Tropical Agricultural Research Vol. 1 1989

A Survey of Cinnamon Germplasm in Sri Lanka

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ABSTRACT. Cinnamon (Cinnamomum verum, Presl.) germplasm from six districts that would represent 'Negombo cinnamon' and 'Southern cinnamon' were evaluated for four qualitative variables; bark appearance, petiole and wet bark pungency/taste and dry bark pungency and the corresponding behaviour in their percentage of oil in the processed dry bark. Considerable variability exists for all parameters observed. However, there were no detectable differences among the four groups. Testing the hypothesis that 'Negombo cinnamon' is superior to that of 'Southern material', the evidence was contrary to the above belief that 'Southern cinnamon' (samples from Matara and Galle) had more percentage oil than that from two of the three districts (Colombo & Matale) that represent 'Negombo cinnamon' if percentage of oil is an indicator of quality.

INTRODUCTION

The true cinnamon (*Cinnamomum verum*, Pesl.) belong to the family Lauraceae and is indigenous to Sri Lanka. Cinnamon was believed to be traded with the Roman Empire as early as the first century (Brown *et al.*, 1959). As far back as the 16th century, cinnamon products were traded with the West on a regular basis and ultimately resulted in several foreign invitations of the island changing its course of history. The cultivated land extent of 40,000 acres (16,000 ha) produces about 7500 MT. earnings about 450 million rupees in foreign exchange to the national income. (Economics Research Unit, Department of Minor Export Crops).

Present cultivation of cinnamon is centered around 3 main pockets. The well known Negombo cinnamon belt is the first organized cultivation by the Dutch in the 16th century and is fast vanishing due to rapid

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industrialization in the area. The second and the largest cinnamon extent is found in Ambalangoda, Meetiyagoda area of Galle district and the third being Kamburupitiya Hakmana tracts in Matara district. (Wijesekera *et al.*, 1975).

Being native to Sri Lanka, considerable genetic variability of cinnamon could be expected in this island. Sri Lanka also happens to be the centre of diversity of cinnamon and by looking at the land races found in farmer's fields this could be easily established. The forms recognised by growers include sweet or honey cinnamon (*Peni kurundu*), Camphor cinnamon (*Kapuru kurundu*), Astringent cinnamon (*Kahata kurundu*), Mucilaginous cinnamon (*Sevel kurundu*) and Bloom cinnamon (*Mal kurundu*). Though farmers tend to explain 6 – 7 types of cinnamon among the cultivars clear distinction is not found. (Samarawira, 1964).

There is a popular belief that the cinnamon grown in Negombo belt produces superior quality cinnamon relative to other growing areas. Also no information is available about the yielding ability and its relationship to quality in respective land races. For the on-going genetic improvement programme of cinnamon, it is important to know the probable relationship between the yielding ability and the quality with special reference to organoleptic properties. Therefore the main objective of this study is to see the variation in the organoleptic properties in the germplasm of cinnamon.

MATERIALS AND METHODS

Cinnamon stick samples were randomly collected from different locations of major cinnamon growing districts in Sri Lanka (Table 1). The number of samples taken from each location was variable according to the cultivated extent involved and the social-economic status of the farmers. At least 3 members of the seven member experienced panel went to the field at a time and selected the cinnamon sticks randomly, recorded the bark appearance, petiole and wet bark pungency/taste. They were given instructions to categorise the wet bark samples into 4 groups, according to their level of pungency (low, medium, high and very high) and also to record any other special taste that was found *i.e.* bitter, sweet *etc.* The level of petiole pungency (low, medium, high and very high) as well as other special tastes and the bark appearance

Table 1. The mean, the co-efficient of variability, and standard error values for percentage oil content in cinnamon bark from six districts for four qualitative variables

