



**Quality Standards &**

**Maintenance of Artisanal Tea '**

*By*

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At National Institute of Plantation Management

Aturugiriya.



**‘Tea Quality Standards’**

**&**

**‘Maintenance of the Quality of  
Artisanal Tea’**

# 1/. 'Tea Quality Standards'

- Sri Lankan (or National) Standards – eg. SLS
- International Standards – eg. ISO
- Global – Producer Country Stds. – eg. GB, JP, KS, IS..
- Global – Consumer Country Stds. – eg. BS, EU, NZ, SASO ...
- Private (or regulatory) Standards – SLTB/MQS

# 1/. 'Tea Quality Standards' Cont'd...

- Black Tea Standards – ISO 3720: 2011  
SLSI 135:2009 (AMD 421:2011)
- Green Tea Standards – ISO 11287:2011  
SLSI 1413:2011
- Instant Tea Standards – ISO 6079:2021
- Purple Tea – KS/ ISO 2745:2017



# Major elevation categories in tea plantations in Sri Lanka

In Sri Lanka, black tea produce from three major growing areas

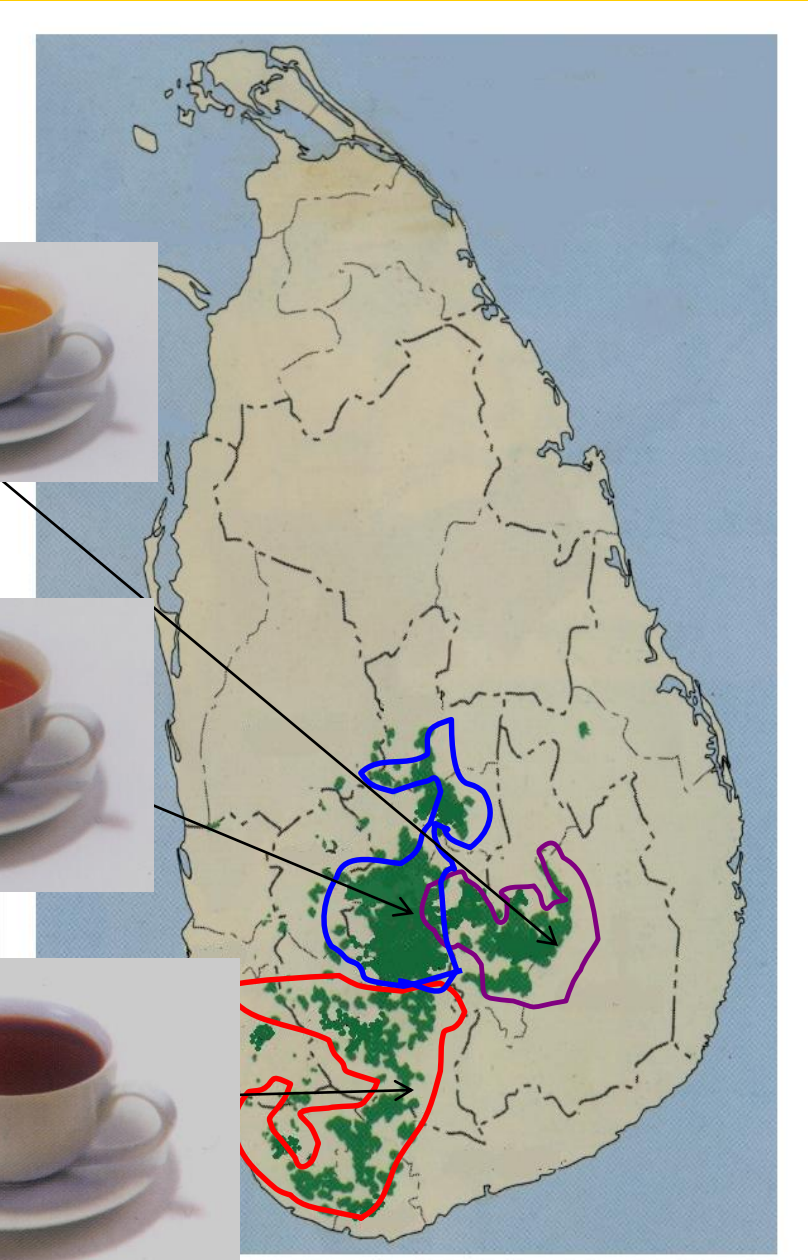
☛ **High grown** – produced 24%  
-Over 1,200m(4,000ft),MSL



