

**XV. GYRINOPS LEDERMANNII (THYMELAEACEAE),
BEING AN AGARWOOD-PRODUCING SPECIES PROMPTS CALL
FOR FURTHER EXAMINATION OF TAXONOMIC IMPLICATIONS IN
THE GENERIC DELIMITATION BETWEEN AQUILARIA AND GYRINOPS**

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SUMMARY

Field research conducted in Papua New Guinea (PNG) has recorded *Gyrinops ledermannii* Domke (Thymelaeaceae) as an agarwood-producing species for the first time.

Aquilaria malaccensis Lam. (incl. *A. agallocha* Roxb.; Thymelaeaceae) or agarwood (also known as aloeswood, eaglewood, gaharu, and incensewood, and many other vernacular names) after infection by certain fungi develops a fragrant substance called agar in its wood. This has been traded since biblical times for its use in religious, medicinal, and aromatic preparations (see also Chadha, 1985).

Agarwood-producing species in the Thymelaeaceae [*Aetoxylon sympetalum* (Steen. & Domke) Airy Shaw, *Aquilaria beccariana* Tiegh., *A. filaria* (Oken) Merr., *A. hirta* Ridl., *A. malaccensis*, *A. microcarpa* Baill., and *Gonostylus bancanus* (Miq.) Kurz] are found from India eastwards to Hainan, S China, and New Guinea.

Agarwood is found naturally in only a small percentage of trees – with the highest-grade ‘product’ usually harvested from certain species of *Aquilaria* and despite the high levels of harvest and trade, only *A. malaccensis* is listed on Appendix II of the Convention on International Trade of Endangered Species of Wild Flora and Fauna (CITES). Over 1000 tonnes of agarwood were reported in international trade under the name *A. malaccensis* in 1998.

The island of New Guinea is the eastern border of the agarwood-producing species’ range, and could also be the world’s last frontier for substantial wild agarwood stocks. But even New Guinea’s agarwood faces the threat of unprecedented levels of harvest and trade that have expanded over the past five years.

On the PNG side of the border, harvesting has been prevalent since 1997 (O. Gideon, pers. comm. to TRAFFIC Oceania, 1999). At that time, PNG government authorities presumed that the species harvested for agarwood was *A. filaria* (Oken) Merr., which has been recorded from several locations in Irian Jaya (Ding Hou, 1960).

The catalyst for this ‘sudden’ discovery of agarwood in PNG is most likely associated with Asian traders visiting the Sepik provinces bordering Irian Jaya, but could also involve Melanesian clan groups whose traditional lands traverse both sides of the border. Prior to the past five years, most indigenous PNGeans had never heard of the agarwood tree, nor used it for any traditional applications. It was widely regarded as just another forest tree unsuitable for making canoes or houses.

