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PRELIMINARY STUDY ON THE GROWTH OF NATURAL MULANJE CEDAR ON MULANJE MOUNTAIN

Abstract

The diameter growth of natural Mulanje Cedar is reported. The data from sample trees is recorded for further study.

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Introduction

Widdringtonia cupressoides (commonly called 'Mulanje Cedar' in Malawi) occurs naturally on some mountain ranges of southern Africa. It is only on Mulanje Mountain that the species attains the huge dimentions of over 40m in height and 1m in diameter. Despite its economic value and botanical importance, very little data is available concerning the growth rates of the species on the mountain.

The author collected some specimens (discs) of the tree from Mulanje Mountain to carry out stem analysis. But, regrettably, this aim was not achieved because of the complexity of the annual rings. The tree often produces false annual rings, and the annual ring itself is sometimes obscure; in addition the rings are extremely close together especially as the tree becomes older; because of this, accurate ring counts were not possible. Consequently as a preliminary to further study the author decided to record all available data. The discs are stored at The Forestry Research Institute of Malawi in Zomba.

1.Specimen data

The specimens were collected from the C.C.A.P. cedar forest on Lichenya Plateau, Mulanje Mountain, from 21st to 23rd March and 18th to 22nd April 1988.

Four trees were felled - two dead and two live - and the discs cut. The discs were left to dry indoors, then planed to facilitate ring counts.

The data is presented in Table 1 - 4.

2.Preliminary study on cedar growth

2-a Method

The diameter growth of each sample at 1.5m height was studied. But, because of its irregular shape (see Table 1), the disc for Tree A was taken from a height above ground of 3.3m.

The radius of each of the 10 annual rings in four directions was measured, and the mean diameter and area calculated. The age was estimated by adding 5 years to the number of annual rings (10 years for Tree A) for convenience' sake.

The results are shown in Table 5 - 8. It must be admitted that there are some errors in the annual ring count for the reasones mentioned in the

Table I

Tree A

- Dead tree

- **Collected Disc**

Disc No (A-)	I	2	3	4	5	6	7	8	9	I0
height from ground (m)	0.3	I.3	3.3	5.3	7.3	9.3	II.3	I3.3	I5.3	I7.3
remarks										

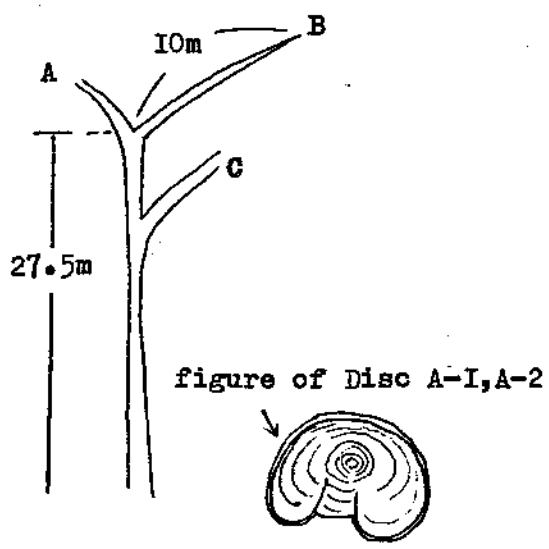
II	I2-①	I2-②	I3-①	I3-②	I4	I5	I6
(I9.3)	(2I.3)	(2I.3)	(23.3)	(23.3)	(25.3)	(26.3)	(27.3)
shift D0.2m	D0.4m	U0.25	D0.4m	U0.4m	D0.2m	U0.2m	D0.2m

U – upward
D – downward

- **Branch**

height (m)	diameter (cm)	direction	remarks
I3.3	I0.2	W	
I3.6	5	S80°W	
I4.0	I9	S80°W	
I4.3	20	W	
2I.2	I7.5	S70°W	
2I.9	II.	N30°E	
23.I	I3.0	S	
25.3	9.5	N	
26.I	I3.0	S80°W	
26.4	24.0	N	Branch C
27.5	30	S60°W	" B
"	I8.5	N45°W	" A

- **Others**



Tree B

∘ Dead tree

∘ Collected Disc

Disc No (B-)	0	I	2	3	4	5	6	7	8	9
height from ground (m)	0	I.5	3.0	6.0	9.0	I2.0	I5.0	I8.0	2I.0	24.0
remarks							break into some pieces			

