THE GENUS *CAMPOMANESIA* (MYRTACEAE) IN ATLANTIC RAINFOREST FRAGMENTS IN SERGIPE, NORTHEAST REGION OF BRAZIL

Myrna F. Landim[1]

Departamento de Biologia
Universidade Federal de Sergipe
49100-000, São Cristóvão, SE, BRAZIL
mlandim@ufs.br

Leslie R. Landrum

Department of Plant Biology
Arizona State University
Tempe, AZ 85287-1601, U.S.A.
les.landrum@asu.edu

ABSTRACT

The Atlantic forest is one of the ecosystems of Brazil that has suffered the greatest destruction and it is still imperiled, especially in the Northeast. Sergipe is one of the states where the Atlantic forest has been most greatly reduced, but it still has some fragments varying in size and degree of conservation. Despite their importance, botanical studies within these fragments are still greatly needed. In this paper we report for the first time the occurrence of four species of *Campomanesia* in Sergipe: *C. aromatica*, *C. dichotoma*, *C. guaviroba*, and *C. viatoris*. The last, formally thought to be known from only two collections from Alagoas, has a relatively wide distribution in Sergipe, and is found in forest and restinga areas of different districts. *Campomanesia guaviroba* is reported for the first time from the Northeast of Brazil. We hope that studies on the composition of these remnants may contribute to the local preservation of this ecosystem and help future programs of forest restoration. We emphasize the need for a greater collecting effort, more studies on plant taxonomy, and the training of new specialists.

RESUMO

A mata atlântica é um dos ecossistemas brasileiros mais destruídos e ainda hoje ameaçado, sendo a sua devastação mais pronunciada no Nordeste do Brasil. Um dos estados com menor área de mata atlântica, Sergipe apresenta ainda hoje alguns fragmentos florestais com tamanho e grau de conservação variáveis. Apesar de sua importância, os estudos botânicos nesses fragmentos são ainda insuficientes. Nesse trabalho registra-se a ocorrência inédita de quatro espécies de *Campomanesia* em Sergipe: *C. aromatica*, *C. dichotoma*, *C. guaviroba* e *C. viatoris*. Esta última, anteriormente conhecida apenas por duas coletas, ambas em Alagoas, apresenta uma distribuição relativamente ampla no Estado, sendo encontrada em áreas de mata e restinga de diversos municípios. Registra-se, ainda, a ocorrência de *C. guaviroba* pela primeira vez na região Nordeste. Espera-se que estudos sobre a composição desses fragmentos possam contribuir para a preservação desse ecossistema a nível regional e subsidiar programas futuros de recomposição florestal. Salienta-se a necessidade de um esforço de coletas mais intenso, de mais estudos sistemáticos e da formação de novos especialistas.

KEY WORDS: *Campomanesia*, Myrtaceae, Sergipe, Atlantic rainforest fragments

INTRODUCTION

The objective of this note is to report the occurrence in Sergipe, Brazil of four species of *Campomanesia* Ruiz et Pavón (Myrtaceae), usually known locally as "guabirobas" or a variant of this name (e.g., guavirobas, gobiraba, gabiroba). None

[1] Universitat Bremen, UFT-AG Heyser, D-28359, Bremen, GERMANY. Email: landim@uni-bremen.de

of these species, nor any other species of *Campomanesia*, was known for Sergipe when Landrum (1986) monographed the genus, and one species (*C. guaviroba*) has not been reported before in Brazil's Northeast region (Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe, Bahia). The fact that recent floristic exploration can reveal so much is an indication of the importance of continuing efforts in this field.

Despite the great biological diversity of the Brazilian coastal forests, little of its original cover still persists. At the time of the European discovery such forest covered about 1,000,000 km^2 of Brazil, while today its area has been reduced to an estimated 5% (Consórcio Mata Atlântica 1992), 6% (Prance et al. 2000), or 8% (INPE and IBAMA 1990) of its original size. In spite of being protected by law, destruction of coastal forest still continues. The remaining areas consist of fragments varying in size and degree of conservation and are "typically small, isolated and highly disturbed" (Viana et al. 1997). Ranta et al. (1998) recently studied the degree of fragmentation in the Northeast Atlantic forest of Brazil, and emphasize the importance of fragment size and shape for the long-term survival of biodiversity. Smaller fragments and more irregularly shaped fragments have a higher proportion of their areas in edges, which are more vulnerable to plant extinction. Because fragmentation in Sergipe has progressed so far, extinction is more imminent.

