

## Dipterocarpaceae of Bohol Island, Philippines

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An account of the Dipterocarpaceae of Bohol Island, Philippines, comprising 15 species in five genera is presented; 12 of the species are new records for the island, viz. *Dipterocarpus grandiflorus*, *D. hasseltii*, *Hopea acuminata*, *H. philippinensis*, *H. quisumbingiana*, *Shorea almon*, *S. assamica* subsp. *philippinensis*, *S. contorta*, *S. guiso*, *S. malibato*, *S. polita* and *Vatica mangachapoi* subsp. *mangachapoi*. All 15 species, except *D. grandiflorus*, *S. almon* and *S. malibato*, occur in forests over limestone.

**Key words:** dipterocarps, Dipterocarpaceae, endemic species, karst limestone, Bohol Island, Philippines.

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## INTRODUCTION

The Dipterocarpaceae are the main timber trees of tropical Asia and are also ecologically major components of the lowland rain forests (Ashton 1982, Whitmore 1984, Newman *et al.* 1996). In the most recent comprehensive monograph of the family for the *Flora Malesiana* (Ashton 1982), six genera and 45 species were recorded for the Philippines of which about 46 percent are endemic. Before and after this excellent treatise of Ashton (1982), the Philippine species have been variously treated in a number of previous publications (*e.g.* Foxworthy 1911, 1918, 1938; Tamesis & Aguilar 1953, Rojo 1979, De Guzman *et al.* 1981, Newman *et al.* 1996, 1999). In all of these accounts, however, including the checklists of Merrill (1923) and Rojo (1979, 1999), and the handbook by Rojo & Aragonés (1997), only three species of dipterocarps, were recorded for Bohol Island, and only by Foxworthy (1918, 1938) for *Anisoptera thurifera* (Blanco) Blume, *Hopea plagata* (Blanco) Vidal, and *Shorea palosapis* (Blanco) Merr., by Tamesis & Aguilar (1953) also for *Hopea plagata* and by Rojo & Aragonés (1997) also for *Shorea palosapis*. This is surprising considering that Bohol is the 10<sup>th</sup> largest island in the Philippine archipelago with an area of nearly 4,000 km<sup>2</sup>, more than three times the size of Basilan Island where at least 15 species of dipterocarps have been previously reported (Rojo 1979). Merrill (1926) earlier noted that in some of the Visayan islands (including Bohol) 'botanical exploration has been at most superficial'.

On Bohol Island, the most significant remaining forested area is that within the 93,000 ha covered by the Rajah Sikatuna Protected Landscape (RSPL), the Loboc Watershed Reserve (LWR), and the Eskaya area in Duero. All of these are on the southern part of the island and all mainly on karst limestone. The birds of the RSPL have been listed by Brooks *et al.* (1995) and that of the bats by van Vegchel (2003). Of the plants, only the pteridophytes (Barcelona *et al.* 2006) have, thus far, been accounted for.

The island of Bohol is regarded as being part of the Greater Mindanao Island of the Pleistocene epoch (Heaney 1985, 1986) that also included Samar, Biliran, Leyte, Dinagat, Mindanao and Basilan islands. These islands are considered as a distinct biogeographic region and share exclusively many similar animal species including for examples, the Philippine Tarsier (*Tarsius syrichta*) and the Philippine Flying Lemur (*Cynocephalus volans*) for mammals (Heaney *et al.* 1998) and the Mindanao Bleeding Heart (*Gallicolumba criniger*) and Silvery Kingfisher (*Alcedo argentata*) for birds (Collar *et al.* 1999).

The present paper provides an account of the Dipterocarpaceae of Bohol Island, comprising five genera and 15 species in all, 12 of which have not previously been reported and are new records for the island.

## MATERIALS AND METHODS

In September - December 2006, field surveys of dipterocarp trees were undertaken by us in the Rajah Sikatuna Protected Landscape (RSPL), Loboc Watershed Reserve (LWR), and in other areas on Bohol Island where small patches of forest still remain (*e.g.* Danao, in the north-central part of the island). The RSPL

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and LWR areas are mostly on karst limestone with caves and sinkholes and with very rugged terrain. These two areas encompass five municipalities and 18 barangays (villages). From January to August 2007, more field surveys were conducted in the same areas, plus the Eskaya area near Duero (also on karst limestone). During these surveys, photographs were taken and voucher herbarium specimens were collected under a permit issued to the Bohol Environment Management Office and the Soil and Water Resources Conservation Foundation. All voucher specimens are deposited in the Forestry Herbarium (LBC), Museum of Natural History, University of the Philippines Los Baños. Comparisons of specimens, field notes and photographs with the keys, descriptions and figures in Foxworthy (1911, 1918, 1938), Tamesis & Aguilar (1953), Rojo (1979), De Guzman *et al.* (1981), Ashton (1982), Newman *et al.* (1996, 1999) and Rojo & Aragones (1997) and with images of type specimens available on-line at L, MO, NY and US were undertaken.

These surveys follow the excellent work of Barcelona *et al.* (2006) on the ferns and fern allies of Bohol Island. In the RSPL, specimens were collected from trees within 10 m adjacent to established foot trails used for the Biodiversity Monitoring System (BMS) of the protected area. In the other areas, foot trails used by the local people into the interior of the forests were used or the survey team proceeded directly to specific sites where dipterocarp trees were suspected to occur based on local knowledge.

## RESULTS AND DISCUSSION

A total of 15 species in five genera of Dipterocarpaceae are here recorded to occur on Bohol, 12 of these are new records for the island; nine of these species are endemic to the Philippines. They are listed here in alphabetical order. For each species, the citation of literature includes the original publication of the name, major revisions or monographs and other taxonomic accounts relating to the Philippine dipterocarp species. This list for Bohol is preliminary as other dipterocarp species may still be found in areas that have not yet been explored.

All the species reported here, except *Dipterocarpus grandiflorus* (Blanco) Blanco, *Shorea almon* Foxw. and *S. malibato* Foxw., were found in forests over limestone. Co *et al.* (2006) also recorded *S. palosapis* (Blanco) Merr., *S. contorta* Vidal and *S. falciferoides* Foxw. as occurring in forests over limestone in northern Luzon near Palanan, Isabela. Whitford (1911) earlier already noted the presence of *Shorea guiso* (Blanco) Blume, *S. contorta* and *Parashorea malaanonan* (Blanco) Merr. in some limestone regions in the Philippines (e.g. Samal Island, in the Davao Gulf in Mindanao). In Bohol, *S. guiso*, *S. contorta*, and *S. palosapis* were found on karst limestone as reported in this paper. However, *P. malaanonan*, the lone representative of its genus in the Philippines, is unexpectedly absent on limestone substrate or elsewhere in Bohol, although it is rather widespread in the rest of the archipelago.

According to Ashton (1982), the limestone dipterocarp flora is poor. Of the Philippine species only *S. guiso* is mentioned by Ashton (1982) and Newman *et al.* (1999) as occurring on limestone in West and Central Borneo and *Dipterocarpus hasseltii* in Java (Ashton 1982). In eastern Mindanao, on the soft coral limestones,

Ashton (1982) also noted dipterocarps but that these did not differ from that on other substrates.