I0	II	I2	I3	I4	I5
27.0	30.0	33.0	36.0	37.5	39.0

from NoI5 to the tree top I.Im

∘ Branch

height (m)	diameter (cm)	direction
24.5	I6	S50°W
27.6	22	S
29.4	I3	W
3I.0	20	W
"	I0	E
3I.4	23	S
33.I	I0	W
34.8	I2	N80°W
35.2	I7	E
36.5	20	E

∘ Others

* sapwood is rotten

Table 3

Tree C

∘ Live tree

∘ Collected Disc

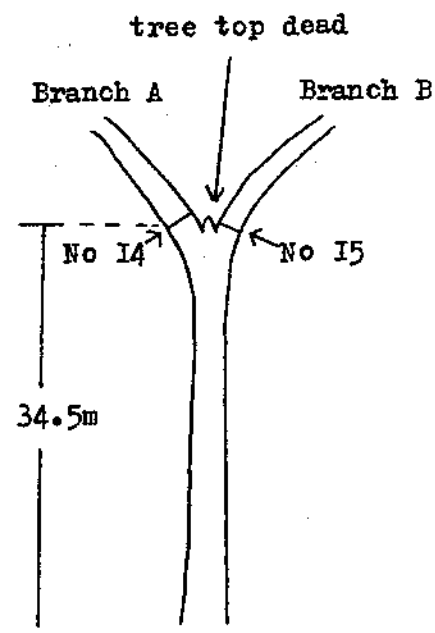
Disc No (C-)	0	I	2	3	4	5	6	7	8	9
height from ground (m)	0	I.5	3.0	6.0	9.0	I2.0	I5.0	I8.0	2I.0	(24.0)
remarks										shift D0.7m

I0	II	I2	I3	from NoI3 to the tree top I.5m	I4	I5
27.0	30.0	3I.5	33.0		see below	

∘ Branch

height (m)	diameter (cm)	direction	remarks
I8.I	9	S	dead
I8.7	5	S45°W	dead
2I.0	I0	S	live
2I.0	I0	W	dead
↓	many live branches		

Others



Tree D

• Live tree

◦ Collected Disc

Disc No (D-)	0	I	2	3	4	5	6	7	8	9
height from ground (m)	0	I.5	3.0	6.0	9.0	I2.0	I5.0	(I8.0)	2I.0	24.0
remarks		break into two pieces			shift U0.8m					

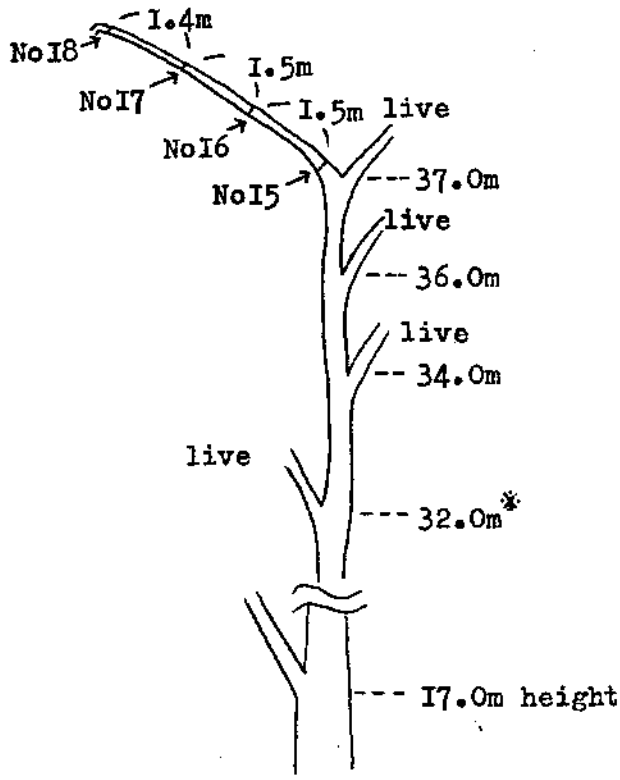
I0	II	I2	I3	I4
27.0	30.0	33.0	34.5	(36.0)
				shift D0.2m

I5	I6	I7	I8
see below			

from NoI4 to the tree top I.0m

◦ Branch

height (m)	diameter (cm)	direction	remarks
I7.0	22	N50°W	dead
I8.3	I4	N50°W	dead
27.0 ~	many dead branches		
※32.0	20	N	live



Data of Disc A-3 (height 3.3m)