The historical pattern of almost complete elimination of the native forest covering in Brazil's Northeast is explained by the relative gentle relief of the landscape and ease of access to all areas. Farther south, the mountainous terrain of the Serra do Mar makes access more difficult, and thus greater portions of Atlantic rainforests there are relatively protected. Sergipe, the smallest of the Brazilian states, originally had about 41% its area covered by forests (Campos 1912), but its forest covering today is estimated to be less than 1%. For this reason, Sergipe has been excluded in some mappings of the remnants of Atlantic forest carried out at the national level. However, floristic surveys in areas of Atlantic forest in the state (Landim et al. 1998) have shown it to be a forest with unique floristic and structural characteristics. Additional studies are urgently needed that contribute to knowledge of the forest's composition, structure and dynamics, with the aim being a knowledge base for reforestation initiatives.

The family Myrtaceae is mainly a tropical and subtropical family (Heywood 1993), with about 3500 species and approximately 100 genera, with two main centers of development: tropical America and Australasia (Barroso et al. 1991). It is a family of great importance in the neotropical forests, being one of the dominant families in Atlantic coastal forest (Barroso & Peron 1994; Leitão-Filho 1993; Mori et al. 1983; Peixoto & Gentry 1990; Reitz et al. 1978). In a study of Atlantic forest in São Paulo, Mantovani (1993) found 38 tree species of Myrtaceae (21% of the total). He considers Myrtaceae to be "the most character-

istic family of arboreal species of Atlantic forest in the south coast of the State of São Paulo, with floristic and structural importance."

In general, species of Myrtaceae are quite common in the Atlantic forest areas of the Northeast, (Siqueira 1994), and this has proved to be true the fragments studied in Sergipe. In a phytosociological study in the Mata do Crasto, in the Municipality of Santa Luzia do Itanhy (Landim et al. 1998), this family accounted for 10.3% of the sampled trees, and was the sixth in basal area, and fifth in importance value index (I.V.I.).

Voucher specimens of collections described below are deposited in the herbaria of the Department of Biology of the Federal University of Sergipe (ASE), the University of Brasília (UB), and Arizona State University (ASU).

RESULTS

Description of *Campomanesia*

Campomanesia can be distinguished from other genera of Myrtaceae by: **1)** ovary with (3–)4–18 locules (Fig. 1D); **2)** ovules several per locule, biseriate, all or all but one aborting in each locule; **3)** locule-wall in the mature fruit chartaceous to slightly woody, strongly glandular, serving as a false seed coat (Fig. 1C). In Sergipe, *Campomanesia* can be distinguished from most other genera of Myrtaceae when in flower by its 5-merous flowers and inflorescences of solitary flowers or dichasia. *Psidium* L. and *Calycolpus* O. Berg can be confused with *Campomanesia* in flowering specimens but generally have coriaceous leaves, whereas *Campomanesia* usually has submembranous to membranous leaves.

Campomanesia is quite distinctive in fruit. There seem to be several seeds in each fruit arranged in a ring, each with a glandular covering (Fig. 1D). However, each of these "seeds" is a locule, and usually only some of them have a seed inside. In others the ovules have all aborted. Other genera of Myrtaceae either have few seeds (e.g., 1 or 2 in *Myrcia*, *Eugenia*, or *Calyptranthes*) or the seeds are numerous and hard (e.g., *Psidium*, *Calycolpus*). In no other American genus of Myrtaceae do the seeds have a glandular covering.

The bark of the trunk of *Campomanesia* is usually rough with numerous narrow, papery plates, unlike most other genera that have smooth to scaly bark. The lateral veins of the leaves are generally prominent and broadly arch near the margin and the smaller veins often show an intricate reticulate pattern (Fig. 2).

