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BREEDING SYSTEMS OF TWO ENDEMIC RAINFOREST SPECIES IN SOUTHERN CHILE: *AMOMYRTUS MELI* (PHIL.) LEGR. ET KAUS. (MYRTACEAE) AND *LUZURIAGA POLYPHYLLA* (HOOK.) MACBR. (PHILESIACEAE)

SISTEMA REPRODUCTIVO DE DOS ESPECIES ENDEMICAS DEL BOSQUE LLUVIOSO DEL SUR DE CHILE: AMOMYRTUS MELI *(PHIL.) LEGR. ET KAUS. (MYRTACEAE) Y* LUZURIAGA POLYPHYLLA *(HOOK.) MACBR. (PHILESIACEAE)*

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ABSTRACT

Experimental hand self- and cross-pollinations, spontaneous selfing trials and emasculation tests to detect compatibility status, selfing capacity and agamospermy, along with natural fruiting levels were undertaken in the rainforests of Chiloé, 42°S on *Amomyrtus meli* (Myrtaceae), endemic to Chile and belonging to a genus endemic to temperate southern South America, and on *Luzuriaga polyphylla* (Philesiaceae), endemic to Chile and belonging to a small genus of Gondwanan distribution. *Amomyrtus meli* is genetically self-compatible and non-agamospermous. Natural pollination fruit set was statistically indistinguishable from hand cross-pollination and hand self-pollination fruit set. This is the second record of genetic self-compatiblity in *Amomyrtus*, confirming that the entire genus is self-compatible. Self-compatibility in *Amomyrtus* contrasts with presence of genetic self-incompatibility in other genera of Myrtaceae (*Luma* and *Myrceugenia*) in the temperate rainforest of southern South America. *Luzuriaga polyphylla* is strongly self-incompatible and non-agamospermous. Natural pollination fruit set was statistically indistinguishable from hand cross-pollination fruit set, indicating efficient pollination in the rain forest of Chiloé. Self-incompatibility in *L. polyphylla* constitutes a second report of this breeding system among South American species of the genus, where *L. radicans* has also been reported as self-incompatible, and adds another species to the growing list of obligately outbred species among woody and semi-woody elements in the rainforest flora of southern South America.

KEYWORDS: *Amomyrtus meli*, *Luzuriaga polyphylla*, Myrtaceae, Philesiaceae, genetic self-compatibility, genetic self-incompatibility, endemic species of Chile, rainforest, Chile.

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RESUMEN

Se dan a conocer los resultados de pruebas de autopolinización manual, polinización cruzada manual, autopolinización automática y emasculación, para la detección del tipo de compatibilidad, autogamia y agamospermia en *Amomyrtus meli* (Myrtaceae), especie del bosque lluvioso, endémica de Chile, y perteneciente al género sudamericano austral endémico, y en *Luzuriaga polyphylla* (Philesiaceae), especie endémica a Chile y perteneciente a un género de distribución Gondwanica. *Amomyrtus meli* es genéticamente autocompatible. La producción de frutos mediante la polinización natural es estadísticamente indistinguible del nivel de fructificación obtenido por polinización cruzada manual y autopolinización manual. El registro de autocompatibilidad genética en *A. meli* constituye el segundo de este sistema de reproducción para el género, confirmando que la autocompatibilidad es característica a nivel genérico. La autocompatibilidad genética en el género *Amomyrtus* contrasta con la presencia de autoincompatibilidad genética en otros géneros de la familia Myrtaceae (*Luma* and *Myrceugenia*) del bosque lluvioso del sur de Sudamérica. *Luzuriaga polyphylla* es altamente autoincompatible y no presenta agamospermia. La producción de frutos mediante la polinización natural es estadísticamente indistinguible al nivel de fructificación obtenido mediante la polinización manual cruzada, indicando un sistema de polinización muy eficiente en esta especie en los bosques de Chiloé. La presencia de autoincompatibilidad genética en *L. polyphylla* constituye el segundo registro de este sistema de reproducción entre las especies sudamericanas del género, donde *L. radicans* fue recientemente documentada como genéticamente autoincompatible. Con el presente trabajo se agrega otra especie genéticamente incompatible a la lista creciente de especies exógamas entre los elementos leñosos y semi leñosos de los bosques lluviosos del sur de Sudamérica.

