

A revision of *Ehretia* (Boraginaceae) for Madagascar and the Comoro Islands

James S. MILLER

Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.
james.miller@mobot.org

ABSTRACT

A revision is presented of the genus *Ehretia* P. Browne *sensu stricto* for Madagascar and the Comores. *Ehretia cymosa* Thonn. and *E. obtusifolia* A. DC. are both known also from Africa, but the remaining species (*E. australis* J.S. Mill., *E. decaryi* J.S. Mill., *E. meyersii* J.S. Mill., *E. phillipsonii* J.S. Mill., and *E. seyrigii* J.S. Mill.) are all endemic and described as new.

KEY WORDS

Ehretia,
Boraginaceae,
Madagascar.

RÉSUMÉ

Révision du genre *Ehretia* (Boraginaceae) à Madagascar et aux Comores.

Une révision du genre *Ehretia* P. Browne *sensu stricto* pour Madagascar et les Comores est présentée. *Ehretia cymosa* Thonn. et *E. obtusifolia* A. DC. sont tous deux connus d'Afrique, tandis que les autres espèces (*E. australis* J.S. Mill., *E. decaryi* J.S. Mill., *E. meyersii* J.S. Mill., *E. phillipsonii* J.S. Mill., et *E. seyrigii* J.S. Mill.) sont toutes endémiques, nouvelles et décrites ici.

MOTS CLÉS

Ehretia,
Boraginaceae,
Madagascar.

INTRODUCTION

Boraginaceae have not yet been treated in the *Flore de Madagascar et des Comores*. Furthermore, few collections were available from Madagascar before 1900, so the family is poorly represented in the encyclopedic works of the 1800s (e.g. CANDOLLE 1845) and the woody Borages (subfamilies Cordioideae and Ehretioideae), were treated only at a generic level in ENGLER & PRANTL's *Die Natürlichen Pflanzenfamilien* (1895) and not at all in ENGLER's *Pflanzenreich*,

unlike parts of the herbaceous subfamily Boraginoideae (GURKE 1921, 1931).

Ehretia P. Browne comprises a group of trees and shrubs that are widespread in the tropics and subtropical areas, but are concentrated in the Old World. A member of the subfamily Ehretioideae, *Ehretia* has been assumed to be one of the more primitive genera of Boraginaceae, and is well known from the fossil record as far back as the Eocene (REID 1923; REID & CHANDLER 1933; CHANDLER 1961, 1962, 1964). *Ehretia* has not been treated in its entirety since de CANDOLLE's

(1845) treatment of the subfamilies Cordioideae, Ehretioideae, and Heliotropioideae. The genus, however, has been treated regionally for the New World (MILLER 1989), east tropical Africa (VERDCOURT 1991), the Flora Zambesiaca region (MARTINS 1990), southern Africa (RETIEF & VAN WYK 2001), Iran (RIEDL 1967), Pakistan (KAZMI 1970), Sri Lanka, (NOWICKE & MILLER 1991), Malaysia (RIEDL 1997), and China (ZHU et al.).

Patrick BROWNE (1756) described the genus *Ehretia*, naming it in honor of Georg Dionysius EHRET who illustrated BROWNE's *Civil and Natural History of Jamaica*, and LINNAEUS (1759) validated the name by publishing the combination *Ehretia tinifolia* L. in the 10th edition of his *Systema Naturae*. De CANDOLLE (1845) broadened delimitation to include 58 species, many of which were subsequently placed in *Bourreria* P. Browne, *Carmona* Cav., *Rochefortia* Sw., and *Rotula* Lour. by later authors. De CANDOLLE's assignment of species into four sections does not correspond with most modern concepts of relationships within the genus. His sect. *Ehretia* consists of species still assigned to the genus by most modern authors. His sect. *Carmona* (Cav.) DC. comprised two species now treated as conspecific and recognized either as a distinct genus (e.g. NOWICKE & MILLER 1991) or included within *Ehretia* (e.g. GOTTSCHLING & HILGER 2001). The other two sections, sect. *Bourreria* (P. Browne) DC. and sect. *Xeroderma* DC. were heterogeneous collections of species, which most modern authors do not feel are closely related and have been variously assigned to *Ehretia*, *Bourreria*, *Carmona*, *Rotula*, and *Rochefortia*.

John MIERS (1869) separated the species with valvate calyx lobes, fleshy rotate corollas, included stamens, and fruits with 4 pyrenes ridged or winged on the outer surface, most of which occur in and around the Caribbean, into the genera *Bourreria* and *Crematomia* Miers. SCHULZ (1911) united these in a more broadly defined *Bourreria* and his generic concept has been followed by most modern authors. BENTHAM & HOOKER's (1876) circumscribed taxa that correspond more closely with modern thoughts on relationship, although their units were recognized as sections of *Ehretia*: *Carmona*, *Euehretia*, and *Bourrerioides*. Although Ivan

JOHNSTON devoted much of his career to the study of Boraginaceae, he commented little on the circumscription of these genera, although he did recognize *Bourreria* (e.g. JOHNSTON 1949), *Carmona*, and *Rotula* (JOHNSTON 1951) each as distinct from *Ehretia*.

THULIN (1987) transferred five east African species of *Ehretia* to *Bourreria* noting that they shared valvate calyx lobes and ridged outer surfaces of the pyrenes of the fruit, characters also seen in the New World species of *Bourreria*. A recent analysis of ITS1 sequence data (GOTTSCHLING & HILGER 2001) confirms THULIN's assumption that these east African species are more closely related to the New World species of *Bourreria* than to African species of *Ehretia*. However, while New World species of *Bourreria* and the group of five African species transferred by THULIN appear closely related, they comprise distinct well-supported clades and an equally supportable argument can be made for the recognition of both as distinct yet related genera. As the two differ in a large number of distinct morphological characters, *Ehretia* is treated here in a narrow sense, with the east African species related to *Bourreria* (along with a group of undescribed species from Madagascar assigned to *Hilsenbergia* Tausch ex Sieber (MILLER, in prep.). Thus, as defined here, *Bourreria* has about 35 New World species centered in the Caribbean, *Hilsenbergia* is a genus of east Africa, Madagascar, and the Mascarenes, and *Ehretia* is pantropical.

The question of the generic status of *Carmona*, *Rotula*, and *Rochefortia* is not as clearly resolved. The analysis of ITS1 data by GOTTSCHLING & HILGER (2001) suggests that both *Carmona* and *Rotula* are embedded within *Ehretia* sensu lato. *Ehretia* species comprise two clades, one characterized by having endocarps that separate into two 2-seeded dispersal units (including *E. tinifolia*, the type of the genus) and the other with fruits whose endocarps separate into four pyrenes at maturity (including the species from Madagascar treated here). On the other hand, the members of these two clades share similar floral features. Their results suggest two possible interpretations. The resolution of generic limits could be accomplished by recognizing a broadly defined *Ehretia*, including both *Carmona* and

TABLE 1. — Collection and conservation information for the species of *Ehretia* in Madagascar. *Ehretia cymosa*, which is widespread and common is not included. Extent of Occurrence in Sq. km. and Area of Occupancy in 10 km² grid cells occupied. Conservation status follows IUCN, 2001.

Species	Number of Collections	Most Recent 2 Collections	Extent of Occurrence	Area of Occupancy	IUCN Red List Category
<i>E. australis</i>	8	1990, 1975	4,100	5	Endangered
<i>E. decaryi</i>	7	1975, 1956	1,100	5	Endangered
<i>E. obtusifolia</i>	4	1967, 1967	200	3	Endangered
<i>E. meyersii</i>	3	1990, 1970	400	3	Endangered
<i>E. phillipsonii</i>	13	1988, 1987	3,200	5	Endangered
<i>E. seyrigii</i>	15	1996, 1962	128,000	10	Vulnerable

Rotula. If, however, *Carmona* and *Rotula* are maintained as distinct (as was done by NOWICKE & MILLER 1991), species currently assigned to *Ehretia* would be placed in two clades, one of which would have to be recognized as a distinct segregate genus. GOTTSCHLING & HILGER'S (2001) molecular analysis did not include any species of *Rochefortia*, only a sample of the diverse species of *Ehretia* from China and Africa, and they are continuing their molecular studies including additional taxa. As a consequence it seems premature at this time to divide the genus. For the present study, *Ehretia* is therefore defined conservatively, following GOTTSCHLING & HILGER (2001), to include the species that occur in Madagascar. Because the circumscription of *Ehretia* adopted here differs from that used in other recent treatments, a generic description is provided below.

Recent review of the collections of *Ehretia* at the Muséum National d'Histoire Naturelle in Paris revealed that the genus is moderately diverse in Madagascar, with seven species recognized in the present treatment, five of which are endemic and described here as new.

Geography and conservation

Of the seven species of *Ehretia* that occur in Madagascar, *E. cymosa* Thonn. is a widespread plant in tropical Africa and it is commonly found in littoral habitats in northern Madagascar. It appears native and common throughout Africa, Madagascar, the Comores, and Mascarenes and has been collected regularly in recent years. The

remaining six species are all plants of dry regions with restricted distributions in Madagascar, none are apparently common, and are few recent collections of any of them. *Ehretia obtusifolia* A. DC. also occurs from southern and eastern Africa through India but the remaining five species are all endemic. These species are known primarily from older collections and an analysis of their conservation status is presented in Table 1.

The specimen locality data for all of the species treated here have been analyzed as a preliminary measure of their risk of extinction following IUCN Red List Categories and Criteria (IUCN 2001). The data and conclusions from this analysis are summarized in Table 1 and a more specific discussion is provided in the taxonomic treatment following each species. Woody Boraginaceae generally have hard wood and they are often valued as firewood. In the short dry forests where these species occur, there is great pressure on any woody species of decent burning quality and it is likely that these species are being selectively removed for firewood, so they have become rare even where forest continues to exist due to their selected removal. Almost all of these species occur in forests that are highly threatened and further fieldwork will be necessary to verify the true status of the populations so assignment to IUCN categories here is therefore provisional.

Morphology

Authors of recent treatments of the African species of *Ehretia* (MARTINS 1990; VERDCOURT

1991; RETIEF & VAN WYK 2001) have all noted that species may be difficult to tell apart and have postulated that the complex patterns of morphological variation may be the result of hybridization in some places. Whatever the cause, it is certain that *Ehretia* in Madagascar presents a similarly complex problem and few morphological features are consistent and without overlapping variation between species. However, the morphological features of the Malagasy species do seem to correlate well with differences in habitat preference defined by elevation, rainfall, and substrate preference. Ecological characters are therefore included in the following key, as they may greatly assist confirmation of identification based on single morphological features.

Habit

The Malagasy species of *Ehretia* range from trees with arching branches to small, densely branched shrubs growing in the dry parts of the extreme south. Few collections note characteristics of the bark, but exfoliating bark, which is a common character in *Bourreria* and *Hilsenbergia* is not noted on any specimen labels.

Inflorescences

The inflorescences of the Malagasy *Ehretia* are all more or less cymose and differ primarily in their size and indument of the branches. The cymes of *E. cymosa* are usually noticeably larger than inflorescences of the species from the dry south, but size does not allow differentiation among the southern taxa. The inflorescence branches of *E. obtusifolia* and *E. phillipsonii* have evident, simple, erect hairs with a glandular apex on their inflorescence branches, which easily distinguish them from the other species. In some cases, particularly with *E. phillipsonii*, glandular hairs may be sparse, but often sand or soil adhering to the inflorescence branches indicates their presence. The non-glandular species, occasionally have short, non-stalked glandular or granular hairs mixed with simple hairs on the calyces but their inflorescences are devoid of glands and have only simple hairs without a glandular

apex. It is not clear whether the non-stalked glandular hairs on the calyx of some species are homologous with the stalked hairs of *E. obtusifolia* and *E. phillipsonii*.