KEY TO THE SPECIES OF *CAMPOMANESIA* IN SERGIPE

1. Calyx nearly closed in bud; inflorescence a dichasium with peduncle 2–6 cm long _____ **Campomanesia dichotoma**

1. Calyx open in bud; inflorescence uniflorous or a dichasium with peduncle up to 2 cm long.
   2. Hypanthium attenuate at base, constricted near apex; anthers 1–2 mm long _____ **Campomanesia viatoris**

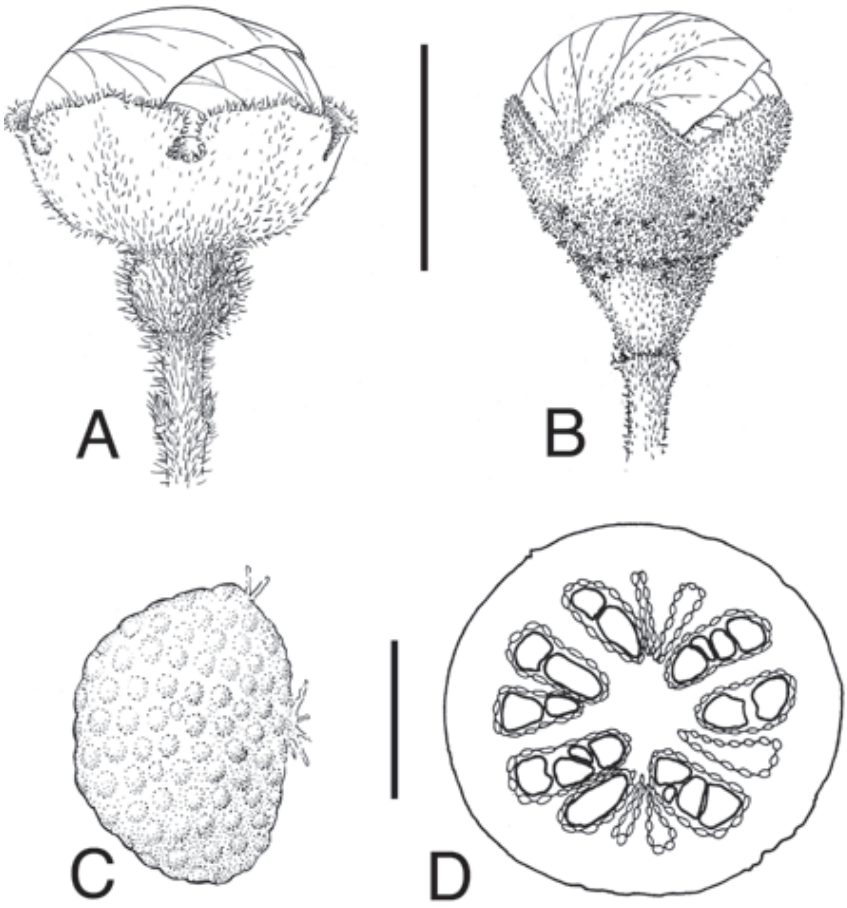

Fig. 1. A, Flower bud of *Campomanesia viatoris*. B, Flower bud of *C. guaviroba*. C, Locule containing a seed showing the glandular locular wall that serves as a false seed coat. D, Cross section of a fruit having 13 locules, each with a glandular wall, but only 8 of which contain seeds. Because the embryos are spiral in form, in section they may be cut in more than one place. Upper bar = 5 mm for A & B. Lower bar = 4 mm for C and 10 mm for D.

2. Hypanthium neither attenuate at base nor constricted near apex; anthers 0.5–1 mm long.
   3. Calyx-lobes hemiorbicular to oblong-truncate, 0.7–2.5 times as long as wide; leaves immature at anthesis; fruit black _____ **Campomanesia aromatica**
   3. Calyx-lobes broadly triangular or broadly rounded, 0.4–0.9 times as long as wide; leaves mature at anthesis; fruit yellow or orangish ____ **Campomanesia guaviroba**

Campomanesia aromatica (Aubl.) Grisebach

Shrub or tree 2–20 m high; leaves immature at anthesis, elliptic, ovate, lanceolate,

