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REPORT ON EUC. CAMALDULENSIS (RIVER GUM) PROVENANCE TRIAL FOR INSECT RESISTANCE (W/P28/68)

SUMMARY

1. Results of trials with eleven (11) provenances from various localities in Australia and overseas, are set out after 6 years trial at Southern Cross, W.A. Results from Morawa and North Eneabba W.A., are incomplete.

2. Resistance to insect attack appears to be linked (at least superficially) with presence or absence of anthocyanins in leaves.

3. Five of the eleven provenances appear suited to local dry area environments and resistant to a high degree to insect attack.

4. Lerps have been noted on S/N 4113 only and were not observed on any S/N in November, 1976 when heavy infestations were occurring in moister, cooler parts of South Western Australia.

5. Hosts for relevant insect predators are shown as per Table 3.

6. Details of all provenances used, are set out in Table 1 and summarized details of growth and survival of 5 of the best performed provenances are shown in Table 2.

INTRODUCTION

Interim reports have been submitted on this trial in 1972 and 1974. The aim was to determine suitable provenances of River Gum for various localities in the Northern, North Eastern and Southern Wheatbelt areas.

After establishing plots of similar provenance components, floods and other misfortune, left only plots established at Southern Cross, Morawa (Heitman) and North Eneabba.

Because of ease of inspection of the former plots, results have been greater from there and form the bulk of data used in this report.

METHOD

Up to seventeen (17) seedlings of each provenance were planted in available land at each of the localities in August 1970. In the main, planting sites were Vorox 'AA' sprayed for weed control prior to spot cultivation of planting sites. Seedlings were wire netted where possible, to guard against rabbit attack. Plants were watered (approx. ½ gallon/tree) in using the power spray unit of the Inland Arboreta unit.

RESULTS

Survival counts were made at three (3) intervals as shown in Table 2. Basic data of provenance sources is set out in Table 1.

Periodic height growth of the best 5 performed provenances are set out in diagram 1, which also indicates survival percentages for the same time sequences.

DISCUSSION

From the results it seems evident that provenances exhibiting even weak presence of anthocyanins in leaves, are likely to be more resistant to insect attack than those without this factor. As the structure of anthocyanins are essentially chemical elements Carbon, Hydrogen and Oxygen in a benzene ring with attached pyran rings and associated hydroxyl ions, there is little likelihood of these substances being toxic to insects i.e. having an insecticidal effect. It is postulated however, that the presence of these materials indicates a low Nitrogen level in the plant concerned

and also a low sap content. As moisture is essential to retention of Nitrogen in plants, insects apparently are not attracted to plants with low N (& hence low moisture), moisture being possibly the prime requirement of insects in dry areas for completion of the life cycles. This does not necessarily mean such trees are in a stress condition, but rather less attractive than other species.

Examination of localities from which provenances originated exhibiting anthocyanins, reveals no common factor except perhaps that of lowest minimum temperatures, which ranges from 27°F to 36.4°F and also the presence of lignotubers. Attached graph suggests a possible correlation between % lignotubers and minimum temperatures for areas of origin of provenances which have this feature.

The fact that provenances with the feature are also from pure stands, seems significant i.e. hybridisation may remove it.

The 5 most successful provenances are:-

S/N 4111 - Origin Newcastle Waters Creek N.T.
4114 - Little Swamp 5 miles W of Port Lincoln S.A.
4117 - Gilbert R. 40 miles W of Georgetown
4118 - Goodarra Creek, ½ mile from Tennant Creek Junction N.T.

This is based on freedom from insect attack, growth performance and survival percentage.

Inability to maintain checks on trials set out at W. Morawa and Nth. Eneabba has not elucidated suitability of these provenances for the same areas.

Data up to 8/11/72 suggests S/N° 4110, 4111, 4115, 4118 & 4119 are suitable for the Morawa area and S/Ns 4110, 4115 - 4118 are most suitable for the North Eneabba area.

CONCLUSIONS

1. Insect resistance in this species seems identifiable by the presence of anthocyanins in leaves.

2. Insect resistance appears likely to be related to low levels of Nitrogen in leaf material and associated lower levels of moisture in leaves, making such plants less palatable to insects.

3. For best results in establishment of River Gum, the following S/N°s are considered most suitable of those tested for the following areas (with reservations for North Eneabba & W. Morawa, due to lack of data).