☛ **Mid grown** – produced 16%  
-in between 600m-1,200m  
(2000-4000 ft), MSL



☛ **Low grown** – produced 60%  
-below 600m(2,000ft), MSL





# • Geographical locations in high grown region where speciality teas were produced

## ☼ High grown

- Nuwara Eliya
- (10 Nos. Tea Factories)



- Dimbula
- (97 Nos. Tea Factories)



- Udupussalawa
- (14 Nos. Tea Factories)



- Uva
- (65 Nos. Tea Factories)





# What is artisanal tea?





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# What is artisanal tea?

Artisanal tea is it just a synonym for handmade tea?

The making of any tea variety requires a whole chain of production steps. Any of these steps can be done manually, or with the help of some sort of machine.

It is also often the case, that different persons realize different steps, everyone having his own area of expertise.

In view, the most important aspect of artisanal tea is the tea artisan himself. To be called “artisanal”, a product has to be planned and realized by tea artisans, according to their intensions.



# What is artisanal tea?

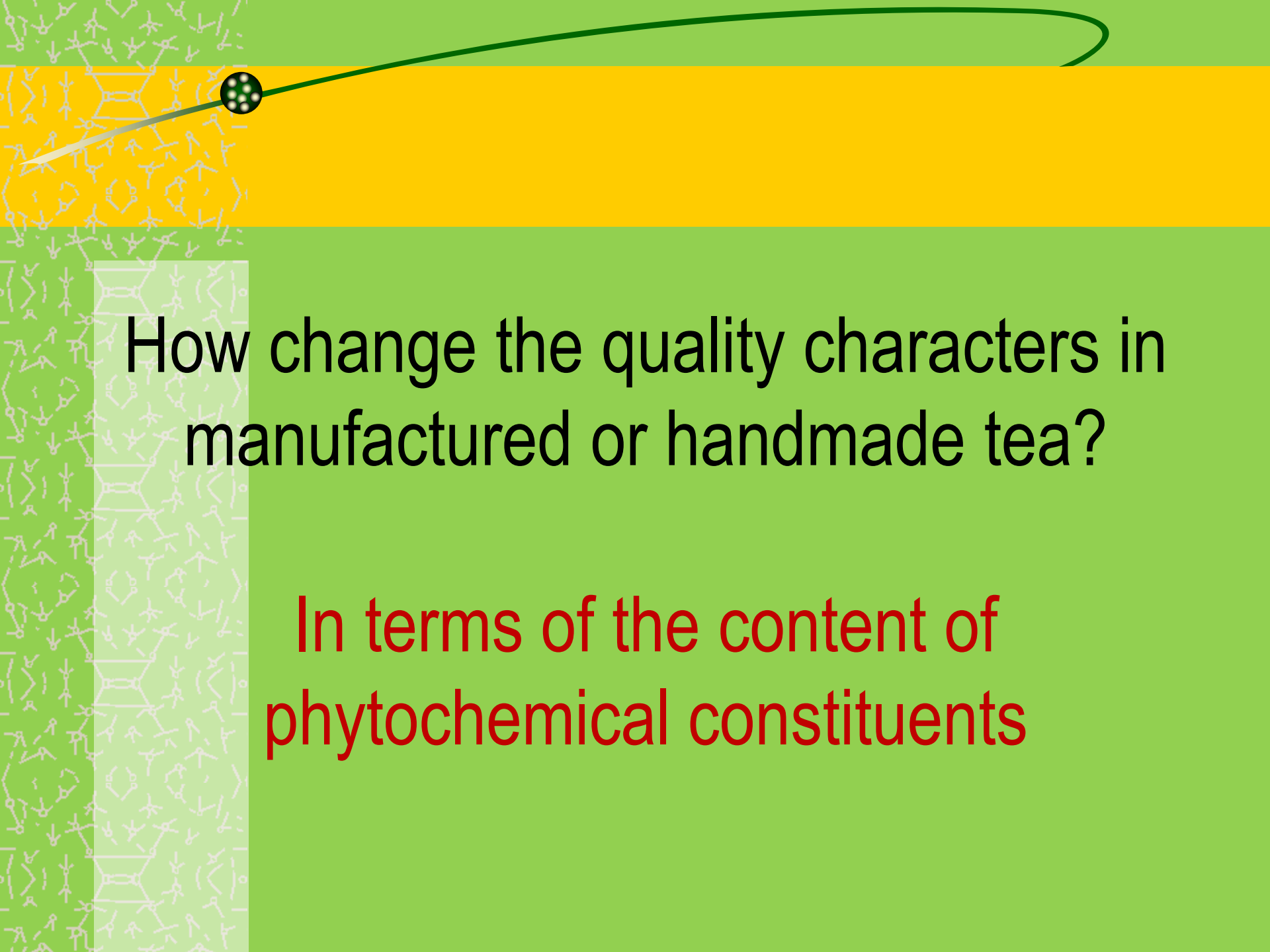


## Black tea



Differences in artisanal Vs Traditional tea





How change the quality characters in  
manufactured or handmade tea?

In terms of the content of  
phytochemical constituents

# Possible factors effects on differences of teas produce in different elevations

- Genetic factors
  - Type of cultivar, Seedling, VP
- Environmental factors
  - Soil factors, Weather & Climatic factors (mainly precipitation), Light intensity, Wind velocity, Shade, RH (Relative humidity), Altitude
- Agricultural practices
  - Field, Planting, Fertilizer, Pesticides applications
- Manufacturing practices
  - **Traditional:-** Plucking, Withering, Rolling, Roll braking, Fermentation/ Aeration, Firing, storing
  - **Artisanal:-** Plucking, soft withering, manual operation