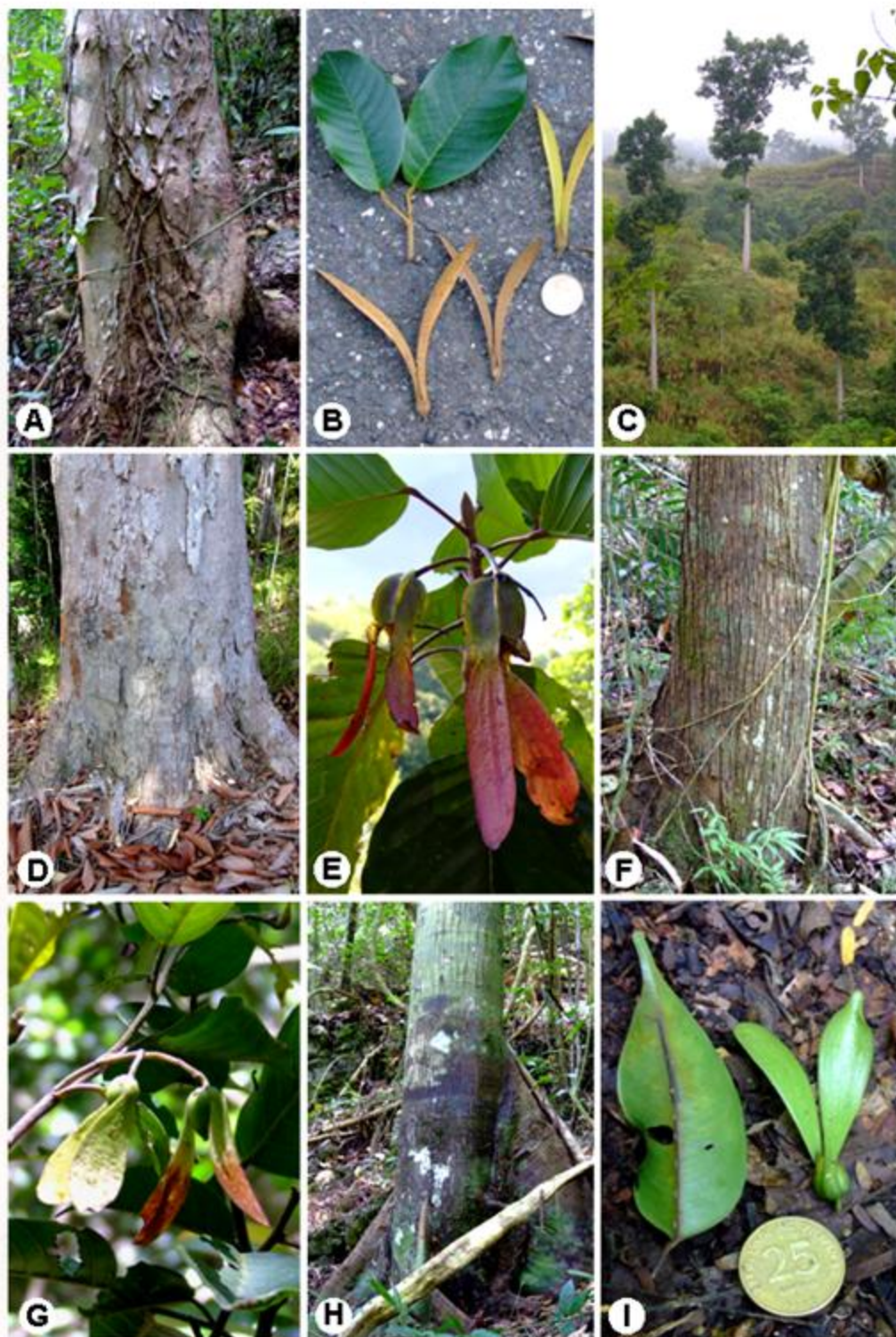
#### ANNOTATED CHECKLIST

1. *Anisoptera thurifera* (Blanco) Blume subsp. *thurifera* **Figure 1A & B**  
Blume, Ann. Mus. Bot. Lugd.-Bat. 2: 42 (1852); - Merrill, Enum. Philipp. Fl. Plts. 3: 92 (1923); - Foxworthy, Philipp. J. Sci. (Bot.) 67(3): 267 (1938); - Tamesis & Aguilar, Dept. Agr. Nat. Res. Philipp. Pop. Bull. 44: 101, fig. p. 104 (1953); - Rojo, Sylvatrop, Philipp. For. Res. J. 4(3): 131 (1979); - De Guzman et al., Guide to Philippine Flora and Fauna 1: 12, fig. 3 (1981); - Ashton, Fl. Males. ser. 1, 9: 333, figs. 27B-B4, 31 (1982); - Soerianegara & Lemmens, Plant Resources SE Asia 5(1): 102 (1994); Newman et al., Manuals of Dipterocarps for Foresters: Philippines 59, fig. 1 (1996); - Rojo & Aragones, Botanical Identification Handbook on Philippine Dipterocarps 5, figs. 3-5 (1997); - Newman et al., Foresters CD-ROM Manual of Malesian Dipterocarps 72, fig. 2 (1999); Rojo, Revised Lexicon Philipp. Trees 78 (1999); - *Anisoptera brunnea* Foxworthy, Philipp. J. Sci. (Bot.) 6(4): 254, pl. 40 (1911), 13(0-x): 181 (1918), 67(3): 270 (1938); - Merrill, Enum. Philipp. Fl. Plts. 3: 92 (1923).

This species was first recorded for Bohol Island by Foxworthy (1938, p. 269). This record, however, has not been taken up by any of the later authors. *Anisoptera thurifera* subsp. *thurifera* is one of three taxa in Bohol that occur on both limestone and non-limestone substrates. It is characterized by its flaky bark (in mature trees), especially in the basal part of the trunk (Figure 1A) and leaves with intra-marginal veins prominent on the abaxial surface. The fruit has three linear short wings (calyx lobes) and two narrowly spatulate long wings (Figure 1B).

**Figure 1.** A. *Anisoptera thurifera* subsp. *thurifera*, trunk base and outer bark, tree in forest over limestone in the Rajah Sikatuna Protected Landscape, 300 m alt., Bilar, Bohol Island, Philippines. (Photo: E.S. Fernando, 07 Dec 2006); B. *Anisoptera thurifera* subsp. *thurifera*, leaves and juvenile fruits, specimens (Fernando et al. 2047) from tree in forest over limestone in the Loboc Watershed Reserve, 310 m alt., Bilar, Bohol Island, Philippines. coin scale = 2 cm (Photo: E.S. Fernando, 10 Aug 2007); C. *Dipterocarpus grandiflorus*, habit, three of a few remaining trees in a small population, 160 m alt., Danao, Bohol Island, Philippines. (Photo: E.S. Fernando, 12 Sep 2006); D. *Dipterocarpus grandiflorus*, trunk base and outer bark, tree in same area as in Figure 1C. (Photo: E.S. Fernando, 11 Aug 2007); E. *Dipterocarpus grandiflorus*, twig and fruits, specimen (Fernando et al. 2053) from same tree in Figure 1D. (Photo: E.S. Fernando, 11 Aug 2007); F. *Hopea acuminata*, trunk base and outer bark, tree in forest over limestone in the Rajah Sikatuna Protected Landscape, 435 m alt., Bilar, Bohol Island, Philippines. (Photo: E.S. Fernando, 10 Aug 2007); G. *Hopea acuminata*, twig and fruits, specimen (Fernando et al. 2042) from same tree as in Figure 1F. (Photo: E.S. Fernando, 10 Aug 2007); H. *Hopea quisumbingiana*, trunk base and outer bark, tree in forest over limestone in the Rajah Sikatuna Protected Landscape, 400 m alt., Bilar, Bohol Island, Philippines. (Photo: E.S. Fernando, 10 Aug 2007); I. *Hopea quisumbingiana*, leaf and fruit, specimen (Fernando et al. 2041) from same tree as in Figure 1H. coin scale = 2 cm (Photo: E.S. Fernando, 10 Aug 2007).

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*Distribution:* Endemic to the Philippines. Luzon (Ilocos Norte, Ilocos Sur, Abra, Cagayan, Nueva Vizcaya, Nueva Ecija, Zambales, Bataan, Pangasinan, Tarlac, Laguna, Quezon, Camarines Norte, Camarines Sur and Albay), Sibuyan, Ticao, Masbate, Panay, Negros, Samar, Bohol and Mindanao (Zamboanga).

*Vernacular name:* *Palosapis*.

*Specimens examined:* PHILIPPINES. Bohol Island: Municipality of Bilar, Loboc Watershed Reserve, 310 m alt., *Fernando et al. 2047* (LBC), Rajah Sikatuna Protected Landscape, Brgy. Riverside, c. 300 m alt., *Fernando & Sopot 1909* (fruiting material) and *Fernando & Sopot 1910* (sterile material) (LBC), 400 m alt., *Fernando et al. 2040* (LBC); Municipality of Sevilla, Brgy. Magsaysay, Loboc Watershed Reserve, 195 m alt., *Gumapac SWCF s.n.* (LBC); Municipality of Danao, Brgy. San Miguel, 160 m alt., *Fernando & Sopot 1934* (sterile material) (LBC).