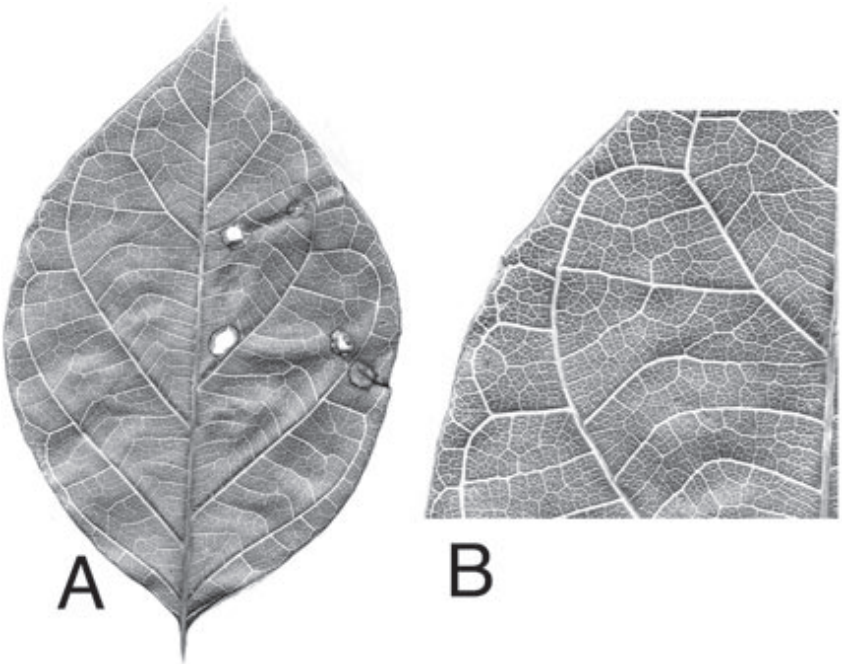

Fig. 2. A, typical leaf of *Campomanesia guabiroba* showing its venation pattern (blade 9 cm long). B, magnified view of portion of same leaf showing detail of venation (*Landrum 2490*, ASU).

or oblanceolate, 4–12(–15) cm long, 2–4(–7.5) cm wide, 1.7–4 times as long as wide; peduncles 0.3–2.6 cm long, uniflorous; bracteoles 1–4 mm long; calyx-lobes hemiorbicular to oblong-truncate, 2–4.3 mm long; hypanthium obconic to campanulate, 1.5–2.5 mm long; stamens 80–90, 4–7 mm long; anthers 0.5–0.8 mm long; ovary 4–6-locular; ovules 4–7 per locule; fruits ca. 1 cm long, black.

Specimens examined. **Mun. Salgado:** Capoeira de mata subperenifólia, 18 Dec 1981, *G.N. Silva 39* (ASE). **Mun. Lagarto:** Caatinga hipoxerófila, 7 May 1982, E. *Carneiro 374* (ASE). **Mun. Itabajana:** Capoeira de caatinga hipoxerófila, 20 Jul 1988, *M. Fonseca 857* (ASE). **Mun. Sta. Luzia do Itanhy:** Mata Atlântica, Mata do Crasto, 3 May 1995, *M. Landim 354* (ASE, ASU, UB).

Although species of *Campomanesia* are usually known locally as "gabiroba" or variations of this name, a specimen collected in the caatinga region was called "cadeia brava."

In his revision of this genus, Landrum (1986) cited only a few collections of *C. aromatica* in the Northeast, namely in the states of Maranhão, Ceará, Rio Grande do Norte, Paraíba and Bahia. The species also occurs in Bolivia (Landrum 1986), an interesting disjunction of over 2000 km. In the present study, it has

been found in areas of coastal forest (Mata Atlantica) as well as caatinga, a shrubby vegetation of dry areas. A greater sampling effort is needed to better understand the distribution of this species.

Campomanesia dichotoma (O. Berg) J.R. Mattos
Shrub or tree up to 10 m high; leaves mature at anthesis, elliptic, elliptic-oblong, ovate or suborbicular, 3–9.5 cm long, 1.5–6 cm wide, 1–2.3 times as long as wide; peduncles 2–6 cm long, bearing 3–15 flowered dichasia; bracteoles ca. 2 mm long; calyx nearly closed in the bud, the calyx-lobes 1–2 mm long, the calyx tearing between the lobes at anthesis; hypanthium (including closed calyx) 5–8 mm long; stamens 200–350, 3–10 mm long; anthers 0.8–1 mm long; ovary 6–10-locular; ovules 7–18 per locule; fruits ca. 1 cm long.

