Among the Oak Forests of Borneo and Java

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One may be surprised to learn that on Borneo, Java and other regions of Indonesia and Malaysia there are oaks growing in the rainforests. In fact, Fagaceae are widespread in the Malaysian region, with more than 100 *Lithocarpus* species and 19 *Quercus* species. All the *Quercus* in the area belong to the subgenus *Cyclobalanopsis* (Oerststed) Schneider, which is confined to eastern and south-eastern Asia. Other genera of the oak family, such as *Castanopsis* and *Trigonobalanus*, also occur in the Malaysian region. The Malaysian *Quercus* species are distributed as follows: Malay Peninsula (8 spp.), Sumatra (10 spp.), West and Central Java (5 spp.), Borneo (18 spp.), and Palawan (1 species).

Quercus spp. in Malaysia often constitute the canopy of the primary evergreen lowland, and even more commonly, the lower montane rainforest. Species occur from sea level up to 3400 m, most commonly at altitudes of 700 — 1800 m, growing in various types of forest such as mixed dipterocarp forest, swamp forest and ridge forest (Lemmons et al., 1995).

Borneo is the third largest island of the world, with a total area of nearly 750,000 square kilometres, but a population of only 10 million. Three quarters of Borneo belongs to Indonesia, constituting the part called Kalimantan. The rest is divided between the two Malaysian states, Sabah and Sarawak, and Brunei. Much of Borneo is no longer wild and tranquil rainforests, since burning and logging have destroyed more than 50 percent of the rainforest. Even in remote areas one will

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hardly find any virgin rainforest; more often you will see endless plantations of oil palms. And in steeper and more difficult areas, the forests are burnt down for a few years of pineapple culture for the local markets.

Within easy access is the Malaysian state of Sabah, a unique spot for mountaineers and botanists from all over the world because Borneo's highest peak, Mount Kinabalu, reaches 4101 m. The whole mountain massif was transformed into a national park. Kinabalu massif is not only an important water catchment, but also a treasure of flora and fauna, with lots of endemic species that grow nowhere else in the world. The Kinabalu massif is by far the most interesting place in Borneo to see Malaysian oaks, as there are more than 10 species of *Quercus* growing here, with three species endemic to this location.

