</td>
</tr>
<tr>
<td>length</td>
<td>50–120 cm long</td>
<td>40–130 cm long</td>
<td>40–120 cm long</td>
<td>15–30 cm long</td>
</tr>
<tr>
<td>width</td>
<td>6–9.5 cm wide</td>
<td>9–12 cm wide</td>
<td>8–11 cm wide</td>
<td>4–5.5 cm wide</td>
</tr>
<tr>
<td>article</td>
<td>4–7.5 cm long</td>
<td>6–9.5 cm long</td>
<td>5–8.5 cm long</td>
<td>2.5–4 cm long</td>
</tr>
<tr>
<td>Seed color</td>
<td>brown</td>
<td>blackish purple</td>
<td>brown</td>
<td>brown–dark brown</td>
</tr>
<tr>
<td>shape</td>
<td>suborbicular, convex, margin angular</td>
<td>suborbicular, compressed, margin rounded</td>
<td>suborbicular, compressed, margin rounded</td>
<td>irregularly ovoid</td>
</tr>
<tr>
<td>size</td>
<td>3.5–5.5 × 3.3–4.5 cm</td>
<td>5.2–7.4 × 4.7–5.5 cm</td>
<td>3.5–5.7 × 3.5–5 cm</td>
<td>1.8–2 × 1.6–1.9 cm</td>
</tr>
<tr>
<td>thickness</td>
<td>1–1.5 cm</td>
<td>1.6–2.3 cm</td>
<td>2–2.5 cm</td>
<td>0.8–1.1 cm</td>
</tr>
<tr>
<td>Distribution</td>
<td>Southeast Asia to the South Pacific</td>
<td>Vietnam, China, Taiwan, Japan</td>
<td>Africa, Indo-Pacific region, northern Australia</td>
<td>Philippines</td>
</tr>
</tbody>
</table>
Red List of Japan only *Entada phaseoloides* is listed in the Ryukyu Islands (Kagoshima and Okinawa) as a category IB (EN) plant. Our study suggests the single species on the Red List includes two different taxa, *Entada phaseoloides* and *E. tonkinensis*, which should be considered separately for further conservation.

Key to the species in the Ryukyu Islands, including *Entada parvifolia* and *E. rheedii*

A1. Trailing or scendent shrubs; second (distal) pinna with 8–11 pairs of leaflets; distal leaflets of the second pinna 1.5–3 cm long, 0.6–1.1 cm wide; pods 15–30 cm long, 4–5.5 cm wide; seeds irregularly ovoid, 1.8–2 × 1.6–1.9 cm …………………………………………*E. parvifolia* (known only from the Philippines)

A2. Large climbing vine; second (distal) pinna with less than 6 pairs of leaflets; distal leaflets of the second pinna more than 6 cm long, and more than 2.5 cm wide; pods more than 40 cm long, more than 6 cm wide; seeds compressed laterally, more than 3.5 × 3.5 cm …………………………………………B

B1. Leaflets of second pinna 4 or 5 (or 6) pairs; distal leaflets 6–9 long, 2.5–4 cm wide, usually nearly symmetrical (equal sided), apex obtuse to rounded; pods with hard woody endocarp, 8–11 cm wide; seeds more than 2 cm thick …………………………………………*E. rheedii* (Africa, Indo-Pacific region, Australia)

B2. Leaflet of second pinna less than 4 pairs; distal leaflets more than 7 cm long, more than 3.5 cm wide, distinctly asymmetrical (unequal sided), apex acute to obtuse; pods with parchment-like endocarp ………… C

C1. Pods 6–9.5 cm wide; seeds 3.5–5.5 cm long, 3.3–4.5 cm wide, convex, 1–1.5 cm thick, brown, margin angular …………………………………………………………………………………… 1. *E. phaseoloides*

C2. Pods 9–12 cm wide; seeds 5.2–7.4 cm long, 4.7–5.5 cm wide, compressed, 1.6–2.3 cm thick, blackish purple, margin rounded 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Scale bar: 5 cm.