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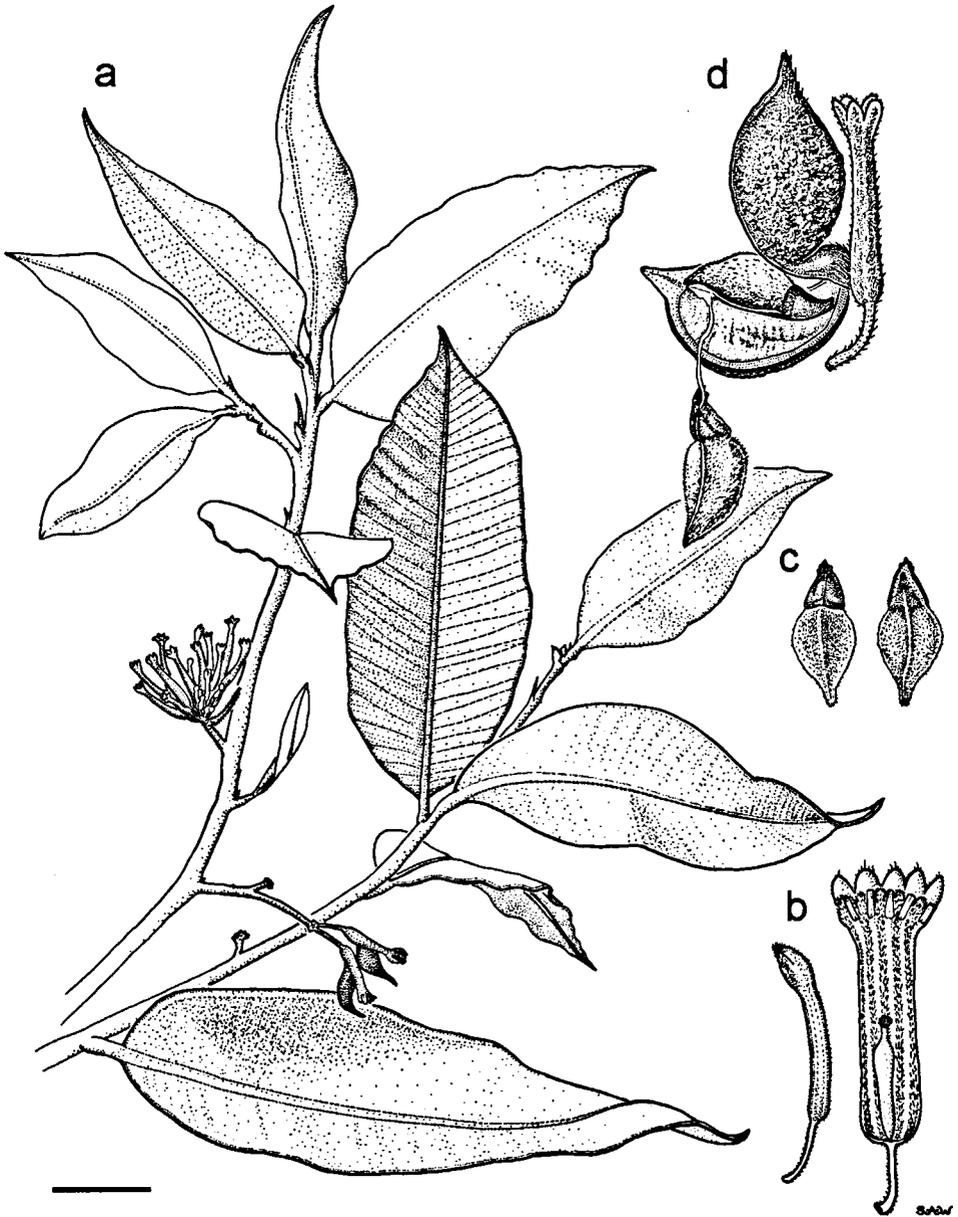


Fig. 1. *Gyrinops ledermannii* Domke. a. Habit; b. flower bud (left), opened flower (right); c. seed dorsal view (left), ventral view (right); d. dehiscent fruit emerging from lateral slit of floral tube with one seed hanging out on funicle. Herbarium specimen *Zich 315*, CANB Accession Number 531408. — Scale bar: a = 1.4 cm; b, c & d = 0.45 cm. [© S.A. Wragg.]

IDENTIFICATION

Herbarium specimens collected in the PNG provinces of East and West Sepik, from trees that produce agarwood, have been identified as *Gyrinops ledermannii* Domke on the basis of flowering and fruiting material. Only one reference is known to indicate that a species of *Gyrinops* Gaertn. produces agarwood: *G. versteegii* (Gilg) Domke in Indonesia (H. Wiriadinata, BO, in litt. to TRAFFIC Oceania, 2001).

Gyrinops versteegii is listed as an 'included' species (along with *A. beccariana*, *A. hirta*, and *A. microcarpa* under the 2001 Indonesian export quota of 75 tonnes for *A. malaccensis* in a list of CITES Appendix II species in trade from Indonesia. A separate export quota for the non-CITES listed *A. filaria* from Irian Jaya and the Moluccan islands has been set at 125 tonnes, bringing the total Indonesian agarwood export quota in 2001 to 200 tonnes (Indonesian Ministry of Forestry, 2001).

The genus *Gyrinops* is found in Sri Lanka, in some eastern Indonesian islands (Lombok, Sumbawa, Flores, Sumba, Celebes, and the Moluccas) and in New Guinea. It consists of seven species, five of which are found in New Guinea: *G. caudata* (Gilg) Domke, *G. ledermannii*, *G. podocarpa* (Gilg) Domke, *A. salicifolia* Ridl., and *G. versteegii* (Ding Hou, 1960: 39–42).