Flowers

The Malagasy species of *Ehretia* are remarkably consistent in their floral features and it would be difficult to separate them based on floral characters. At the generic level, however, several floral features serve to distinguish *Ehretia* from *Hilsenbergia* and *Bourreria*. The calyx of *Ehretia* has five lobes that are free nearly to the base and they are imbricate in bud. The lobes are variable in their external indument, but are nearly always ciliate on the margin and glabrous or nearly so on the internal surface. In contrast, the calyces of *Hilsenbergia* and *Bourreria* are also five-lobed (although not in all *Bourreria* species), but generally divided only about half the distance to the base, and valvate in bud. The lobes in these two genera also are variable in their external indument, but are generally tomentose on the interior surface, as opposed to species of *Ehretia*, which have different kinds of indument on the interior of the lobes, but are never densely tomentose. The calyces of *Bourreria* are more coriaceous and more frequently tubular compared with the campanulate calyces of *Hilsenbergia*.

All three genera can be easily distinguished from one another by the form of their corollas and androecia. The corolla of *Ehretia* is tubular with reflexed to spreading lobes that are usually lanceolate to oblong and often as long as or longer than the tube. The corolla is chartaceous, and often thin and membranous in the tube (the tube often drying white or nearly transparent in herbarium material). In addition, the stamens of *Ehretia* are generally prominently exerted. The corolla of *Hilsenbergia* is urceolate, with reflexed lobes that are much shorter than the rather fleshy tube. The stamens of *Hilsenbergia* are included in the tube. The corolla of *Bourreria* is rotate, the lobes are shorter than the tube and usually spreading (the flowers are sometimes slightly zygomorphic) and the texture is often leathery. The stamens are usually, but not always, included in the tube.

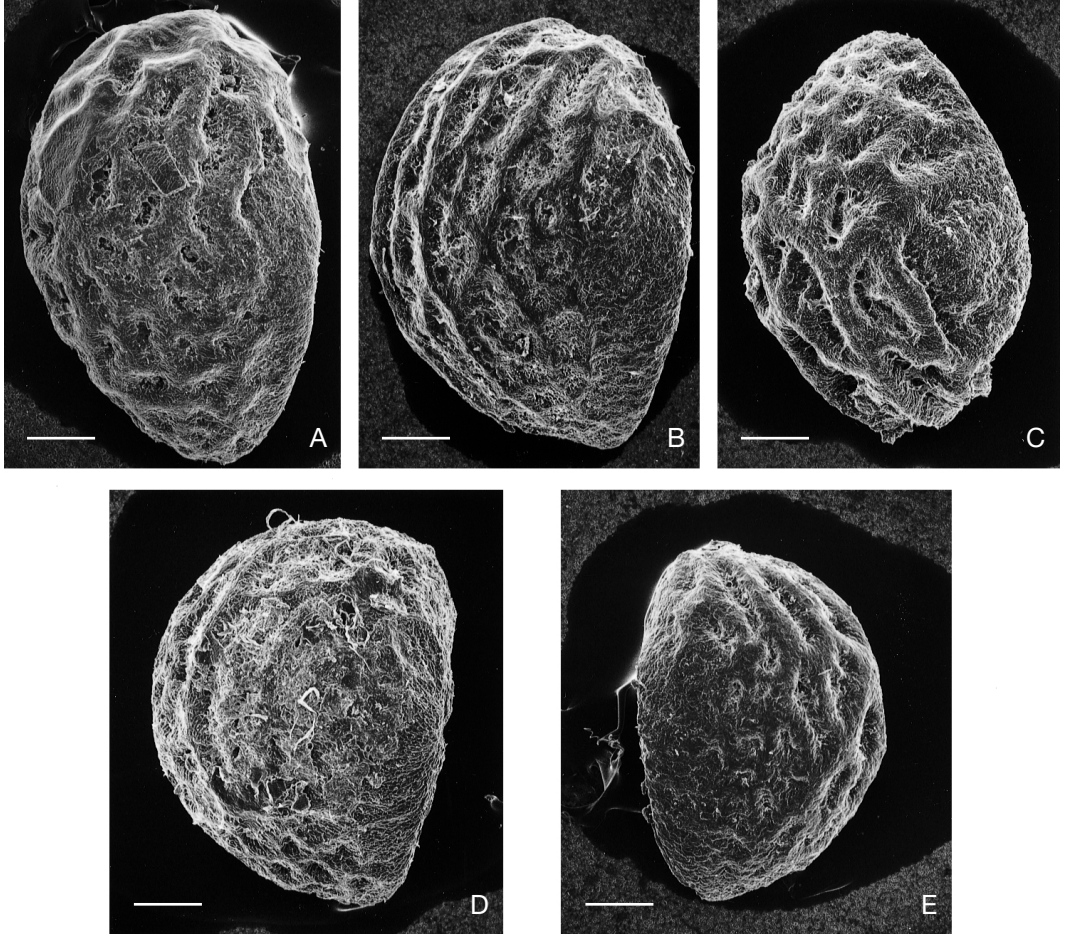


Fig. 1. — Pyrenes of *Ehretia* : **A**, *E. australis* J.S. Mill. (Bossler 4082, P); **B**, *E. decaryi* J.S. Mill. (Bossler 10116, P); **C**, *E. meyersii* J.S. Mill. (Keraudren-Aymonin & Aymonin 25483, P); **D**, *E. phillipsonii* J.S. Mill. (Bossler 10393, P); **E**, *E. seyrigii* J.S. Mill. (Service Forestier: SF 15588, P). Bars : 500 μ m.

Fruits

The fruits of *Ehretia*, *Bourreria*, and *Hilsenbergia* are more or less drupaceous and are borne with a persistent calyx. In *Ehretia*, the calyx is open and the lobes are free nearly to the base. In *Bourreria* and *Hilsenbergia* the calyx is more cup-like with the lobes usually triangular and divided only about half the length of the calyx. All three genera have thin mesocarp (*Bourreria* in particular) and an endocarp that divides into two or four parts at maturity (*Ehretia latifolia* A. DC. the sole exception). *Bourreria* and

Hilsenbergia have endocarps that divide into four pyrenes at maturity that are prominently ridged to winged on the outer surface. Most, but not all, species of *Bourreria* have pyrenes whose apices are attached to the gynobase by linear fibers. The pyrenes often remain attached after the fruits are dry and the endocarp has torn so that individual pyrenes may hang together attached only by this fibrous connection. In *Hilsenbergia* and some species of *Bourreria* the base of the pyrenes are attached to the gynobase and the pyrenes are dispersed separately as the fruit breaks apart at maturity.

The endocarps of *Ehretia* are more diverse. *Ehretia latifolia* A. DC., of Mexico and Central America, has an endocarp that is completely fused and remains entire with four locules. The other New World species and many of those from China have endocarps that breaks into two 2-seeded units at maturity. All of the African and some of the Asian species have endocarps that divide into four separate, single-seeded pyrenes at maturity, as in *Bourreria* and *Hilsenbergia*. The outer surface of these endocarps/pyrenes varies but it is neither ridged nor winged, but rather reticulate, areolate, or nearly smooth. The species of *Ehretia* in Madagascar have fruits that are quite typical for the genus and, the five species described below have pyrenes with a reticulate outer surface (Fig. 1).

EHRETIA P. Browne

Civ. Nat. Hist., Jamaica: 168 (1756).

TYPE. — *Ehretia tinifolia* L.

Trees or shrubs, often multi-stemmed; glabrous or with an evident indument of simple, 2-3-celled,

or multicellular, capitate, glandular hairs. Leaves alternate, or clustered near the apices of short lateral branches, petiolate, the margin entire or serrate, the venation pinnate, brochididromous or less commonly semicraspedodromous or craspedodromous. Inflorescences terminal, cymose to paniculate. Flowers bisexual; calyx deeply 5-lobed, imbricate or open in bud, the margin ciliate, inner surface glabrous; corolla white, blue, or pink, tubular with 5 spreading to reflexed lobes, these often as long as or longer than the tube; stamens 5, usually exserted, the anthers oblong to ellipsoid; ovary ovoid, 2- or 4-locular, the style 1, terminal, bifid, the stigmas 2, clavate to capitate. Fruits drupaceous, ovoid to nearly spherical, the endocarp separating into 2, 2-seeded pyrenes or into 4, 1-seeded pyrenes, or rarely remaining entire, the pyrenes often reticulate or ridged on the exterior surface, but not winged.

A pantropical genus with three species in the Neotropics, about 10 in Africa, and perhaps 20 more in Asia. Seven species are known from Madagascar and the Comores, five of which are newly described.

Key to the Malagasy species of *Ehretia*

1. Inflorescence branches with glandular hairs 2
- 1'. Inflorescence branches lacking glandular hairs 3
2. Leaf blades 1.2-3 cm wide, the widest point near the middle, leaf apex usually acuminate to acute; secondary veins 5-7; 600-1200 m 4. *E. obtusifolia*
- 2'. Leaf blades 0.8-1.7 cm wide, the widest point above the middle, leaf apex usually obtuse to acute; secondary veins 3-4; <200 m 6. *E. philipsonii*
3. Leaf base rounded to cordate or obtuse; widest point of leaf blade below the middle; petioles 12-35 mm long; inflorescences to 8(-13) cm broad; trees of coastal habitats or along rivers in northern Madagascar, north of 23°S latitude 2. *E. cymosa*
- 3'. Leaf base cuneate to attenuate; widest point of leaf blade at or above the middle; petioles less than 10(-15) mm long; inflorescences to 5 cm broad; shrubs or small trees from dry forests, mostly from southern Madagascar 4
4. Leaf blades elliptic, widest at or near the middle; plants of mid-elevations, 650-1100 m 7. *E. seyrigii*
- 4'. Leaf blades obovate to lance-obovate or widely obovate, widest above the middle; plants of low elevations, less than 300 m 5
5. Petioles 0-3(-5) mm long; inflorescence branches usually puberulent; plants of extreme southern dry forests 1. *E. australis*
- 5'. Petioles greater than 5 mm long; inflorescence branches glabrous 6.
6. Leaves clustered on short lateral fascicles, blades obovate to lance-obovate, more than twice as long as wide, 2-4(-5.8) cm long; plants of extreme southern dry forests 3. *E. decaryi*
- 6'. Leaves evenly alternate along the stems, blades obovate, 4-8.5 cm long; plants of northeastern dry forests 5. *E. meyersii*

1. *Ehretia australis* J.S. Mill., *sp. nov.*

Frutex, ramunculis glabris, ceraceis. Folia decidua, nonnulla alterna sed proparte majore in fasciculos ramunculis lateralibus brevibus insidentes disposita; lamina obovata usque late-obovata, 0.5-1.2(-2.5) cm longa, 0.3-0.9(-2) cm lata, apice rotundata, basi cuneata, margine integra, adaxialiter glabra leviter granulata vel minute strigillosa, abaxialiter glabra vel puberulenta; petiolo 0-3(-5) mm longo. Inflorescentiae terminale, cymosae, 0.7-1.5 cm latae. Flores bisexuales; calyce campanulato, 2.5-3 mm longo, 5-loba, sparsim puberulo. Fructus late-ovoideus vel globosus, 3.5-4.5 mm longus; pyrenis 4, reticulatis.

TYPUS. — *Humbert & Swingle 5517*, Madagascar, Prov. Toliara, environs d'Ampanihy, lieux sablonneux, 200-300 m, 24°42'S, 44°45'E, fl., 30 Aug.-7 Sep. 1928 (holo-, P!; iso-, MO!).