S/N°s	NORTH ENEABBA	W. MORAWA	SOUTHERN CROSS
4110	✓	✓	-
4111	-	✓	✓
4114	-	-	✓
4115	✓	✓	-
4116	-	-	✓
4117	-	-	✓
4118	✓	✓	✓
4119	-	✓	-

The S/N° successful in all three localities is S/N 4118.

4. Insect attack is predominantly associated with:-
   (i) leaf tiers, curlers and eaters of the Curculionidae families
   (ii) Lerps of the Psyllidae, Glyraspis sp
   (iii) Gregarious gall weevils - of the Curculionids, Strongylorhinus sp.
   (iv) Leaf hoppers - Eurymela spp.

of these, the 'Lerp' and Gregarious gall weevil are regarded as the most damaging due to destruction of leaves by the former and weakening of wood tissue (hence structural strength) of the tree bole and branches.

RECOMMENDATIONS

1. River Gum stock raised for sale to inland areas, should be restricted to the above S/N°s.

2. Seed orchard of these S/N° be established to ensure supply of seed: Mundaring area could be suitable in this regard.

ACKNOWLEDGEMENTS

The help of several officers including Mr. P. Richmond & Messrs. Loneragon & Batini, in making observations in the Southern Cross plantings, is greatly appreciated and acknowledged as are photographs by Mrs. L. LeRoy of Hamel.

