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How many species change names in a germplasm bank? Study of the Anhembi Experimental Station eucalypt germplasm bank and practical implications

Quantas espécies mudam de nome em um banco de germoplasma? Estudo do banco de germoplasma de eucalipto da Estação Experimental de Anhembi e implicações práticas

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Abstract

Eucalypts are a long-cycle crop that have been introduced in Brazil during several decades. The germplasm banks of the country make available several populations whose botanical classifications are somewhat outdated since these classifications have been subject to several modifications over the years. This study outlines a review of species with outdated classifications in the Anhembi Experimental Station of Forest Sciences (ESALQ/USP), one of Brazil's main eucalypt germplasm banks and discusses the possible implications for the breeding programs that use said germplasm. In this survey, we found records that indicate introductions were made of populations of 20 eucalypts species. However, this number has increased according to the most recent update of botanical classifications, and the Anhembi Germplasm Bank has currently 22 species after a few species were reclassified. Furthermore, a major change has been the reclassification of some species from the genus *Eucalyptus* to the genus *Corymbia.* One original introduction, *Eucalyptus maculata,* is now considered to be (according to original provenances), *Corymbia maculata* and *C. variegata*. One species originally introduced as *E. pellita* has been renamed *E. scias*; *E. pellita* still exists in north Queensland, Australia and Papua New Guinea, while *E. scias* has a much smaller southerly distribution in New South Wales, Australia. Similarly, an introduction of *E. phaeotricha* is now generally considered to be *E. tindaliae,* and an introduction of *E. resinifera* is now considered to be *E. macta* (according to the provenance area of the introduction). The confusing classification of the species is aggravated, in some cases, by the lack of detailed studies that allow comparing the species introduced with the same name, regarding wood productivity, tolerance and/or traits that are fundamental for defining the species to be introduced or worked on by the breeding programs.

Keywords: *Eucalyptus*; *Corymbia*; Taxonomy changes.

Resumo

O eucalipto é uma cultura de ciclo longo que foi introduzida no Brasil há décadas. Os bancos de germoplasma do país têm várias populações disponíveis cujas classificações botânicas estão um tanto desatualizadas, uma vez que essas classificações foram sujeitas a várias modificações ao longo dos anos. Este estudo apresenta uma revisão das espécies com classificações desatualizadas na Estação

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Experimental de Ciências Florestais de Anhembi (ESALQ/USP), um dos principais bancos de germoplasma de eucalipto do Brasil, e discute as possíveis implicações para os programas de melhoramento que utilizam esse germoplasma. Nesta pesquisa, encontramos registros que indicam a introdução de populações de 20 espécies. No entanto, esse número aumentou de acordo com a atualização mais recente das classificações botânicas, e o Banco de Germoplasma de Anhembi atualmente possui 22 espécies, após algumas espécies terem sido reclassificadas. Além disso, uma mudança importante foi a reclassificação de algumas espécies do gênero *Eucalyptus* para o gênero *Corymbia*. Um exemplo é a introdução do *Eucalyptus maculata*, agora é considerada (de acordo com as procedências originais) *Corymbia maculata* ou *C. variegata*. Um material originalmente introduzido como *E. pellita* foi renomeado *E. scias. E. pellita* é do norte de Queensland, Austrália, e Papua-Nova Guiné, enquanto *E. scias* tem uma distribuição muito menor no sul de New South Wales, Austrália. Da mesma forma, o *E. phaeotricha* introduzido na estação agora é considerado o *E. tindaliae*, e o *E. resinifera* agora é considerado como *E. macta* (devido à procedência da introdução). A classificação incorreta das espécies é agravada, em alguns casos, pela falta de estudos que detalhem as procedências utilizadas, o que não permite a correção das mudanças taxonômicas que possam ocorrer, dificultando assim a obtenção de informações sobre produtividade da madeira, tolerância e/ou características fundamentais para definir as espécies a serem introduzidas ou trabalhadas pelos programas de melhoramento

Palavras-chave: *Eucalyptus*; *Corymbia*; Mudanças taxonômicas.