The flora of New Guinea is relatively poorly known. At present, there are three agarwood-producing species known from New Guinea: *A. filaria*, *G. ledermannii*, and *G. versteegii*. The former two are only recorded from Irian Jaya. However, it is conceivable that these two species also occur in PNG and also that there are more agarwood-producing species than presently known. Further surveys and herbarium specimens of agarwood-producing plants are needed from New Guinea and nearby islands to confirm the identity and distribution of agarwood-producing species.

As of August 2001, no specimens of *Aquilaria* had been recorded from PNG. Until June 2001, no specimens of *G. ledermannii* were held at LAE, UPNG, in PNG, nor CANB, Australia. The type material of *G. ledermannii* formerly at B was destroyed in WWII (Dr. B. Zimmer, B, in litt. to TRAFFIC Europe-Germany, 2001).

TAXONOMY

Hallier f. (1922) and Ding Hou (1960) mentioned the similarity between *Aquilaria* and *Gyrinops*. The only differentiating character is the number of stamens: 10 in *Aquilaria*, 5 in *Gyrinops*.

Hallier f. considered that this difference was insufficient and reduced *Gyrinops* to *Aquilaria*.

Ding Hou (1960: 4), in his revision of the Malesian Thymelaeaceae retained the two, stating that further research was required as the "merging of *Aquilaria* and *Gyrinops* might give a better reflection of the natural affinities, as the single character separating [these two genera] is, in my opinion, not a natural segregation."

Gyrinops ledermannii (Domke, 1932) was based on a single collection by Ledermann (7401, 25 May 1912) at the Pfingstberg (Mt Pentecost) on the May River, between the present May River station and the village of Hotmin. He was a member of the German Kaiserin-Augusta-Fluss Expedition of 1912–1913 that explored and mapped the Sepik River and most of its tributaries (cf. Veldkamp et al., 1988). The first illustration ever published is presented here.

Table 1. Herbarium collections of *Gyrinops ledermannii* made in East Sepik Province.

Date	Village	Latitude and Longitude	Collector and Collector No.	CANB Accession Number	Duplicates
25 May 1912	Pentecost Mt	4° 25' S, 141° 36' E	<i>Ledermann 7401</i>	n.a.	B, lost
18 April 2001	Gahom	4° 37' S, 142° 40' E	<i>F.A. Zich 296</i>	CANB 531392	LAE, L
18 April 2001	Gahom	4° 37' S, 142° 40' E	<i>F.A. Zich 297</i>	CANB 531396	LAE, BISH, BO
23 April 2001	Bugapuki	4° 35' S, 142° 32' E	<i>F.A. Zich 300</i>	CANB 531400	LAE, A
27 April 2001	Wagu	4° 23' S, 142° 43' E	<i>F.A. Zich 304</i>	CANB 531404	LAE, L
2 May 2001	Hotmin	4° 35' S, 141° 34' E	<i>F.A. Zich 310</i>	CANB 531384	LAE, A, BO
4 May 2001	Mapusi	4° 33' S, 142° 13' E	<i>F.A. Zich 311</i>	CANB 531388	LAE, DNA
4 May 2001	Mapusi	4° 33' S, 142° 13' E	<i>F.A. Zich 312</i>	CANB 531380	LAE, L, K
5 May 2001	Sowano	4° 32' S, 142° 09' E	<i>F.A. Zich 315</i>	CANB 531408	LAE, BRI, L, NSW, UPNG

Ding Hou, in absence of additional material, copied his description from Domke and agreed that it appears to be distinct from two closely related species, *G. moluccana* (Miq.) Baill. (from the Moluccas) and *G. decipiens* Ding Hou (Celebes). It is distinguished from these by a combination of floral characters and leaf shape. Specimens collected in East Sepik during this study differ in certain characters from the description given by Domke and Ding Hou. This is attributed to the fact that Domke's original description was made from a single collection [and perhaps because it came from a different place than was sampled by Zich, see Table 1 (Ed.)].

DISTRIBUTION AND HABITAT

The type specimen of *Gyrinops ledermannii* was collected in the East Sepik Province, and additional specimens were collected there in 2001.