## 2. *Dipterocarpus grandiflorus* (Blanco) Blanco

Figure 1C, D & E

Blanco, Fl. Filip. ed. 2 (1845) 314; Foxworthy, Philipp. J. Sci. (Bot.) 6(4): 251, pl. 36 (1911), 13(3): 179 (1918), 67(3): 259 (1938); - Merrill, Enum. Philipp. Fl. Plts. 3: 89 (1923); - Tamesis & Aguilar, Dept. Agr. Nat. Res. Philipp. Pop. Bull. 44: 93, fig. p. 87 (1953); Rojo, Sylvatrop, Philipp. For. Res. J. 4(3): 133 (1979); - De Guzman *et al.*, Guide to Philippine Flora and Fauna 1: 22, fig. 8 (1981); - Ashton, Fl. Males. ser. 1, 9: 317, fig. 17D (1982); - Soerianegara & Lemmens, Plant Resources SE Asia 5(1): 180 (1994); Newman *et al.*, Manuals of Dipterocarps for Foresters: Philippines 69, fig. 2 (1996); - Rojo & Aragones, Botanical Identification Handbook on Philippine Dipterocarps 13, 21, figs. 10-12, 17 (1997); - Newman *et al.*, Foresters CD-ROM Manual of Malesian Dipterocarps 125, fig. 11, pl. 12 (1999); - Rojo, Revised Lexicon Philipp. Trees 79 (1999).

This is the first record of this species for Bohol Island. The trees in Danao, on the north-central part of the island, occur on the ridges and slopes of about three hills (Figure 1C) and are estimated to consist of less than a hundred mature individuals, the largest of which measured about 110 cm in stem diameter. The surrounding area is subjected to intensive shifting agricultural cultivation and burning of the grass beneath the trees occurs frequently in the dry months which put the trees at greater risk. *Dipterocarpus grandiflorus* has a characteristic trunk with low, rounded buttresses (when present), flaky outer bark, the smoother areas often lenticellate (Figure 1D) and glabrous, long-petioled leaves and large winged fruits with distinctive ridges on the calyx tube (Figure 1E). The species is thus far known in Bohol only from the Danao area.

*Distribution:* Philippines. Luzon (most provinces), Mindoro, Palawan, Sibuyan, Panay, Biliran, Samar, Leyte, Bohol, Mindano and Basilan. Also known from Andaman Is., Mergui, Peninsular Thailand, Peninsular Malaysia, Singapore, Sumatra and Borneo.

*Vernacular names:* *Apitong, Hagakhak.*

*Specimens examined:* PHILIPPINES. Bohol Island: Municipality of Danao, Brgy. San Miguel, c. 160 m alt., *Fernando et al. 1932* (LBC), *Fernando et al. 1932A* (sterile material) (LBC), *Fernando et al. 2053* (LBC).

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### 3. *Dipterocarpus hasseltii* Blume

Blume, Fl. Java (1828-29) 22, t. 6; - Merrill, Enum. Philipp. Fl. Plts. 3: 89 (1923); Foxworthy, Philipp. J. Sci. (Bot.) 67(3): 251 (1938); - Tamesis & Aguilar, Dept. Agr. Nat. Res. Philipp. Pop. Bull. 44: 98 (1953); Rojo, Sylvatrop, Philipp. For. Res. J. 4(3): 133 (1979); - De Guzman *et al.*, Guide to Philippine Flora and Fauna 1: 24, fig. 9 (1981); - Ashton, Fl. Males. ser. 1, 9: 306, fig. 24 (1982); - Soerianegara & Lemmens, Plant Resources SE Asia 5(1): 181 (1994); Newman *et al.*, Manuals of Dipterocarps for Foresters: Philippines 70, fig. 2 (1996); - Rojo & Aragones, Botanical Identification Handbook on Philippine Dipterocarps 13, 24 (1997); - Newman *et al.*, Foresters CD-ROM Manual of Malesian Dipterocarps 127, fig. 12, pl. 13 (1999); - Rojo, Revised Lexicon Philipp. Trees 79 (1999). - *Dipterocarpus trinervis* (*non* Blume) Foxworthy, Philipp. J. Sci. (Bot.) 6(4): 247 (1911), 13(3): 177 (1918); - Merrill, Enum. Philipp. Fl. Plts. 3 (1923) 91; - *Dipterocarpus subalpinus* Foxworthy, Leaf. Philipp. Bot. 6: 1950 (1913); Foxworthy, Philipp. J. Sci. (Bot.) 13(3): 177 (1918), 67(3): 255 (1938); Tamesis & Aguilar, Dept. Agr. Nat. Res. Philipp. Pop. Bull. 44: 100 (1953).

This species is also a new record for Bohol Island where it is known to occur only on karst limestone substrates. It is characterized by trunk with low rounded buttresses (when present) and outer bark lenticellate and irregularly flaky.

*Distribution:* Philippines. Luzon (Nueva Ecija, Laguna), Palawan, Negros, Biliran, Leyte, Bohol, Mindanao (Zamboanga), Basilan. Also known from Peninsular Thailand, Peninsular Malaysia, Sumatra, Java, Borneo Bali, S and E Borneo to SE Sabah.

*Vernacular name:* Hasselt's panau.

*Specimens examined:* PHILIPPINES. Bohol Island: Municipality of Bilar, Rajah Sikatuna Protected Landscape, c. 300 m alt., *Fernando & Sopot 1915* (LBC); Municipality of Sierra Bullones, Brgy. Bugsoc, Rajah Sikatuna Protected Landscape, c. 600 m alt., *Dolotina et al. 037* (LBC).

### 4. *Hopea acuminata* Merr.

### Figure 1F & G

Merrill, Philipp. Govt. Lab. Bur. Bull. 29: 30 (1905); - Foxworthy, Philipp. J. Sci. (Bot.) 6(4): 264 (1911), 13(3): 183 (1918); - Merrill, Enum. Philipp. Fl. Plts. 3: 93 (1923); Tamesis & Aguilar, Dept. Agr. Nat. Res. Philipp. Pop. Bull. 44: 69, fig. p. 62 (1953); - Gutierrez, Acta Manil. 4A: 47, fig. 9, pl. 5 (1968); - Rojo, Sylvatrop, Philipp. For. Res. J. 4(3): 135 (1979); - De Guzman *et al.*, Guide to Philippine Flora and Fauna 1: 34, fig. 14 (1981); - Ashton, Fl. Males. ser. 1, 9: 420, fig. 64A (1982); - Soerianegara & Lemmens, Plant Resources SE Asia 5(1): 244 (1994); Newman *et al.*, Manuals of Dipterocarps for Foresters: Philippines 78, fig. 3 (1996); - Rojo & Aragones, Botanical Identification Handbook on Philippine Dipterocarps 33, 37, figs. 21-22, 27 (1997); - Newman *et al.*, Foresters CD-ROM Manual of Malesian Dipterocarps 189, fig. 22 (1999); - Rojo, Revised Lexicon Philipp. Trees 80 (1999); - *Hopea maquilangensis* Foxworthy, Philipp. J. Sci. (Bot.) 13: 184 (1918).

*Hopea acuminata* was surprisingly also not recorded for Bohol Island by Merrill (1923), Foxworthy (1938), De Guzman *et al.* (1981), Newman *et al.* (1996) or Rojo (1979, 1999). It is a rather frequent species in forests over limestone on the island. It is easily distinguished in the field by its prominently fissured bark and low rounded buttresses (Figure 1F). The fruits have two longer and three shorter calyx lobes and are borne on terminal or axillary, short panicles (Figure 1G).

**Distribution:** Endemic to the Philippines. Babuyan Islands, Luzon (widespread in most provinces), Mindoro, Leyte, Samar, Bohol and Mindanao (Zamboanga, Misamis Oriental, Cotabato, Davao).