INTRODUCTION

Taxonomy or systematics is the botanical field that deals with the description, identification, nomenclature and classification of plants, starting with four basic groups (bryophytes, pteridophytes, gymnosperms, and angiosperms), and reaching the subspecies level. It is noteworthy that this classification is based on morphological and physiological traits, natural geographic distribution, and phylogeny of plant species (Scanavaca Júnior & Garcia, 2021).

In the case of the genus *Eucalyptus*, the species of greatest commercial interest in Brazil belong to the sections *Exsertaria* (*E. brassiana, E. camaldulensis,* and *E. tereticornis*), *Latoangulatae* (*E. grandis, E. pellita, E. saligna,* and *E. urophylla*) and *Maidenaria* (*E. benthamii, E. badjensis, E. dunnii, E. globulus, E. nitens, E. smithii,* and *E. viminalis*) (Nicolle, 2021) within the subgenus *Symphyomyrtus.* This group of species possesses different tolerances to biotic and abiotic stresses, making them suitable for planting in a wide range of environments (Rezende et al., 2014; Scanavaca Júnior & Garcia, 2021); though all are capable of high growth rates in conditions where there is sufficient soil depth and rainfall. Additionally, according to Rezende et al. (2014), several companies in the Brazilian productive sector have also shown more recent interest in species of the genus *Corymbia*, subgenus *Blakella* and section *Maculatae* including species such as *C. citriodora, C. maculata* and *C. variegata* (all members of the spotted gum species complex); as well as *C. torelliana* of the section *Torellianae* (Nicolle, 2021). Therefore, sections and species must also be considered when elaborating the strategy of breeding programs, aiming at complementing the traits of interest (Fonseca et al., 2010). Furthermore, the correct choice of provenance within the species is critical to the success of breeding programs (Eldridge et al., 1993). Additionally, many species are capable of hybridization if they are closely enough related (for example numerous species combinations within the subgenus *Symphyomyrtus* and among the aforementioned spotted gums and other *Corymbia* species, but not between genera or subgenera). Hybridization can capitalize on complementary traits of different species, origins or a single individual (Lee et al., 2005; Lee, 2007; Resende & Assis, 2008). Some of the world's most widely planted eucalypt taxa are hybrids including hybrids involving *E. grandis*, *E. camaldulensis*, *E. urophylla*, *E. tereticornis*, "*urograndis*" (*E. urophylla* x *grandis*); the latter being a key commercial taxon in Brazil.

Since eucalypts are very long-lived organisms, many populations that have been introduced to Brazil many decades ago are still of practical use in breeding and selection. However, the material in these germplasm banks is now likely or is known to have outdated botanical classifications; as the eucalypt classification has undergone several changes over the years (Brooker, 2000; Hill & Johnson, 1995, 2000; Nicolle & Jones, 2018). This aspect may hinder achieving the goals of the breeding programs, because many times the decision on which material should be included in breeding programs is dependent on previous knowledge of the

species and information by published literature from elsewhere in the world. If the nomenclature in records of species adaptability and performance does not match the labelling in the gene banks, then incorrect selections are very likely to result.

In this context, the aim of this study is to assess the accuracy of classifying populations of eucalypts' species planted at the Anhembi Experimental Station, one of the main eucalypt germplasm banks. We discuss the possible implications for the breeding programs that have used or will use the germplasm in future and suggest corrective actions where necessary.

MATERIAL AND METHODS

The Anhembi Experimental Station belongs to the Department of Forest Sciences of the College of Agriculture Luiz de Queiroz of the University of São Paulo (Esalq/USP). The station is located at Anhembi, SP, at 22º40' S latitude and 48º10' W longitude, and 455 m altitude. The flat topography has two soil types, Latosol and Quartzarenic Neosol. According to the Köppen-Geiger classification, the climate in the area is classified as Cwa, with a dry and warm winter and hot and humid summer. The estimated minimum and maximum temperatures are 23.5 and 34 ºC with 1,100 mm average annual rainfall, while frosts are rare.