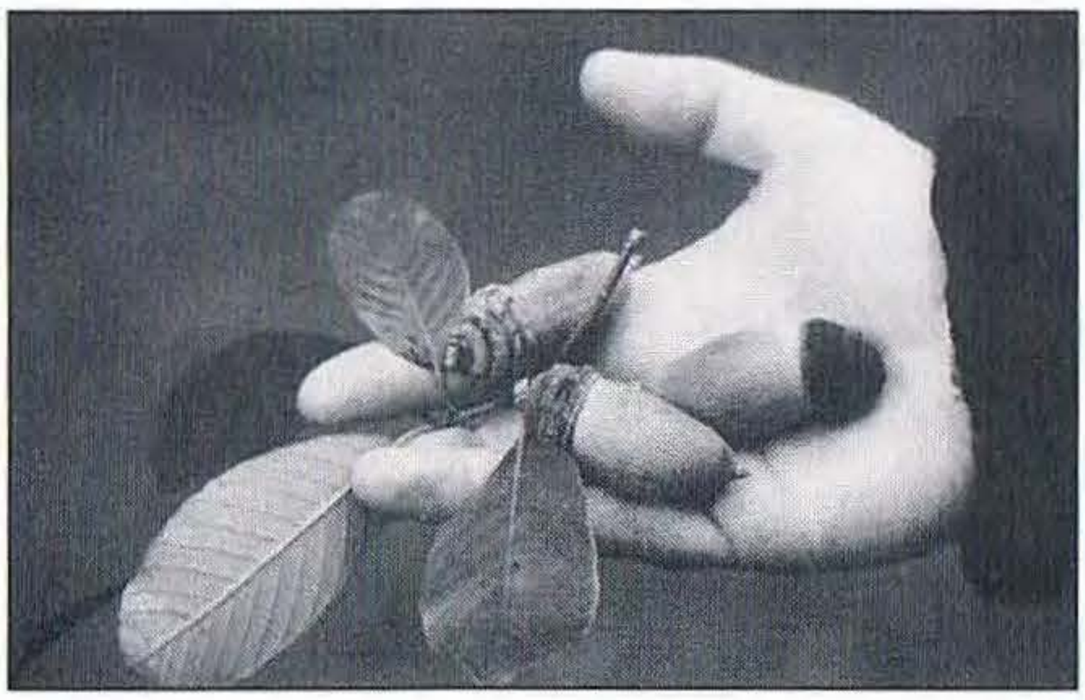

photo by Eike Jablonski

Quercus lowii *acorns collected at approximately 2000 m on Mt. Kinabalu, Sabah, Borneo.*

Mount Kinabalu has an interesting history. The massif is quite young and is composed of exposed granite rock which began rising out of the basic soils about 10 million years ago. It is said that Kinabalu is still pushing up at around 5 mm a year, and that 10,000 years ago the mountain was probably some hundred meters higher with an ice-capped top. Former glaciation is still visible on the summit. The rich spectrum of vegetation arises from the great variety of climatic zones and marked differences in soil types. On average, there is a drop in mean temperature of 0.55°C for every 100 m increase in elevation. Therefore, the lowland forests around the base of the mountain have daily mean temperatures of 28°C, while in the summit region, temperatures are only around 6-8°C, with occasional frost associated with drought. A characteristic feature of tropical mountains is the high air humidity and increasing water surplus with saturation of the soil. The daily clouds that cover the mid-zone from 1200-2000 m to 3000-3200 m are a stable feature and this area is the primary oak-forest zone.

On Kinabalu, four characteristic floristic zones develop: the lowland forest up to 1200 m; the lower montane zone up to 2000-2300 m; the upper

mountain zone up to 2800 m; and a subalpine zone at 2800-3400 m. Oaks are present in all zones except the subalpine zone. The soils are generally acid at higher elevations, with very peaty soils in the montane forest zones. From the montane zones to the summit a large range of Ericaceae (e.g. around 35 species of *Rhododendron*), and some lesser-known Gymnosperms (like *Agathis Dacrydium*), are abundant. The lower zones differ in soil types, with ultra-basic soils not uncommon, and this is the preferred soil type of some oaks like *Quercus lowii*.

The abundance of tree species and the relative uniformity in leaf shape and habit makes it very difficult to discover the oaks amongst the dwarfs and giants of the lower and upper montane forest. Viewing the bark helps, as most of the Malaysian Fagaceae are recognisable in the field by their characteristic light-greyish, smooth and mottled bark. Still you need to find out what Fagaceae species you have discovered. Cockburn (1976) writes: "[For determination] however, it has been impossible not to use fruits in many cases; these are often found scattered below the trees in the forest, and remain for some time." If there are no fruiting specimens — meaning fallen acorns on the ground — you will miss 95 percent of the oaks along the way. That means that while climbing Mount Kinabalu, one looks more to the ground in search of acorns than to the left or the right. Anyway this keeps you right on the trail. Occasionally one looks

photo by Eike Jablonski

Specimens of Quercus gemelliflora, *showing extensive buttressed root systems on trees 140 years of age at Bogor, West Java, Indonesia.*

around and discovers a mysterious world of unspoilt mountain forest, with rhododendrons blooming far away in the distance, and tree ferns, orchids, pitcher plants and oaks in between. That makes up for leeches on your neck or mosquitoes in your sleeping bag.

Common on the lower parts of the summit trail is *Quercus lowii* King, a handsome tree with large acorns, which, amazingly, sometimes stand upright. In August it was fruiting season for this oak, which is hard to find in the forest. We saw *Quercus lowii* growing in small groups or as single trees, nowhere abundant, but present up to 2500 m. The leaves are not that variable in size. There are two different types of *Q. lowii* with different foliar features. According to Soepadmo (1972) the leaves of the lowland form are glabrous, while in the mountain form they are mostly tomentose beneath. The acorns are so large that it is difficult to carry many. They are ovoid and up to 3 cm long. Out