**Vernacular name:** *Manggachapui*.

**Specimens examined:** PHILIPPINES. Bohol Island: Municipality of Bilar, Loboc Watershed Reserve, 295 m alt., *Fernando et al. 2079* (LBC), Rajah Sikatuna Protected Landscape, c. 300 m alt., *Fernando & Sopot 1901* (LBC), 320 m alt., *Fernando et al. 2038* (LBC), 435 m alt., *Fernando et al. 2042* (LBC); Municipality of Sevilla, Brgy. Magsaysay, Loboc Watershed Reserve, 210 m alt., *Gumapac SWCF s.n.* (LBC); Municipality of Sierra Bullones, Brgy Nan-od, Rajah Sikatuna Protected Landscape, c. 600 m alt., *Fernando & Sopot 1930* (LBC).

### 5. *Hopea philippinensis* Dyer

Dyer, J. Bot. 16: 100 (1878); - Merrill, Enum. Philipp. Fl. Plts. 3: 94 (1923); Tamesis & Aguilar, Dept. Agr. Nat. Res. Philipp. Pop. Bull. 44: 71, fig. p. 64 (1953); - Gutierrez, Acta Manil. 4A: 65, fig. 13, pl. 9 (1968); - Ashton, Fl. Males. ser. 1, 9: 434, f. 74 A-A4 (1982); - Rojo, Sylvatrop Philipp. For. Res. J. 4(3): 136 (1979); - De Guzman *et al.*, Guide to Philippine Flora and Fauna 1: 46, fig. 20 (1981); - Ashton, Fl. Males. ser. 1, 9: 434, fig. 74 A-A4 (1982); - Rojo & Aragones, Botanical Identification Handbook on Philippine Dipterocarps 37, 43, fig. 30 (1997); - Rojo, Revised Lexicon Philipp. Trees 82 (1999).

This species is also another new record for Bohol. *Hopea philippinensis* is a small to medium sized tree, rarely reaching 40 cm in diameter, with rather steep, plank buttresses and irregularly flaky bark. The leaves are characteristically oblong-elliptic with prominently oblique or unequal base.

**Distribution:** Endemic to the Philippines. Luzon (Laguna, Quezon, Camarines, Albay), Panay, Negros, Samar, Biliran, Leyte, Samar, Bohol and Mindanao (Zamboanga, Lanao, Agusan).

**Vernacular name:** *Guisok-guisok*.

**Specimens examined:** PHILIPPINES. Bohol Island: Municipality of Bilar, Loboc Watershed Reserve, 290 m alt., *Fernando et al. 2045* (LBC); Municipality of Sierra Bullones, Brgy. Nan-od, Rajah Sikatuna Protected Landscape, c. 600 m alt., *Fernando & Sopot 1929* (LBC).

### 6. *Hopea plagata* (Blanco) Vidal

Vidal, Sinopsis Atlas t. 15A (1883); Vidal, Rev. Pl. Vasc. Filip. 62 (1886); - Foxworthy, Philipp. J. Sci. (Bot.) 13(3): 183 (1918), 67(3): 278 (1938); Merrill, Enum. Philipp. Fl. Plts. 3: 94 (1923); - Tamesis & Aguilar, Dept. Agr. Nat. Res. Philipp. Pop. Bull. 44: 82, fig. p. 65 (1953); - Gutierrez, Act. Manil. 4A (1968) 55, f. 11, pl. 7; - Rojo, Sylvatrop Philipp. For. Res. J. 4(3): 136 (1979); - De Guzman *et al.*, Guide to Philippine Flora and Fauna 1: 48, fig. 21 (1981); - Ashton, Fl. Males. ser. 1, 9: 423, f. 72A-A4 (1982); - Soerianegara & Lemmens, Plant Resources SE Asia 5(1): 264 (1994); - Newman *et al.*, Manuals of Dipterocarps for Foresters: Philippines 79, fig. 3 (1996); - Rojo & Aragones, Botanical Identification Handbook on Philippine Dipterocarps 34, 45, figs. 25-26, 31 (1997); - Newman *et al.*, Foresters CD-ROM Manual of Malesian Dipterocarps 224, fig. 25 (1999); - Rojo, Revised Lexicon Philipp. Trees 82 (1999).



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This species was previously recorded from Bohol Island by Foxworthy (1918, 1938) and by Tamesis & Aguilar (1953). It is a large tree and has been recorded to reach up to 180 cm in trunk diameter (Foxworthy 1938, Tamesis & Aguilar 1953, De Guzman *et al.* 1981; Newman *et al.* 1996) but more commonly only trees seldom attaining 60 cm diameter are found (Tamesis & Aguilar 1953). *Hopea plagata* has prominent buttresses and the bark is fissured-flaky in large mature trees. The species is now rather rare on Bohol Island and only small trees are known.

*Distribution:* Philippines. Luzon (Cagayan, Nueva Vizcaya, Nueva Ecija, Pangasinan, Bulacan, Bataan, Rizal, Laguna, Quezon, Camarines and Sorsogon), Mindoro, Tablas, Leyte, Bohol, Mindanao, Basilan and Tawi-Tawi. Also known from NE Borneo.

*Vernacular names:* *Saplungan, Yakal-saplungan*

*Specimens examined:* PHILIPPINES. Bohol Island: Municipality of Sierra Bullones, Brgy. Bugsoc, Rajah Sikatuna Protected Landscape, c. 600 m alt., *Dolotina et al.* 205 (LBC).

### 7. *Hopea quisumbingiana* Gutierrez

Figure 1H & I

Gutierrez, Acta Manil. 4A, 2: 31, fig. 5, pl. 1 (1968); - Rojo, Sylvatrop, Philipp. For. Res. J. 4(3): 137 (1979); - De Guzman *et al.*, Guide to Philippine Flora and Fauna 1: 50, fig. 22 (1981); - Ashton, Fl. Males. ser. 1, 9: 398 (1982); - Rojo & Aragones, Botanical Identification Handbook on Philippine Dipterocarps 37, 48 (1997); - Rojo, Revised Lexicon Philipp. Trees 82 (1999).

This species was previously known only from the type collection from Samar Island (Gutierrez 1968). It is, however, also a rather common species on Bohol Island in forests over limestone. The tree reaches up to 20 m tall and 30 cm in trunk diameter. *Hopea quisumbingiana* is characterized by its low, plank buttresses and straight, cylindrical bole, generally smooth bark, sometimes with short or broken shallow fissures, especially near the base of the trunk (Figure 1H). The leaves are broadly elliptic to suborbicular and have a truly 'dryobalanoid' venation (*i.e.* 'with more or less indistinct nerves and with many equally prominent, shorter secondary, and indistinct reticulate tertiaries resembling those of *Dryobalanops*' (Ashton 1982) and occasionally with tomentose domatia along basal half of the midrib (Figure 1I). It is, thus far, the only species of *Hopea* in Bohol with a 'dryobalanoid' venation. The fruit (Figure 1I) is described here for the first time: Fruit glabrous; pedicel to 2 mm long x 1 mm wide; two longer calyx lobes to c. 0.8-1.1 x 4.9-6.2 cm, with 7-8 nerves, broadly spatulate, obtuse at apex, tapering to 2 mm near the base, the saccate base 8 x 2 mm; the three short calyx lobes to c. 8 x 9 mm, shorter than the nut, broadly ovate, acute at apex; nut to c. 0.6-0.8 x 1.1-1.3 mm, broadly ovoid, tapering to an acute or apiculate apex.

*Distribution:* Endemic to the Philippines: Samar and Bohol.

*Vernacular name:* *Quisumbing guisok*.

*Specimens examined:* PHILIPPINES. Bohol Island: Municipality of Bilar, Brgy. Riverside, Rajah Sikatuna Protected Landscape, c. 300 m alt., *Fernando & Sopot 1904* and *Fernando 1904A* (LBC), 330 m alt., *Fernando et al. 2039* (LBC), 400 m alt., *Fernando et al. 2041* (LBC); Municipality of Sevilla, Brgy. Magsaysay, 180 m alt.,

*Gumapac SWCF s.n.* (LBC); Municipality of Sierra Bullones, Brgy Nan-od, Rajah Sikatuna Protected Landscape, c. 600 m alt., *Fernando & Sopot 1920* (LBC), Brgy. Bugsoc, Rajah Sikatuna Protected Landscape, c. 600 m alt., *Dolotina et al. 077* (LBC); Municipality of Duero, Brgy. Taytay, 700 m alt., *Fernando et al. 2035* (LBC).