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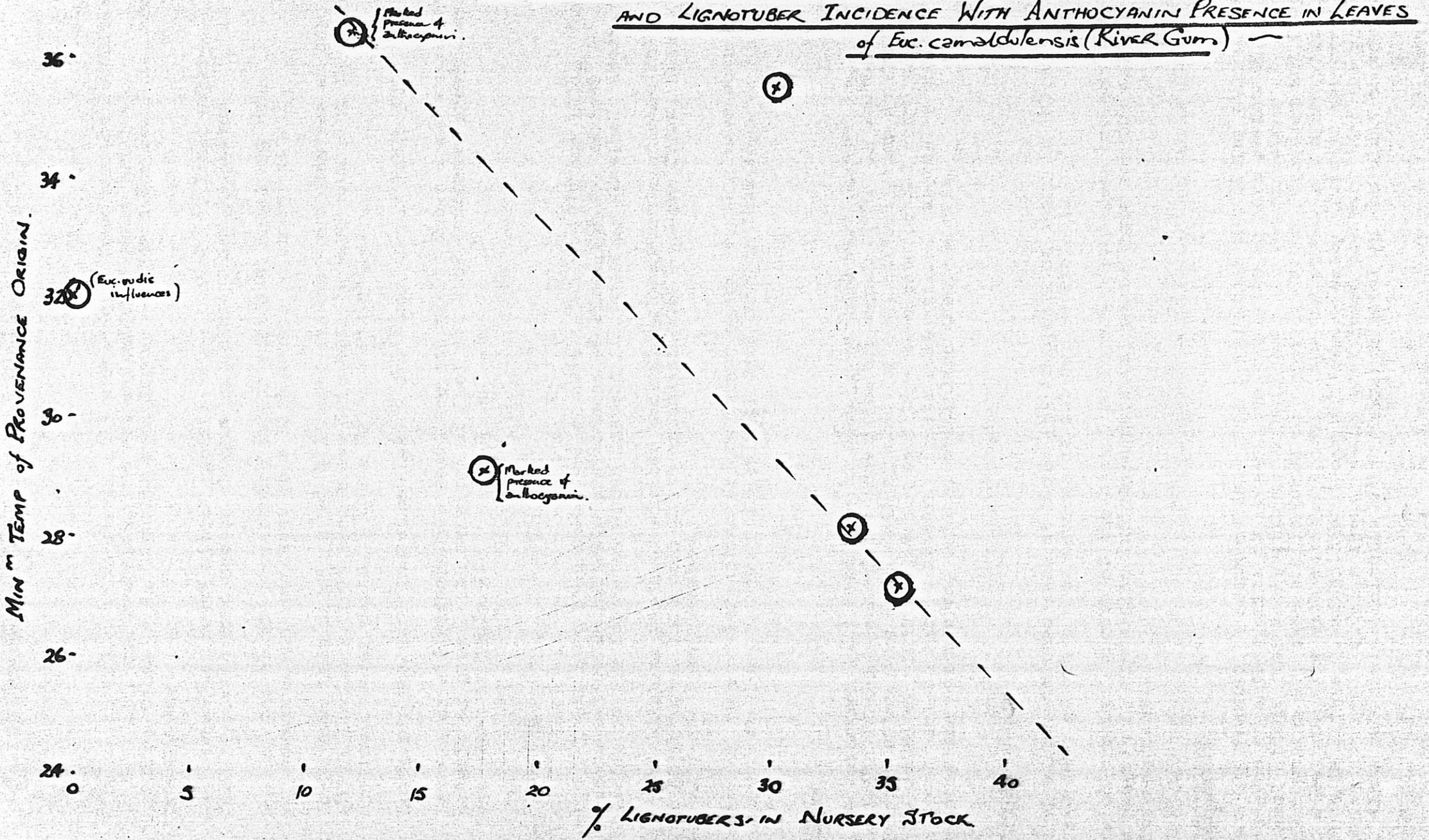
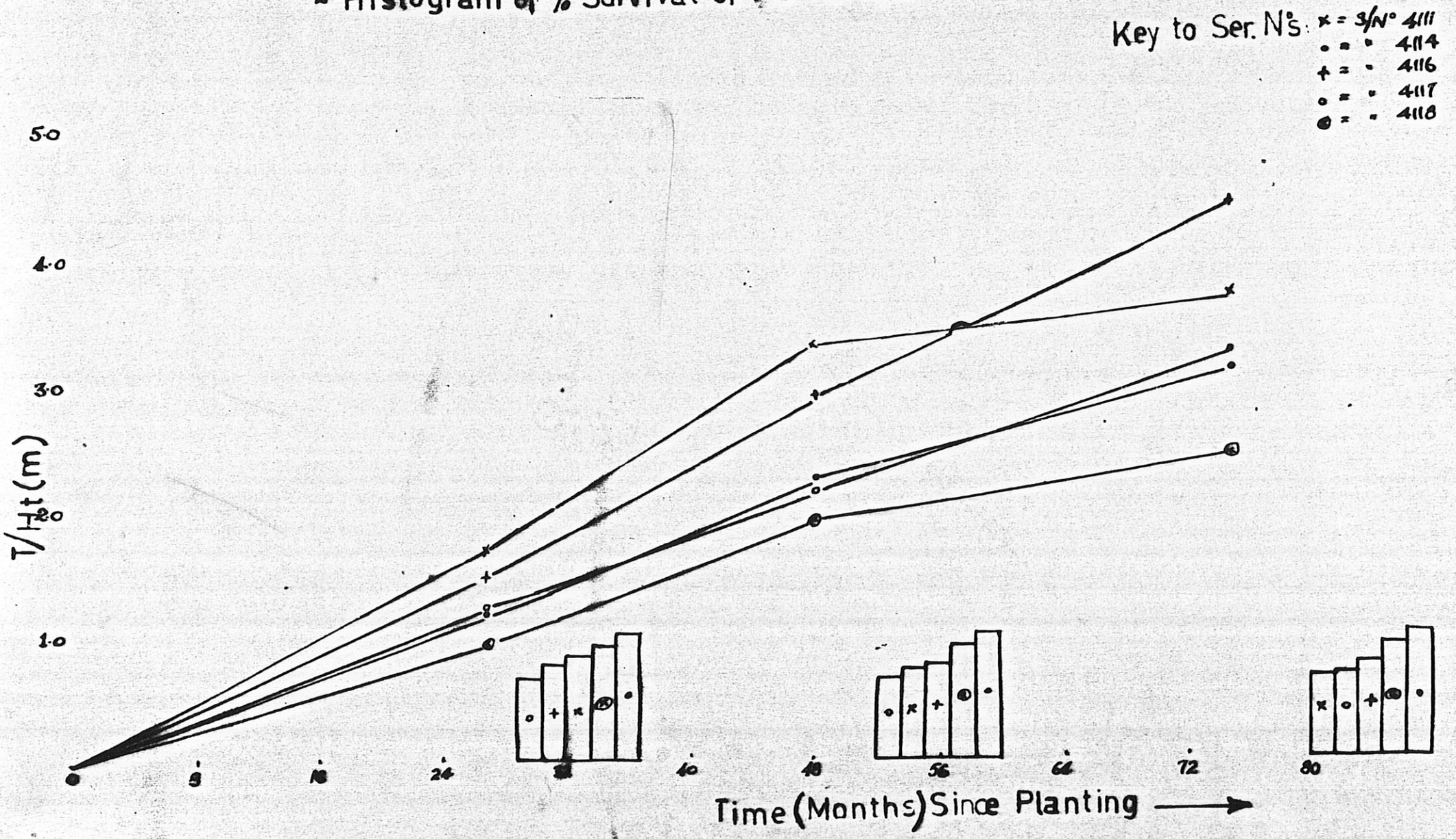
~ Possible Correlation Between Minimum Temperature and Lignotuber Incidence With Anthocyanin Presence in Leaves of Euc. camaldulensis (River Gum) ~