Qulitv. Variable	Qulitv. varib. Cate.	MATARA X	MATARA SE+++	GALLE X	GALLE SE	COLOMBO X	COLOMBO SE	GAMPAHA X	GAMPAHA SE	MATALE X	MATALE SE	KANDY X	KANDY SE
		% Oil Content (V/W dry weight basis)											
+Bark appearance	01	1.44	0.88	1.72	0.11	0.71	0.08	1.41	0.21	1.22	0.08	1.04	0.16
	02	1.89	0.08	1.44	0.13	1.07	0.20	1.26	0.10	0.96	0.16	0.46	-
	03	1.76	0.09	0.90	-	1.22	0.34	1.48	0.09	-	-	-	-
++Petiole Pungency level	01	1.45	0.11	1.49	0.12	-	-	-	-	1.31	0.16	1.33	0.37
	02	1.72	0.09	1.86	0.15	0.84	0.08	1.59	0.03	0.97	0.40	0.85	0.31
	03	1.51	0.25	1.87	0.22	-	-	-	-	-	-	0.53	0.14
* Wet bark Pungency level	01	1.24	0.11	0.86	0.09	-	-	1.54	0.02	0.53	0.04	-	-
	02	1.62	0.17	1.62	0.25	0.76	0.07	1.61	0.02	1.61	0.19	1.05	0.20
	03	1.80	0.16	1.23	0.32	1.46	0.41	-	-	1.12	0.09	0.69	0.20
**Dry bark Pungency level	01	1.57	0.25	1.41	0.15	0.82	0.22	1.59	0.03	0.90	0.15	1.59	0.03
	02	1.51	0.13	1.32	0.13	1.31	0.24	1.38	0.11	1.24	0.19	1.38	0.11
	03	1.49	0.14	1.42	0.13	0.79	0.05	1.16	0.04	1.12	0.18	1.16	0.04

\+ Bark appearance category 01 - Smooth; 02 - Medium; 03 - Rough

++ Petiole Pungency level 01 - Low; 02 - Medium

* Wet bark Pungency level 01 - Low; 02 - Medium; 03 - High

** Dry bark Pungency level 01 - Low; 02 - Medium (rough, medium and smooth) of the selected cinnamon stems were also recorded.

Selected cinnamon stems were processed into cinnamon quills and given to the same panel for tasting again. They were given the instructions to categories the samples into 3 groups as low, medium and high pungency levels. Moisture and volatile oil contents of the separated dried cinnamon samples were determined by the American Spice Trade Association (ASTA) analytical methods 2.0 and 5.0 respectively (Anon. 1968). Descriptive sensory analysis was used to explain the type of the taste and the level of pungency in the petiole, wet and dry bark of cinnamon. Numerical values were allotted to the descriptive words for the statistical analysis (Stone *et al.*, 1974). The data was analysed by using SAS (Statistical Analysis System) package micro-computer version at the Post-Graduate Institute of Agriculture (PGIA) Computer Unit.

RESULTS AND DISCUSSION

The mean % of oil content (V/W dry basis), their coefficient of variability and standard error value for the cinnamon samples collected from Matara, Galle, Colombo, Gampaha, Matale and Kandy districts, when grouped according to their appearance and pungency level in relation to the four qualitative parameters, bark appearance, petiole, wet bark and dry bark pungency level are given in Table 1. It should be noted that in petiole pungency/taste groupings, seven categories, *i.e.* low, medium, high, very high, bitter, sevel and sweet and in wet bark pungency/taste all these seven categories and an eighth; kahata were recorded. The frequency of occurrence of the categories from the very high to kahata were low for most of the districts. Hence these latter stated categories are given in Histograms A to E but not included in the analysis presented in Table 1, but will be used in future genetic evaluations. The grand mean value for percentage oil contents in all samples is 1.25 and ranged from 0.39 in one sample from Kandy to 1.87 from Galle. Whether one looks at the variability when grouped according to bark appearance or petiole pungency/taste or the other two qualitative variables, still considerable variation is observed for this parameter. The standard error values for the estimates are smaller but often high values shown for the coefficient of variability may have been due to the environmental variation over locations within a district.