#### 8. *Shorea almon* Foxw.

Foxworthy, Philipp. J. Sci. 67: 313 (1938); -Tamesis & Aguilar, Dept. Agr. Nat. Res. Philipp. Pop. Bull. 44: 47, fig. p. 37 (1953); - Rojo, Sylvatrop, Philipp. For. Res. J. 4(3): 138 (1979); - De Guzman et al., Guide to Philippine Flora and Fauna 1: 60, fig. 26 (1981); - Ashton, Fl. Males. ser. 1, 9: 507, f. 7 (1982); - Soerianegara & Lemmens, Plant Resources SE Asia 5(1): 391 (1994); - Newman et al., Manuals of Dipterocarps for Foresters: Philippines 93, fig. 7 (1996); - Rojo & Aragones, Botanical Identification Handbook on Philippine Dipterocarps 58, 66, figs. 38-39 (1997); - Newman et al., Foresters CD-ROM Manual of Malesian Dipterocarps 286, fig. 36 (1999); - Rojo, Revised Lexicon Philipp. Trees 83 (1999). - *Shorea eximia* (non (Miq.) Scheff.) Foxworthy, Merrill, Enum. Philipp. Fl. Plts. 3: 96 (1923);

This species is another new record for Bohol where it is known only from non-limestone substrates. It is a large tree with buttresses and with fissured bark and leaves which are boat-shaped (markedly concave on abaxial surface), especially in older ones.

*Distribution:* PHILIPPINES. LUZON (Quezon, Camarines, Albay, Sorsogon), Negros, Samar, Leyte, Bohol, Mindanao (Surigao, Agusan, Bukidnon, Davao, Misamis, Zamboanga), Basilan. Also known from Borneo (Sarawak and Sabah).

*Vernacular name:* *Almon*.

*Specimen examined:* PHILIPPINES. Bohol Island: Municipality of Danao, Brgy. San Miguel, 140 m alt., *Fernando et al. 2052* (LBC).

#### 9. *Shorea assamica* Dyer subsp. *philippinensis* (Brandis) Sym.

Symington, Gard. Bull. S.S. 9 (1938) 331; - Rojo, Sylvatrop, Philipp. For. Res. J. 4(3): 138 (1979); - Ashton, Fl. Males. ser. 1, 9: 492 (1982); - De Guzman et al., Guide to Philippine Flora and Fauna 1: 64, fig. 28 (1981); - Ashton, Fl. Males. ser. 1, 9: 492 (1982); - Soerianegara & Lemmens, Plant Resources SE Asia 5(1): 409 (1994); Newman et al., Manuals of Dipterocarps for Foresters: Philippines 95, fig. 8 (1996); - Rojo & Aragones, Botanical Identification Handbook on Philippine Dipterocarps 59, 67, fig. 52 (1997); - Newman et al., Foresters CD-ROM Manual of Malesian Dipterocarps 299, fig. 53 (1999); - Rojo, Revised Lexicon Philipp. Trees 83 (1999). - *Shorea philippinensis* Brandis, J. Linn. Soc. Bot. 31: 88 (1895); - Merrill, Enum. Philipp. Fl. Plts. 3: 98 (1923); - Foxworthy, Philipp. J. Sci. (Bot.) 67(3): 302 (1938); Tamesis & Aguilar, Dept. Agr. Nat. Res. Philipp. Pop. Bull. 44: 59, fig. p. 56 (1953).

This species is also another new record for Bohol. It is a large tree with buttresses and shallowly and irregularly fissured bark. The leaves have rather persistent stipules. It is locally common in many parts of the RSPL.

*Distribution:* PHILIPPINES. LUZON (Cagayan, Isabela, Bulacan, Laguna, Quezon and Camarines), Ticao, Leyte, Mindanao (Lanao, Davao, Agusan del Norte) and Basilan. Also known from SE Borneo.

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*Vernacular name:* Manggasinoro.

*Specimens examined:* PHILIPPINES. Bohol Island: Municipality of Bilar, Brgy. Riverside, Rajah Sikatuna Protected Landscape, c. 300 m alt., *Fernando & Sopot 1900* (LBC), 315 m alt., *Fernando 2037 et al.* (LBC); Municipality of Sierra Bullones, Brgy Nan-od, Rajah Sikatuna Protected Landscape, c. 600 m alt., *Fernando & Sopot 1919* and *1922* (LBC); Municipality of Duero, Brgy. Taytay, 670 m alt., *Fernando et al. 2034* (LBC).

### 10. *Shorea contorta* Vidal

### Figure 2A & B

Vidal, *Sinopsis Atlas* 15, t. 15E (1883); Vidal, *Rev. Pl. Vasc. Filip.* 88 (1886); - Merrill, *Philipp. J. Sci.* 1 Suppl.: 98 (1906); - Rojo, *Sylvatrop, Philipp. For. Res. J.* 4(3): 139 (1979); - De Guzman *et al.*, *Guide to Philippine Flora and Fauna* 1: 68, fig. 30 (1981); - Ashton, *Fl. Males. ser. 1*, 9: 467, fig. 84 (1982); - Soerianegara & Lemmens, *Plant Resources SE Asia* 5(1): 393 (1994); Newman *et al.*, *Manuals of Dipterocarps for Foresters: Philippines* 96, fig. 7 (1996); - Rojo & Aragones, *Botanical Identification Handbook on Philippine Dipterocarps* 65, 70, figs. 50-51, 53 (1997); - Newman *et al.*, *Foresters CD-ROM Manual of Malesian Dipterocarps* 324, fig. 38 (1999); - Rojo, *Revised Lexicon Philipp. Trees* 83 (1999). - *Pentacme contorta* (Vidal) Merr. & Rolfe, *Philipp. J. Sci. (Bot.)* 3: 115 (1908); - Merrill, *Enum. Philipp. Fl. Plts.* 3: 95 (1923); - Foxworthy, *Philipp. J. Sci.* 67 (1938) 287; Tamesis & Aguilar, *Dept. Agr. Nat. Res. Philipp. Pop. Bull.* 44: 50, fig. p. 39 (1953); - *Pentacme mindanensis* Foxworthy, *Philipp. J. Sci. (Bot.)* 13: 185 (1918), 67: 289 (1938); - Merrill, *Enum. Philipp. Fl. Plts.* 3: 95 (1923).

This species is also another new record for Bohol. *Shorea contorta* is a large buttressed tree with characteristic V-section fissured bark (Figure 2A) and ovate or oblong-lanceolate, glabrous leaves with distantly set, prominent secondary nerves of 5-8 pairs. The fruits have three long wings and two short wings (Figure 2B) and like most other dipterocarp species, the seeds quickly germinate near the base of the parent tree. In Bohol, *S. contorta* occurs on both karst limestone and non-limestone substrates.

*Distribution:* Endemic to the Philippines. Babuyan Is., Luzon (in most provinces), Polillo, Mindoro, Sibuyan, Marinduque, Masbate, Negros, Leyte, Samar, Bohol, Mindanao (Zamboanga, Lanao, Agusan) and Basilan.

*Vernacular name:* White lauan.

*Specimens examined:* PHILIPPINES. Bohol Island: Municipality of Bilar, Loboc Watershed Reserve, 290 m alt., *Fernando et al. 2049* (LBC); Rajah Sikatuna Protected Landscape, c. 300 m alt., *Fernando 1818A* (LBC), *Fernando & Sopot 1903* (LBC); Municipality of Sierra Bullones, Brgy Nan-od, Rajah Sikatuna Protected Landscape, c. 600 m alt., *Fernando & Sopot 1917* (LBC), Brgy. Bugsoc, Rajah Sikatuna Protected Landscape, c. 600 m alt., *Dolotina et al. 056* (LBC); Municipality of Duero, Brgy. Taytay, 650 m alt., *Fernando et al. 2036* (LBC); Municipality of Danao, Brgy San Miguel, 160 m alt., *Fernando & Sopot 1934* (LBC).