Shrub, the twigs glabrous, waxy. Leaves alternate but mostly borne in fascicles on short, lateral branches, deciduous; blades obovate to widely obovate, the widest point at or above the middle, 0.5-1.2(-2.5) cm long, 0.3-0.9(-2) cm wide, the apex rounded, the base cuneate, the margin entire, the adaxial surface glabrous to slightly granular or minutely strigillose, the abaxial surface glabrous to moderately and evenly puberulent, the venation brochidodromous, all but the midrib evident only on the abaxial surface, the midrib even with or slightly impressed on the adaxial surface, raised on the abaxial surface, the secondary veins 3-4, the tertiary venation reticulate; petioles 0-3(-5) mm long, sparsely puberulent, canaliculate on the adaxial surface. Inflorescences terminal on short lateral spurs, small cymes of c. 10 or fewer flowers, 0.7-1.5 cm broad, peduncle 1-4 mm long, the branches puberulent, the hairs all simple; flowers bisexual; calyx campanulate, 2.5-3 mm long, the 5 lobes 2-2.5 mm long, sharply acute at the apex, sparsely puberulent, ciliate on the margin; corolla pale pink, tubular with reflexed to spreading lobes, the tube 2-3 mm long, the 5 lobes oblong, 2.5-3 mm long; stamens 5, prominently exerted, the filaments 3.5-5 mm long, the upper 2-3 mm free, glabrous, the anthers obloid, 1.2-1.5 mm long; ovary ovoid, c.1 mm long, the style 2.5-3.5 mm long, divided 1/3-1/2 of its length, glabrous, the 2 stigmas capitate. Fruits drupaceous, borne in the persistent calyx, color at maturity unknown, broadly ovoid to globose,

3.5-4.5 mm long, 3.5-4.5 mm wide, the endocarp bony, separating into 4 pyrenes at maturity, these 3 mm long, 1.5 mm wide, reticulate on the outer surface. — Fig. 2.

Ehretia australis is distinctive among the Malagasy members of the genus in its small leaves, less than 1.2 cm long and mostly clustered in axillary fascicles, and small inflorescences, less than 1.5 cm broad.

DISTRIBUTION. — *Ehretia australis* is known only from dry regions of southern Madagascar (Fig. 3) and the limited collection data available would indicate that it occurs on rocky terrain.

VERNACULAR NAME. — Manindra.

CONSERVATION STATUS. — Provisional IUCN Red List Category: Endangered (EN B1abi-iv+B2abi-iv). With an Extent of occurrence of 4,100 sq. km. and an Area of Occupancy of only 500 sq. km. *Ehretia australis* occurs in an area in southern Madagascar where the vegetation is increasingly fragmented. No populations are known from currently protected areas.

PARATYPES. — MADAGASCAR: *Bosser 4082*, Prov. Toliara, Ifotaka, 24°48'S, 46°08'E, fr., Nov. 1952 (P!); *Croat 31441*, Prov. Toliara, 1-4 km W of Etrobeke, 150 m, 24°48'S, 44°31'E, fr., 16 Feb. 1975 (MO!, P!); *Decary 4303*, Prov. Toliara, Antanimora, sur les trachytes, 24°49'S, 45°40'E, fl., 11 July 1926 (MO!, P!); *Decary 4466*, Prov. Toliara, Antanimora, terrain gneissique, 24°49'S, 45°40'E, fl., 16 July 1926 (MO!, P!); *Dequaire s.n.*, SW Madagascar, fl., s.date (P!); *Randrianasolo 159*, Prov. Toliara, 30 km SW of Fort Dauphin, N of the village of Italy, 25°09'S, 46°45'E, fr., 16 Oct. 1990 (MO!); *Services Forestier: SF 12670 (Ralaiarison)*, Prov. Toliara, Ampanihy, 200 m, 24°42'S, 44°45'E, fl., fr., 3 Dec. 1954 (P!).

2. *Ehretia cymosa* Thonn.

Thonn. in Schumach. & Thonn., *Beskr. Fuin. Pl.* 129 (1827). — Type: *Thonning 89*, Ghana, s.loc. (holo-, C; iso-, FT, P-JU!).

Shrub or tree to 10 m tall, the bark grey, smooth, the branches spreading and drooping, stems pubescent to glabrous; leaves alternate, deciduous; blades elliptic-ovate to ovate-oblong, the widest point below the middle, 4-14 cm long,

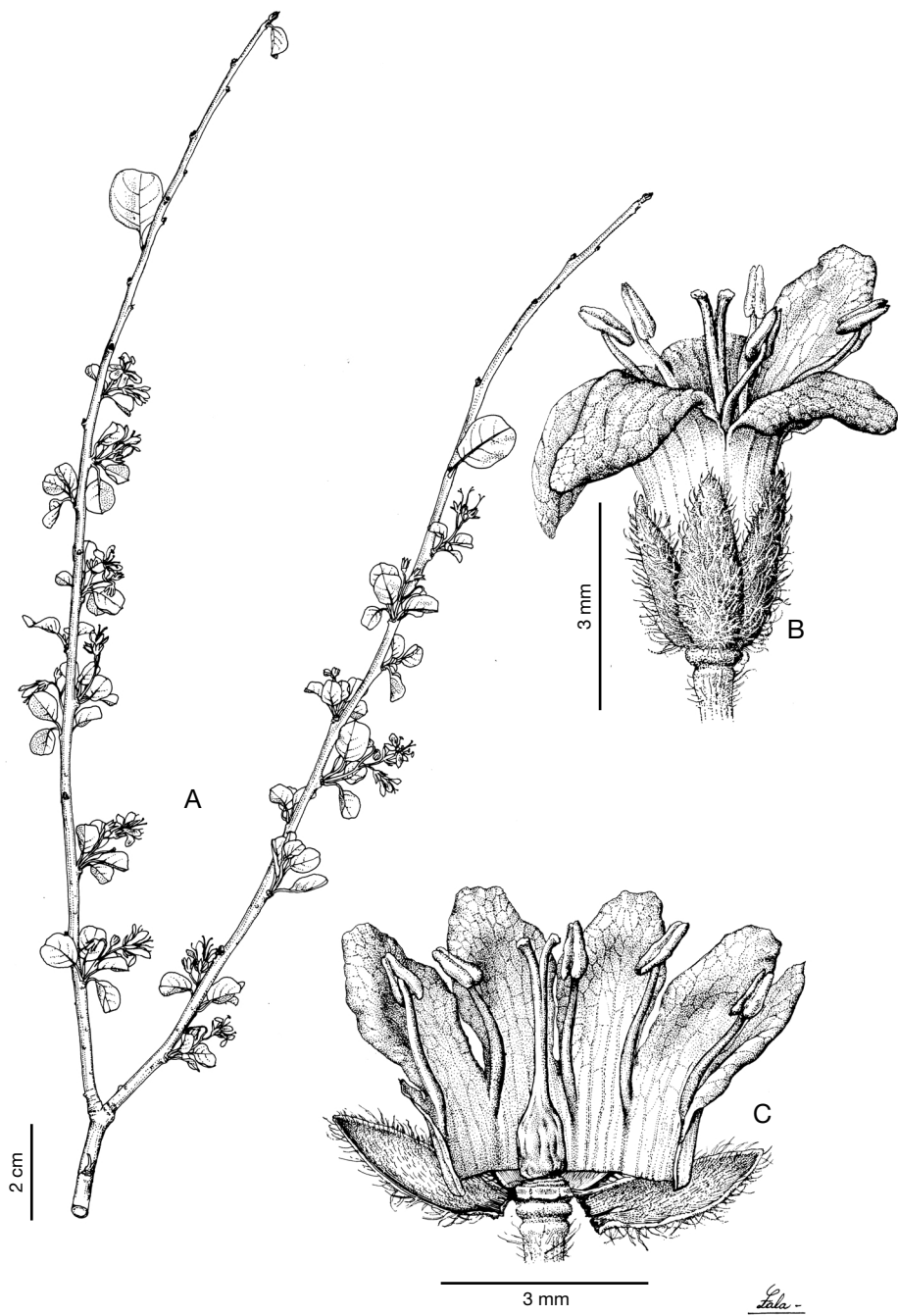


Fig. 2. — *Ehretia australis* J.S. Mill.: A, flowering branch; B, flower; C, flower with open corolla. A-C, from *Humbert & Swingle 5517 (P)*.

2-8 cm wide, the apex acuminate, the base rounded to cordate or obtuse, the margin entire, the adaxial surface glabrous, the abaxial surface usually glabrous except sometimes pubescent along the mid-rib, secondary veins, and vein axils, venation brochidodromous, the midrib impressed on the adaxial surface, raised on the abaxial surface, the secondary veins 3-7, the tertiary venation reticulate; petioles 12-35 mm long, glabrous, canaliculate on the adaxial surface. Inflorescences terminal, cymose, to 8(-13) cm wide, the branches glabrous to puberulent, the hairs all simple; flowers bisexual; calyx campanulate, 2-2.5 mm long, the 5 lobes lanceolate, 0.5-1.2 mm long, acute at the apex, puberulent to glabrous and ciliate on the margin; corolla white, tubular with spreading to reflexed lobes, 4-8 mm long, the tube 1.5-3 mm, the 5 lobes oblong, 1.5-4 mm long; stamens 5, prominently exerted, the filaments 4-5.5 mm long, the upper 2.5-3.5 mm free, glabrous, the anthers obloid, 0.8-1.2 mm long; ovary ovoid, c. 1 mm long, the style 3-4.3 mm long, shortly bifid, glabrous, the stigmas capitate. Fruits borne in the persistent calyx, orange, red, or black at maturity, globose to ovoid, 3-5 mm long, 3-5 mm wide, the endocarp bony, breaking into 4 pyrenes at maturity, these 2.5-3.5 mm long, 2-2.5 mm wide, ridged on the outer surface.

Ehretia cymosa is very distinct and easily recognized from the other Malagasy species by its large leaves, 4-14 cm long, that are widest below the middle. There has been much debate about the recognition of varieties of *E. cymosa* (see VERDCOURT 1991), but collections from Madagascar all have calyces 2-2.5 mm long, but have either glabrous or puberulent inflorescence axes indicating that these are probably *E. cymosa* var. *divaricata* (Baker) Brenan if the varieties are recognized.

DISTRIBUTION. — *Ehretia cymosa* is widespread in tropical Africa from Sierra Leone to Ethiopia and south to Mozambique (MARTINS 1990; VERDCOURT 1991). In Madagascar it is primarily a tree of coastal habitats, along rivers, and on northern islands (Fig. 4). The Malagasy populations are most frequently found at low elevations (except for RN 11488 from 800 m at Antam-

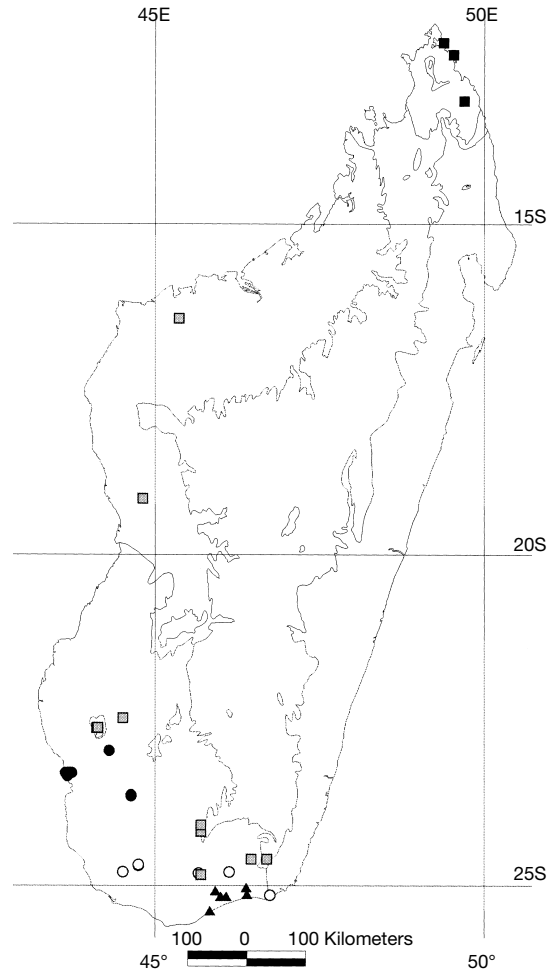


Fig. 3. — Distributions of the endemic species of *Ehretia*, mapped on the bioclimate zones of Madagascar (after CORNET 1974; see SCHATZ 2000). *E. australis* (○), *E. decaryi* (▲), *E. meyersii* (■), *E. philipsonii* (●), *E. seyriigii* (□).

bohobe), whereas in East Africa *E. cymosa* is primarily an upland plant.