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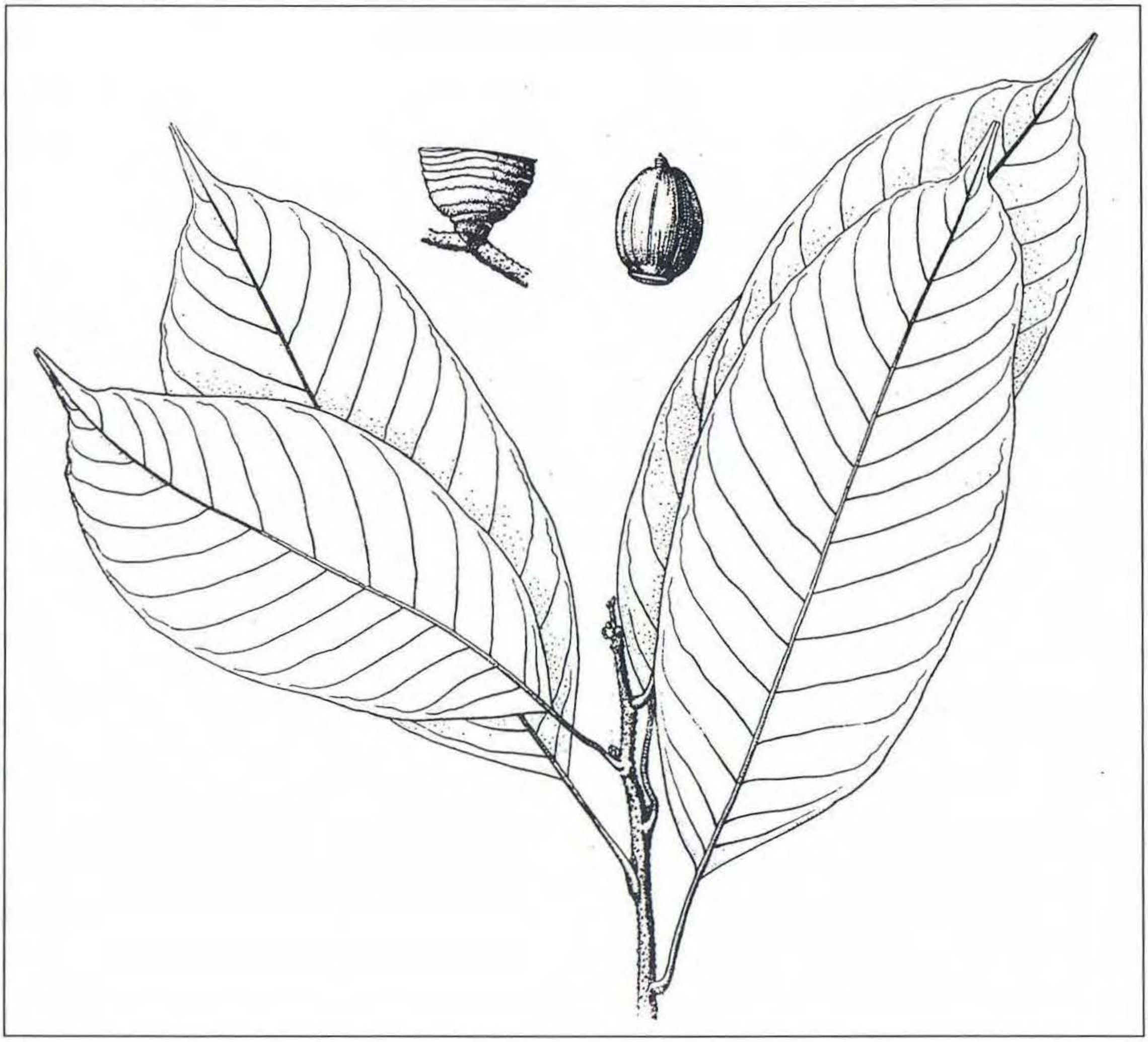
photo by Eike Jablonski

Fruits and bark of Quercus gemelliflora *at Bogor, West Java, Indonesia.*

of the Kinabalu area there is one record of *Q. lowii* from Mount Liang Gagang in western Kalimantan. Soepadmo writes that this oak prefers ultra-basic soils.