PALABRAS CLAVES: *Amomyrtus meli*, *Luzuriaga polyphylla*, Myrtaceae, Philesiaceae, autocompatibilidad genética, autoincompatibilidad genética, especies endémicas de Chile, bosque lluvioso, Chile.

to that obtained under hand cross-pollination. For self-pollination, pollen from the same flower or from other flowers on the same individual was used. For cross-pollination, fresh pollen was collected from individuals located distant from the test plant, and transported immediately to the receptive stigmas of bagged flowers. Each flower was pollinated on three separate occasions so as to increase the likelihood of encountering the stigmas at their maximum period of receptivity and of obtaining physiologically maximal fruit and seed sets. All pollinations were carried in the early afternoon when temperatures were warmer and the flowers were fully open. Following marking, all manipulated flowers were immediately rebagged. Complete fruit maturation in *Luzuriaga polyphylla* in Chiloé requires around 8-9 months (Smith-Ramírez & Armesto, 1994). Long fruit maturation periods have also been described in *L. marginata* (Arroyo & Leuenberger, 1988) and would appear to be characteristic of the genus. In order to avoid loss of fruits in the experimental crosses and other tests due to autumn and winter storm damage, we harvested fruits of this species in late summer as they began to mature. Fruit maturation in *Amomyrtus meli* occurs over the period December to April (Smith-Ramírez & Armesto, 1994). For our experiments, fruits were harvested in April, 1998. In both species pollination bags were retained on the plants until the time of fruit collection, so as to prevent fruit loss through the action of the biotic dispersal agents (Armesto *et al.*, 1987) and facilitate capture of any mature fruits that potentially could have fallen by the time of fruit harvest. Fruits of *Luzuriaga polyphylla* tend to fall easily with any disturbance.

RESULTS AND DISCUSSION

Under hand self-pollination 13.5% of the flowers of *Amomyrtus meli* produced fruits, in comparison with 24.3% under hand cross-pollination. In the spontaneously selfing trials, 10.5% of the tested flowers produced fruits (Table I). Cross-pollination and self-pollination fruit set for *A. meli* (G_{adj} = 2.234; NS) were not significantly different, as was the case for self-pollination and spontaneous self-pollination (G_{adj} = 0.269; NS). Cross-pollination fruit set was significantly higher than spontaneous self-pollination fruit set (G_{adj} = 5.415; $p<0.05$). The ISI (measure of degree of self-incompatibility fluctuating between 0 and 1; 0 = full self-incompatibility; 1 = full compatibility - see Ruiz & Arroyo, 1978) for *A. meli* is 0.50, which is well above the value of 0.2 used by convention to differentiate between self-incompatible and self-compatible species (c.f. Arroyo & Squeo, 1990b). *Amomyrtus meli* thus is classed as a self-compatible species, although clearly, the level of compatibility is only moderate.

Only 3.5% of the hand self-pollinated flowers of *Luzuriaga polyphylla* produced fruit (Table II). In the spontaneously selfing trials, no flowers produced fruits, as was the case for emasculated flowers (Table II). In contrast, 58.5% of hand pollinated cross-pollinated flowers produced fruits, a proportion that is much higher than with hand self-pollination. These results give an ISI value of 0.026, which is well below the cut-off value of 0.2 and allow the conclusion of a high level of genetic self-incompatibility in *Luzuriaga polyphylla.*

Natural fruit production in *Amomyrtus meli* was moderate (Table III), but not significantly different from that in any of the experimental treatments (G_{adj} = 1.696; NS; (spontaneous selfing); G_{adj} = 0.519; NS (hand self-pollination); G_{adj} = 0.413, NS (hand cross pollination)). Therefore the fruits produced under natural conditions of pollination in *Amomyrtus meli* could have been derived from spontaneous intra-flower self-polllination or geitonogamy (self-pollination as a result of pollen transference among flowers of the same individual) or cross-pollination. Mostly likely natural pollination fruit set is derived from all types of pollination.