VERNACULAR NAMES. — Andiambavy (infusion of leaves used against fever), Havezo, Hazodrahintiky, Malazovoafitetika, Malazovoany, Mavoampotaka, Refeko, Resavatsy, Sarivatoana, Tafitao, Tamatorantsavoka, Tokika, Tsikataoka, Voarafitra. There appears to be little consistency in the use of the majority of these vernacular names and only Malazovoafitetika and Malazovoany are repeated on multiple collections.

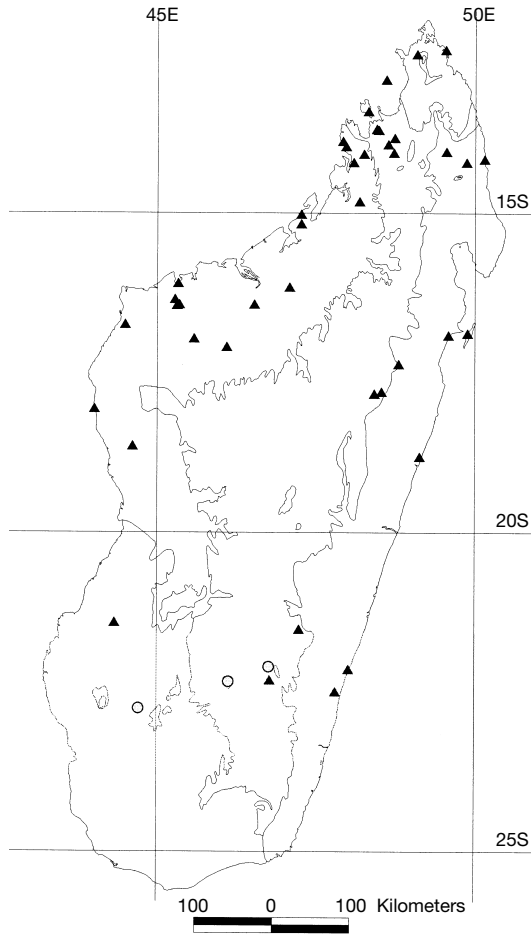


Fig. 4. — Distributions of the non-endemic species of *Ehretia*, mapped on the bioclimate zones of Madagascar (after CORNET 1974; see SCHATZ 2000). *E. cymosa* (▲), *E. obtusifolia* (○).

DISTRIBUTION. — Provisional IUCN Red List Category: Least Concern. *Ehretia cymosa* is a common widespread species that apparently persists in disturbed areas. It is known from relatively large numbers of collections, many recent, and it is widespread and common outside of Madagascar.

MATERIAL EXAMINED. — MADAGASCAR: *Appert 810*, Prov. Toliara, 10 km N of Manja, 21°25'S, 44°20'E, fr., 16 Nov. 1977 (MO!); *Baron 6470*, s.loc., fl., s.date (P!); *Baron 6927*, s.loc., fl., s.date (K!); *Blackburn 186*, s.loc., fr., s.date (K!); *Boivin 1801*, Prov. Toamasina, Ile St. Marie, 16°53'S, 49°53'E, fl.,

Mar. 1847 (P!); *Boivin 2490*, Prov. Antsiranana, baie de Rigny, 12°26'S, 49°32'E, fl., fr., Oct. 1848 (P!); *Catat s.n.*, Prov. Mahajanga, route de Majunga, fl., Oct. 1889 (P!); *Chapelier s.n.*, s.loc., fl., s.date (P!); *Cours 1988*, forêt d'Analamihilana, 850 m, fr., 27 Dec. 1944 (MO!, P!); *Cours 2919*, Prov. Toamasina, Ambila Lemaitso, 3-5 m, 18°49'S, 49°08'E, fr., 9 Sep. 1946 (P!); *Cowan s.n.*, Mataniro to Marosika, fl., Oct.-Nov. 1884 (BM!, P!); *Decary 1108*, Prov. Mahajanga, Maromandia, 14°12'S, 48°05'E, fl., 9 Oct. 1922 (P!); *Decary 1169*, Prov. Mahajanga, Maromandia, 14°12'S, 48°05'E, fl., 22 Oct. 1922 (P!); *Decary 1216*, Prov. Mahajanga, Maromandia, 14°12'S, 48°05'E, fl., 22 Oct. 1922 (P!); *Decary 8267*, Prov. Mahajanga, Maintirano, 18°04'S, 44°02'E, fl., 31 Aug. 1930 (MO!, P!); *Decary 15615*, Prov. Mahajanga, Besalampy, 16°45'S, 44°30'E, fl., fr., 13 Sep. 1940 (MO!, P!); *Decary 15652*, Prov. Mahajanga, Besalampy, 16°45'S, 44°30'E, fr., 13 Sep. 1940 (MO!, P!); *Decary 15777*, Prov. Mahajanga, dist. de Soalala, Réserve No. 8, Namoroka, 16°26'S, 45°22'E, fl., 16 Sep. 1940 (P!); *Decary 15778*, Prov. Mahajanga, dist. de Soalala, Réserve No. 8, Namoroka, 16°26'S, 45°22'E, fl., 16 Sep. 1940 (P!); *Derleth 148*, Prov. Antsiranana, Analanantsoa, Ambodisakoana, bords de la Manongarivo, 40 m, 14°05'S, 48°20'E, fr., 28 Aug. 1994 (P!, TAN!); *Du Petit Thouars s.n.*, s.loc., fl., s.date (P!); *Du Puy, Du Puy, & Raharilala 382*, Prov. Mahajanga, Boina region, c. 15 km NW of the village of Vilanandro, Réserve Nationale Intégrale de Namoroka, 140 m, 16°26'S, 45°21'E, fl., 26 Sep. 1989 (MO!, P!); *Greve 89*, s.loc., fl., s.date (BM!, MO!, P!); *259*, s.loc., s.date, fl., fr. (MO!); *Hildebrandt 3025*, Prov. Antsiranana, Anorotsangana, 13°55'S, 47°55'E, fl., June 1879 (BM!, MO!, P!); *Homolle 186*, Prov. Toamasina, lac Alaotra, entre Menasaka et Ambodiriana, bords du Maningory, 17°22'S, 48°48'E, fl., fr., Dec. 1944 (P!); *Homolle 1988*, forêt d'Analamihilana, fr., 27 Dec. 1944 (P!); *Humbert & Capuron 23960*, Prov. Antsiranana, vallée inférieure de l'Androranga, affluent de la Bemarivo, aux environs d'Antongondriha, 100-250 m, 14°12'S, 49°52'E, fl., 1-24 Nov. 1951 (MO!, P!); *Humbert & Cours 17491*, Prov. Toamasina, Mont Ankaraka au sud-est du lac Alaotra, 1200-1400 m, 17°48'S, 48°32'E, fl., Oct. 1937 (P!); *Lantz s.n.*, Prov. Fianarantsoa, Manakara, 22°09'S, 48°01'E, fl., 1881 (P!); *Perrier de la Bâthie 1107*, Prov. Mahajanga, environs de Madirovalo, 16°26'S, 46°32'E, fl., fr., Oct. 1900 (MO!, P!); *Perrier de la Bâthie 10219*, Prov. Mahajanga, Marovoay, 16°58'S, 44°35'E, fl., July 1908 (P!); *Perrier de la Bâthie 10226*, Prov. Antsiranana, vallée du Sambirano, 13°55'S, 48°38'E, fl., May 1909 (MO!, P!); *Perrier de la Bâthie 10258*, Prov. Antsiranana, Bemarivo près Sambava, 14°09'S, 50°09'E, fl., fr., Nov. 1912 (MO!, P!); *Perrier de la Bâthie 10288*, Prov. Mahajanga, Andara, plateau d'Ankarana, Boina, 17°13'S, 46°16'E, fl., Sep. 1902 (P!); *Perrier de la Bâthie 18722*, Prov. Antsiranana, Nosy Mitsio, 12°54'S, 48°36'E, fl., Oct.

1932 (P!); *Perville 319*, Prov. Antsiranana, Nosy Mitsio, 12°54'S, 48°36'E, fl., 9 Nov. 1840 (MO!, P!); *Perville 409*, Prov. Antsiranana, Nosy Be, 13°18'S, 48°16'E, fr., 18 Jan. 1841 (MO!, P!); *Perville 2085bis*, Prov. Antsiranana, Nosy Be, 13°18'S, 48°16'E, fl., 1849 (MO!, P!); *Réserves Naturelles: RN 74*, Prov. Mahajanga, Réserve Naturelle 8, Namoroka, 16°26'S, 45°22'E, fl., fr., 18 Oct. 1957 (P!); *Réserves Naturelles: RN 2043*, Prov. Mahajanga, Ankarafantsika, 16°10'S, 47°05'E, fl., 9 Nov. 1950 (MO!, P!); *Réserves Naturelles: RN 2181 (Randrianasolo)*, Prov. Mahajanga, Soalala, Ampiliranjirika, 16°21'S, 45°17'E, fl., 24 Nov. 1950 (P!); *Réserves Naturelles: RN 3026 (Rakoto)*, Prov. Antsiranana, Réserve Naturelle 6, Marovaliha, 13°24'S, 48°19'E, fl., 2 Nov. 1951 (MO!, P!); *Réserves Naturelles: RN 5641 (Saboureau)*, Prov. Mahajanga, Réserve Naturelle 8, Namoroka, 16°26'S, 45°22'E, fl., 8 Sep. 1953 (P!, TEF!); *Réserves Naturelles: RN 6289*, Prov. Antsiranana, Réserve Naturelle 4, Tsaratanana, 13°57'S, 48°52'E, fl., 18 Aug. 1954 (P!); *Réserves Naturelles: RN 6707*, Prov. Mahajanga, Soalala, 16°06'S, 45°20'E, fl., 1 Sep. 1954 (P!); *Réserves Naturelles: RN 8128*, Prov. Mahajanga, Soalala, Réserve Naturelle Namoroka, 16°06'S, 45°20'E, fl., 12 Aug. 1956 (P!, TAN!); *Réserves Naturelles: RN 8138*, Prov. Mahajanga, Soalala, 16°06'S, 45°20'E, fl., 8 Sep. 1956 (P!); *Réserves Naturelles: RN 8764*, Prov. Mahajanga, Soalala, 16°06'S, 45°20'E, fl., 15 Jan. 1957 (P!); *Réserves Naturelles: RN 11488*, Prov. Fianarantsoa, Antambohobe, dist. Ivohibe, 22°19'S, 46°47'E, fl., 26 Oct. 1961 (P!); *Réserves Naturelles: RN 11293*, Prov. Toamasina, Ambatondrazaka, 17°50'S, 48°25'E, fl., 19 Nov. 1960 (P!); *Réserves Naturelles: RN 11957*, Antsiranana, Nosy Be, 13°24'S, 48°19'E, fl., 25 Oct. 1961 (MO!, P!); *Richard s.n.*, s.loc., fl., s.date (P!); *Richard 431*, s.loc., fl., s.date (P!); *Saboureau 29*, Prov. Antsiranana, Beangona-Ambanja, 14°03'S, 48°42'E, fl., s.date (P!); *Service Forestier: SF 789 (Capuron)*, Prov. Antsiranana, Réserve Naturelle Marojejy, Antongondriha, vallée de l'Androranga, district de Sambava, fl., fr., 9 Nov. 1950 (MO!, P!); *Service Forestier: SF 2492*, Prov. Toamasina, Soanierana Ivongo, 16°55'S, 49°35'E, fr., 27 Dec. 1949 (P!); *Service Forestier: SF 5837*, Prov. Antsiranana, Benavony-Ambanja, 13°42'S, 48°29'E, fl., fr., 3 Oct. 1952 (MO!, P!); *Service Forestier: SF 6499*, Prov. Fianarantsoa, Analava-Ambohitsara-Vohipeno, 22°21'S, 47°51'E, fr., 22 Nov. 1952 (P!); *Service Forestier: SF 7686*, Prov. Mahajanga, Maromandia-Ambanja, 14°12'S, 48°05'E, fr., 24 Sep. 1953 (P!); *Service Forestier: SF 7697*, Prov. Antsiranana, Ambanja, 13°41'S, 48°27'E, fr., 18 Oct. 1953 (P!); *Service Forestier: SF 10777*, Prov. Mahajanga, Ambondro-Analalava, 50 m, 15°01'S, 47°16'E, fl., 30 Sep. 1954 (P!); *Service Forestier: SF 11118*, Prov. Mahajanga, Analalava, 100–411 m, 14°49'S, 48°15'E, fr., 21 Oct. 1954 (P!); *Service Forestier: SF 12396*, Prov. Fianarantsoa, Farafangana, 22°49'S, 47°49'E,