To conduct this study, all the populations of the species of the genera *Corymbia* and *Eucalyptus* in the station's collection since the 1970s were compiled and listed. Following this, the classification of the species at the time of introduction was compared with the current classification of Nicolle (2021). This comparison was conducted for each population that carried a correct germplasm identification, including the place of collection (provenance) of the seeds.

RESULTS

We identified 87 populations with 20 eucalypt taxa according to the botanical classification used at the time of their introduction. Observed were changes at the level of Genera/Subgenera, species classification and at the level of subspecies (Table 1).

Table 1. Populations of species of the genus *Corymbia* and *Eucalyptus* in the Anhembi Experimental Station, in Anhembi, São Paulo, Brazil.

Species	Populations	Establishment date at Anhembi Station	Species taxonomic change
Corymbia	**16**		
citriodora	10	1/6/1980	Yes*
maculata/variegata	2	15/3/1982	Yes, in one population.
nesophila	1	15/3/2006	Yes*
torelliana	3	15/8/1979	Yes*
Eucalyptus	**71**		
camaldulensis	7	15/6/1980	Yes**
cloeziana	5	16/6/1980	No
deglupta	1	15/7/2005	No
dunnii	2	15/10/1978	No
grandis	13	15/11/1976	No
microcorys	2	15/6/1982	No
paniculata	2	15/8/1979	No
pellita/scias	4	15/3/1982	Yes, inserted origin.
phaeotrica/tindaliae	1	15/6/1982	Yes
pilularis	3	15/3/1982	No
propinqua	2	15/8/1978	No
pyrocarpa	1	15/6/1982	No
resinifera/macta	1	15/2/1987	Yes
saligna	1	15/7/1998	No
tereticornis	3	15/6/1980	No
urophylla	23	15/5/1977	No
Total	**87**	-	-

* Changes at the level of Genera/Subgenera; ** Several changes at the level of subspecies (McDonald et al., 2009).

Older studies categorized the *Eucalyptus camaldulensis* into just two subspecies: *camaldulensis* and *simulata*. The current classification has expanded the number, totaling seven subspecies (Nicolle, 2021):

- *acuta:* found in the states of Queensland and New South Wales (river red gum);
- *arida:* found in Western Australia, Northern Territory, Queensland, South Australia, and New South Wales (Centralian river red gum);
- *camaldulensis:* found in Victoria, New South Wales, South Australia, and Queensland (river red gum);
- *minima:* found in South Australia (Flinders Ranges river red gum);
- *obtusa:* found in Queensland, Northern Territory, and Western Australia (northern river red gum);
- *refulgens:* found in Western Australia (shiny-leaved river red gum);
- *simulata:* found in Queensland (Laura red gum).

DISCUSSION

In the present survey, we identified populations of 20 eucalypt taxa according to the botanical classification used at the time of their introduction. However, on application of the Nicolle (2021) taxonomy, this number rose slightly to 22 taxa.

Classification divergences were observed for four existing species at Anhembi Station. The most significant, but easily corrected change was the introduction of the genus *Corymbia* (Hill & Johnson, 1995). Another finding within the genus *Corymbia* was the introduction of two populations, both classified as *Eucalyptus maculata* at the time of introduction; but in the current classification, one of the populations has been reclassified as *Corymbia variegata* while the other remained as *Corymbia maculata*.

Two other species have undergone taxonomic changes after their introduction, *E. phaeotricha*, currently considered to be subdivided into two separate taxa: *E. tindaliae* and some provenances of *E. resinifera*, which are now considered to be *E. macta.* Another change was found within a multi-provenance population, of *E. pellita*. Some provenances of which are now considered to be *E. scias*; but since it was introduced into a multi-provenance population, the species is mixed with *E. pellita*.