Natural fruit production in unbagged flowers of *Luzuriaga polyphylla* was surprisingly high (Table IV) for a strongly self-incompatible species and not significantly different (G_{adj} = 1.46; NS) from that obtained under hand-pollination in which all stigmas were artificially pollinated, suggesting high efficiency of the natural pollination system. Seed number per fruit was somewhat higher in naturally pollinated flowers than in hand cross-pollinated flowers (t (d.f. = 80) = 5.598; $p < 0.001$) (Table IV). This last situation is commonly encountered in field pollination tests (c.f. Arroyo & Squeo, 1990a) where, in spite of repeated pollinations, it is difficult to

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TABLE I. Results of controlled hand pollinations, spontaneous selfing trials and emasculation tests in *Amomyrtus meli* (Myrtaceae) in temperate rainforest in Chiloé.

Test	Plants	Flowers	Fruits			Mean Seeds/flower crossed
			N	Percent	Seed	
Self-pollinated	4	52	7	13.5	7	0.13
Cross-pollinated	5	70	17	24.3	19	0.27
Spontaneously self-pollinated	5	95	10	10.5	12	0.13
Emasculated	5	51	0	0	-	-

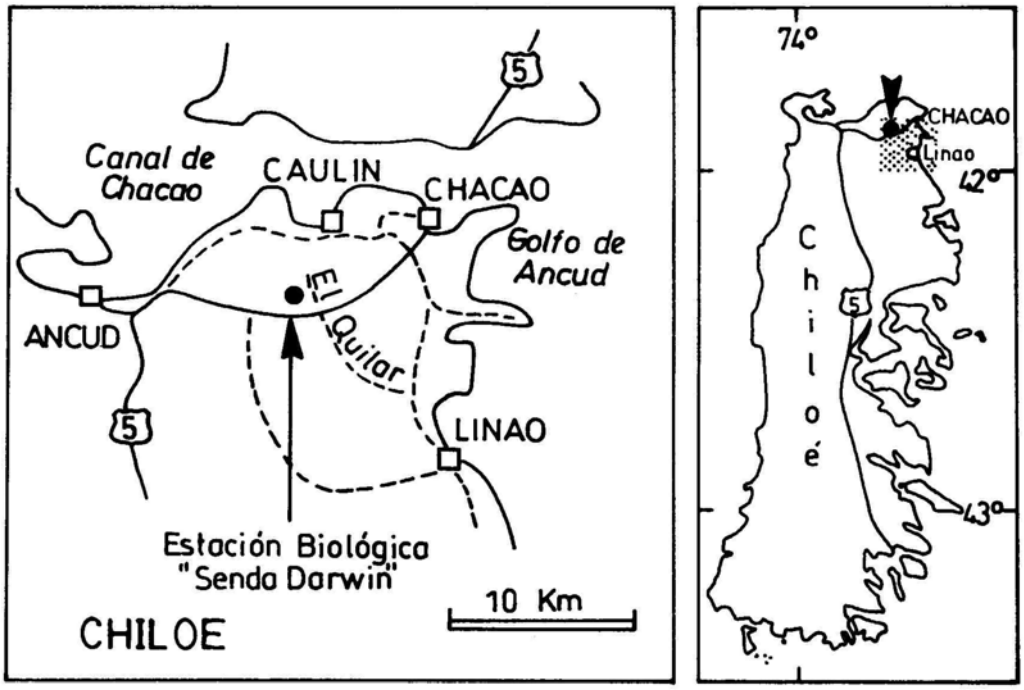

FIGURE 1. Location of "Senda Darwin" study site on the island of Chiloé.

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