11. *Shorea guiso* (Blanco) Blume

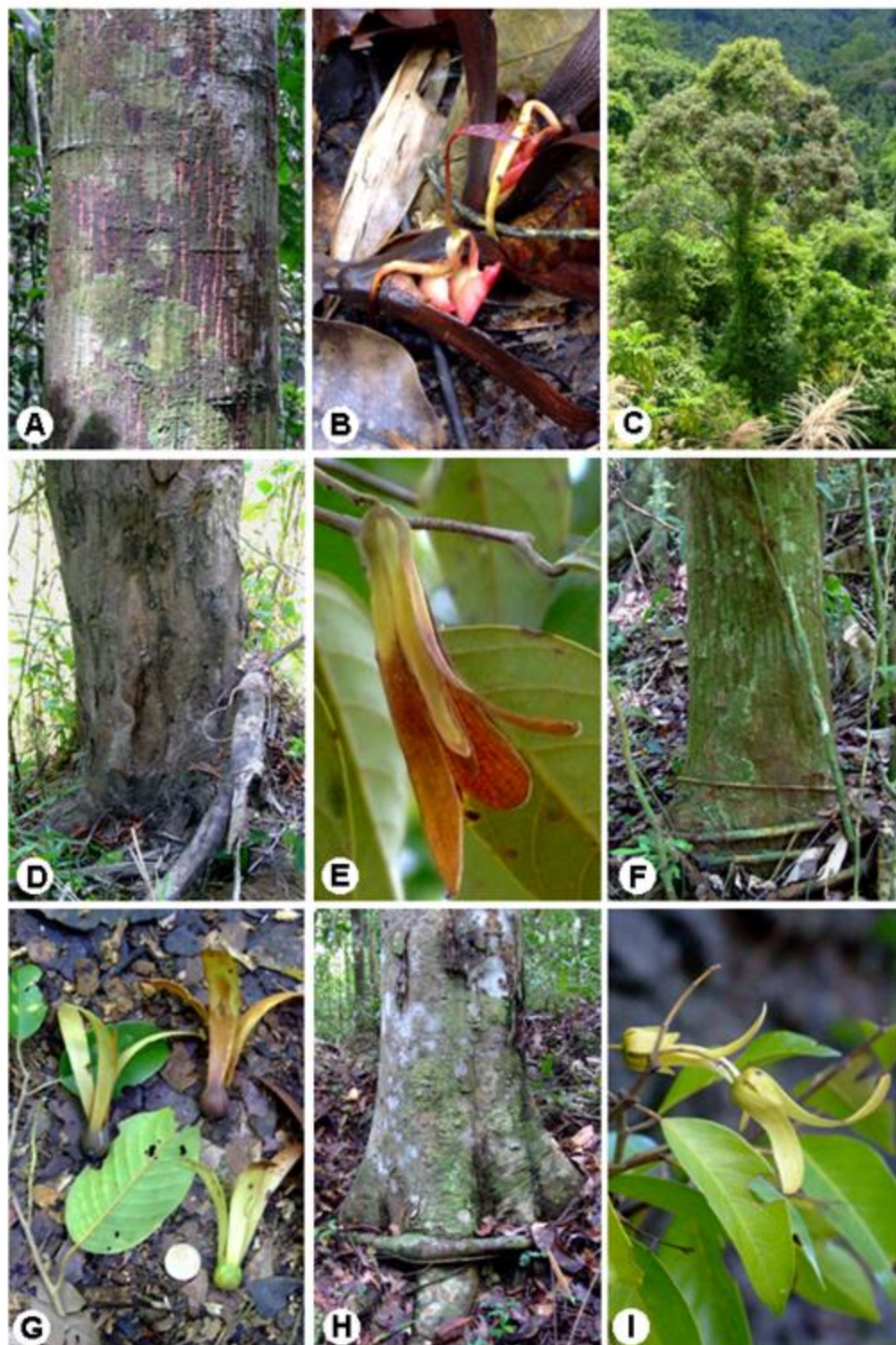
Blume, Ann. Mus. Bot. Lugd.-Bat. 2: 34 (1852); - Merrill, Enum. Philipp. Fl. Plts. 3: 97 (1923); - Foxworthy, Philipp. J. Sci. (Bot.) 67: 292 (1938); Tamesis & Aguilar, Dept. Agr. Nat. Res. Philipp. Pop. Bull. 44: 52, fig. p. 54 (1953); - Rojo, Sylvatrop, Philipp. For. Res. J. 4(3): 140 (1979); - De Guzman *et al.*, Guide to Philippine Flora and Fauna 1: 72, fig. 32 (1981); - Ashton, Fl. Males. ser. 1, 9: 447 (1982); - Soerianegara & Lemmens, Plant Resources SE Asia 5(1): 393 (1994); Newman *et al.*, Manuals of Dipterocarps for Foresters: Philippines 98, fig. 5 (1996); - Rojo & Aragonés, Botanical Identification Handbook on Philippine Dipterocarps 59, 72 (1997); - Newman *et al.*, Foresters CD-ROM Manual of Malesian Dipterocarps 372, fig. 32 (1999); - Rojo, Revised Lexicon Philipp. Trees 83 (1999).

This is another new record for Bohol Island where it is restricted to forests over limestone. Elsewhere in the Philippines, this species was also known to occur on limestone on Samal Island (Whitford 1911) and on non-limestone substrates in slightly seasonal areas. In West and Central Borneo, this species is said to be confined to limestone hills (Ashton 1982). *Shorea guiso* is a strongly buttressed medium to large tree with bark irregularly vertically cracked, sometimes scaly. The leaves are thinly coriaceous and generally with many pairs of secondary nerves, usually more than 15.

*Distribution:* Philippines. Luzon (widespread in most provinces), Mindoro, Masbate, Panay, Negros, Leyte, Samar, Bohol, Mindanao and Basilan. Also known from Peninsular and SE Thailand, S Vietnam, Peninsular Malaysia, Sumatra and Borneo.

**Figure 2.** A. *Shorea contorta*, trunk and outer bark, tree in forest over limestone in the Rajah Sikatuna Protected Landscape, 400 m alt., Bilar, Bohol Island, Philippines (Photo: E.S. Fernando, 23 Sep 2006); B. *Shorea contorta*, fruits and germinating seeds (*Fernando 1818A*), beneath tree in Figure 2A (Photo: E.S. Fernando, 23 Sep 2006); C. *Shorea malibato*, habit, solitary relict tree on steep ravine, 160 m alt., Danao, Bohol Island, Philippines (Photo: E.S. Fernando, 11 Aug 2007); D. *Shorea malibato*, trunk and outer bark, same tree as in Figure 2C. (Photo: E.S. Fernando, 11 Aug 2007); E. *Shorea malibato*, twig with fruit, specimen (*Fernando et al. 2050*) from same tree as in Figure 2C and 2D (Photo: E.S. Fernando, 11 Aug 2007); F. *Shorea polita*, trunk base and outer bark, tree in forest over limestone in the Rajah Sikatuna Protected Landscape, 450 m alt., Bilar, Bohol Island, Philippines (Photo: E.S. Fernando, 10 Aug 2007); G. *Shorea polita*, twig and fruits, specimen (*Fernando et al. 2043*) from same tree as in Figure 2F. coin scale = 2 cm (Photo: E.S. Fernando, 10 Aug 2007); H. *Vatica mangachapoi* subsp. *mangachapoi*, trunk base and outer bark, tree in forest over limestone in the Rajah Sikatuna Protected Landscape, 480 m alt., Bilar, Bohol Island, Philippines (Photo: E.S. Fernando, 23 Sep 2006); I. *Vatica mangachapoi* subsp. *mangachapoi*, twig and fruits, specimen (*Fernando et al. 2046*) from tree in forest over limestone in the Loboc Watershed Reserve, 315 m alt., Bilar, Bohol Island, Philippines (Photo: E.S. Fernando, 10 Aug 2007).

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*Vernacular name:* *Guijo*.

*Specimens examined:* PHILIPPINES. Bohol Island: Municipality of Bilar, Loboc Watershed Reserve, 310 m alt., *Fernando et al. 2048* (LBC); Rajah Sikatuna Protected Landscape, c. 300 m alt., *Fernando 1905* (LBC); Municipality of Sevilla, Brgy. Magsaysay, 180 m alt., *Balibing SWCF s.n.* (LBC); Municipality of Sierra Bullones, Brgy Nan-od, c. 600 m alt., *Fernando et al. 1921* (LBC).