In this first ever study of the variability of *Cinnamomum verum* germplasm, we wanted to know whether there are any significant differences in percentage oil content when the samples were grouped according to each of the groups of four qualitative variables (Figures 2 to 5). As could be seen from these Figures, though some variability exists, they were not statistically different. It may be that the influence of varying environmental conditions in which these plants were growing were masking their differences even if they existed. This aspect will be re-examined once these materials are evaluated at Pallolpitiya cinnamon substation under uniform conditions.

Another objective of this study was to test whether there are any detectable differences in cinnamon from different districts. There is a popular belief among people of Sri Lanka as well as in reports (Purseglove *et al.,* 1981) that the cinnamon produced in Negombo cinnamon tracts are superior in quality relative to cinnamon from the South of the island. When the data were analysed to test differences in percentage oil from six districts one could find some significant differences. With all four qualitative variable groups there were some differing districts for this trait. Since they were the same samples in most instances, the behaviour of mean percentage oil in the bark from different districts with respect to dry bark pungency grouping is presented in Table 2 and in Figure 1. From this table it is evident that district 1 as well as district 2 differ from that of districts 3, 4 or 5. This means that the percentage oil content in the bark samples from Matara and Galle differ from that of Matale, Colombo or Kandy. The cinnamon samples from Matara and Galle represent the 'Southern cinnamon' while Colombo represents part of 'Negombo cinnamon'. Samples from Matale is basically material brought from Negombo germplasm to Matale for evaluation. The origin of Kandy district cinnamon is uncertain. One could argue that the percentage oil in the bark samples of 'Southern cinnamon' is different from that of Negombo material or its progenies grown elsewhere. This statement would have been stronger if Gampaha material behaved similar to that of Colombo which also represents Negombo cinnamon. However, the common mean value for percentage oil in cinnamon bark from Galle and Matara districts was 1.45 whereas the corresponding value for Colombo, Matale and Kandy districts was 1.15. This shows that 'Southern cinnamon' has more oil in the bark than 'Negombo cinnamon'. There is no evidence in literature to show that the percentage oil in the bark is positively correlated to pungency. Even if the pungency/taste is related in that

Table 2. The results of the test of differences in mean values among districts for percentage oil content in bark when grouped according to dry bark pungency categories.

District + / + District	1	2	3	4	5	6
1						
2	NS					
3	**	*				
4	**	*	NS			
5	***	**	NS	NS		
6	NS	NS	NS	NS	*	

\+ 1. Matara
2. Galle
3. Matale
4. Colombo
5. Kandy
6. Gampaha

* Significant at 5% level
** Significant at 1% level
*** Significant at 0.1% level

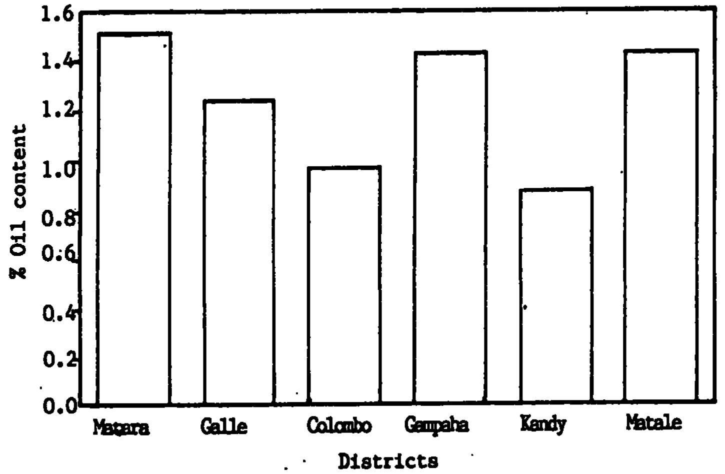

Fig.1. Mean percentage values of oil in dry bark of cinnamon from six districts.