fl., 25 Nov. 1954 (MO!, P!); *Service Forestier: SF 18828 (Capuron)*, Prov. Mahajanga, forêt d'Ambondro-Ampasy, exploitation Loysseau, Canton d'Antonibe, District d'Analalava, 15°01'S, 47°16'E, fl., fr., 29 Oct.–3 Nov. 1958 (MO!, P!); *Service Forestier: SF 20058 (Capuron)*, Prov. Antsiranana, massif de la montagne d'Ambre, rive gauche de la rivière des Makis entre les Roussettes et la Grande Cascade, 12°32'S, 49°10'E, fl., 22 Nov. 1958 (MO!, P!, TEF!); *Service Forestier: SF 26204*, Prov. Mahajanga, forêt de Beandro, Antsalova, 18°39'S, 44°37'E, fl., 23 Sep. 1966 (P!, TEF!); *Service Forestier: SF 26213*, Prov. Mahajanga, Betaboara, Antsalova, 18°39'S, 44°37'E, fl., 18 Oct. 1966 (P!); *Service Forestier: SF 27106 (Capuron)*, Prov. Mahajanga, vestige forestier, sur scories basaltiques, au lieu dit Analankeboka, à l'ouest de Bealanana, 14°33'S, 48°45'E, fl., 20 Nov. 1966 (MO!, P!, TEF!); *Ursch 191*, Prov. Antsiranana, ravine au Diégo-Suarez, 12°18'S, 49°21'E, fl., fr., s.date (MO!, P!). — COMORES: *Boivin s.n.*, Moheli, fl., Mar. 1850 (MO!, P!); *Boivin 3229*, Mayotte, fl., fr., s.date (MO!, P!); *Fauve 1019*, Mayotte, fr., 27 Nov. 1989 (P!); *Humblot 380*, s.loc., fl., 1884 (BM!); *Humblot 1380*, Mayotte, fl., 4 Nov. 1884 (MO!, P!); *Kirk (Ehretia 4)*, Mohilla Island, fl., Apr. 1861 (K!); *Labat, Yahaya & Darouèche 3190*, Moheli, Djando, Itsamia, Chissiva Madahani, 30 m, 12°22'S, 43°52'E, fl., 22 Nov. 1999 (MO!, P!); *Pascal 97*, Mayotte, îlot Bandrele, fl., 2 Oct. 1995 (P!); *Pascal 221*, Mayotte, Dapani, fl., 21 Nov. 1995 (K!, P!); *Pascal 726*, Mayotte, Pointe Saziley, 100 m, fl., 17 Oct. 1996 (P!); *Pascal 892*, Mayotte, Convalescence, 400 m, fr., 19 Feb. 1997 (P!); *Pascal & Halle 678*, Mayotte, bord de route, vers trevani, 20 m, fl., fr., 21 Sep. 1996 (P!); *Pobeguain 85*, Mayotte, fl., s.date (MO!, P!); *Richard 210*, Anjouan, Mohilla, fl., s.date (P!).

3. *Ehretia decaryi* J.S. Mill., sp. nov.

Frutex vel arbor parva, ramunculis glabris. Folia decidua, alterna vel in fasciculos ramunculis lateralibus brevibus insidentes disposita; lamina obovata usque oblanceolata, 2-4(-5.8) cm longa, 1-2(-2.8) cm lata, apice obtusa usque rotundata, basi cuneata usque attenuata, margine integra, adaxialiter ut videtur glabra (magnificatione sparsim et minutissime puberula), abaxialiter glabra; petiolo 5-10 mm longo. Inflorescentiae terminale, cymosae, usque ad 5 cm latae. Flores bisexuales; calyce campanulato, 1.8-2 mm longo, 5-loba, fere glabro vel granulati-puberulo, margine ciliato. Fructus drupaceus, late-ovoideus, c. 4 mm longus; pyrenis 4, reticulatis.

TYPUS. — *Decary 9500*, Madagascar, Prov. Toliara, Mahatomotsy, au nord d'Ambovombe, sur les sables, 25°05'S, 45°55'E, fl., 9 Dec. 1931 (holo-, P!; iso-, MO!, P!).

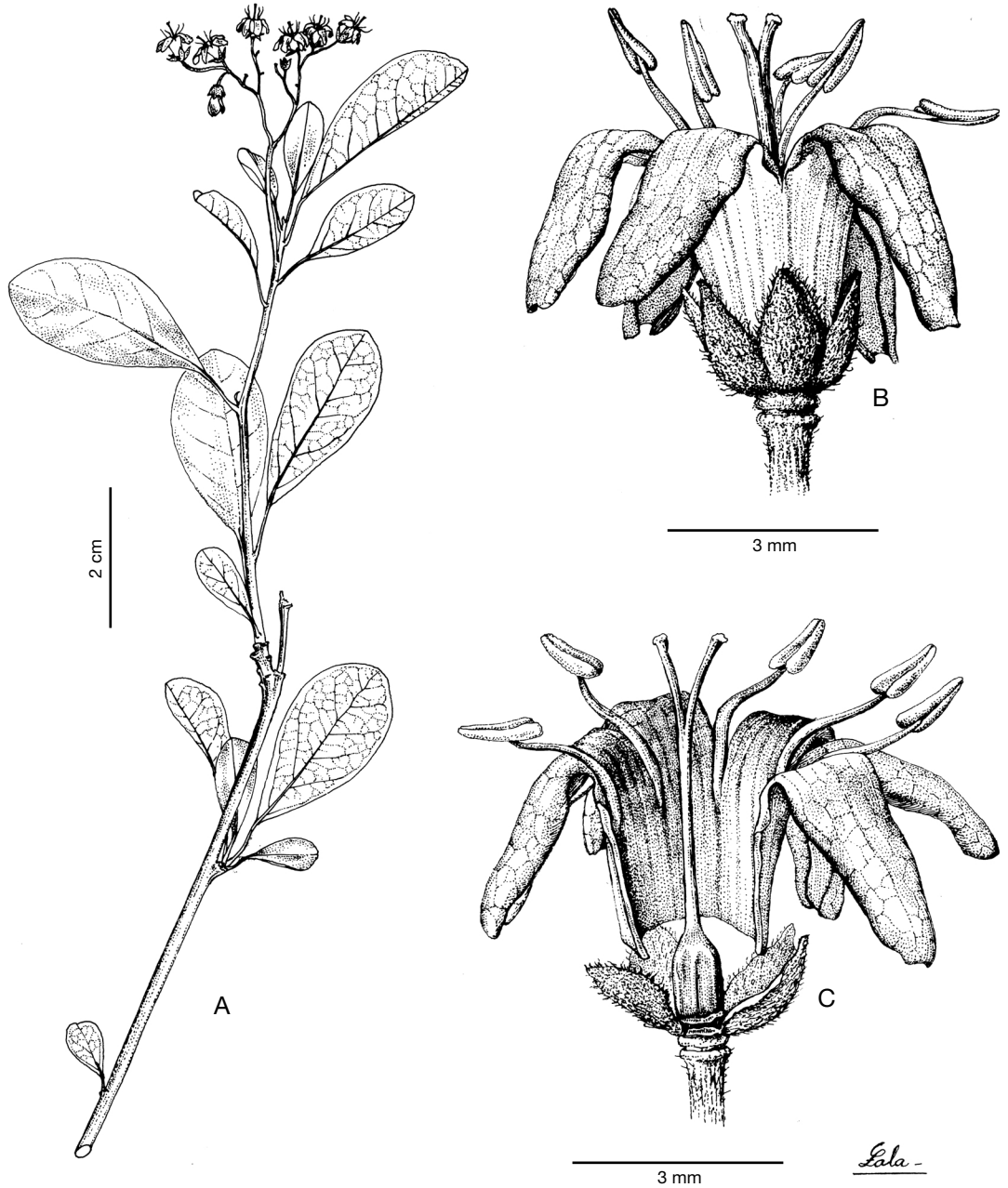


Fig. 5. — *Ehretia decaryi* J.S. Mill.: **A**, flowering branch; **B**, flower; **C**, flower with open corolla. A-C, from Decary 9500 (P).

Shrub or small tree, the twigs glabrous; leaves alternate or clustered on short lateral branches, deciduous; blades obovate to oblanceolate, the

widest point above the middle, 2-4(-5.8) cm long, 1-2(-2.8) cm wide, the apex obtuse to rounded, the base cuneate to attenuate, the mar-

gin entire, the adaxial surface appearing glabrous, sparsely and very minutely puberulent (this visible only with magnification), the abaxial surface glabrous or nearly so, sometimes with a few hairs in the axils of the secondary veins, the venation brochidodromous, the midrib even with or slightly raised from the adaxial surface, raised on the abaxial surface, the secondary veins 4-5, the tertiary venation reticulate; petioles 5-10 mm long, glabrous, narrowly canalicate on the adaxial surface. Inflorescences terminal, subterminal, or terminal on short lateral branches, cymose, to 5 cm broad, the branches glabrous; flowers bisexual; calyx campanulate, 1.8-2 mm long, the 5 lobes narrowly triangular, 1.3-1.5 mm long, sharply acute at the apex, nearly glabrous or granular puberulent, ciliate on the margin; corolla white, sometimes tinted pink, 4-5 mm long, the tube 2-3 mm long, the 5 lobes oblong, 2-4 mm long; stamens 5, prominently exerted, the filaments 4.5-5 mm long, the upper 2.5 mm free, glabrous, the anthers obloid, 1 mm long; ovary ovoid, c. 1 mm long, the style 4-4.5 mm long, shortly bifid, glabrous, the 2 stigmas capitate. Fruits drupaceous, borne in the persistent calyx, color at maturity unknown, broadly ovoid, 4 mm long, 4 mm wide, the endocarp bony, separating into 4 pyrenes at maturity, these 3.5 mm long, 2 mm wide, reticulate on the external surface. — Fig. 5.

Ehretia decaryi can be distinguished from *E. australis*, the only other species that occurs at low elevations in extreme southern Madagascar, by its much larger leaves, at least 2 cm long, and its glabrous inflorescence branches. *Ehretia decaryi* is named in honor of Raymond DECARY who collected extensively in Madagascar from 1916-1944 and whose collections add so much to our knowledge of southern vegetation.

DISTRIBUTION. — *Ehretia decaryi* is known only from extreme southern Madagascar (Fig. 3), where it apparently grows on sand at low elevations.