### 12. *Shorea malibato* Foxw.

Figure 2C, D & E

Foxworthy, Leaflet. Philipp. Bot. 6: 1955 (1913); - Foxworthy, Philipp. J. Sci. (Bot.) 13: 189 (1918), 67: 298, pl. 6 (1938); - Merrill, Enum. Philipp. Fl. Plts. 3: 97 (1923); Tamesis & Aguilar, Dept. Agr. Nat. Res. Philipp. Pop. Bull. 44: 80 (1953); - Rojo, Sylvatrop, Philipp. For. Res. J. 4(3): 140 (1979); - De Guzman *et al.*, Guide to Philippine Flora and Fauna 1: 76, fig. 34 (1981); - Ashton, Fl. Males. ser. 1, 9: 460 (1982); - Soerianegara & Lemmens, Plant Resources SE Asia 5(1): 431 (1994); - Newman *et al.*, Manuals of Dipterocarps for Foresters: Philippines 99, fig. 6 (1996); - Rojo & Aragones, Botanical Identification Handbook on Philippine Dipterocarps 74 (1997); - Newman *et al.*, Foresters CD-ROM Manual of Malesian Dipterocarps 426, fig. 33 (1999); Rojo, Revised Lexicon Philipp. Trees 84 (1999).

This is another new record for Bohol Island. It is a very rare species and is known on Bohol Island, thus far, only from a single relict tree in the non-limestone area of Danao (Figure 2C). *Shorea malibato* has low, rounded buttresses and the outer bark is vertically cracked and scaling off in small patches (Figure 2D). It is also characterized by ovate-lanceolate leaves which are light golden brown on the abaxial surface and with strongly geniculate petioles and the mature fruit with three longer and two shorter wings (calyx lobes) (Figure 2E).

*Distribution:* Endemic to the Philippines. Luzon (Quezon, Camarines), Leyte, Bohol and Mindanao (Zamboanga, Agusan, Surigao del Sur).

*Vernacular names:* *Guisok, Yakal-malibato*.

*Specimen examined:* PHILIPPINES. Bohol Island: Municipality of Danao, Brgy. San Miguel, 160 m alt., *Fernando et al. 2050* (LBC).

### 13. *Shorea palosapis* (Blanco) Merr.

Merrill, Sp. Blancoanae 271 (1918); Merrill, Enum. Philipp. Fl. Plts. 3: 98 (1923); Rojo, Sylvatrop, Philipp. For. Res. J. 4(3): 141 (1979); - De Guzman *et al.*, Guide to Philippine Flora and Fauna 1: 80, fig. 36 (1981); - Ashton, Fl. Males. ser. 1, 9: 517 (1982); - Soerianegara & Lemmens, Plant Resources SE Asia 5(1): 399 (1994); Newman *et al.*, Manuals of Dipterocarps for Foresters: Philippines 103, fig. 7 (1996); - Rojo & Aragones, Botanical Identification Handbook on Philippine Dipterocarps 64, 76, figs. 47-49 (1997); - Newman *et al.*, Foresters CD-ROM Manual of Malesian Dipterocarps 460, fig. 45 (1999); Rojo, Revised Lexicon Philipp. Trees 85 (1999). - *Shorea squamata* (Turcz.) Dyer., Foxworthy, Philipp. J. Sci. (Bot.) 6(4): 275 (1911), 13(3): 191 (1918), 67(3): 310 (1938); Tamesis & Aguilar, Dept. Agr. Nat. Res. Philipp. Pop. Bull. 44: 49, fig. p. 38 (1953).

This species was also previously recorded for Bohol Island by Foxworthy (1918, 1938) as *Shorea squamata* (Turcz.) Dyer but not by Merrill (1923), Rojo (1979, 1999), De Guzman *et al.* (1981) or Newman *et al.* (1996). Rojo & Aragones (1997, p. 77) also

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mention this species for the island. Like *Anisoptera thurifera* subsp. *thurifera* and *S. contorta* in Bohol, this species occurs on both karst limestone and non-limestone substrates. *Shorea palosapis* is a large tree with buttresses and fissured bark and characteristic large coarse leaves and prominent and persistent stipules.

*Distribution:* Endemic to the Philippines. Luzon (Ilocos Norte, Cagayan, Isabela, Nueva Ecija, Bulacan, Rizal, Laguna, Quezon, Camarines, Albay and Sorsogon), Polillo, Mindoro, Marinduque, Leyte, Samar, Bohol, Mindanao (Zamboanga, Misamis, Bukidnon, Davao, Agusan, Surigao) and Basilan.

*Vernacular name:* *Mayapis*.

*Specimens examined:* PHILIPPINES. Bohol Island: Municipality of Bilar, Loboc Watershed Reserve, 270 m alt., *Fernando et al. 2044* (LBC); Municipality of Sevilla, Brgy. Magsaysay, Loboc Watershed Reserve, 190 m alt., *Balibing SWCF s.n.* (LBC); Municipality of Sierra Bullones, Brgy. Nan-od, 600 m alt., *Fernando & Sopot 1918* (LBC); Municipality of Danao, Brgy. San Miguel, 140 m alt., *Fernando et al. 2051* (LBC).

### 14. *Shorea polita* Vidal

### Figure 2F & G

Vidal, Sinopsis Atlas 15, t. 15D (1883); - Foxworthy, Philipp. J. Sci. (Bot.) 13(3): 190 (1918), 67(3): 304 (1938); - Merrill, Enum. Philipp. Fl. Plts. 3: 98 (1923); - Tamesis & Aguilar, Dept. Agr. Nat. Res. Philipp. Pop. Bull. 44: 60, fig. p. 55 (1953); - Rojo, Sylvatrop, Philipp. For. Res. J. 4(3): 141 (1979); De Guzman *et al.*, Guide to Philippine Flora and Fauna 1: 82, fig. 37 (1981); - Ashton, Fl. Males. ser. 1, 9: 487, f. 92 (1982); - Soerianegara & Lemmens, Plant Resources SE Asia 5(1): 412 (1994); - Newman *et al.*, Manuals of Dipterocarps for Foresters: Philippines 104, fig. 8 (1996); - Rojo & Aragones, Botanical Identification Handbook on Philippine Dipterocarps 63, 77 (1997); - Newman *et al.*, Foresters CD-ROM Manual of Malesian Dipterocarps 481, fig. 55 (1999); - Rojo, Revised Lexicon Philipp. Trees 85 (1999). - *Shorea mindanensis* Foxworthy, Philipp. J. Sci. (Bot.) 13(3): 192 (1918); - Merrill, Enum. Philipp. Fl. Plts. 3: 97 (1923).

This is another new record for Bohol Island where it is also rather rare and known only from karst limestone substrates. Only a few individuals are known from the RSPL. *Shorea polita* is a large tree with long, straight cylindrical bole and fissured bark similar to that of *Shorea assamica* subsp. *philippinensis* but without the usual prominent buttresses (Figure 2F). The leaves have a distinctly light coloration on the abaxial surface and fruits with three long and two short wings (calyx lobes) (Figure 2G). Some fruits of this species (*Fernando et al. 2043*) yielded 2-3 seedlings when sown, indicative of polyembryony in the seed (*Fernando et al.*, in prep.). This is the first time that such phenomenon is reported for *S. polita*. Ashton (1982, p. 263) regards polyembryony as unusual but accordingly, can occur in many species and genera. Bawa (1998) listed at least 17 other species of dipterocarps where multiple seedlings from a single fruit have been reported.

*Distribution:* Endemic to the Philippines. Luzon (Cagayan, Ilocos Sur, Pangasinan, Zambales, Nueva Ecija, Rizal, Laguna and Quezon), Mindoro, Samar, Bohol, Mindanao (Agusan, Surigao, Davao) and Basilan.

*Vernacular name:* Malaanonang.