Climbers, woody. Stems to 40 m long, often flattened and spiraling, base to 3 m in diam. Leaves alternate, petiolate, bipinnate; petiole 1.5–3.5 cm long including basal pulvinus, glabrous or puberulous; rachis, midrib and margins of leaflets glabrous or puberulous; rachis 2–5 cm long, ending in a bifid tendril; pinnae usually 2 pairs but 1 pair on juvenile plants, 6–20 cm long; leaflets (pin- nules) opposite, (1 or) 2 or 3 pairs on first (basal) pinna and (1 or) 2–4 pairs (3 or 4 pairs on Ryukyu plants) on second (distal) pinna, increasing in size upward, rigidly chartaceous to coriaceous, adaxially shiny, drying considerably darker than abaxial surface), obliquely oblong to obliquely elliptic or obliquely obovate-elliptic, asymmetrical, base unequal-sided, apex acute to obtuse and more or less retuse, entire, 4–11 cm long, 2.5–5.5 cm wide (4–9.5 cm long, 2–4.5 cm wide in Ryukyu plants), distal pinnales second pinna 7–11 cm long, 3.5–5.5 cm wide (7–9.5 cm, and 3.5–4.5 cm wide in Ryukyu plants). Inflorescences spikes, solitary, in leaf axils or sometimes several spikes from short shoots, densely flowered, 12–30 cm long including peduncle; peduncle glabrous or puberulous, 1–6 cm long, 1.2–1.5 cm across; rachis rather densely puberulous. Bracts lanceolate, 0.6–1 mm long, abaxially puberulous, persistent. Flowers sessile or subsessile, pentameric, distyloous; flowers with short styles usually on lower half of spike, flowers with long styles on upper half of spike. Calyx green, broadly cup shaped, glabrous, 1.2–1.9 mm long; teeth inconspicuous, ciliate. Petals 5, valvate, green with reddish base, oblong or lanceolate, apex acute, 2.8–4 mm long, 1.1–1.8 mm wide. Stamens 10, filiform, 5.5–8.2 mm long, white, turning yellow after anther dehiscence; anthers 0.6–1.1 mm long, with a deciduous apical gland. Pistil stippitate; style 0.1–0.2 mm long in short styled flowers, ovary 0.7–1.1 mm long; ovules several, less than 0.1 mm long; style 2.7–4.8 mm long in long styled flowers, ovary 1.4–2.1 mm long, ovules 12–18, 0.1–0.2 mm long. Pods compressed, straight to slightly curved, sometimes slightly twisted, 0.4–1.2 m long, 6–10 cm wide, more or less constricted between seeds; exocarp falling at maturity, endocarp parchment-like, pale brown to pale grayish brown, splitting into 1-seeded, turgid segments; segments 6.5–7.5 cm long; sutures woody, thick, continuous, forming a hoop from which the enclosed segments readily detach at maturity. Seeds 9–16, reddish brown, suborbicular, compressed, convex, margin angular, 3.5–5.5 by 3.3–4.5 cm, 1–1.5 cm thick; hilum 0.5–3 mm long; with air filled cavity between cotyledons. Germination hypogeous; coty- ledons remaining in seed coat; seedling leafless, first several nodes with only cataphylls.


Distribution. Japan (Ryukyu Islands), Taiwan (Pingtung Co.), Philippines, Malaysia (Sarawak), Indonesia, Papua New Guinea, Australia (E. coast of Queensland), Northern Mariana Islands, Palau, Micronesia (Yap, Truk, Pohnpei [Ionape] and Kusai Islands), Solomon Islands, Kiribati, Vanuatu, New Caledonia, Fiji, Tonga, Samoa and French Polynesia (Fig. 2).

Ryukyu Islands: Okinawa and Yaeyama islands (Ishigaki, Kohama, Iriomote and Yonaguni
islands). Forests bordering littoral swamps and mangrove and riverine vegetation. Flowering in June on Okinawa, April to August in Yaeyama Islands.

*Entada phaseoloides* is widely distributed in tropical and subtropical areas of Asia and the Pacific. Examination of many specimens of the genus from Asia and the Pacific shows that *E. phaseoloides* is not in southeastern continental Asia, but extends throughout the islands of the biogeographic province of Malesia, through the Pacific and along the eastern coast of Queensland (Fig. 2).