# Important morphological characters of tea shoot may specific to *Camellia sinensis* plant grown in Sri Lanka

Surface area of leaf  
Length of the leaf  
Width of the leaf  
Length between internode  
Growth rate of bud  
Shade affected from top leaf  
Disturbance from under leaf  
Erectness of leaf  
Traffic on plucking table  
Micro environment on climax

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# Important morphological characters of tea shoot may specific to *Camellia sinensis* plant grown in Sri Lanka

Specially the tea phytochemicals highest in leaf bud/ immature leaf, behave individually and no chance to react each other or no contact with tea enzymes such as polyphenol oxidase.





# Important morphological characters of tea shoot may specific to *Camellia sinensis* plant grown in Sri Lanka

No shade trees  
Maximum solar intensity  
Cold climate

Tea cultivars commonly used;  
TRI 2021  
TRI 2023  
TRI 3013

High geographical elevations



Important morphological characters of tea shoot may specific to *Camellia sinensis* plant grown in Sri Lanka

**Moderate shade cover**  
**Medium solar intensity and period**  
**Moderate Humid climate**

Tea cultivars commonly used;  
TRI 2021  
TRI 2023  
TRI 3013

**Medium geographical elevations**



# Important morphological characters of tea shoot may specific to *Camellia sinensis* plant grown in Sri Lanka

High shade cover  
Low solar intensity and shorter light period  
High humidity climate

Tea cultivars commonly used;  
TRI 2021  
TRI 2023  
TRI 3013

Low geographical elevations

# Major constituents of tender shoots of tea may be identical for 'Ceylon tea'

1. Polyphenols
2. Caffeine
3. Amino acids
4. Proteins/Enzymes
5. Volatile compounds
6. Carbohydrates
7. Vitamins & Minerals



The taste and the quality of brewed tea depend on the water-soluble constituents of the tender shoots and their water-soluble derivatives obtained during the process of tea manufacture. (Ref: Wickramasingha, 1978).