Age	Radius (cm)				Mean diameter (cm)	Area (m^2)
	r_1(N)	r_2(E)	r_3(S)	r_4(W)		
bark	lost	lost	lost	lost		
336	34.7	29.3	28.7	38.4	65.55	0.3375
330	34.5	-*(29.2)	-*(28.5)	38.2	65.20	0.3339
320	34.1	-*(29.1)	-*(28.4)	37.9	64.75	0.3293
310	33.9	-*(29.0)	-*(28.2)	37.5	64.30	0.3247
300	33.5	-*(28.9)	-*(28.1)	37.1	63.80	0.3197
290	33.3	-*(28.7)	-*(27.9)	36.7	63.30	0.3147
280	32.9	-*(28.6)	27.8	36.2	62.75	0.3093
270	32.6	-*(28.5)	27.5	35.8	62.20	0.3039
260	32.2	-*(28.3)	27.3	35.6	61.70	0.2990
250	31.9	-*(28.2)	27.0	35.2	61.15	0.2937
240	31.5	28.1	26.5	34.5	60.30	0.2856
230	31.0	27.7	26.0	33.9	59.30	0.2762
220	30.5	27.3	25.7	33.3	58.40	0.2679
210	29.7	26.9	25.3	32.5	57.20	0.2570
200	29.0	26.4	24.6	31.2	55.60	0.2428
190	28.0	25.9	24.0	30.4	54.15	0.2303
180	27.1	25.1	23.4	28.5	52.05	0.2128
170	26.2	24.5	22.8	27.1	50.30	0.1987
160	25.3	23.8	22.2	26.4	48.85	0.1874
150	24.4	23.0	21.4	25.1	46.95	0.1731
140	23.1	22.1	20.9	23.2	44.65	0.1566
130	22.1	21.0	20.2	22.2	42.75	0.1435
120	21.0	19.9	19.4	21.4	40.85	0.1311
110	19.6	18.7	18.4	20.1	38.40	0.1158
100	18.1	17.1	17.3	18.4	35.40	0.0985
90	16.3	15.7	16.0	17.0	32.50	0.0830
80	15.0	14.2	15.0	15.8	30.00	0.0707
70	13.3	12.1	13.5	13.7	26.30	0.0543
60	10.1	9.9	11.7	11.2	21.45	0.0361
50	7.7	8.0	10.5	9.3	17.75	0.0247
40	5.4	6.1	8.2	7.1	13.40	0.0141
30	4.1	4.7	6.7	5.4	10.45	0.0086
20	2.3	2.3	2.4	2.4	4.70	0.0017
10	0.0	0.0	0.0	0.0	0	0

* Age = Annual ring + 10

Table 6

Data of Disc B-I (height I.5m)

Age	Radius (cm)				Mean diameter (cm)	Area (m^2)
	r_1(N)	r_2(E)	r_3(S)	r_4(W)		
bark	lost	lost	lost	lost		
sapwood	rotten	exist	exist	rotten		
Max. diameter	3I.7(*33.7)	38.3	53.6	34.0(*36.0)	80.80	0.5I28
⋮	⋮	⋮	⋮	⋮	⋮	⋮
270	30.8	35.5	48.4	33.0	73.85	0.4283
260	30.3	34.9	47.8	32.I	72.55	0.4I34
250	29.7	34.3	47.0	3I.6	7I.30	0.3993
240	29.3	33.9	45.6	3I.I	69.95	0.3843
230	28.7	33.2	44.2	30.7	68.40	0.3675
220	28.2	32.8	43.0	30.3	67.I5	0.354I
2I0	27.7	32.5	4I.8	29.7	65.85	0.3406
200	26.7	3I.8	40.8	28.9	64.I0	0.3227
I90	26.I	30.6	40.0	28.3	62.50	0.3068
I80	25.7	29.6	38.4	27.2	60.45	0.2870
I70	25.3	28.7	36.6	26.6	58.60	0.2697
I60	24.4	27.9	35.0	25.8	56.55	0.25I2
I50	23.3	26.6	33.7	25.2	54.40	0.2324
I40	22.5	24.9	3I.7	24.4	5I.75	0.2I03
I30	2I.4	23.5	30.2	23.2	49.I5	0.I897
I20	20.4	22.4	28.5	2I.9	46.60	0.I706
II0	I9.I	20.9	26.7	20.5	43.60	0.I493
I00	I7.6	I8.8	24.3	I9.0	39.85	0.I247
90	I6.I	I6.9	2I.9	I7.5	36.20	0.I029
80	I5.2	I5.6	I9.7	I6.3	33.40	0.0876
70	I3.7	I4.3	I7.6	I4.7	30.I5	0.07I4
60	II.6	II.8	I4.8	I2.4	25.30	0.0503
50	8.9	9.3	II.8	I0.0	20.00	0.03I4
40	6.5	6.7	9.0	7.3	I4.75	0.0I7I
30	4.9	5.2	6.7	5.3	II.05	0.0096
20	3.4	3.5	4.4	3.6	7.45	0.0044
I0	I.3	I.I	I.2	I.I	2.35	0.0004