**2. Entada tonkinensis** Gagnep.


Climbers, woody. Stems often flattened and spiraling, base to 60 cm across. Leaves alternate, petiolate, bipinnate, glabrous; petiole 1.5–4 cm long including basal pulvinus; rachis 3–6.5 cm long, ending in a bifid tendril; pinnae usually 2 pairs, but 1 pair on juvenile plants, 10–22 cm long; leaflets (pinnules) opposite, 2 pairs on first (basal) pinna, 2 or 3 pairs on second (distal) pinna, increasing in size upward, rigidly chartaceous, adaxially shiny, sometimes drying considerably darker than abaxial surface, obliquely elliptic, or obliquely obovate-elliptic, asymmetrical, base unequal sided, apex acute to obtuse, entire, 5–12 cm long, 2.5–6 cm wide, distal pinnules on second pinna 8.5–12 cm long, 4.4–6 cm wide. Inflorescences spikes, solitary in leaf axils or several spikes from short shoots, densely flowered, 9–25 cm long including glabrous peduncle; rachis puberulous. Peduncle 1–7 cm long, 1.3–1.5 cm across. Bracts lanceolate, 0.6–1 mm long, abaxially puberulous, persistent. Flowers sessile or subsessile, ca. 6 mm long, pentamerosus, distyloous; short styled flowers usually on lower half of spike; long styled flowers on upper half of spike. Calyx green, broadly cup shaped, glabrous, 1.2–2 mm long; teeth inconspicuous. Petals 5, valvate,
Fig. 2. Distribution map of *Entada phaseoloides* (● from herbarium specimens) and *E. tonkinensis* (▲).
pale green with reddish base, elliptic to oblong, apex acute, 3–3.2 mm long, 1.3–1.5 mm wide. Stamens 10, filiform, 5.5–7 mm long, white, turning yellow after anther dehiscence; anthers 0.5–1 mm long, apically with a deciduous gland. Pistil stipitate; style of short styled flowers 0.1–0.6 mm long, ovary 0.5–1 mm long; ovules several, less than 0.1 mm long; style of long styled flowers 4–4.7 mm long, ovary 1.8–2 mm; ovules 12–18, 0.1–0.2 mm long. Pods compressed, straight to slightly curved, 0.5–1.5 m long, 9–12 cm wide, exocarp falling at maturity; endocarp parchment-like, pale brown, splitting into 1-seeded, turgid segments 6.5–7.5 cm long; sutures woody, thick, continuous and forming a hoop from which enclosed segments readily detach at maturity. Seeds 9-16, blackish purple, compressed, suborbicular, margin rounded, 5.2–7.4 by 4.7–5.5 cm, 1.6–2.3 cm thick. Germination hypogeous, cotyledons remaining within seed coat; seedling leafless, first several nodes with only cataphylls.

*Japanese name.* Modama.

*Distribution.* Japan (Ryukyu Islands), Taiwan (northern and central counties), China (Hong Kong, Fujian, Guangdong, Guangxi, Yunnan), North Vietnam (Fig. 2).


In the Ryukyu Islands, *Entada tonkinensis* has always been treated as *E. phaseoloides* (Table 1), but can be clearly distinguished by seed shape and size (Table 2). The type specimen (Balansa 2130) of *E. tonkinensis* at P has leaves with two pairs of obliquely elliptic and distinctly asymmetrical leaflets, but has no seeds. According to the original description (Gagnepain 1911), the seeds of *E. tonkinensis* are compressed, but not at all convex.

*Entada tonkinensis* ranges from the northern Ryukyu Islands through northern and central Taiwan and southeastern China to northern Vietnam. Entada tonkinensis grows in inland evergreen forests, especially along streams at low and medium elevations.

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(TAI, TUS); Chiopeng, Chiopeng river, 22°06′29.9″N, 120°52′55.5″E, alt. 30–50 m, 22 Sep. 2003, *Wakita 240922-I (URO)*/3, *ibid.*, 22°06′32.0″N, 120°52′51.9″E, alt. 30–50 m, 22 Sep. 2003, *Wakita 240922-2 (URO)*/3, *ibid.*, 22°06′44.1″N, 120°52′46.2″E, alt. 30–50 m, 22 Sep. 2003, *Wakita 240922-3 (URO)*/4, Nanjen-shan, 22°05′68.7″N, 120°53′47.7″E, alt. 20–50 m, 23 Sep. 2003, *Wakita 240923 (URO)*/3-4, Nanjen-shan–Chiopeng, alt. ca. 200 m, 2 Nov. 1982, *Okashi et al. 14406 (TUS), 14410 (TUS), 14499 (TUS) & fr/4557 (TAI, TUS)*.


NORTHERN MARIANA ISLANDS. Saipan: Angaur I., seedl, *Tuyama s.n. (TII)*.


Oct. 1992, fl, Widjaja et al. *EW6219* (L);2: Vogelkop, Manokwari subdist. Warnapi, 15 km north of Ransiki, alt. ± 20 m, 27 Sep. 1948, Kostermans 2804 (BO, L, SING)2; W. New Guinea, Servei, 26 Sep. 1939, yfr, van Dijk 998a (BO, L);2: Mamberamo region, Idenburg River, alt. 125 m, 1 Sep. 1914, fl, Feuillletou de Bruyn 79 (BO)2; Wandermon Pen., Wondiwoi Moutains, alt. 800 m, 28 Feb. 1962, fl, Schran 13311 (KYO, L)3; Div. South N. Guinea, along river Maro, between Merauke and Tajam, 12 Jul. 1962, frs, Kalkman BW3732 (BO, L)2/S; South New Guinea, Sg. Aoendoena near Oeta, alt. 3 m, 9 Jul. 1941, fl, Aet 492 (BO, L);2: Kp. Tajam, 29 Jul. 1941, fl, Anta 204 (L)2.


SAMOA. Upolu I. Southern coast, Safata, Saanapu, on trail in mangrove forest, alt. 0 m, 26 Oct. 2002, fr.s, *Kajita et al. 02102605* (TI)2/S; Satatao mangrove forest, alt 0 m, 28 Oct. 2002, fr.s, *Kajita et al. 02102801* (TI)2/S.

*Entada tonkinensis* Gagnep.