Specimens examined: **Mun. Santa Luzia do Itanhy:** Mata Atlântica, Mata do Crasto, 19 Apr 1995, *M. Landim 333* (ASE, UB), 3 May 1995, *M. Landim 356* (ASE, ASU, UB), 12 Jun 1995, *M. Landim 406* (ASE, ASU, UB), 24 May 1996, *M. Landim and V.M. Schettino 920* (ASE, ASU).

The common name "bacalhau" is used for this species as well as the more common generic designation of "gobiraba."

Campomanesia dichotoma is known from the coastal region of the Northeast of Brazil and the state of Rio de Janeiro (Landrum 1986). So far in Sergipe, examples have been found in only one fragment of Atlantic coastal forest.

Campomanesia guaviroba (A.P. de Candolle) Kiaerskou
Tree up to ca. 12 m high; leaves mature at anthesis, mainly elliptic, less often ovate, lanceolate, suborbicular, or ovate, 4–13 cm long, 1.7–8 cm wide, 1.4–3 times as long as wide; peduncle 0.3–2.5 cm long, uniflorous; bracteoles ca. 4 mm long; calyx-lobes broadly triangular or rounded, 1.5–3 mm long; hypanthium obconic to campanulate, 4–6 mm long; stamens 250–500, 3–9 mm long; anthers 0.5–1 mm long; ovary 7–14-locular; ovules 13–20 per locule; fruit 1–3.5 cm long, yellow or orangish. (Fig. 1 B).

Specimens examined. **Mun. Santa Luzia do Itanhy:** Mata Atlântica, Mata do Crasto, 3 May 1995, *M. Landim 346* (ASE, UB), 25 Apr 1996, *M. Landim 906* (ASE, ASU).

Until recently *Campomanesia guaviroba* was known only from Brazil's Atlantic forest from Espirito Santo to Rio Grande do Sul and adjacent Argentina and Paraguay (Landrum 1986). The collections cited above extend the range far to the north (ca. 1200 km) and are the only ones known to us from the Northeast of Brazil. Recently a collection has extended the known range to Bolivia [Santa Cruz, Velasco Province, Parque Nacional Noel Kempff Mercado, 5 km S del campamento Las Gamas (14º48'14"S, 60º23'59"W), 850 m, *A Rodriguez & J. Surubi' 558* (ASU)]. It thus has a disjunct distribution similar to that of *C. aromatica*.

In one area of São Paulo (Mantovani 1993) this species was represented by only two individuals, having an I.V.I of 0.58. Apparently rare, it was not found in the forest gap areas in the same study, although other Myrtaceae were, e.g.,

Eugenia, *Marlieria*, *Calyptranthes*, *Myrcia* and *Gomidesia*. This may mean that it is less tolerant of disturbance (anthropogenic or not) and thus is at a higher risk of going extinct through habitat disturbance and fragmentation.

Campomanesia viatoris Landrum

Shrub or tree to ca. 12 m high; leaves mature at anthesis, elliptic to ovate, 3–13 cm long, 2–6.5 cm wide, 1.5–2 times as long as wide; peduncle 0.5–2 cm long, uniflorous or bearing a 3-flowered dichasium; bracteoles ca. 3 mm long; calyx-lobes truncate-auriculate, 1–3 mm long; hypanthium 8–10 mm long, attenuate at base, constricted near summit of ovary; stamens ca. 300, 4–8 mm long; anthers ca. 1–2 mm long; ovary 7–8-locular; ovules 11–16 per locule; fruit globose except for an attenuate base, up to ca. 2.5 cm in diameter. (Fig. 1 A).