• Age = Annual ring + 5

*For convenience max diameter is estimated by adding 2cm (mean

Table 7

Data of Disc C-I (height I.5m)

Age	Radius (cm)				Mean diameter (cm)	Area (m^2)
	r_1(N)	r_2(E)	r_3(S)	r_4(W)		
bark	32.8	29.0	33.0	35.6	65.20	
210	31.2	27.8	31.1	34.0	62.05	0.3067
200	-*(31.1)	27.5	30.9	33.8	61.65	0.2985
190	-*(31.0)	27.2	30.7	33.4	61.15	0.2937
180	-*(30.9)	26.9	30.1	32.7	60.30	0.2856
170	30.8	26.2	28.9	31.5	58.70	0.2706
160	29.2	25.0	27.7	30.8	56.35	0.2494
150	28.3	24.3	26.7	28.9	54.10	0.2299
140	27.1	23.4	26.0	27.9	52.20	0.2140
130	25.5	22.4	24.9	26.6	49.70	0.1940
120	23.7	21.2	23.3	24.8	46.50	0.1698
110	21.7	19.7	21.5	22.9	42.90	0.1445
100	19.9	18.1	19.8	21.0	39.40	0.1219
90	18.0	16.6	18.3	18.9	35.90	0.1012
80	16.2	15.0	16.3	17.0	32.25	0.0817
70	13.9	12.6	14.2	14.4	27.55	0.0596
60	11.7	11.0	12.4	12.2	23.65	0.0439
50	9.6	9.1	10.6	10.0	19.65	0.0303
40	7.1	7.3	8.4	7.7	15.25	0.0183
30	5.6	5.4	6.6	5.9	10.75	0.0091
20	3.9	3.5	4.3	3.8	7.75	0.0047
10	1.1	1.1	1.1	1.0	2.15	0.0036

Data of Disc D-I (height I.5m)

Age	Radius (cm)				Mean diameter (cm)	Area (m^2)
	r_1(SW)	r_2(SE)	r_3(NE)	r_4(NW)		
bark	37.5	33.6	38.8	broken	73.27	
284	36.2	32.0	38.0		70.80	0.3937
280	36.0	3I.7	-※(37.7)		70.27	0.3878
270	35.7	3I.4	-※(37.4)		69.67	0.38I2
260	35.2	3I.0	37.I		68.87	0.3725
250	34.6	30.5	36.2		67.53	0.3582
240	34.3	30.I	35.5		66.60	0.3484
230	33.6	29.8	33.8		64.80	0.3298
220	32.9	29.3	33.I		63.53	0.3I70
2I0	32.4	28.7	32.I		62.I3	0.3032
200	3I.6	28.2	3I.3		60.73	0.2897
I90	30.9	27.5	30.7		59.40	0.277I
I80	30.5	27.I	30.I		58.47	0.2685
I70	29.7	26.7	29.3		57.I3	0.2564
I60	28.8	26.3	28.5		55.73	0.2440
I50	28.I	25.8	28.0		54.60	0.234I
I40	27.I	25.2	27.5		53.20	0.2223
I30	25.8	24.6	26.5		5I.27	0.2064
I20	25.I	24.2	25.9		50.I3	0.I974
II0	24.I	23.3	24.7		48.07	0.I8I5
I00	23.0	22.4	23.2		45.73	0.I643
90	2I.6	2I.3	2I.9		43.20	0.I466
80	20.I	20.I	20.8		40.67	0.I299
70	I8.2	I8.2	I8.9		36.87	0.I067
60	I6.2	I6.0	I6.7		32.60	0.0835
50	I3.6	I4.3	I4.2		28.07	0.06I9
40	I0.5	II.5	II.I		22.07	0.0382
30	6.9	8.3	7.7		I5.27	0.0I83
20	4.6	5.3	4.9		9.87	0.0076
I0	I.3	I.6	I.5		2.93	0.0007

∘ Age = Annual ring + 5

※ For convenience the figures were estimated on the weighted average to calculate the mean diameter.