Corymbia (ex-Eucalyptus) maculata **(Hook.) K.D. Hill & L.A.S. Johnson -*Corymbia variegata*** **(Hook.) K.D. Hill & L.A.S. Johnson**

In a major taxonomic revision, Hill & Johnson (1995) placed the bloodwoods in the new genus *Corymbia*, with 33 of 113 described as new species. Thus, the species known as "spotted gums" and formerly classified as *Eucalyptus*: *C. citriodora*, *C. maculata, C. henryi** (if considered as a species), and *C. variegata* were included within this genus. In the most recent classification of this genus, these species of *Corymbia* are reclassified within the subgenera *Blakella* and the section *Maculatae* (Nicolle, 2021).

Corymbia variegata, reinstated from synonymy, refers to the populations in northern New South Wales (NSW) and south-eastern Queensland (QLD), Australia, which are morphologically approximate intermediates between *C. citriodora* and *C. maculata*, but whose leaves are not lemon-scented (Hill & Johnson, 1995). In regions where the populations of *C. citriodora* and *C. variegata* overlap, intergrading populations with a gradient in the amount of citronellal in the leaves occur (Hill & Johnson, 1995). The areas where the lemon-scent trait varies are around 24.5° S, from near Maryborough and some inland areas to the west.

The two provenances (CSIRO 14426 from Woondum State Forest, QLD and CSIRO 14434 from Wondai State Forest, QLD) of the species introduced as *E. maculata* planted in the Anhembi Experimental Station would now be considered to be *C. variegata*, which was possible to confirm by cross checking the seedlot information with data held at the CSIRO Australian Tree Seed Centre, which routinely updates the taxonomic classification of its records as changes are made. The Brazilian Agricultural Research Corporation (Embrapa) sent the seeds from these two provenances to IPEF which established this population at the Anhembi Station in 1987. Because this germplasm was made available to various institutions over the years (Higa et al., 1997), it is possible that, in Brazil, much of the material classified as *C. maculata* is actually *C. variegata*.

In general, *C. variegata* has a wider distribution in terms of altitude, annual rainfall, as well as maximum and minimum temperatures (Boland et al., 2006), in addition to a greater capacity to adapt to frosts, as compared to *C. maculata* (Table 2). *Corymbia variegata* has a subtropical and tropical distribution, with summer-dominant rainfall while *C. maculata* has a uniform or winter-dominant distribution, making it better adapted to warm temperate and Mediterranean climates where it can significantly outgrow *C. variegata*, particularly in terms of diameter increment. In Australia. A limiting factor for *C. maculata* and some proveances of *C. variegata* is the susceptibility to *Quambalaria pitereka,* a debilitating shoot blight (Pegg et al. 2011).

Table 2. Environmental conditions in areas of naturally occurring species of *Corymbia maculata* and *C. variegata.*

Characteristics	*Corymbia maculata*	*Corymbia variegata*
Altitude (m)	0-650	30-1,100
Temperature in the warmer months (°C)	25-26	26-29
Temperature in the coldest months (°C)	4-6	0-6
Incidence of frost	Low to moderate in inland sites, with a maximum recorded of 60 in one year.	Moderate to high.
Annual rainfall (mm)	680-1,700	600-2,000
Distribution of annual rainfall	Uniform	Higher incidence in the summer.

Source: Boland et al. (2006).

A recent study conducted in Brazil showed small differences between the species *C. maculata* and *C. variegata* (Silva et al., 2022), but the work was carried out at a single site with mild climate conditions (Cwa - Subtropical climate with dry winter and temperatures below 18ºC and hot summer with temperatures above 22ºC). The comparison of the *C. variegata* provenances showed that the material formerly classified as *E. maculata* is the second-best provenance among the seven studied at that location (Silva et al., 2022).

Eucalyptus pellita F. Muell and *E. scias* L.A.S. Johnson & K.D. Hill

Native to eastern Australia, Papua New Guinea and West Papua (formerly Irian Jaya), Indonesia, the species *Eucalyptus pellita* belongs to the subgenus *Symphyomyrtus*, section *Latoangulatae* and series *Robustae* (Boland et al., 2006; Flores et al., 2016; Nicolle, 2021). This species is restricted to the coastal strip between 12° 30' and 18° 30’ S latitudes in northeastern QLD (Brooker & Kleinig, 2004; Boland et al., 2006).