Quercus subsericea A. Camus is more common on Kinabalu, but all-in-all, scattered. The distribution is wider than that of *Q. lowii*, and extends from Sumatra, Java, and Banka, to the Malay Peninsula (where we discovered some near Malacca) and Borneo. It is more of a lowland species, growing from 850 m in Java to around 1800 m on Mt. Kinabalu. Its leaves vary greatly in shape, which makes it extremely difficult to identify only from foliar samples. Soepadmo (1972) described them as follows: "Leaves thin-coriaceous, elliptic-lanceolate, rarely ovate, 5-16 by 1-5 cm, base acute or roundish, margin entire or remotely serrulate near the sharply acute or 0.5 - 1.5 cm acuminate apex; beneath with a sparse stellate tomentum, above glossy, glabrous; midrib and nerves prominent beneath, impressed above, nerves 6-12 pairs, at an angle of 45-60°, parallel, arcuating towards the margin; reticulation obscure; petiole slender, 1-2.5 cm, adaxially furrowed." The acorns are small, and we found abundant quantities on the ground in August that were quite a few weeks old. A tree at the Botanical Garden at Bogor shows a typical coppicing habit with many branchlets rising from the ground, a feature also to be seen on Mount Kinabalu. The tree at Bogor reaches 25 m.

Quercus gemelliflora Blume is a widespread oak in Sabah and on Mount Kinabalu. Growing up to 2200 m, it is more common in hill forest at 600 m. Often this species grows along streams on clay or ultra-basic soil overlying



Drawings courtesy of Juri Menitsky, Petersburg, Russia

Quercus argentata *Korth*

sandstone or granite. *Quercus gemelliflora* is used locally as timber for house construction. The bark contains tannin and also is used by the local tribes. This medium-sized tree grows up to 30 m. The leaves are elliptical-lanceolate to elliptic-oblong, 5-15 cm x 2-6 cm, with a remotely serrulate margin in the upper half, which makes this species easier to identify than some of the other Malaysian oaks. Acorns are large, 2.0 -5.5 cm by 1-2 cm, and conical in shape. No fruiting specimen was observed at Kinabalu in August. Soepadmo (1972) writes that fruiting seems to be irregular. Two old specimens were planted at Bogor Botanical Garden, West Java, dating back to 1860. These huge trees have impressive buttress roots, and the trunks reach 35 m in height. As mentioned by Soepadmo (1972), fruits and flowers have been observed here together in August.