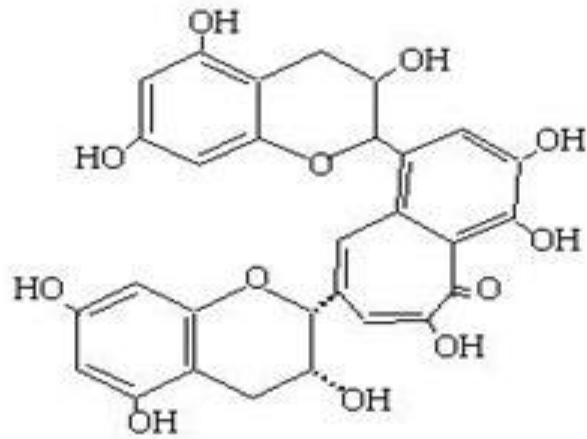


# Major Hot Water Extractable Organic Compounds of Black Tea may specific to 'Ceylon tea'

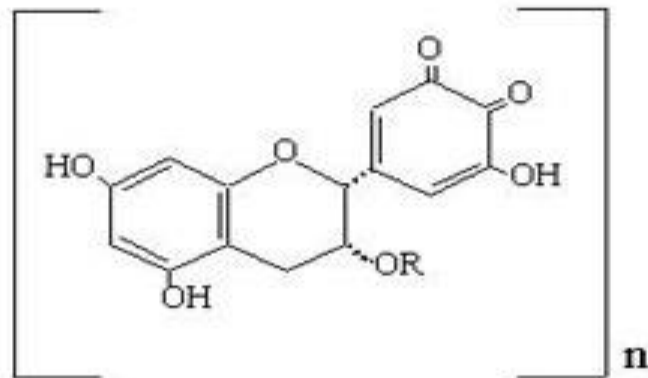
<i>Name of organic compound</i>	<i>% (m/m)</i>
<b>Caffeine</b>	<b>2 - 6</b>
<b>Total catechins;</b>	<b>1 - 5</b>
– <i>Epigallocatechin gallate (EGCG)</i>	<b>0.5 - 2.5</b>
– <i>Epigallocatechin (EGC)</i>	<b>0.1 - 0.3</b>
– <i>Epicatechin gallate (ECG)</i>	<b>0.5 - 1.5</b>
– <i>Epicatechin (EC)</i>	<b>0.1 - 0.5</b>
– <i>Catechin (C)</i>	<b>0.01 - 0.1</b>
<b>Theaflavins</b>	<b>0.5 - 1.0</b>
<b>Thearubigins</b>	<b>13 - 14</b>
<b>Total polyphenols content</b>	<b>18 - 23</b>

• (Modder & Amarakoon, 2002)

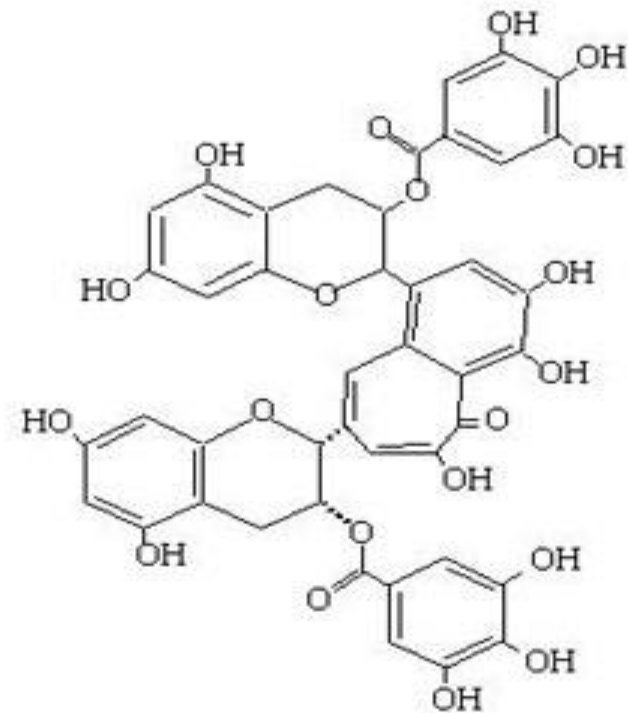
# Theaflavins and Thearubigins in 'Ceylon tea' **may** be a tool to categorize tea



