Short Note: Cleistogamy in *Eucalyptus tereticornis* Sm. and its Genetic Implications

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Abstract

In a provenance cum progeny trial comprising 13 provenances and 91 families of *Eucalyptus tereticornis* Sm. of Australian and Papua New Guinean (PNG) origin, laid out in India in 2002, cleistogamy was found in a family emanating from CSIRO seed lot no. 13418, (tree no. DS000141) Sirinumu Sogeri Plat, PNG. This trait appears to be under genetic control, and presumably results in obligate selfing. This may lead to inbreeding depression in this family.

Key words: Eucalyptus tereticornis, cleistogamy, inbreeding depression, autogamy, self-pollination.

The genus Eucalyptus, that comprises about 700 species and varieties (ELDRIDGE *et al.,* 1993), normally has chasmogamous flowers. It's species are generally considered to be largely cross-pollinated, and interspecific hybridization is quite frequent where spatial isolation barriers to inbreeding have either broken down or have been removed (PENFOLD and WILLIS, 1961; PRYOR, 1976; POTTS *et al.,* 2003). However the frequency of selfing or out crossing is both genetically and environmentally conditioned (FRYXELL, 1957).

In the year 2002 a provenance cum progeny trial of *Eucalyptus tereticornis* comprising 13 provenances and 91 families of Australian and Papua New Guinea (PNG) origin and local control (*Table 1*) was established in the campus of Forest Research Institute, Dehradun, India (30° N, 76° E, 610 m altitude, mean annual rainfall 216 cm). For carrying out inter- and intra-provenance crossing, phenological observations pertaining to flowering were taken in October 2004 for selection of parents.

In one family seed lot no. 13418 tree/Family DS 000141, cleistogamous flowers were observed (*Fig 1a*), while all 3000 other trees grown at the same site from 12 other provenances showed normal chasmogamous flowers. Since all 15 flowering plants belonging to this family spread over eight replicates showed cleistogamy, this trait appears to be genetically controlled.

In the cleistogamous flowers, the opercula showed an unusual tardiness in shedding. Although they separated from the floral receptacle as usual, the opercula were not shed and remained sitting on the style even after withering and turning brown in colour after fruit formation (*Fig 1b*). Such withered and dark brown opercula could be seen even after one month of fruit formation (*Fig 1b*). A close examination of such cleistogamous flowers at a relatively early stage, before their opercula turned brown revealed that many stamens and much pollen grains were sticking to the stigma, which were glistening with nector. Such a condition will presumably result in forced selfing because insects are unlikely to be able to contact anthers and stigma beneath the operculum (*Fig. 1a*). These observations are identical to those made by VENKATESH *et al.* (1973) on cleistogamous flowers of *E. tereticornis.* However, they differ from observations of cleistogamous flowers of a species of Eucalyptus in Tasmania whose opercula did not abscise from the receptacles (BARBER, 1954).

If cleistogamy and obligate selfing persist in the subsequent generations raised through seeds, this may lead to complete homozygosity in the population of this family and inbreeding depression. VENKATESH (1971) and VENKATESH *et al.* (1973) have shown that the mean number of seeds/capsule from cleistogamous flowers was considerably less than those developed from chasmogamous

Table 1. – Detail of geographical locations of *E. tereticornis* sources.

Seed lot No.	Tree No.	Origin			
		Locality	Lat. (° ‘)	Long. (° ‘)	Altitude (m)
13399	JD945, JD946, JD948, JD949, JD952, JD953	Oro bay to Emo, PNG	08 57	148 28	200
13418	DS000141	Sirinumu Sogeri Plat, PNG	09 30	147 26	580
17762	MM1184, MM1185, MM1186, MM1187	Warwick, QLD	28 15	152 05	450
17768	MM1222, MM1223, MM1224, MM1225, MM 1226	Yurammie SF, NSW	36 49	149 45	170
17770	MM1232, MM 1233, MM1234, MM1235	Buckenbowra SF, NSW	35 40	150 07	110
18732	DL590, DL591, DL592, DL 593, DL594, DL596, DL597, DL598, DL599, DL600	Selection flat SF559, NSW	29 10	152 58	40
19315	AS11 to AS21	Credition SF, QLD	21 7	148 31	730
20468	PK76, PK77, PK79, PK80, PK81, PK82, PK83, PK84, PK85	Cardwell, QLD	18 10	145 58	84
20469	PK53 to PK57	Mitchell River MT Molloy, QLD	16 44	145 20	390
20470	JSL3228, JSL3230, JSL3232, JSL3233, PK70, PK71, PK72, PK73, PK74	Mill stream archer creek, QLD	17 39	145 21	670
20471	AA473, AA475, AA476, AA477, AA479, AA480, AA485, AA490, AA491	Helenvale, QLD	15 48	145 15	325
20472	PK62 to PK68	Walsh River, QLD	17 20	145 18	762
20474	PK87 to PK97	Burdekin River, QLD	19 48	146 04	291
Local	O.P seed collected from trees of FRI-4, FRI-5 and Mysore gum (*E.tereticornis*)		30 30	76 04	640

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Figure 1. – (a) A portion of branch of *E. tereticornis* showing cleistogamous flowers. (b) Close up view of a branch showing development of fruits from cleistogamous flowers. Note that the opercula are still sitting on withered stigmas even after one month of fruit formation.

flowers. Our studies suggest that this cleistogamous family may also suffer inbreeding depression.

An assessment made for growth parameters viz. height and collar diameter of provenances/families at age 18 months revealed that this particular provenance/family performed poorly in relation to others. It ranked last but one in position with regard to height and diameter. For height and diameter, respectively it was 46.6 and 42.8% inferior to the best performing provenance/family and 18.9 and 24.5% inferior to the pooled means of the provenances. In general all 32 plants were poor in respect of growth performance. In addition, out of 32 plants, only 15 were found to initiate flowers at the age of 18 months.

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Soil Temperature and Precipitation Affect the Rooting Ability of Dormant Hardwood Cuttings of *Populus*

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Abstract

In addition to genetic control, responses to environmental stimuli affect the success of rooting. Our objectives were to: 1) assess the variation in rooting ability among 21 *Populus* clones grown under varying soil temperatures and amounts of precipitation and 2) identify combinations of soil temperature and precipitation that promote rooting. The clones belonged to five genomic groups ([*P. trichocarpa* Torr. & Gray x *P. deltoides* Bartr. ex Marsh] x *P. deltoides* 'BC'; *P. deltoides* 'D'; *P. deltoides* x *P. maximowiczii* A. Henry 'DM'; *P. deltoides* x *P. nigra* L. 'DN'; *P. nigra* x *P. maximowiczii* 'NM'). Cuttings, 20 cm long, were planted in Iowa and Minnesota, USA, in randomized complete blocks at 1.2- x 2.4-m spacing across three planting dates during 2001 and 2002. Soil temperatures were converted to belowground growing degree days (GDD) (base temperature = 10 °C) accumulated over 14 days. Genomic groups responded similarly

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