Eucalyptus scias belongs to the subgenus *Symphyomyrtus*, section *Latoangulatae* and series *Annulares* (Nicolle, 2021). The species *E. scias* is further divided into three subspecies: *callimastha*, *scias* and *apoda*, all occurring in the state of NSW while the last subspecies has its occurrence restricted to the Australian town of Tenterfield (Nicolle, 2021). Boland et al. (2006) and Nicolle (2021) consider that the subspecies *scias* and *callimastha* may be over ranked, and might alternatively be considered to be the single subspecies *scias*.

At the Anhembi Station, the species survey indicated that *E. scias* material introduced in 1986 originated from two provenances: Cessnock District (CSIRO 7536) and Newcastle District (CSIRO 7442), both in NSW and at the time of introduction classified as *E. pellita*. The species *E. pellita* and *E. scias* are closely related, but *E. scias* occurs at latitudes above 26^0 S in the Australian state of NSW (Boland et al., 2006). In this context, *E. scias* is perhaps more suitable for the southern region of Brazil because it originates from a more subtropical and relatively cooler region (Table 3) (Boland et al., 2006). Despite this, *E. scias* (recorded as *E. pellita* from Cessnock) was introduced in the Itamarandiba region (subtropical area with dry winter) in 1985, where growth and adaptation were similar to *E. pellita*. Compared to *E. pellita, E. scias* has narrower leaves, with a silvery sheen and larger fruits. On the other hand, *E. pellita* has potential for humid and sub-humid tropical regions and is especially tolerant to diseases such as *Austropuccinia psidii*, *Ceratocystis fimbriata,* and *Cylindrocladium pteridis* (Guimarães et al.,

2010; Mafia et al., 2011). Since obtaining material resistant to foliar diseases is one of the great challenges of breeding programs worldwide, this species has become one of the most widespread where humid tropical conditions prevail (Silva et al., 2017).

Table 3. Environmental conditions in areas of naturally occurring species of *Eucalyptus pellita*, *Eucalyptus scias* subspecies *scias* and *Eucalyptus scias* subspecies *apoda.*

Characteristics	*Eucalyptus pellita*	*Eucalyptus scias* subspecies *scias*	*Eucalyptus scias* subspecies *apoda*
Altitude (m)	0-600	0-500	800-900
Temperature in the warmer months (°C)	31-38	24-31	25-26
Temperature in the coldest months (°C)	10-19	4-8	-1-2
Incidence of frost	Low	Low to moderate at higher altitudes.	High
Annual rainfall (mm)	1,200-3,300	900-1,200	800-900
Distribution of annual rainfall	Summer dominant.	± Uniform all over the year.	Summer dominant.

Source: Boland et al. (2006).

Eucalyptus resinifera Smith - *Eucalyptus macta* L. A. S. Johnson & K. D. Hill

Eucalyptus resinifera, classified within the subgenus *Symphyomyrtus*, section *Latoangulatae,* and series *Annulares* (Nicolle, 2021), is found in subtropical regions (Table 4), between 25° and 35° S latitudes (Hill & Johnson, 2000; Boland et ATSC seedlot 14421 (25-36 km SE Mareeba, Queensland, collected 1983) was introduced to Brazil by the Embrapa genetic conservation project for *Eucalyptus* spp. populations (02/51/070/02187) in the early 1980s. In 1987, a population of *E. resinifera* whose germplasm was collected in Mareeba, QLD (17°06' S) was also planted at Anhembi Experimental Station (Higa et al., 1997). However, there are reports in the literature indicating that this species is not present in the aforementioned Australian region (Hill & Johnson, 2000; Boland et al., 2006); however the *E. resinifera* subsp*. resinifera* is present close to there. While accessing the ATSC provenance field sheet (a document which provides more detailed information on where seedlots were collected) it was revealed that this provenance was collected by accessing an 11 km stretch of forestry road travelling towards Mt. Haig. This example illustrates an important point: provenances are often referred to in a fairly nominal or arbitrary way. Sometimes a provenance name will accurately reflect the exact location where a seedlot was collected from. However, it is also possible that the provenance name is that of a nearby town that might be quite distant from the collection location, or the provenance was collected along a transection (often an access road) that may stretch for kilometers or tens of kilometers. If there are significant differences between seedlots that are collected from provenances that are nominally the same are indicated, these facts should be borne in mind. If the seedlot was collected by the ATSC, it is advised to contact CSIRO to seek extra information. This discussion also highlights the difference between a provenance and a subpopulation: the former is the name of a place or region where a seedlot was collected from; while the latter is a genetically distinct entity defined by quantitative or molecular genetic studies. If a provenance is a genetically distinct entity can only be confirmed by genetic testing.