Euc camaldulensis (River Gum) W/P28/68

1 Mean Height Growth for 5 Best Provenances at Southern Cross since 8 70 to 11 76

2 Histogram of % Survival of the same 5 Provenances



EUC. CAMALDULENSIS (RIVER GUM) PROVENANCE DETAILS
(TRIALS ESTABLISHED AT NORTH ENEABBA, MORAWA (HEITMAN'S) & SOUTHERN CROSS)

TABLE 1

(28/5/70) (27/5/7) (6/8/70)

SERIAL NO.	F&T.B. NO. (S)	LOCALITY OF COLLECTION	LATITUDE	LONGITUDE	ALTITUDE	SOIL	ASSOCIATED SPECIES	HT OF PARENT TREE(S)	DBH	LOWEST RECORDED TEMP	RAIN-FALL /ANN (MM)
4110	S8409/14	Upper Waterhole -5miles from P/Station for Wyndam Water Supply	15°41'S	128°5'E	300'	Brown alluvial soil, loam texture	Melaleuca sp as fringing forest near water	40'-45'	10"-25"	50°F	682.5
4111	S7080	Newcastle Waters Creek N.T.	17°30'S	133°30'E	700	Clay to sandy clay loam	Pure stand - some Euc.cyanoclada at distance	30'-45'	15"-23"	28.5°F	476.5
4112	S6991	Walpola Island S.F. 35 miles W of Mildura N.S.W.	34°10'S	142°6¼'E	185	Heavy grey clay PH7.	Pure with Euc. largiflorens on drier ground away from creek	50'-120'	24"-36"	23°F	242.75
4113	S6980/89	Silverton - 13 miles W of Broken Hill	31°57'S	141°28'E	700	Deep course red sand PH7	Pure stand in creek beds	35'-50'	18"-30"	27°F	230.4
4114	S6975/79	Little Swamp 5 miles W of Port Lincoln S.A.	34°40'S	135°50'E	100	Rendzina with limestone outcrops - shallow water table PH8	Some Euc. diversifolia & Euc.landsdownea present	25'	15"	32°F	456
4115	S8176	Charters Towers	20°0'S	146°17'E	1,019	Sandy Loam	?	?	?	35.5°F	633.75
4116	S8301	10 miles W of Mt. Isa on Mary Catherine Rd.	20°43'S	139°35'E	1200	Shales & (sand & loam) of creek bed	Pure stand on creek	15'-35'	10"-24"	27°F	162.5
4117	S8298	Gilbert R. 40 miles W of Georgetown	18°10'S	142°50'E	800	River loam & alluvial over granite	Melaleuca sp. plus occ. Casuarinasp.	25'-35'	10"-18"	29°F	711
4118	S7116	Goodarra Creek ½mile from junction with Tennant Creek N.T.	19°34'S	134°19½E	1100'	Sandy loam	Pure stand	25'-45'	14"-27"	36.4°F	346.25
4119	S7084	20 miles N of Three Springs W.A.	29°20'S	115°35'E	1,000	Silty grey loam	Euc.loxophleba associated Aff. with Euc. rudis	?	?	32.0°F	394.75
3919	-	Zanzibar	6°30'S	39°20'E	?	?	Suspected hybrid from Zanzibar	?	?	?	?