CONSERVATION STATUS. — Provisional IUCN Red List Category: Endangered (EN B1abi-iv+B2abi-iv). With an Extent of occurrence of 1,100 sq. km. and an Area of Occupancy of only

500 sq. km. *Ehretia decaryi* occurs in an area in southern Madagascar where the vegetation is increasingly fragmented. No populations are known from currently protected areas.

PARATYPES. — MADAGASCAR: *Bosser 10116*, Prov. Toliara, Ambovombe, 25°10'S, 46°05'E, fl., fr., Oct. 1956 (P!, TAN!); *Croat 31696*, Prov. Toliara, along road between Ambondro and Ambovombe, 100-150 m, 25°10'S, 46°00'E, fr., 18 Feb. 1975 (MO!, P!); *Decary 3168*, Prov. Toliara, Ambovombe, bord de routes, sable, 25°10'S, 46°05'E, fl., 19 Oct. 1924 (MO!, P!); *Decary 3209*, Prov. Toliara, Ampasimpolaka, dist. Ambovombe, terrain calcaire, 25°08'S, 46°24'E, fl., 7 Oct. 1924 (P!); *Decary 3221*, Prov. Toliara, Amboasary, dist. Ambovombe, sable, 25°02'S, 46°23'E, fl., 9 Oct. 1924 (MO!, P!); *Decary 8418*, Prov. Toliara, Kotoala, Ambovombe, sables et calcaires littoraux, 25°23'S, 45°50'E, fl., 21 Jan. 1931 (MO!, P!).

4. *Ehretia obtusifolia* A. DC.

In DC., Prodr. 9: 507 (1845). — Type: *Schimper 652*, Ethiopia, Tigre, Medschara, near Gapdia, (holo-, G; iso-, K).

Ehretia fischeri Gurke in Engl., Die Pflanzenwelt Ost-Afrikas und der Nachbargebiete: 336 (1895). — Syntypes: *Fischer 323*, Tanzania, Mwanza Dist., Kagehi (B); *Stuhlmann 850*, Tanzania, Biharamulo/Mwanza Dist., Usinga near French Mission at Usambiro (B).

Shrub or small tree to 3 m tall, the twigs glabrous to sparsely pubescent, with both glandular and simple hairs. Leaves alternate, deciduous; blades elliptic, widest at or near the middle, 2.7-6 × 1.2-3 cm, the apex acuminate to obtuse, the base cuneate to acute, the margin entire, the adaxial surface glabrous to sparsely and minutely strigillose, puberulent along the midrib, the abaxial surface sparsely to moderately puberulent, more so on the major veins, the venation brochidodromous, the midrib raised on both surfaces, the secondary veins 5-7, the tertiary venation reticulate; petioles 1-7 mm long, glabrous to sparsely puberulent, canalicate on the adaxial surface. Inflorescences terminal, cymose, 3-5.5 cm broad, the branches pubescent, with both glandular and simple hairs; flowers bisexual; calyx campanulate, 2-2.2 × 1 mm long, the 5 lobes

elliptic, 1.5-1.8 mm long, the apex acute, puberulent with both glandular and simple hairs and ciliate on the margin; corolla white, tubular with reflexed to spreading lobes, the tube c. 3 mm long, the 5 lobes oblong, 3-4 mm long; stamens 5, prominently exerted, the filaments 4.5-5 mm long, the upper 2.5-3 mm free, glabrous, the anthers obloid, 1.3-1.5 mm long; ovary ovoid, c. 1 mm long, the style 3-4.5 mm long, divided 1/3-1/2 its length, glabrous to sparsely hirsute, the 2 stigmas capitate. Fruits drupaceous, borne in the persistent calyx, color at maturity unknown, broadly ovoid, c. 3 × 3 mm, the endocarp bony, separating into 4 pyrenes at maturity, these 4 × 3 mm, reticulate on the outer surface.

All four collections of *E. obtusifolia* from Madagascar are of immature individuals in early flower so the dimensions of mature leaves probably exceeds those given in the description above. Fruits are not known from the Madagascar collections, so the description of fruits above is based on African material. Also, the inclusion of *Leandri 3568*, in very early flower with essentially no leaves, in this species must be considered provisional. *Ehretia obtusifolia* is the only upland species in Madagascar with glandular pubescence on the inflorescence branches.

DISTRIBUTION. — *Ehretia obtusifolia* is widely distributed in East Africa, from Somalia, to southern Africa (Angola, Mozambique, and South Africa), through the middle east to Afganistan, Pakistan, and India. In Madagascar, this species is known from only four collections, all from the south central part of the island from Sakaraha to near Ihosy from 600-1200 m in elevation (Fig. 4).

VERNACULAR NAME. — Vovonana.

CONSERVATION STATUS. — Provisional IUCN Red List Category: Endangered in Madagascar (EN B1abi-iv+B2abi-iv). With an Extent of occurrence of 200 sq. km. and an Area of Occupancy of only 200 sq. km. *Ehretia obtusifolia* occurs in an area in southern Madagascar where the vegetation is increasingly fragmented. Two of the four known collections are known from protected areas. This species is widespread from Africa through India and this analysis considers only Malagasy populations.

MATERIAL EXAMINED. — MADAGASCAR: *Bernardi 11231*, Prov. Fianarantsoa, Ihosy, in monte Lalanandro, 1100-1200 m, 22°23'S, 46°08'E, fl., 5 Nov. 1967 (P!); *Leandri 3568*, Prov. Toliara, forêt de Zombitsy, au NE de Sakaraha, 150 km NE de Tuléar, 600-800 m, 22°46'S, 44°43'E, fl., 1-3, 17-21 Nov. 1960 (MO!, P!); *Service Forestier: SF 26467*, Prov. Fianarantsoa, Réserve Naturelle Andringitra, Antambohobe, Lohony, Ankazomby, dist. Ivohibe, 22°19'S, 46°47'E, fl., fr., 18 Oct. 1967 (P!; TEF!); *Service Forestier: SF 27876 (Capuron)*, Prov. Fianarantsoa, vestiges de forêt ombrophile sur la crête supérieure du massif de Lalanandro, au N d'Ihosy, 22°21'S, 46°08'E, fl., 6 Nov. 1967 (P!, TEF!).

5. *Ehretia meyersii* J.S. Mill., *sp. nov.*

Arbor, ramunculis glabris. Folia alterna, decidua; lamina obovata, 4-8.5 cm longa, 2.5-5 cm lata, apice obtusa, basi asymmetrica acuta, margine integra, utrinque glabra vel fere glabra; petiolo 8-22 mm longo. Inflorescentiae cymosae, usque ad 6 cm latae. Flores bisexuales; calyx campanulato, 5-loba, glabro sed margine ciliato. Fructus drupaceus, depresso-globosus, 3-4 mm longus, pyrenis 4, reticulatis.

TYPUS. — *Meyers 232*, Madagascar, Prov. Antsiranana, Mantamena, part of Bekaroka Range, 7 km NE of Daraina (Vohemar), Faritany, Antsiranana, 112-330 m, 13°08'S, 49°42'E, fr., 14 Dec. 1990 (holo-, MO!; iso-, P!, TAN).

Tree, the stems glabrous. Leaves alternate, deciduous; blades obovate, the widest point above the middle, 4-8.5 cm long, 2.5-5 cm wide, the apex obtuse, the base asymmetrically acute, the margin entire, the adaxial surface glabrous, the abaxial surface glabrous or with a few hairs in the axils of the secondary veins, the venation brochidodromous, the midrib impressed on the adaxial surface, raised on the abaxial surface, the secondary veins 4-6, the tertiary venation reticulate; petioles 8-22 mm long, glabrous, canaliculate on the adaxial surface. Inflorescences cymose, to 6 cm broad, the branches glabrous; flowers bisexual; calyx campanulate, the 5 lobes narrowly triangular, 1.2-1.6 mm long, acute at the apex, glabrous but ciliate on the margin; corollas white?, tubular with spreading to reflexed lobes, c. 4 mm long, the tube c. 3 mm long, the 5 lobes oblong, c. 3 mm long, rounded at the apex; stamens prominently exerted, the filaments c. 4.5 mm long, the upper

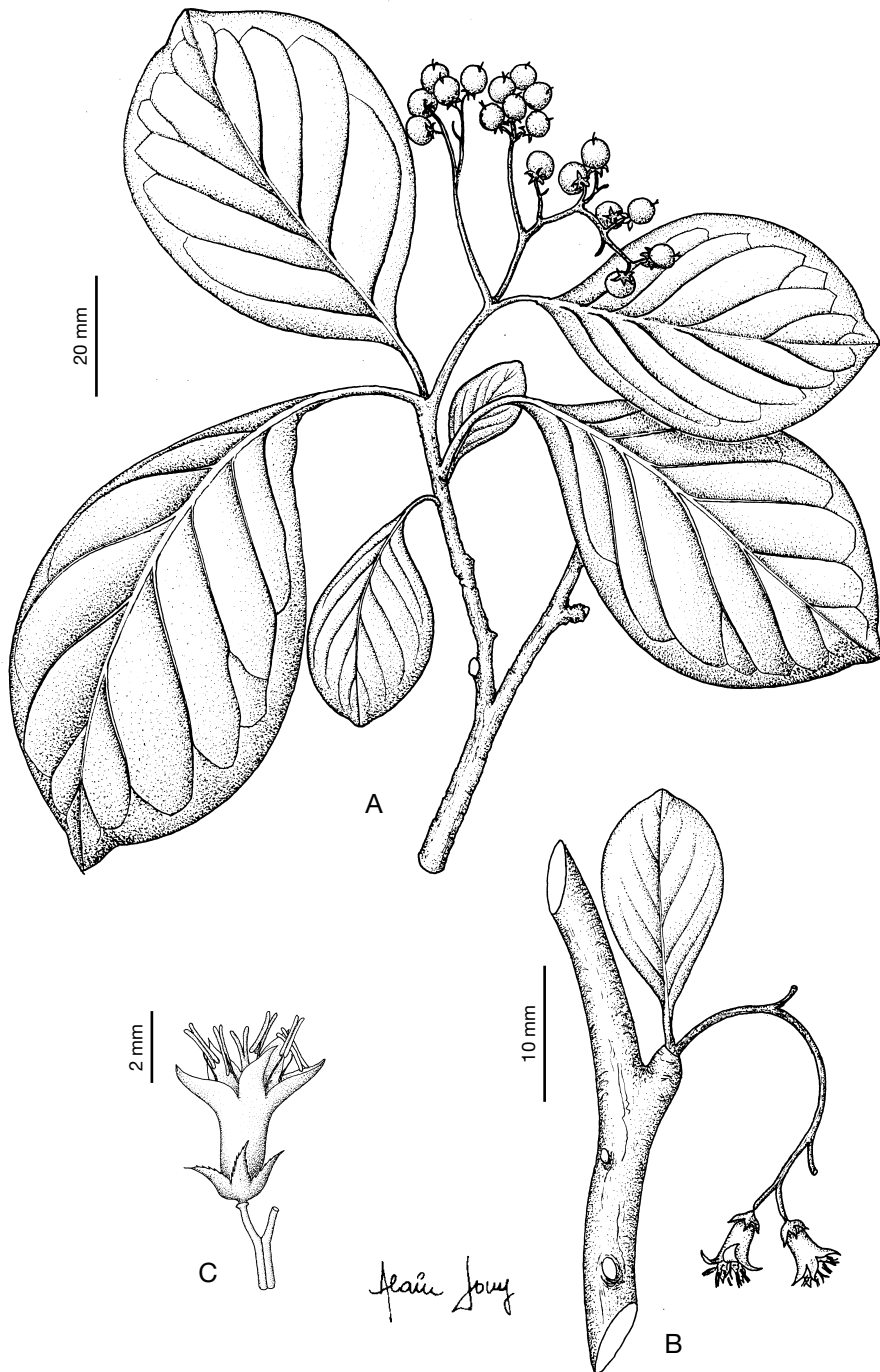


Fig. 6. — *Ehretia meyersii* J.S. Mill.: **A**, fruiting branch; **B**, flowering branch; **C**, flower. A-C, from Keraudren-Aymonin & Aymonin 25483 (P).

c. 2 mm free, glabrous, the anthers oboid, c. 1.5 mm long; ovary ovoid, c. 1 mm long, the style c. 3.5 mm long, bifid for c. 1 mm, the 2 stigmas capitate. Fruits drupaceous, borne with the persistent calyx, color at maturity unknown, depressed globose, 3-4 mm long, 4-5 mm broad, the endocarp bony, separating into 4 single-seeded pyrenes at maturity, these c. 3 mm long, 1.5 mm broad, reticulate on the dorsal surface. — Fig. 6.