Thus, based on this evidence, the species planted in the Anhembi Station could be *E. macta* (Hill & Johnson, 2000). In fact, a major error is observed in the description since the direction from Mareeba should read Southeast (SE). The coordinates (even though pre-GPS) give the location reasonably well and it is as suspected – along Tinaroo Creek Road, QLD – a Forestry track in that area from which many collections of *E. grandis* and *E. resinifera* were conducted in the 80s (ATSC provenance sheet shows that one was collected along an 11 km section of Tinaroo Ck. road). The site is pretty much the same distance to the Northeast (NE) of Atherton. The areas of *E. resinifera* subsp*. resinifera* in north QLD are known as *E. macta* (Hill & Johnson, 2000).

Eucalyptus macta is classified within the subgenus *Symphyomyrtus*, section *Latoangulatae* and series *Annulares* (Nicolle, 2021). This species is little known and studied, but several of the wood's technological traits were probably obtained using the material introduced from Mareeba, according to a study by Leite (2014). Provenance data is often not noted, and taxonomic changes cannot be tracked.

Table 4. Environmental conditions in areas of naturally occurring species of *Eucalyptus resinifera* and *Eucalyptus macta.*

Characteristics	*Eucalyptus resinifera*	*Eucalyptus macta*
Altitude (m)	0-300	NA
Temperature in the warmer months (°C)	24-34	NA
Temperature in the coldest months (°C)	1-13	NA
Incidence of frost	Low to moderate.	NA
Annual rainfall (mm)	900-1,700	NA
Distribution of annual rainfall	Summer dominant in the north to uniform in the southern part of its range.	NA

Source: Boland et al. (2006). NA: Not available.

The correct classification must be considered since there are no studies on wood productivity, tolerance, and/or traits to allow a comparison between the different species which are fundamental for defining the species to be introduced or worked on by the breeding programs.

Eucalyptus phaeotricha Blakely & McKie - *Eucalyptus tindaliae* Blakely

Eucalyptus tindaliae belongs to the subgenus *Eucalyptus*, section *Eucalyptus* and series *Pachyphloiae* (Nicolle, 2021). This species is found in the 26° to 33° S latitudinal range, in Australia (Boland et al., 2006; Flores et al., 2016), but there are different descriptions regarding the region of origin. According to Ferreira et al. (1992), older works report a population close to Atherton, in north QLD (Chippendale & Wolf, 1981), classifying the populations from Atherton as typical representatives of white Stringybark, and those from Toolara (QLD), closer to the populations of NSW, as belonging to a stringybark complex, including others difficult to distinguish (Boland et al., 2006). However, the current classification has *E. tindaliae* in the southernmost area, and *E. reducta* around 17° latitude, near Atherton, QLD. This raises the possibility that these materials also belong to the *E. tindaliae* category (Nicolle, 2021).

In 1982, at Anhembi Experimental Station, a population of the species introduced then as *E. phaeotricha* was based on two seed lots: CSIRO 10903 from Mount Mullen, Toolara, QLD (25°00´ S and 152°47´ E) that is currently classified as *E. tindaliae* and CSIRO 9782 from SW Atherton, QLD (17°22´ S and 145°25´ E), currently *E. reducta*.