Theaflavin



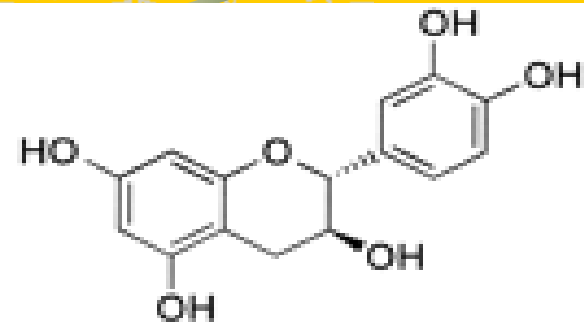
Thearubigins



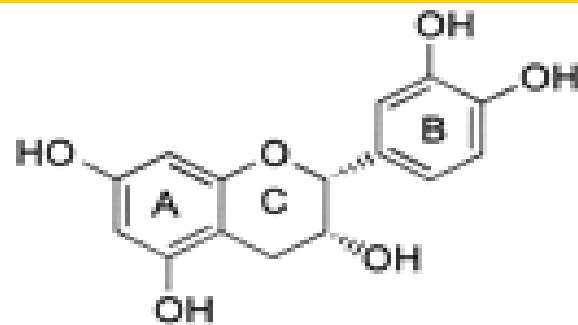
Theaflavin 3,3'-digallate



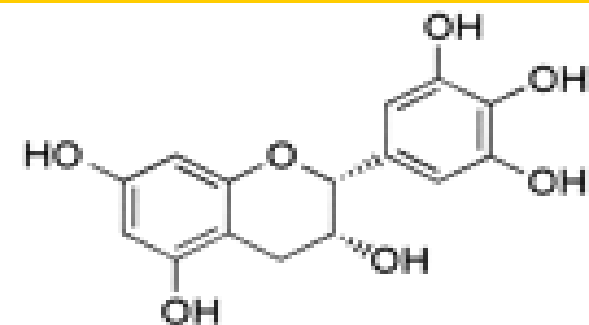
# Major Catechins in 'Ceylon tea' **may** be a tool to categorize tea