Ehretia meyersii is distinctive among the Malagasy species in its rather large leaves (4-8.5 × 2.5-5 cm) that are widest above the middle. It is known from only two dry forest sites in northern Madagascar, while most of the other Malagasy species occur in dry forests in the south. *Ehretia meyersii* is named in honor of David M. MEYERS, who collected plant specimens in poorly explored forests of northern Madagascar near Daraina, including the type of this species.

DISTRIBUTION. — *Ehretia meyersii* is known only from dry, deciduous forests of northeast Madagascar (Fig. 3).

VERNACULAR NAME. — Andovokonio.

CONSERVATION STATUS. — Provisional IUCN Red List Category: Endangered (EN B1abi-iv+B2abi-iv). With an Extent of occurrence of 400 sq. km. and an Area of Occupancy of only 300 sq. km. *Ehretia meyersii* is known only from dry forests in northern Madagascar, which are quite small and not currently protected.

PARATYPES. — MADAGASCAR: *Bovin 2490*, Prov. Antsiranana, baie de Rigny, 12°26'S, 49°32'E, fl., fr., Oct. 1848 (P!); *Keraudren-Aymoin & Aymonin 25483*, Prov. Antsiranana, environs de Diégo-Suarez, forêt littorale au S d'Orangea, 12°15'S, 49°24'E, fl., fr., 24 Nov. 1970 (P!).

6. *Ehretia phillipsonii* J.S. Mill., sp. nov.

Frutex vel arbor parva, ramunculis juventute glanduloso-puberulis. Folia decidua, alterna vel in fasciculos compressos ramunculis lateralibus; lamina obovata usque oblanceolata, 1.5-4.5(-6.7) cm longa, 0.8-1.7(-3) cm lata, apice acuta usque acuminata vel rotundata, basi cuneata, margine integra, utrinque glabra vel minute puberula; petiolo 2-7(-17) mm longo. Inflorescentiae terminale, cymosae, usque ad 5(-7) cm latae. Flores bisexu-

ales; calyce campanulato, 1.8-2.5 mm longo, 5-lobo, glanduloso-puberulo et margine ciliato. Fructus drupaceus, globosus, 3-4 mm longus; pyrenis 4, reticulatis.

TYPUS. — *Humbert 2437*, Madagascar, Prov. Toliara, environs de Tuléar, coteaux calcaires, delta du Fiherenana, 2-10 m, 23°18'S, 43°36'E, fl., 14-26 Sep. 1924 (holo-, P!; iso-, MO!, P!).

Shrub or small tree, the twigs glandular puberulent when young, later glabrous. Leaves alternate or in compressed fascicles on short, lateral branches, deciduous; blades obovate to oblanceolate, the widest point above the middle, 1.5-4.5(-6.7) cm long, 0.8-1.7(-3) cm wide, the apex acute to acuminate or rounded, the base cuneate, the margin entire, both surfaces glabrous to minutely puberulent, the venation brochidodromous, the midrib raised to impressed on the adaxial surface, raised on the abaxial surface, the secondary veins 3-4(-6), the tertiary venation reticulate; petioles 2-7(-17) mm long, glabrous to sparsely puberulent, canalicate on the adaxial surface. Inflorescences terminal on main or short, lateral branches, cymose, to 5(-7) cm broad, the branches densely glandular-puberulent; flowers bisexual; calyx campanulate, 1.8-2.5 mm long, the 5 lobes lanceolate, 1.2-2 mm long, acute at the apex, glandular-puberulent and ciliate on the margin; corolla white, tubular with spreading to reflexed lobes, 5-5.5 mm long, the tube 2.5-3 mm long, the 5 lobes oblong, 2.5-4 mm long; stamens 5, prominently exerted, the filaments 5-6 mm long, the upper 2.5-4 mm free, glabrous, the anthers oboid, 1-1.5 mm long; ovary ovoid, c. 1 mm long, the style 4-5 mm long, shortly bifid, glabrous, the 2 stigmas capitate. Fruits borne in the persistent calyx, drupaceous, orange at maturity, globose, 3-4 mm long, 4-5 mm wide, the endocarp bony, separating into 4 pyrenes at maturity, these 2.5-3 mm long, 1.5-2 mm wide, reticulate on the outer surface. — Fig. 7.

Ehretia phillipsonii is the only lowland species of the genus in Madagascar with glandular pubescence on the inflorescence branches. *Ehretia obtusifolia*, the other glandular species in Madagascar, has elliptic leaves, whereas *E. phillipsonii* differs in its obovate to oblanceolate leaves that are widest above the middle. Two collections from Tuléar

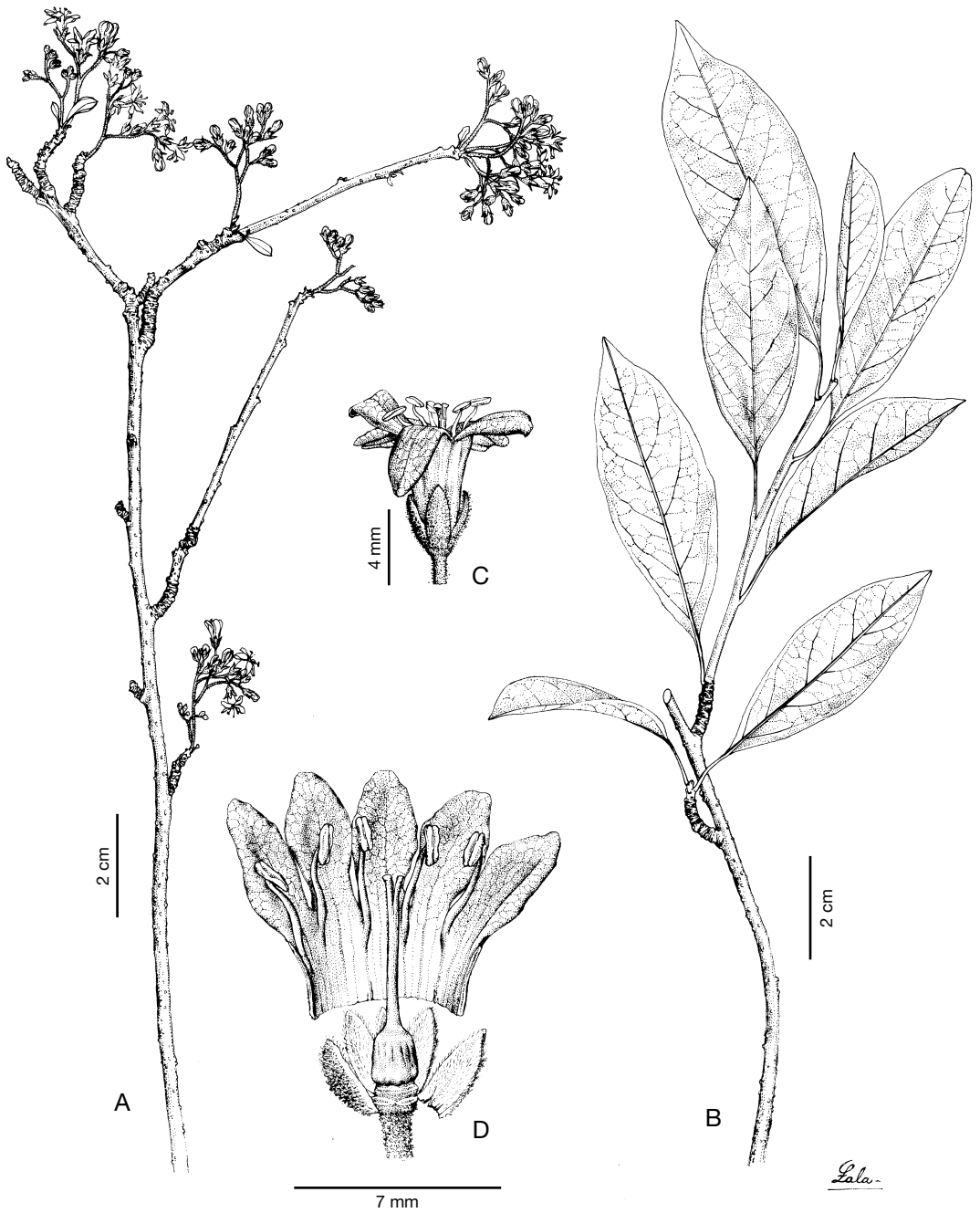


Fig. 7. — *Ehretia philipsonii* J.S. Mill.: **A**, flowering branch; **B**, branch with leaves; **C**, flower; **D**, flower with open corolla. A-D, from Humbert 2437 (P).

(Humbert 2347 and Perrier de la Bâthie 12833) have significantly larger leaves (up to 6.7×3 cm) than the other collections. This species is named in honor of Peter B. PHILLIPSON, who made one of the collections from Beza Mahafaly, and who's collections from southern Madagascar have added so much to knowledge of the flora of the region.

DISTRIBUTION. — *Ehretia phillipsonii* species is known only from low elevation in the vicinity of Tuléar and to the south at Beza Mahafaly (Fig. 3).

CONSERVATION STATUS. — Provisional IUCN Red List Category: Endangered (EN B1abi-iv+B2abi-iv). With an Extent of occurrence of 3,200 sq. km. and an Area of Occupancy of only 500 sq. km. *Ehretia phillipsonii* is known from two regions in southern Madagascar. The protected population at the Beza Mahafaly Special Reserve was discovered only recently and three collections were made there between 1987-1988. There have been no collections since 1959 from the second population, which was known from unprotected dry forests on sand north of Tuléar and along the Fiherenana River. This is an area that has been visited quite regularly by botanists in intervening years. While dry forest vegetation persists in much of this area it is highly disturbed and it may be that this species has been selectively removed for charcoal from these forests.

PARATYPES. — MADAGASCAR: *Bosser 10393*, Prov. Toliaram Miary, $23^{\circ}18'S$, $43^{\circ}44'E$, fr., Nov. 1956 (P!); *Bosser 10602*, Prov. Toliara, environs de Tuléar, $23^{\circ}21'S$, $43^{\circ}40'E$, fl., Nov. 1956 (P!); *Decary 18794*, Prov. Toliara, vallée du Manombo, $22^{\circ}58'S$, $43^{\circ}58'E$, fl., 26 Feb. 1943 (MO!, P!); *Dequaire 24230*, s.loc., fl., s.date (P!); *Dequaire 27417*, Prov. Toliara, le long du canal de Beleboka, $23^{\circ}18'S$, $43^{\circ}41'E$, fl., s.date (MO!, P!); *Geay s.n.*, Prov. Toliara, s.loc., fl., Mar. 1906 (P!); *Grandidier s.n.*, s.loc., fl., s.date (P!); *Herb. Institut Scientifique, Madagascar 27417*, s.loc., fl., s.date (P!); *Miller 3439*, Prov. Toliara, Beza Mahafaly, c. 30 km E of Betioky, along Sakamena River, $23^{\circ}38'S$, $44^{\circ}38'E$, fl., 10 Dec. 1988 (MO!, TAN!); *Peltier 1287*, Prov. Toliara, Behompy, rive gauche du Fiherenana, $22^{\circ}58'S$, $44^{\circ}19'E$, fl., fr., 14 Nov. 1959 (MO!, P!); *Perrier de la Bâthie 12833*, Prov. Toliara, endroits humides, environs de Tuléar, $23^{\circ}21'S$, $43^{\circ}40'E$, fl., Aug. 1919 (MO!, P!); *Phillipson 2390*, Prov. Toliara, Beza Mahafaly Reserve, near Betioky, parcelle no. 1, 140 m, $23^{\circ}40'S$, $44^{\circ}37'E$, fl., 18 Oct. 1987 (MO!, P!); *Sussman 365*, Prov. Toliara, Beza Mahafaly Reserve, 40 km NE of Betioky, Parcel #1,

near Analafaly and Antevamena, $23^{\circ}39'S$, $44^{\circ}39'E$, fl., 4 Oct. 1987 (MO!).