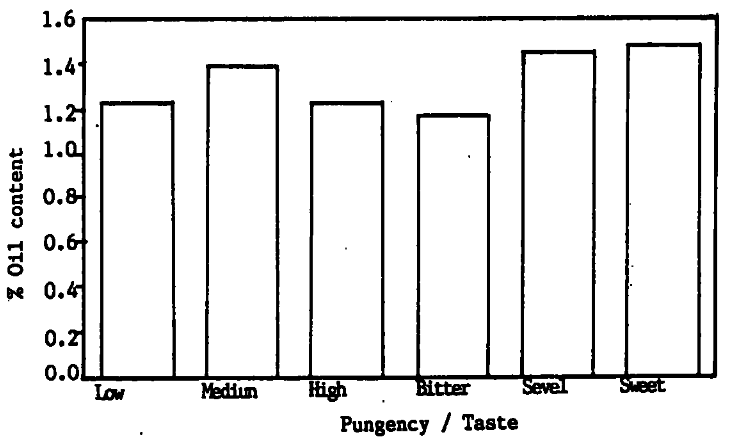

Fig.2. Mean percentage of oil in dry bark samples of cinnamon when grouped according to peteole pungency/taste levels.

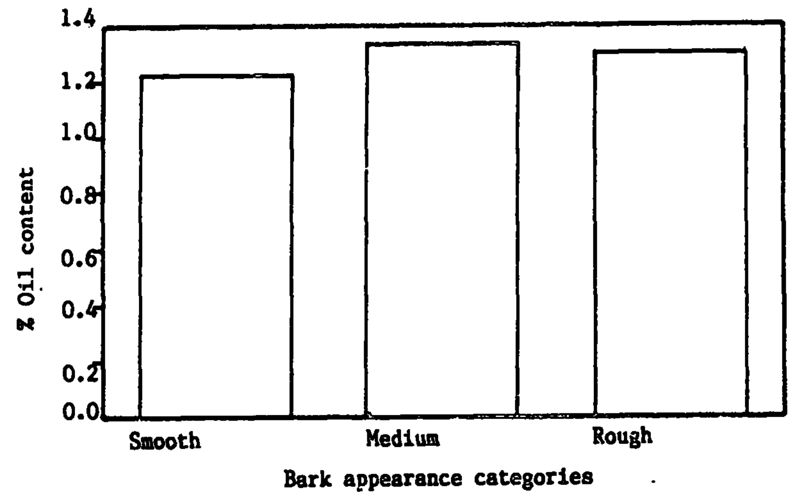

Fig.3. Mean percentage oil in dry bark samples of cinnamon when grouped according to bark appearance categories.

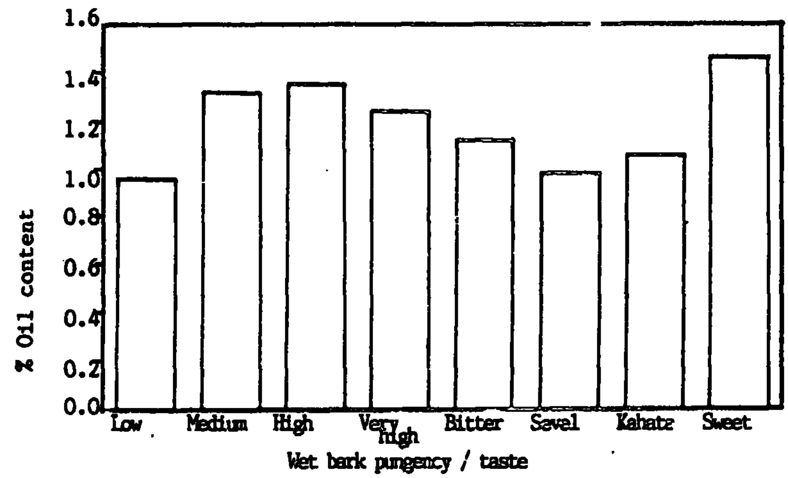

Fig.4. Mean percentage oil in dry bark samples of cinnamon when grouped according to wet bark pungency/taste levels.