TABLE 2

SUMMARY OF GROWTH & SURVIVAL FOR 5 BEST PROVENANCES OF RIVER GUM (EUC.CAMALDULENSIS) AS AT 11/11/76

SERIAL NO.	ORIG. NO. PLANTED	SURVIVORS (%) 16/4/71 STHN. CROSS 16/4/71	MORAWA	ENEABBA (NTH)	8/11/72 STHN. CROSS	MORAWA	29/8/74 STHN. CROSS	11/11/76 STHN. CROSS	BULKED MEAN HT GROWTH (STHN. CROSS ONLY) (M) 8/11/72	29/5/74	11/11/76	THRIFT (ASSESST) (% HEALTHY) 8/11/72	COMMENT
4110	12	4(36)	5(84)	6(60)	(25)	50	25	25	0.89	1.60	2.5	16.6	33.5% lignotubers in nursery. Freedom from insect attack except at Nth. Eneabba. Weak anthocyanin leaves
4111	11	9(89)	4(66)	4(40)	81	50	72.72	63	1.68	3.23	3.64	81.8	
4112	17	8(57)	4(66)	5(50)	46	33.3	47	47	1.68	3.22	5.94	47	Nil anthocyanin. Very salt resistant. Nil lignotubers. Severe insect attack.
4113	12	7(70)	5(84)	8(80)	58	16	58	58	0.95	1.86	2.71	50	
4114	10	10(100)	-	4(40)	100	-	100	100	1.18	2.21	3.05	90	Lignotubers nil. Weak anthocyanin in leaves. Moderate insect attack
4115	7	4(57)	4(66)	7(70)	62	66	57	57	1.08	2.17	3.38	57	Weak anthocyanin leaves. Salt resistant also. 35.5% lignotubers mod. insect attack
4116	12	9(90)	4(66)	4(40)	75	16	75	75	1.43	2.86	4.33	75	
4117	17	13(81)	3(50)	5(50)	64	33.3	64	64	1.20	2.12	3.20	52.9	17.8% lignotubers. Marked anthocyanin in leaves. Virtually nil insect attack
4118	10	9(90)	6(100)	10(100)	90	82	90	90	0.90	1.88	2.39	80	Variable salt resistance. 12.2% lignotubers. Marked anthocyanin in leaves. Little insect attack at Southern Cross
4119	12	6(56)	6(100)	1(10)	33.3	82	33.3	33.3	0.92	1.73	2.63	33.3	
3919	5	2(40)	3(50)	2(20)	40	33.3	20	20	0.70	1.25*	2.0*	-	

* 1 Observation only
Salt resistance estimate ex C.F. & T.B.

PROVENANCE LEAF LIGNOTUBER AND PHYSICAL FEATURES WITH INSECT ATTACK OBSERVATIONS FOR ENEABBA & SOUTHERN CROSS (3 OBSERVATIONS)

SERIAL NUMBER	LEAF LAMINA DIMENSIONS	LEAF COLOUR	LIGNOTUBES AND NUMBER OF OBSERVATIONS/BATCH	HEIGHT OF STOCK Maximum Minimum	GENERAL APPEARANCE AND VIGOUR "A" "B" "C"	M=MARKEDLY - W=WEAKLY ANTHOCYANIN COLOURATION + -	ORIGIN OF SEED	SEED LOT NUMBER	INSECT ATTACK "A" "B" "C"	TOTAL NUMBER OF PLANTS RAISED	RAINFALL OF ORIGIN OF SEED	INSECT AND PROBABLE LIGNOTUBERS SUITABILITY	INSECT OBSn. & IDENTIFICATIONS 12/71	" 11/72 (ENEABBA)	"
4110	Juv. 4½"x1¼" Mat.	Mid Green of 4118	10/42 =23%	Mn=4" Mx=18"	"A"	+ M	Upper waterhole 5 miles from pumping station for Wyndham water supply.	S8409/14	"C"	42	39.00"			Ants Egg specimen on (leaves)	
4111	Juv.4"x⅞" Mat.	Mid Green	14/42 =33.5%	Mn=3" Mx=16½"	"B-C"	+W	Newcastle Water Creek N.T.	S7080	"B"	42	19.1"	XXX		Curculionid Beetle on leaves Ants Leaves	
4112	Juv.4¼"-¾"	Glaucous Green	-/48 ---	Mn=12" Mx=26"	"A"	-	Walpola Island S.F., 35 miles west of Mildura N.S.W.	S6991	"B"	48	9.71			Leaf curlers Leaf suckers Ants on Leaves	
4113	Juv.4"x1" Mat.	Deep Glaucous green	-/70 ---	Mn=5" Mx=15"	"A"	-	Silverton 13 miles west of Broken Hill	S6980-89	"C"	70	9.20"		Beetle infestation (Eneabba)	Giant Curculionid Brown Beetles. Greg. gall weevil. Ants Leaf Suckers (Leaves)	
4114	Juv.3¼"x1¼-1½" Mat.	Deep green glaucous	-/38 ---	Mn=2½" Mx=18½"	"B-C"	+W	Little swamp 5 miles west of Port Lincoln S.A.	S6975-79	"B"	38	18.24"	X		Giant Curculionid (grey) Rusty colored Curculionid Leaf binders & curlers (Leaves)	
4115	Juv.3½"x1" Mat.	Mid Green	10/33 =30.3%	Mn=2½" Mx=16¼"	"B-C"	+	Charters Towers	S8176	"C"	33	12.00"			Grey Curculionid. Greg. gall weevil - Ants (Leaves)	
4116	Juv.6"x1¼" Mat.	Mid Green	17/48 =35.5%	Mn=2¾" Mx=21"	"A"	+W	10 Miles west of Mt. Isa on Mary Katherine Road	S8301	"C"	48	6.5"			Greg. gall weevil - Red/Br Scarab Beetle Ants (Leaves)	
4117	Juv.5"x⅝-1" Mat.	Mid Green Cf 4118	10/56 17.8%	Mn=7" Mx=16½"	"A"	+M	Gilbert River 40 miles West of George Town	S8298	"C"	50	28.43			Vegetable Bug (Leaves)	
4118	Juv.5"x1" Mat.	Mid Green	5/41 =12.2%	Mn=2" Mx=15½"	"A"	+M	Goodairs Creek ½ mile from the junction with Tennant Creek N.T.	S7116	"C"	41	13.85			Greg. gall weevil R/Br scarab beetle Chrysomelid beetle. Leaf curlers Large fly cabbage moth Ants (Leaves)	
4119	Juv.2½"x1½-2"	Mid to	1/48	Mn=3½"	"B"	-	20 miles North of Three Springs	S7084	"A"	44	15.79"	XX		Greg. gall weevil Ants (Leaves)	