Fig.1

Diameter Growth I

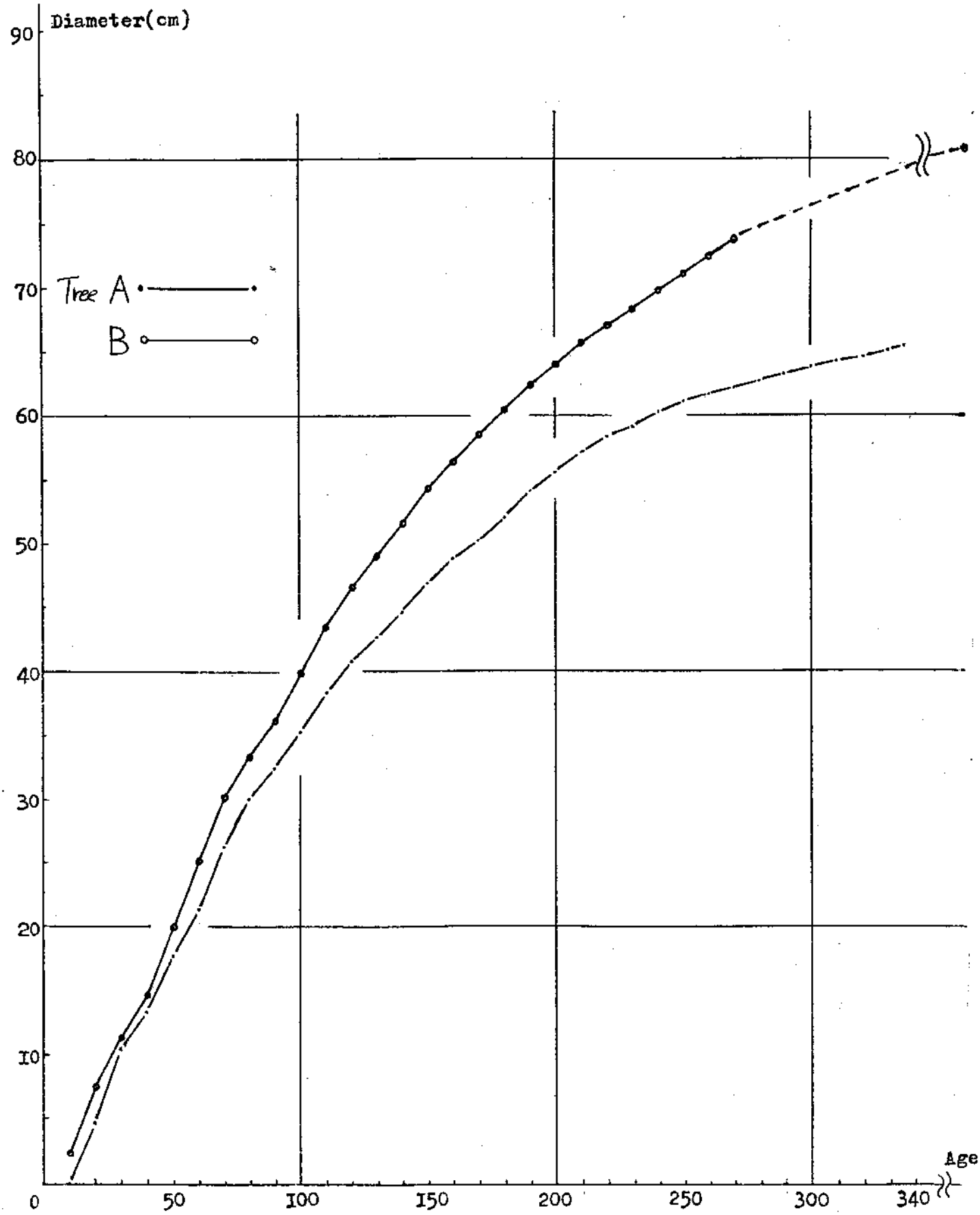
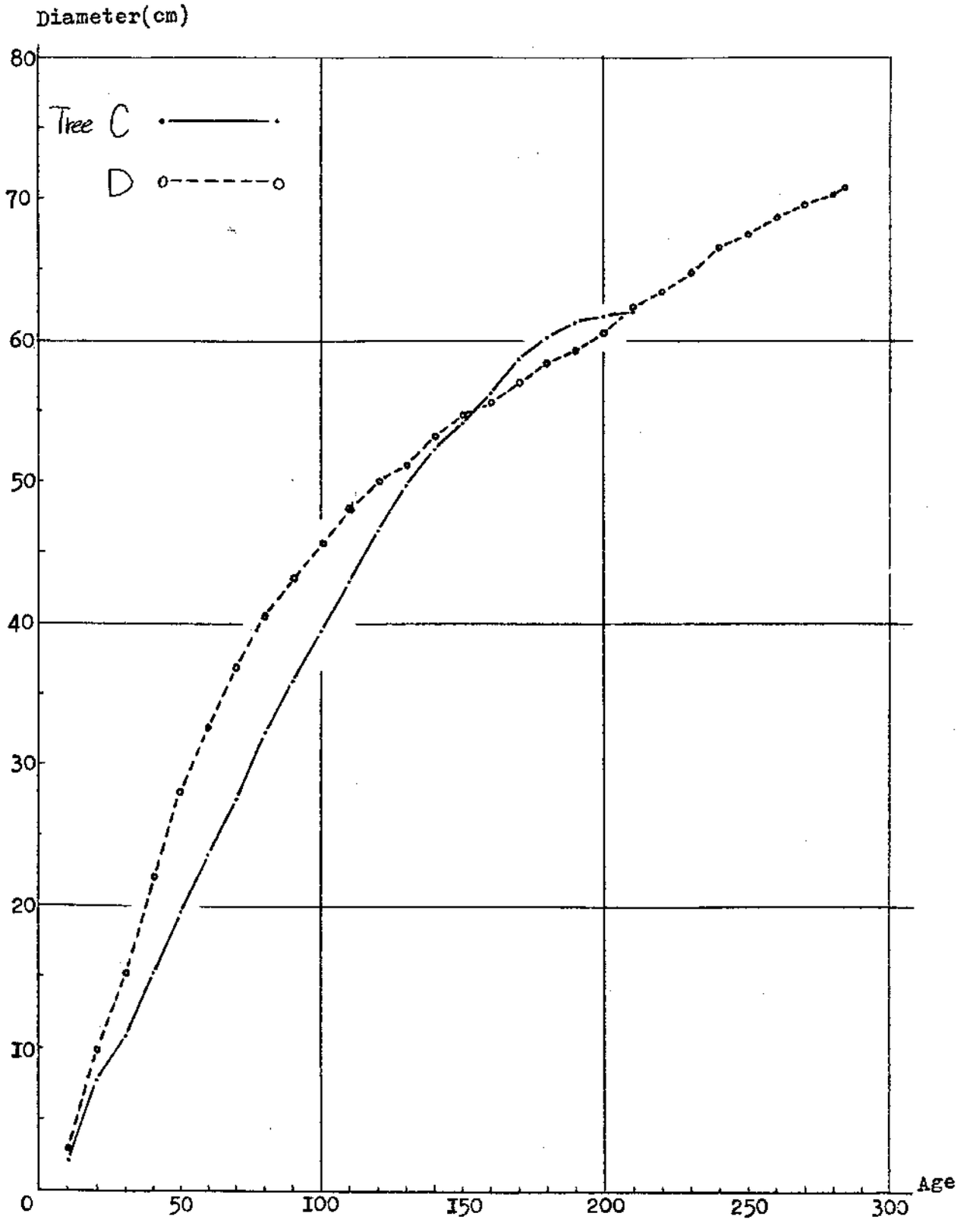


Fig.2

Diameter Growth 2



2-b Discussion

Cedar grows very steady but slowly (see Fig.1,2). It takes 55 - 80 years to reach 30cm diameter, which is much slower than the planted cedar on Zomba Mountain, which takes about 44 years to reach the same diameter in an average of five samples (Anon 1951). At about 200 years age the growth rate declines gradually. At this age it reaches between 55 and 65cm in diameter. During the final stage of its life the annual increment is very slow; it often adds only 0.1mm to its radius.

It is not known why natural cedar on Mulanje grows slower than that planted on Zomba. The difference of soil or climate at each growing stage is possible, and there may be genetic differences. In addition silvicultural treatment may be a contributing factor.

On the other hand there have been no studies on the growth of planted cedar on Mulanje. Such studies should form an essential part of any management plan for cedar on Mulanje Mountain.

Reference

1. Anon : 1951, Preliminary Yield Table for Mulanje Cedar on Evergreen Site on Zomba Mountain
2. Chapman,J.D.: 1961, Notes on Widdringtonia; KIRKIA Vol.1 1960 - 61