The occurrence of *G. ledermannii* has also been confirmed from Sandaun (aka W Sepik) Province (*Kiapranis AS88*, LAE, 2000).

Another specimen (*Pullen 6475*, CANB) collected near Ihu in the Gulf Province on the southern coast of the country is an indeterminate *Aquilaria* or *Gyrinops*. Anecdotal information from villagers and middlemen buyers indicates the possible occurrence of agarwood-producing species in other provinces of PNG, e.g. Manus, Madang, Gulf, Western, and the island of New Britain.

Gyrinops ledermannii is a mid-canopy tree in lowland forests on mountains, hills, and slopes probably below 1000 m, in flat areas with a seasonally high water table, but not inundated for long periods. Soils are usually sticky yellow to red clays, with a thin humus layer and often with a dense surface root mat. The occurrence appears to be strongly clumped with often a very high but localised density.

Trees greater than 5 cm diameter at breast height (dbh) were sometimes seen flowering. Most were weak-stemmed and leaning, and occasional straight-trunked; those growing on slopes and hills were taller at 15–20 m. The largest tree recorded was 22 cm dbh and 26.5 m tall. Individuals of this and larger dimensions were reported during interviews and said to occur in the higher hills and mountains throughout the survey area.

HARVEST AND TRADE DYNAMICS

Agarwood trade from Papua New Guinea began in 1997 in Sandaun Province. Trade from East Sepik Province began in 1998. Early Asian buyers taught villagers to visit the villages to identify trees and techniques to find, harvest, and clean agarwood.

Agarwood normally forms where the tree has sustained damage, either in the roots, the branches, or in the trunk. Villagers were told that when there were small amounts to cut these out and to leave the tree standing. Only if there were large amounts in the heartwood they should cut the tree down. In practice, villagers find these techniques too time-consuming and physically demanding and trees are often chopped down to check for agarwood in the trunk, branches, and roots.

Harvest rates in sample plots in the Hunstein Range, in the Ambunti District of the East Sepik Province, are high, ranging from 12–39% of trees over 5 cm dbh harvested in approximately 18 months.

Grading agarwood is a complicated process of evaluating the size, colour, odour, weight (on scales and in water), and flammability of the wood. Application of grade codes (Super A, A, B, C, D, E) also varies between buyers.

CONCLUSION

The systematic relationship between *Aquilaria* and *Gyrinops* requires further study. Additionally, the botanical identification and description of agarwood-producing species recorded (and anecdotally reported) in PNG and eastern Indonesia should be undertaken. Once the results of more comprehensive studies are available, new species- and genus delimitations can be made.

TRAFFIC Oceania and WWF South Pacific Programme initiated this joint research project in April 2001, with the objective of identifying species being harvested for agarwood, clarifying the existing national regulatory framework, and mapping the current harvest and trade dynamics. The village-level research was concentrated in the Hunstein Range. Actual surveys of forest habitats were from 14 April until 7 May 2001, during which time eight villages and adjoining landholdings were visited. Additional funding support was provided by the CITES Secretariat towards implementing CITES Decisions 11.112 and 11.113 regarding *Aquilaria* sp.

TRAFFIC and WWF are continuing their work on agarwood harvest and trade in Papua New Guinea, and have begun collecting information from Irian Jaya. Other collaborating NGOs include CSIRO's Forestry and Forest Products Division, while an inter-agency committee comprising the PNG National Forest Service, PNG Forest Research Institute, PNG Office of Environment and Conservation, and PNG Internal Revenue Commission, has been convened to focus specifically on agarwood in PNG.

REFERENCES

- Domke, F.W. 1932. Zur Kenntnis einiger Thymelaeaceen. Notizbl. Bot. Gart. Berlin 11: 349–350.
Ding Hou. 1960. Thymelaeaceae. Fl. Males. I, 6: 1–48.
Hallier, J.G. 1922. Beitrag zur Kenntnis der Thymelaeaceen und ihrer natürlichen Umgrenzung. Meded. Rijks-Herb. 44: 1–31.
Veldkamp, J.F., W. Vink & D.G. Frodin. 1988. Ledermann's and some other German localities in Papua New Guinea. Fl. Males. Bull. 10: 32–38.