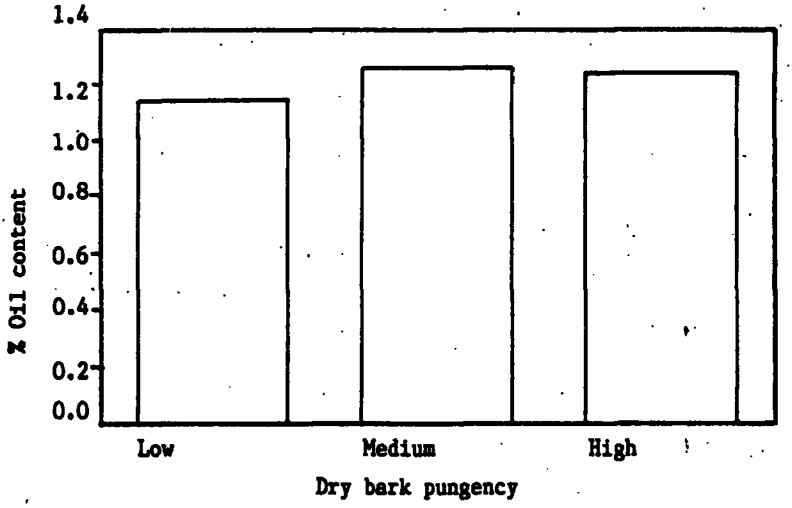

Fig.5. Mean percentage oil in dry bark samples of cinnamon when grouped according to dry bark pungency/taste levels.

manner, then the inevitable result is that the 'Southern cinnamon' is superior to that of 'Negombo cinnamon' which is contrary to the popular belief.

The experience with cinnamon for the last 15 years has shown us that when cinnamon is grown under shade (as seen in Negombo area under coconut) the bark tends to be thinner than when grown under relatively exposed conditions (as seen in the Southern cinnamon). Traditionally, peelers in Negombo area are found to produce cinnamon quills of fine grade because they are relatively thinner due to shade effects and they are used to produce more of this grade than Southern peelers. This type of fine grade could be produced from 'Southern cinnamon' as well if they are harvested at similar maturities. The tradition is to wait a little longer where the bark thickens, the yield increase but the proportion of fine grades decreases. In other words the production of fine grades is due to tradition as well as thickness of the bark of their working material. The samples in this study were of comparable age, but the thickness may have been different due to their degree of shade among other factors. Yet the important factor is that traditionally relatively coarse grade cinnamon of the South has given more oil than that of fine grade cinnamon from Negombo area. This means that the so called 'fine cinnamon' may not necessarily have higher oil in their barks.

In this first ever report on quality variability of true cinnamon germplasm in Sri Lanka, it is interesting to note that there is some evidence to show that they differ with respect to location. Evolutionally these three centres namely, 'Negombo cinnamon', 'Galle cinnamon' and 'Matara cinnamon' are specially separated hence it is quite probable to develop distinct features. A study directed on genetic structuring of these populations will shed more light on regional evolution. More information obtained from this study on the variability in chemical composition of volatile oils will be reported in a separate paper.

ACKNOWLEDGEMENTS

The authors wish to express their gratitude to Dr. S. Kathiragamathaiyah, Director, Department of Minor Export Crops for his encouragement and keen interest on this study as well as for granting permission to publish this work. We are thankful to the Research

Assistants for their numerous help at all stages of this exercise. Assistance extended by the A.DD and E.OO of the Extension Division of the Department is kindly appreciated. Grateful acknowledgements are made to Dr. R.O. Thattil, Senior Lecturer, Biometrics Department, PGIA, Peradeniya for his valuable suggestions in statistical analysis. We are greatly indebted to the Natural Resources, Energy and Science Authority of Sri Lanka for financial support (Grant No: RG/86/C/3).

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