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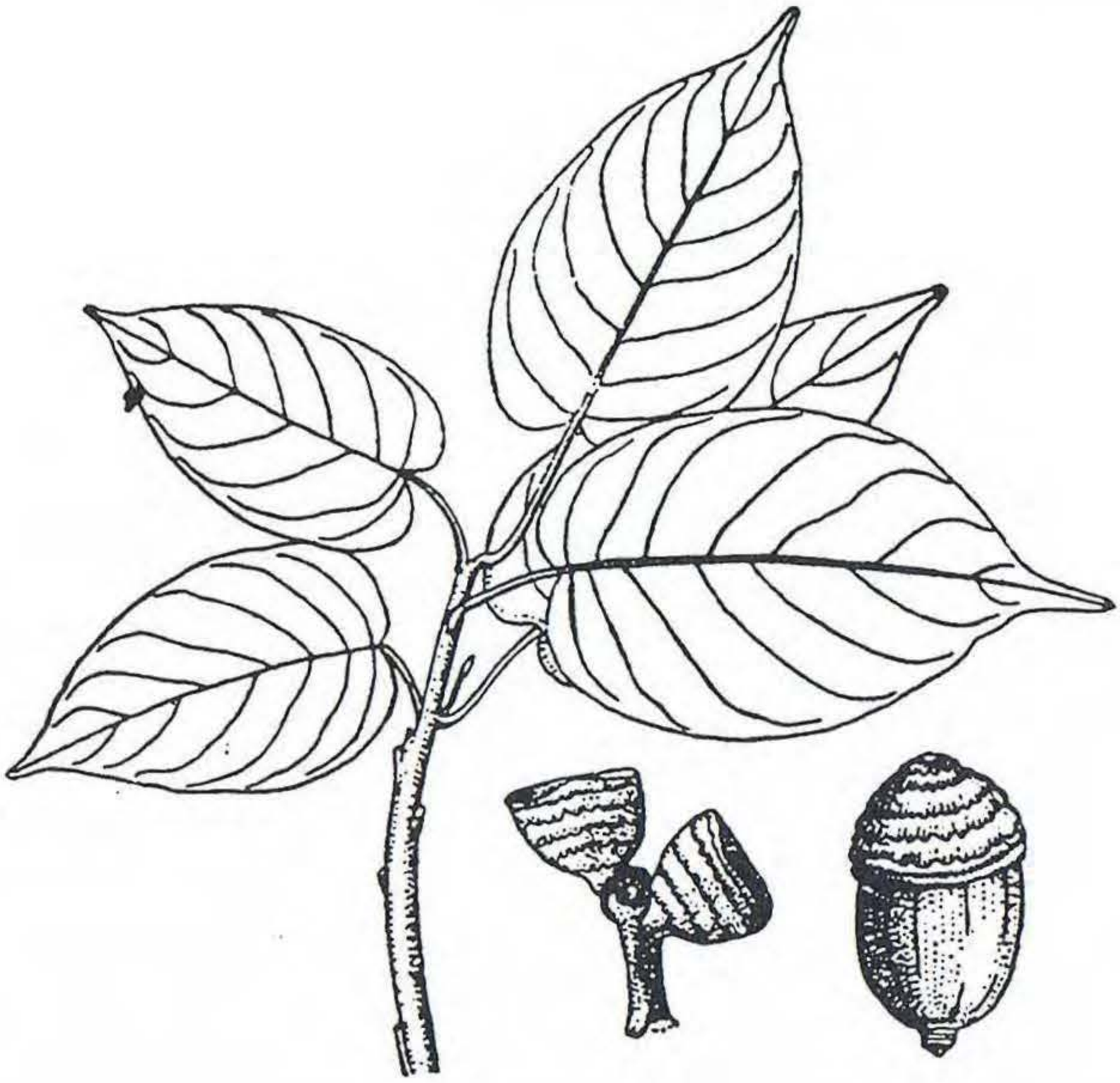
Another medium-sized tree, which occurs scattered on Mt. Kinabalu, is *Quercus lineata* Blume. This species has a wide distribution in Malaysia including Sumatra, the Malay Peninsula, Java and some locations on Borneo. The leaves are similar to those of *Quercus acuta* in size, with an acute tip of 0.5-1.5 cm, with the entire leave ovate-elliptic, 5-16 cm by 2-6 cm, and sometimes an asymmetrical acute base. Acorns are rather small, conical-cylindrical, 2-3 by 1-2 cm. We did not find any fruiting specimens in August. *Quercus lineata* is an important source of *mempening* wood (the Malay name for wood used for all kinds of smaller construction work, including house construction). More important is its use for erosion control when planted on steep slopes in mountainous regions.

One of the largest oaks in Malaysia is *Quercus argentata* Korthals, which grows up to 40 m. The tree is widespread, but uncommon, and can be found from the lowlands (often in swamps) to 2700 m on Kinabalu. On Kinabalu I saw a single tree at one location. The species is more or less easily recognisable because the underside of the leaf is densely silvery tomentose, while the upper side is glaucous. This makes this tree quite distinct from other Malaysian oaks. The tree we saw also had remarkably dense and prominent lenticels on the branchlets. There are also records of *Quercus argentata* from Singapore, the Malay Peninsula, Sumatra, Bangka, the Anambas Islands and West Java.