Specimens examined. **Mun. Sto Amaro das Brotas:** restinga, 10 Dec 1981, *G. Viana 294* (ASE). **Mun. São Cristóvão:** restinga, 21 Mar 1985, *G. Viana 1112* (ASE). **Mun. Pirambu:** Reserva Biológica Santa Isabel, dunas no km 11 de praia na direção de Ponta dos Mangues, 28 Jan 1992, *C. Farney et al. 2944* (ASU). **Mun. Santa Luzia do Itanhy:** cerca de 2.5 km do Distrito de Crasto, na estrada para Sta. Luzia do Itanhy, 27 Nov 1993, *A.M.A. Amorim et al. 1500* (ASU); Mata Atlântica, 7 Apr 1995, *M. Landim 282* (ASE, ASU, UB), 3 May 1995, *M. Landim 355* (ASE, ASU, UB), 5 Jul 1995, *M. Landim 456* (ASE, ASU, UB); Mata Atlântica, Mata do Crasto, 7 Apr 1995, *M. Landim 285* (ASE, ASU, UB), 16 Dec 1996, *M. Landim 1108* (ASE, ASU). **Mun. São Cristóvão:** restinga, 9 Apr 1996, *M. Landim 904* (ASE, ASU). **Mun. Areia Branca:** Mata, Serra de Itabaiana, 28 Mar 1997, *A. Vicente* 7 (ASE).

The common names for this species are "guabiraba," "gabiroba," "gabirobinha," "gobirabinha," and "gobiraba."

Until recently only two collections for this species were known, the type and one other, both from Alagoas (Landrum 1986). The type was collected by Gardner over 150 years ago and the additional specimen has no date. Since the species was thought to be extinct or near extinction, Landrum (1986) urged botanists in Alagoas to search for this rare species. The collections cited above from Sergipe indicate that *Campomanesia viatoris* is at least locally common in the state and additional specimens have also been found in Bahia. [e.g., Mun. Apora, 31 km S of Olindina along highway BR-116, 310 m, 1 Apr 1976, *G. Davidse et al. 11758* (ASU)].

The anthers of *Campomanesia viatoris* anthers are unusually elongate and similar to those of *C. laurifolia*. This unusual shared anther morphology may indicate an interesting pollination mechanism deserving more careful study.

DISCUSSION

Phytogeographic analysis of species of Myrtaceae is greatly hampered by the difficulty in identifying material, due to the fact that American species of Myrtaceae often are very similar in the majority of their characters (McVaugh 1968), and because of the cryptic nature of the characters used to identify the genera (Landrum and Kawasaki 1997). Some floristic and/or phytosociological studies list great numbers of species or individuals of Myrtaceae, but authors often are unable to identify them to species or genus (e.g., Guedes 1992). In

a study of the flora of Atlantic rainforest, Myrtaceae are cited as the family with the greatest number of unknown specimens (Siqueira 1994).

Ecological studies of the Northeast of Brazil will require many more specialists to identify the great number of collections unknown to species, genus, or even family (Siqueira, 1994). Three conditions need to be improved: **1)** there needs to be more collecting in general as this paper demonstrates; **2)** monographers must study the flora of the Northeast and include specimens from the regional herbaria; and **3)** there should be a greater investment in training more specialists.

The absence of reports of *Campomanesia* in Sergipe in Landrum's 1986 revision of the genus reflects the low sampling effort in the state until recently. It is still difficult to describe the distribution of the species in the state because they are known from so few collections. The present study indicates the existence of a flora that is still relatively unknown in the fragments of Atlantic rainforest in Sergipe and indicates the importance of the exploration and conservation of these areas.

The sympatric occurrence of these four *Campomanesia* species in one fragment, the Mata do Crasto, in Santa Luzia do Itanhy, a coastal region in the south of the Sergipe, provides opportunities for more studies. These might involve the identification of possible differences between these four species in flowering and fruiting phenology, pollinators and fruit predators, and reproductive isolating mechanisms that may have led to speciation.

Finally, it is worth noting that even in regions with forest coverings insufficient to be registered in some national surveys, such as Sergipe, the forest remnants that do exist are the last representatives of an entire ecosystem, including plants, animals, fungi, and micro-organisms. These fragments, mostly of medium to small size, are the best possible estimation of the original ecosystem that will ever be available. Studies on the composition of these fragments can contribute to the preservation of that ecosystem at the regional level and will be useful for future reforestation programs. In order to avoid the drastic loss of large portions of biodiversity, the establishment of reserves is necessary, at least for some of these fragments, and conservation management that includes corridors between fragments as well as the involvement of neighboring human communities in this process is desirable

ACKNOWLEDGMENTS

Reviewers R. Schmid and N. Snow offered many helpful suggestions for which we are quite grateful.