7. *Ehretia seyrigii* J.S. Mill., sp. nov.

Frutex vel arbor usque ad 8 m alta, ramunculis glabris vel sparsim puberulis. Folia decidua, alterna vel in fasciculos ramulis lateralibus brevibusinsidentes disposita; lamina elliptica, 1.6-4.5(-7) cm longa, 0.8-2(-4) cm lata, apice acuminata usque acuta, basi cuneata, margine integra, utrinque puberula vel glabra; petiolo 2-5(-15) mm longo. Inflorescentiae terminale, cymosae, usque ad 3 cm latae. Flores bisexualae, calyce campanulato, c. 2 mm longo, inaequaliter puberulo et margine ciliato. Fructus drupaceus, late ovoideus vel globosus, 2.5-3 mm longus; pyrenis 4, reticulatis.

TYPUS. — *Service Forestier: SF 22192 (Capuron)*, Madagascar, Prov. Toliara, bassin de la Mananadabo dans le massif de l'Analavelona, au nord du Fiherenana, 1000-1300 m, $22^{\circ}38'S$, $44^{\circ}12'E$, fr., 13-15 Dec. 1962 (holo-, P!; iso-, G!, K!, MO!, P!, TEF!).

Shrub or small tree to 8 m tall, the twigs glabrous to sparsely puberulent, often prominently lenticillate; leaves alternate or clustered on short lateral branches, deciduous; blades elliptic, the widest point at or near the middle, 1.6-4.5(-7) cm long, 0.8-2(-4) cm wide, the apex acuminate to acute, the base cuneate, the margin entire, the adaxial surface puberulent, sometimes minutely so, to glabrous or with trichomes only along the midrib, the abaxial surface puberulent or less commonly nearly glabrous, the venation brochidodromous, the midrib raised on both surfaces, the secondary veins 4-5, the tertiary venation reticulate; petioles 2-5 (-15) mm long, puberulent to glabrous, canaliculate on the adaxial surface. Inflorescences terminal, mostly on short lateral branches, cymose to 3 cm broad, the branches puberulent, the hairs all simple; flowers bisexual; calyx campanulate, 2 mm long, the 5 lobes narrowly triangular, acute to obtuse at the apex, 1.5 mm long, unevenly puberulent and ciliate on the margin; corolla white, sometimes tinged purple, tubular with reflexed to spreading lobes, 2.5-3.5 mm long, the tube 2-3 mm long, the 5 lobes lance-oblong to oblong, 2.5-3 mm long; stamens 5, prominently exerted, the filaments 4.5-6.5 mm long, the upper 2.5-4 mm free, glabrous, the anthers obloid, 1-1.3 mm long; ovary ovoid, c. 1

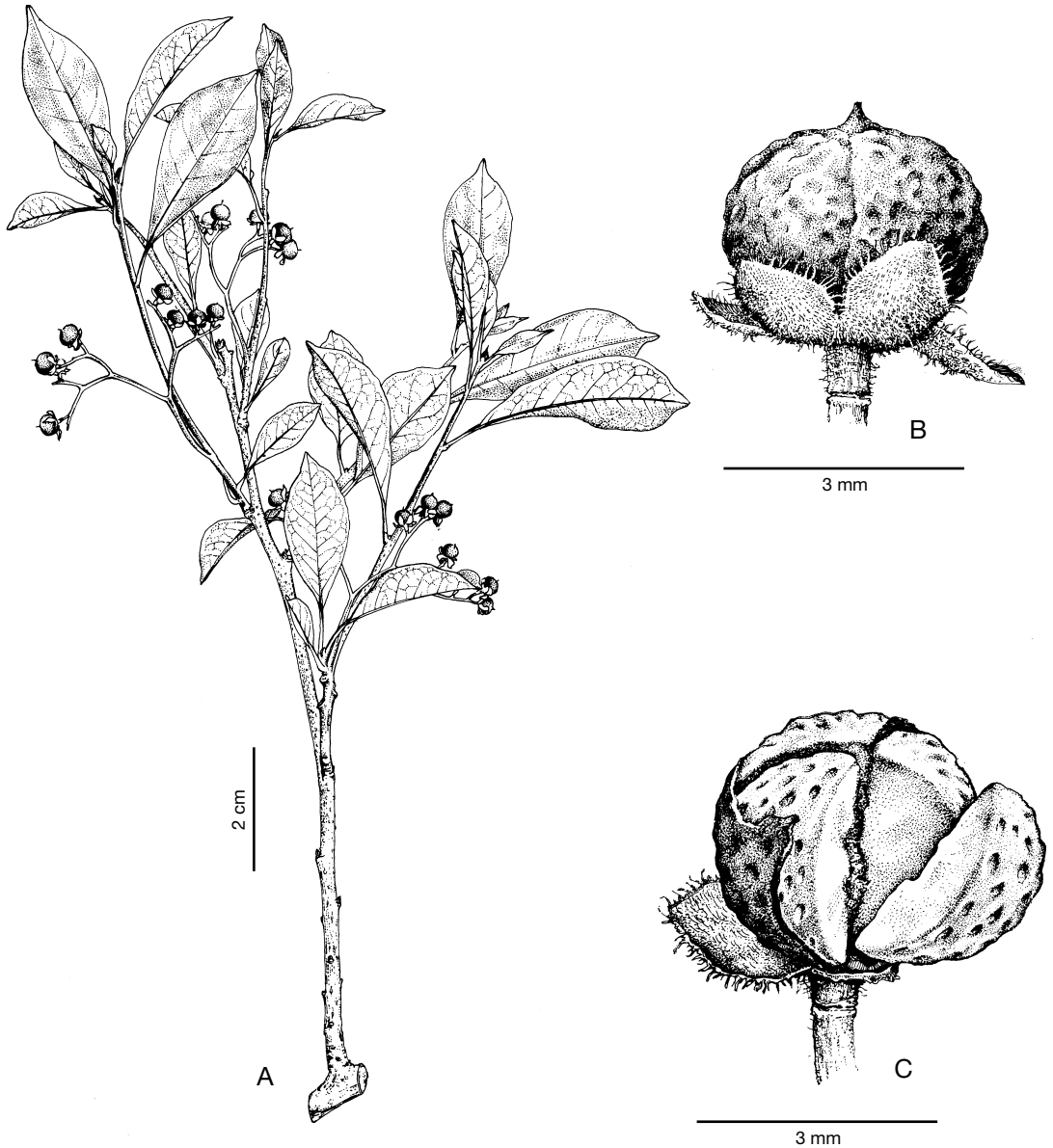


Fig 8. — *Ehretia seyrigii* J.S. Mill.: **A**, fruiting branch; **B**, mature fruit; **C**, fruit with exocarp removed to show outer surface of pyrenes. A-C, from Service Forestier: SF (Capuron) 22192 (P).

mm long, the style 2.5–4 mm long, bifid shortly or to half its length, glabrous, the 2 stigmas capitate. Fruits drupaceous, borne in the persistent calyx, yel-

low to orange at maturity, broadly ovoid to globose, 2.5–3 mm long, 3–4.5 mm wide, the endocarp bony, separating into 4 pyrenes at maturity, these

2.5–3 mm long, 1.5 mm wide, reticulate on the outer surface. — Fig. 8.

Ehretia seyrigii can be recognized from the other species of *Ehretia* in Madagascar by its elliptic leaves, widest near the middle, and simple, non-glandular pubescence of the inflorescence branches. This species is named in honor of Andre SEYRIG, who made many valuable plant collections, particularly in the region of Ampandrandava, including this species.

DISTRIBUTION. — This species is known from upland regions in southern and western Madagascar (Fig. 3).

VERNACULAR NAMES. — Betroko, Hazontaha, Manindra.

CONSERVATION STATUS. — Provisional IUCN Red List Category: Vulnerable (VU B2abi-iv). *Ehretia seyrigii* has an Extent of Occurrence of 128,000 sq. km., but this obviously overestimates its occurrence as it is known from only eight subpopulations and has an Area of Occupancy of only 1,000 sq. km. While this species has a large Extent of Occurrence, it is an upland plant and only a small percentage of that area is suitable habitat. It is recorded from two protected areas (Réserves Naturelles Namoroka and Bemaraha), but many of the southern populations are from areas that are highly deforested, and it is highly possible that these populations no longer exist.

PARATYPES. — MADAGASCAR: *Bosser 10236*, Prov. Toliara, 50 km avant Beraketa, central Sud, 24°11'S, 45°42'E, fr., Oct. 1956 (P!); *Decary 15794*, Prov. Mahajanga, dist. de Soalala, Namoroka, 16°26'S, 45°22'E, fr., 17 Sep. 1940 (MO!, P!); *Herbier du Jardin Botanique de Tananarive 5416*, Prov. Toliara, Ampotamainty-Befandriana-Baibo, 24°36'S, 46°42'E, fr., 29 Oct. 1942 (P!); *Herbier du Jardin Botanique de Tananarivo 6109* (=Seyrig 146?), Prov. Toliara, Ampandrandava, 24°05'S, 45°42'E, fl., Oct. 1943 (P!); *Humbert 11270*, Prov. Toliara, forêt de Besomaty entre le Fiherenana et l'Isahaina (Mangoky), sol sablonneux (grès), 750–800 m, 22°28'S, 44°31'E, fl., Oct. 1933 (P!); *Jongkind 3308*, Prov. Mahajanga, Bemaraha, RNI, Tsingy de Bemaraha, N of the Manambolo river, 50 m, 19°09'S, 44°49'E, fr., 1 Dec. 1996 (MO!); *Jongkind 3350*, Prov. Mahajanga, agricultural area on sandy soil near Bekopaka, 50 m, 19°09'S, 44°48'E, fl., 2 Dec. 1996 (MO!); *Réserves Naturelles: RN 10429*, Prov. Toliara, Tranomaro,

24°36'S, 46°28'E, fl., 21 Nov. 1959 (MO!, P!); *Service Forestier: SF 12085 (Rasolofoson)*, Prov. Toliara, Analavelona-Tuléar, forêt Analavelona, Mikoboka, 22°40'S, 44°10'E, fl., 25 Nov. 1954 (MO1, P!); *Service Forestier: SF 15588 (Bototsalaoendry)*, Prov. Toliara, Analavelona-Tuléar, 22°40'S, 44°10'E, fr., 10 Dec. 1955 (P!); *Seyrig 146*, Prov. Toliara, Ampandrandava (entre Bekily et Tsivory), 1000 m, 24°05'S, 45°42'E, fl., Oct. 1942 (P!); *Seyrig 146B*, Prov. Toliara, Ampandrandava (entre Bekily et Tsivory), 24°05'S, 45°42'E, fl., Nov. 1942 (P!); *Seyrig 146C*, Prov. Toliara, Ampandrandava (entre Bekily et Tsivory), 24°05'S, 45°42'E, fl., Dec. 1943 (P!); *Seyrig 796*, Prov. Toliara, Ampandrandava (entre Bekily et Tsivory), 1000 m, 24°05'S, 45°42'E, fl., Dec. 1943 (MO!, P!).

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