On the site of the Park headquarters there is an old *Quercus pseudoverticillata* Soepadmo growing. This was the only specimen we saw of this oak, one of the rarest oaks of the world, which is endemic only to Mount Kinabalu. It is a medium-sized tree comparable to the other oaks in this area, with an interesting bark, which is scaly and peels off profusely into small rectangular pieces. This oak was named in 1966 by E. Soepadmo, who is the leading authority on Malaysian Fagaceae, and who named a few new species. Other interesting species growing near the Park headquarters are *Acer laurinum*, (one of the evergreen maples), *Trigonobalanus verticillata*, as well as many *Castanopsis* spp. and *Lithocarpus* spp. According to Soepadmo (1972) the following other oak species also occur on Mount Kinabalu, but we did not see any during our stay there in August 1998:

Quercus valdinervosa Soepadmo: widely distributed only on Borneo.



Drawings courtesy of Juri Menitsky, Petersburg, Russia

Quercus lowii *King*

Quercus sumatrana Soepadmo: some scattered locations on Sumatra (Bencoolen, Simalur) and Borneo (northern Sarawak, Western Sabah, in Kalimantan near Balikpapan and Samarinda). Not much is known about this species as there are just a handful of specimens in herbaria. Soepadmo (1972) wrote that "inflorescences are as yet unknown." Also, Lemmens et al. (1995) wrote "*Q. sumatrana* is a still imperfectly known species of forest on sandy loam or basalt-derived soils, up to 1300 m altitude."

Quercus merillii von Seemen: the only oak which grows in the Phillippines (Palawan only), and also scattered in Sarawak and Sabah. It is a typical lowland species, growing in forests from 100-500m.

Quercus kinabaluensis Soepadmo: a fairly large tree up to 40 m tall. It grows in forests from 500 - 2600 m altitude on ultra-basic soils. Only two locations are known: Mt. Kinabalu and the neighbouring Bukit Ampuon.

Quercus treubiana von Seemen: grows on Sumatra (near Palembang), scattered in Kalimantan, and on Mount Kinabalu. The preferable locations are sandy waterlogged soils from 600-2100 m altitude.

Quercus elmeri Merrill: grows on sandy loam or ultra-basic soil from Central Sumatra, the Malay Peninsula and Borneo. First recorded in 1929, the inflorescences are still not known.