REFERENCES

Barroso, G.M., A.L. Peixoto, C.F.L. Ichaso, C.G. Costa, E.F. Guimarães, and H.C. Lima. 1991. Sistemática de angiospermas do Brasil. Vol. 2. Universidade Federal de Viçosa, Viçosa.

Barroso, G.M. and V. Peron. 1994. Myrtaceae. In: M. P. M. Lima and R. R. Guedes-Bruni, orgs. Reserva ecológica de Macaé de Cima, Nova Friburgo, RJ. Aspectos florísticos das espécies vasculares., Vol. 1. Pp. 261–302.

Campos, G. 1912. Mappa florestal. Rio de Janeiro, Serviço Geológico e Mineralógico do Brasil. Consórcio Mata Atlântica/UNICAMP, 1992. Reserva da Biosfera da Mata Atlântica: Plano de Ação. Referências básicas, 1. Campinas.

Guedes, M.L.S. 1992. Estudo florístico e fitossociológico de um trecho da Reserva ecológica da Mata de Dois Irmãos Recife – Pernambuco. Tese de Mestrado, Universidade Federal Rural de Pernambuco, Recife.

Heywood, V.H. (ed.) 1983. Flowering plants of the world. Oxford University Press, New York.

Inpe (Instituto Nacional de Pesquisas Espaciais) and Ibama (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis) 1990. Atlas dos remanescentes florestais do domínio da Mata Atlântica. A web based version is available at http://www.sosmatatlantica.org.br/atlas2001/index.asp.

Landim, M.F., D.M. Santos, C.S. Amaral, and M.M. Maia. 1998. Fitossociologia de um remanescente de mata atlântica em Sergipe, Mata do Crasto. XLIX Congresso Nacional de Botânica. Sociedade Botânica do Brasil, Salvador. Resumos.

Landrum, L.R. 1986. *Campomanesia*, *Pimenta*, *Blepharocalyx*, *Legrandia*, *Acca*, *Myrrhinium*, und *Luma* (Myrtaceae). Fl. Neotrop., Monogr. 45. The New York Botanical Garden, New York.

Landrum, L.R. and M.L. Kawasaki. 1997. The genera of Myrtaceae in Brazil: an illustrated synoptic treatment and identification keys. Brittonia 49:508–536.

Leitão-Filho, H.F. (org.). 1993. Ecologia da Mata Atlântica de Cubatão (SP). Editoras UNESP/UNICAMP.

McVaugh, R. 1968. The genera of American Myrtaceae–an interim report. Taxon 17:354–418.

Mantovani, W. 1993. Estrutura e dinâmica da floresta atlântica na Juréia, Iguape–SP. Tese de Livre Docência. Universidade de São Paulo, Instituto de Biociências, São Paulo.

Mori, S. A., B.M. Boom, A.M. Carvalho, and T.S. Santos. 1983. Ecological importance of Myrtaceae in an eastern Brazilian wet forest. Biotropica 15:68–70.

Peixoto, A.L. and A. Gentry. 1990. Diversidade e composição florística da mata de tabuleiro na Reserva Florestal de Linhares (Espírito Santo, Brasil). Revista Brasil. Bot. 13:19–25.

Prance, G.T., H. Beentje, J. Dransfield, and R. Johns. 2000. The tropical flora remains undercollected. Ann. Missouri Bot. Gard. 87: 67–71.

Ranta, P., T. Blom, J. Niemelä, E. Joensuu, and M. Siitonen. 1998. The fragmented Atlantic rain forest of Brazil: size, shape and distribution of forest fragments. Biodiversity and Conservation 7:385–403.

Reitz, R., R.M. Klein, and A. Reis. 1978. Projeto madeira de Santa Catarina. Sellowia 30(28–30):1–320.

Siqueira, M.F. 1994. Análise florística e ordenação de espécies arbóreas da mata atlântica através de dados binários. Tese de mestrado, Universidade Federal de Campinas, Campinas.

Viana, V.M., A.A.J. Tabanez, and J.L.F. Batista. 1997. Dynamics and restoration of forest fragments in the Brazilian Atlantic moist forests. In: W.F. Laurance and R.O. Bierregard, eds. Tropical Forest Remnants—Ecology, Management, and Conservation of Fragmented Communities. University of Chicago Press, Chicago, IL. Pp. 351–365.