Species adaptation and performance are often correlated with/related to the environmental conditions of the place of origin (Eldridge et al., 1993) although many plantation eucalypts are well adapted beyond the niche indicated by their native range (Booth 2017). Little information is available on the variation present between and within populations of *E. phaeotricha* and/or *E. tindaliae* in the literature, as the species has shown limited commercial potential. According to Ferreira et al. (1992), the two provenances were planted in the Anhembi Station, SP. There are reported provenance effects: with the Atherton, QLD provenance, now classified as *E. reducta,* producing more wood than *E. tindaliae.*

Eucalyptus reducta is very likley be the predominant species in the Anhembi population today, since over time, the stand has been selectively thinned based on growth performance. Had the managers of the Anhembi population been aware of the updated classification, the planting might have been managed differently with the retention of both provenances, now considered separate species. It is possible that while *E. tindaliae* demonstrated inferior growth at the Anhembi site, it may possess other traits of interest or better performance in other

environments. It is important to recognize that access to eucalypt populations from Australia is becoming more difficult due to environmental and policy restrictions, so conservation of genetic resources already introduced to Brazil are becoming of increasing importance.

The classification of *E. paniculata* was also evaluated, since the records state the following origins of CSIRO 9134 (Tomerong (NSW) – 33°04' S and 150°35' E, and 60 m altitude); CSIRO 13328 (Toonumbar State Forest Kyogle (NSW) – 28°32' S and 152°46' E, and 350 m altitude); and CSIRO 13657 – *E. paniculata*, SW of Nowra, NSW. From distribution maps, seedlot 13328 is unlikely to be *paniculata* but could be *siderophloia*. *Eucalyptus paniculata,* native to NSW, possesses inflexed stamens, outer stamens with no anthers (staminodes) and the adult leaves are discolorous. *Eucalyptus siderophloia,* occurs in NSW and Queensland, the stamens are irregularly flexed, all fertile (with anthers) and the adult leaves concolorous.

However, the population at Toonumbar presents some taxonomic difficulties. In 2013, in a field visit[1] to the *E. paniculata* (old introductions in Minas Gerais State in Brazil), a mix of the species was observed. The species *E. siderophloia* and *E. paniculata* trees were very hard to distinguish, with only very minor morphological differences in the flowers and leaves. While analyzing the flowers, it was observed that *E. paniculata* has the anthers at the periphery of the flower buds welded to the filaments, which signaled by their membership to be within Section Adnataria, and not producing pollen, which is produced only in the anthers close to the style. However, some of the analyzed materials had normal anthers. *Eucalyptus paniculata* typically has discolorous leaves, which was not observed in the analyzed trees.

The consequences of misnamed germplasm are various. A serious consequence can result when the performance of taxa are misreported. A common mistake from Brazil and elsewhere is the mistaken assumption that *Eucalyptus maculata* is simply converted to *Corymbia maculata*. Reports of *C. maculata* doing well in subtropical and tropical regions are not likely to be correct – it is much more likely that the taxon is *C. variegata* or *C. henryi*. If the seedlot was supplied by CSIRO and its number retained in records, then this can be simply checked. However, in cases where provenance information is lacking, it is difficult to be certain about which taxon has actually been planted, even with a molecular approach (Oliveira et al., 2023). It is always best to check for taxonomic changes before publishing, and if in doubt, publish as much information about the specific provenance or origin of a taxon as possible.

CONCLUSIONS

Of the 20 species that were introduced to the germplasm bank at the Anhembi Experimental Station, three taxonomic changes (species level) were found after population plantation. In other words, the Anhembi Germplasm Bank has 22 species population under the current classification.

The main consequences of incorrect nomenclature are the misreporting of species performance in the scientific literature and the mismanagement of taxa for breeding and gene conservation purposes.

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[1] Personal comments of David Kleinig and Teotônio Francisco de Assis.

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