There are a few good specimens of other Malaysian oaks in the Botanical

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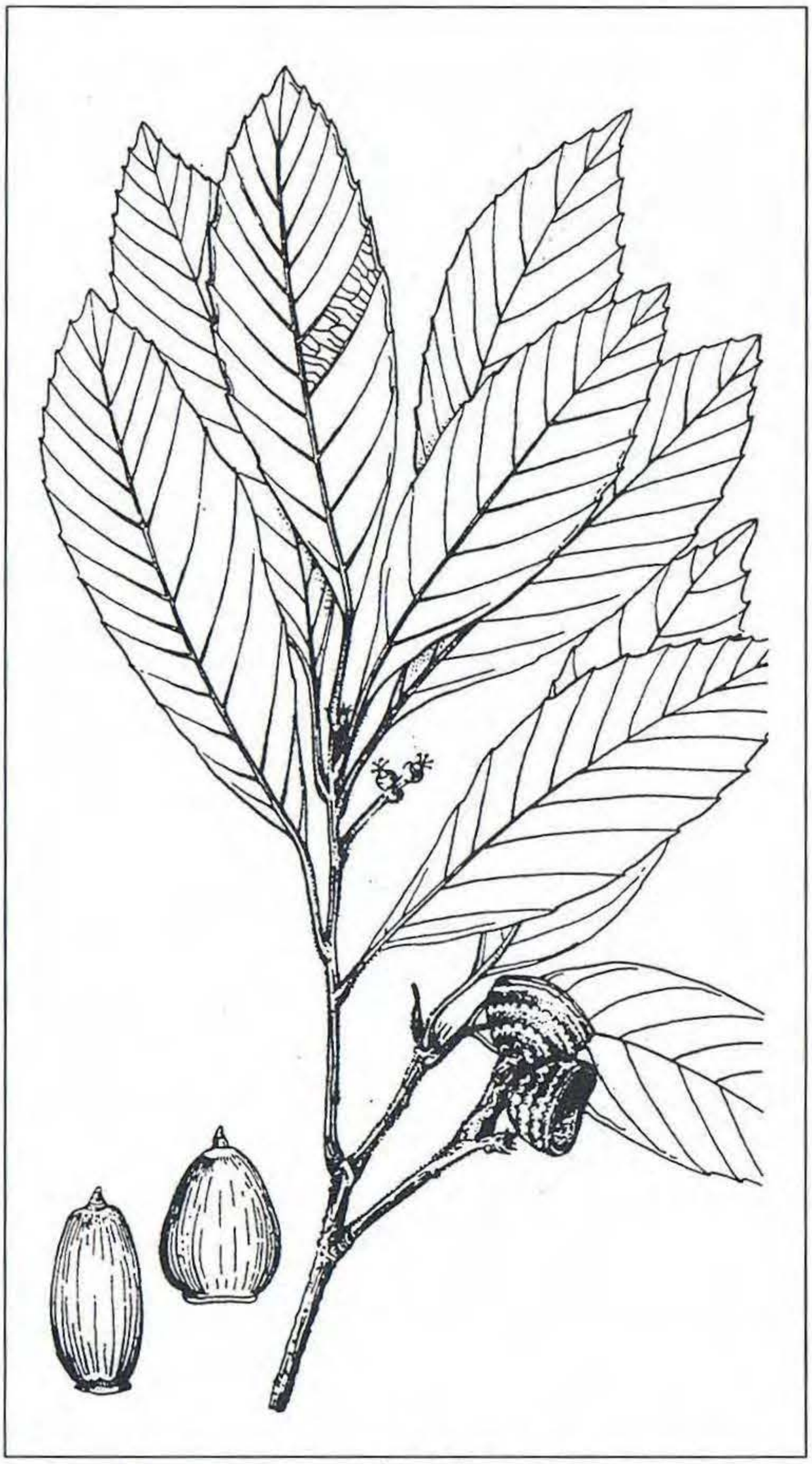
Garden of Bogor, West Java. This Botanical Garden was founded by the Dutch in the last century, and covers an area of 87 hectares in the middle of the city. The Botanical Garden is a must to visit and both the arboretum and herbarium have an international reputation. Some oaks planted around 1860 are still growing in the garden, and the Garden offers one of the rare chances to see mature Malaysian oaks outside the forests. Besides the oaks already noted, there is one more species to be seen:



Drawings courtesy of Juri Menitsky, Petersburg, Russia

Quercus gemelliflora *Blome*

Quercus oidocarpa Korthals is a large tree in the Botanical Garden, up to 40 m. Interesting are the large distinguished buttress roots. *Quercus oidocarpa* has a large distribution from peninsular Thailand down through Malay Peninsula, west and central Java, and west-central Sumatra. It grows from 150 - 1500 m altitude on different soils such as clay, sandy loam or granite.

It was on Central Java where a group of monkeys playing around our cottage turned out to be real monsters. Whilst I was dozing in a chair in the morning sun, two monkeys climbed down a tree to see what special

goodies we had hidden in some bags. But the rascals didn't just look into the bags, no. They grabbed them and carried them 6 m high in a tree so they would have a safer place to investigate what was inside. Guess what was in the bags? Fresh and germinating acorns from Bornean and Javanese oaks, ready to be flown to European greenhouses. That morning Carmen (who accompanied me on all the oak trips, under difficult conditions) had work enough to calm me down. Since that day I have an unpleasant relationship with monkeys.

There are a few other places to view oaks on the Malay Peninsula, including two locations with easy access. The Cameron Highlands in the middle of the Peninsula has scenic walks through tea plantations to the upper hill zone where some *Quercus* species are still growing. Also, on the walk up Penang Hill at Penang Island just south of Thailand. The Arboretum of the Forest Research Institute of Malaysia near Kuala Lumpur also offers the chance to see Malaysian *Quercus* species. These are nearly all the locations where it is more or less easy to view native oaks, since neither the Botanical Gardens of Cibodas in Central Java, nor at Bali have native *Quercus* species planted.

There is definitely a lack of information about these often overlooked oaks. Little is known about flowering status, inflorescences, fruiting, etc. of some lesser known species. Wouldn't it be fitting for the International Oak Society to help to establish a collection of Malaysian oaks in the region?

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