PROVENANCE LEAF LIGNOTUBER AND PHYSICAL FEATURES WITH INSECT ATTACK OBSERVATIONS

FOR ENEABBA & SOUTHERN CROSS (3 OBSERVATIONS)

TABLE 3

	SEED LOT NUMBER	INSECT ATTACK "A" "B" "C"	TOTAL NUMBER OF PLANTS RAISED	RAINFALL OF ORIGIN OF SEED	INSECT AND PROBABLE LIGNOTUBERS SUITABILITY	INSECT OBSn. & IDENTIFICATIONS 12/71	11/72 (ENEABBA)	3/11/75 (STHn. CROSS)	10/9/76 (STHn. CROSS)	11/76 (STHn. CROSS)
waterhole s from g station ndham supply.	S8409/14	"C"	42	39.00"			Ants Egg specimen on (leaves)	NIL OBn	NIL OBn	Leaf eaters
tle Water N.T.	S7080	"B"	42	19.1"	XXX		Curculionid Beetle on leaves Ants Leaves	NIL OBn	"	-
a Island 35 miles f Mildura	S6991	"B"	48	9.71			Leaf curlers Leaf suckers Ants on Leaves	NIL OBn	"	-
ton 13 west of Hill	S6980-89	"C"	70	9.20"		Beetle infestation (Eneabba)	Giant Curculionid Brown Beetles. Greg. gall weevil. Ants Leaf Suckers (Leaves)	Gall attack Leaf curlers	Leaf eaters - Curculionids S/Fam. Leptopiinae Prypnus sp "Lerps" - Psyllidae Glyoaspis sp. Leaf hoppers = Eurg-mela rubrovittata	Leaf eaters
swamp 5 west of incoln	S6975-79	"B"	38	18.24"	X		Giant Curculionid (grey) Rusty colored Curculionid Leaf binders & curlers (Leaves)	Corkscrew leaf only on 2 of 10 Trees	"	
rs Towers	S8176	"C"	33	12.00"			Grey Curculionid. Greg. gall weevil - Ants (Leaves)	Leaf tiers only (PYRALID Moths) S/Fam:Epipaschiinae (New Species)	NIL OBn	
es west Isa on atherine	S8301	"C"	48	6.5"			Greg. gall weevil - Red/Br Scarab Beetle Ants (Leaves)	Leaf tiers only (PYRALID Moths)	"	
t River 40 West of Town	S8298	"C"	50	28.43			Vegetable Bug (Leaves)	NIL OBn	As for 4113	
rs Creek from the on with t Creek	S7116	"C"	41	13.85			Greg. gall weevil R/Br scarab beetle Chrysomelid beetle. Leaf curlers Large fly cabbage moth Ants (Leaves)	Stem borer 1 Tree only (Xyloryctid moth).	NIL OBn	Borers in 1 Stem
les North ree Springs	S7084	"A"	44	15.79"	XX		Greg. gall weevil Ants	Gall attack (Hymenopterous gall wasps)	As for 4113	Leaf eaters