*Specimens examined:* PHILIPPINES. Bohol Island: Municipality of Bilar, Rajah Sikatuna Protected Landscape, 450 m alt., *Fernando & Sopot 1906 and 1911* (LBC), *Fernando et al. 2043* (LBC).

15. *Vatica mangachapoi* Blanco subsp. *mangachapoi* **Figure 2H & I**  
Blanco, Fl. Filip. ed. 1: 401 (1837); Vidal, Sinopsis Atlas t. 15B, f. 1-6 (1883); Vidal, Rev. Pl. Vasc. Philip. 61 (1886); - Foxworthy, Philipp. J. Sci. (Bot.) 6(4): 282 (1911), 13(3): 196 (1918), 67(3): 321 (1938); - Merrill, Enum. Philipp. Fl. Plts. 3: 101 (1923); Tamesis & Aguilar, Dept. Agr. Nat. Pop. Bull. 44: 111, fig. p. 109 (1953); - De Guzman *et al.*, Guide to Philippine Flora and Fauna 1: 92, fig. 43 (1981); - Ashton, Fl. Males. ser. 1, 9: 364, figs. 27B-B4, 31 (1982); - Soerianegara & Lemmens, Plant Resources SE Asia 5(1): 468 (1994); - Rojo & Aragones, Botanical Identification Handbook on Philippine Dipterocarps 84, 89 (1997); - Rojo, Revised Lexicon Philipp. Trees 86 (1999); - *Vatica whitfordii* Foxworthy, Philipp. J. Sci. (Bot.) 67(3): 322, pl. 8 (1938).

This is another new record for Bohol Island where it is known only in forests over limestone. *Vatica mangachapoi* subsp. *mangachapoi* is a medium size tree sometimes reaching to nearly 60 cm in trunk diameter with low, broadly rounded buttresses and bark that appears mottled and irregularly scaly (Figure 2H). The leaves are elliptic and coriaceous and the fruit has two longer and three shorter wings (calyx lobes) which are valvate and joined only at the base (Figure 2I).

*Distribution:* Philippines. Babuyan Islands, Luzon (widespread in most provinces), Leyte, Samar, Bohol and Mindanao (Lanao, Davao). Also known from Peninsular Thailand to N Peninsular Malaysia and Borneo (Sarawak, Brunei and Sabah).

*Vernacular name:* Narig.

*Specimens examined:* PHILIPPINES. Bohol Island: Municipality of Bilar, Loboc Watershed Reserve, 315 m alt., *Fernando et al. 2046* (LBC); Rajah Sikatuna Protected Landscape, c. 480 m alt., *Fernando 1907*, c. 460 m alt., *Fernando & Sopot 1913* (LBC); Municipality of Sevilla, Brgy. Magsaysay, Loboc Watershed Reserve, 190 m alt., *Gumapac SWCF 010* (LBC); Municipality of Sierra Bullones, Brgy. Bugsoc, Rajah Sikatuna Protected Landscape, c. 600 m alt., *Dolotina et al. 079* (LBC).

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## LITERATURE CITED

- Ashton, P.S. 1982. Dipterocarpaceae. Flora Malesiana Series I, 9(3): 237-552.  
Barcelona, J.F., N.E. Dolotina, G.C. Madroñero, W.G. Granert and D.D. Sopot. 2006. The ferns and fern allies of the karst forests of Bohol Island, Philippines. *American Fern Journal* 96(1): 1-20.  
Bawa, K.S. 1998. Conservation of genetic resources in the Dipterocarpaceae, pp.45-55. In: Appanah, S. and J.M. Turnbull (Eds.). *A Review of Dipterocarps: Taxonomy, Ecology and Silviculture*, Center for International Forestry Research, Bogor, Indonesia.



## Bohol Island dipterocarps

- Brooks, T., G. Dutson, B. King and P.M. Magsalay. 1995. An annotated checklist of the forest birds of Rajah Sikatuna National Park, Bohol, Philippines. *Forktail 11*: 121-134.
- Co, L.L., J.V. LaFrankie, D.A. Lagunzad, K.A.C. Pasion, H.T. Consunji, N.A. Bartolome, S.L. Yap, J.E. Molina, M.D.C. Tongco, U.F. Ferreras, S.J. Davies and P.S. Ashton. 2006. *Forest Trees of Palanan, Philippines: A Study in Population Ecology*. Center for Integrative Development Studies, University of the Philippines - Diliman, Quezon City, Philippines, 313 p.
- Collar, N.J., N.A.D. Mallari and B.R. Tabaranza. 1999. *Threatened Birds of the Philippines*. Haribon Foundation and Birdlife International, Quezon City, Philippines.
- De Guzman, E.D., R.M. Umali and E.D. Sotalbo. 1981. Philippine dipterocarps. In: *Guide to Philippine Flora and Fauna*. Volume 1, Natural Resources Management Centre and University of the Philippines, Quezon City.
- Foxworthy, F.W. 1911. Philippine Dipterocarpaceae. *Philippine Journal of Science* 6(4): 231-287.
- Foxworthy, F.W. 1918. Philippine Dipterocarpaceae, II. *Philippine Journal of Science* 13(3): 163-199.
- Foxworthy, F.W. 1938. Philippine Dipterocarpaceae, III. *Philippine Journal of Science* 67(3): 241-333.
- Gutierrez, H.G. 1968. A revision of the genus *Hopea* Roxb. of the Philippines. *Acta Manillana ser. A*, 4(2): 3-86, t.1-9.
- Heaney, L.R. 1985. Zoogeographic evidence for middle and late land Pleistocene bridges to the Philippine Islands. *Modern Quaternary Research in Southeast Asia* 9: 127-143.
- Heaney, L.R. 1986. Biogeography of mammals in South East Asia: estimates of rates of colonization, extinction and speciation. *Biological Journal of the Linnean Society* 28: 127-165.
- Heaney, L.R., D.S. Balete, M.L. Dolar, A.C. Alcala, A.T.L. Dans, P.C. Gonzales, N.R. Ingle, M.V. Lepiten, W.L.R. Oliver, P.S. Ong, E.A. Rickart, B.R. Tabaranza Jr. and R.C.B. Utzurrum. 1998. A synopsis of the mammalian fauna of the Philippine Islands. *Fieldiana (Zoology)* 88: 1-61.
- Merrill, E.D. 1923. *An Enumeration of Philippine Flowering Plants. Dipterocarpaceae*. Volume 3, pp. 88-102. Bureau of Printing, Manila.
- Merrill, E.D. 1926. *An Enumeration of Philippine Flowering Plants*. Volume 4, Bureau of Printing, Manila, 515 p.
- Newman, M.F., P.F. Burgess and T.C. Whitmore. 1996. *Manuals of Dipterocarps for Foresters: Philippines*. Royal Botanic Garden Edinburgh, U.K. and Centre for International Forestry Research, Jakarta, Indonesia, 124 p.
- Newman, M.F., P.F. Burgess and T.C. Whitmore. 1999. *Foresters' CD-ROM Manual of Malesian Dipterocarps*. Royal Botanic Garden Edinburgh, U.K.
- Rojo, J.P. 1979. Updated enumeration of Philippine dipterocarps. *Sylvatrop, Philippine Forest Research Journal* 4(3): 123-145.
- Rojo, J.P. 1999. *Revised Lexicon of Philippine Trees*. Forest Products Research and Development Institute, Los Baños, Philippines, 484 p.
- Rojo, J.P. and E.G. Aragonés Jr. 1997. *Botanical Identification Handbook on Philippine Dipterocarps*. Forest Products Research and Development Institute, Los Baños, Philippines, 97 p.
- Tamesis, F. and L. Aguilar. 1953. *The 'Philippine Mahogany' and Other Dipterocarp Woods*. Popular Bulletin No. 44, Department of Agriculture and Natural Resources, Manila, 123 p.

Van Vegchel, F.J.P. 2003. A survey of the bats of Rajah Sikatuna Protected Landscape, Bohol Island, Philippines and local attitudes towards them. *Sylvatrop*, Philippine Forest Research Journal 13(1&2): 93-106.

Whitford, H.N. 1911. *The Forests of the Philippines. Part I, Forest Types and Products.* Philippine Bureau of Forestry Bulletin No. 10, Bureau of Printing, Manila, 94 p.



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