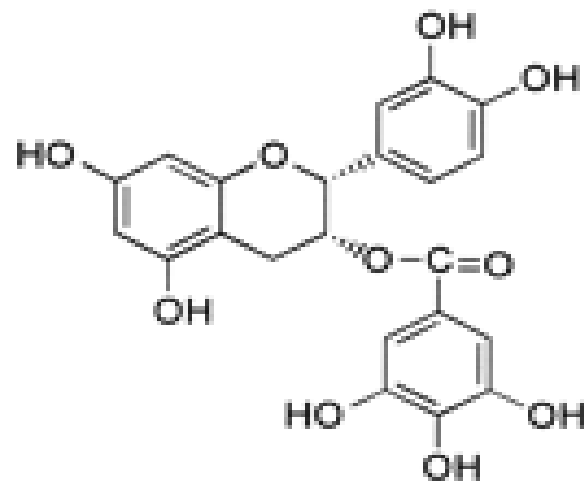
**(+)-Catechin (C)**



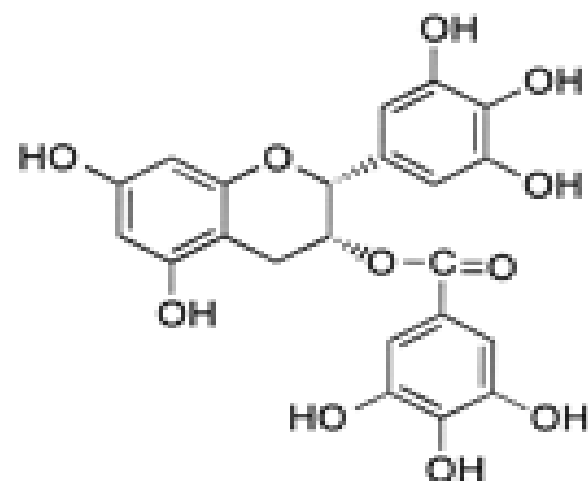
**(-)-Epicatechin (EC)**



**(-)-Epigallocatechin (EGC)**



**(-)-Epicatechin gallate (ECG)**



**(-)-Epigallocatechin gallate (EGCG)**

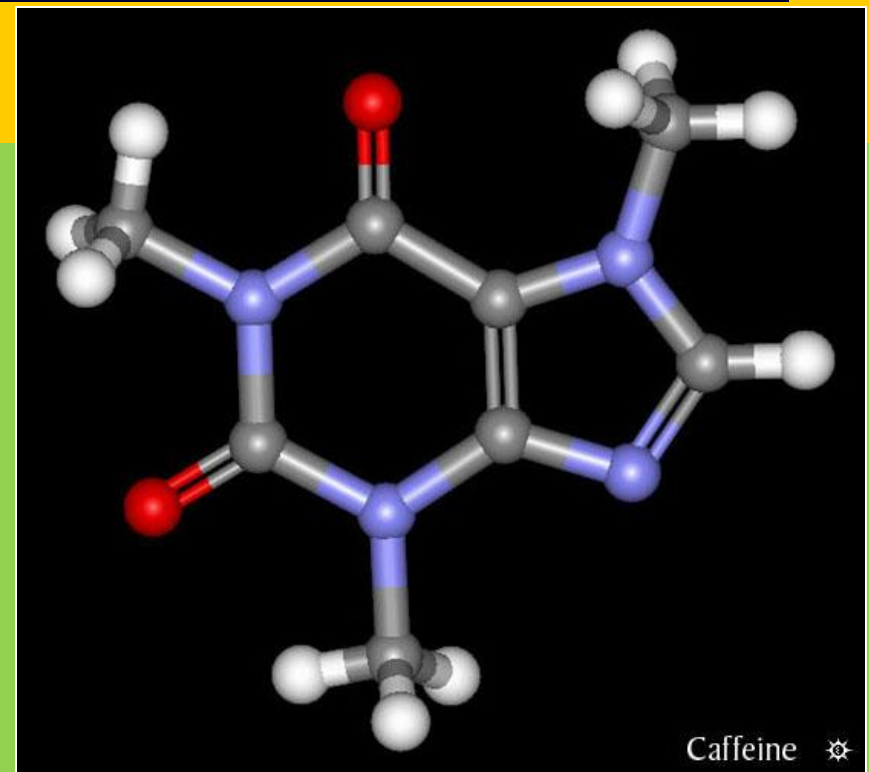
# Caffeine content in 'Ceylon tea' **may** be a tool to categorize tea

☛ Caffeine is soluble in hot water (precipitate on cooling),

☛ Theobromine (dimethyl compd.) and theophylline (monomethyl compd.) are the other methylxanthines in black tea which have closely related structures to caffeine,

☛ Caffeine is colourless, slightly bitter compound,

(Ref: Roberts, 1986).



$C_8H_{10}N_4O_2$ ,  
1,3,7, trimethylxanthine  
194.19 mw, 236<sup>0</sup> bp



# Major tea 'volatile compounds' in different geographical elevations, the composition specific for 'Ceylon tea'

Name of compound	Quality index		
	High Grown	Mid Grown	Low Grown
2. Methyl propanol	0.06±0.001	0.09±0.003	0.14±0.001*
Hexanal	0.03±0.003	0.05±0.002	0.07±0.001
(Z)-2-Hexanol	1.0 ± 0.0	1.0 ± 0.0	1.0 ± 0.0
(Z)-2-Penten-1-ol	0.05±0.003	0.09±0.001	0.14±0.004*
1-Hexanol	0.04±0.002	0.05±0.004	0.07±0.005
(Z)-3-Hexen-1-ol	0.13±0.005	0.18±0.004*	0.14±0.007
(Z)-2-Hexen-1-ol	0.07±0.002	0.14±0.006*	0.14±0.002*
Cis-Linalool-3, 6-Oxide	0.05±0.002*	0.05±0.001*	0.00±0.001
Trans-Linalool-3, 6-Oxide	0.15±0.003*	0.14±0.002*	0.07±0.003
Linalool	0.39±0.015*	0.33±0.003*	0.21±0.002
1-Octanol	0.03±0.002	0.05±0.003	0.07±0.002
n-Hexyl hexanoate	0.02±0.001	0.05±0.001	0.00±0.002
(Z)-3-Hexenyl hexanoate	0.05±0.003*	0.01±0.003	0.00±0.001
(Z)-2-Hexenyl hexanoate	0.84±0.003	0.91±0.014	0.86±0.018
α – Terpeneol	0.26±0.007*	0.05±0.003	0.00±0.001
E-3-Hexenyl (E)-3-hexenoate	0.07±0.001*	0.00±0.001	0.00±0.001
β – Ionone	0.04±0.002	0.01±0.000	0.07±0.001*
Methyl Salicylate	0.15±0.000*	0.14±0.002*	0.07±0.003
Geraniol	0.14±0.004*	0.05±0.004	0.07±0.001
Linalool/2-Methyl Propanol ratio	6.5±0.012	3.7±0.024	1.5±0.015
<b>Total of significant volatiles</b>	<b>3.34±0.027*</b>	<b>3.31±0.016*</b>	<b>3.09±0.033</b>

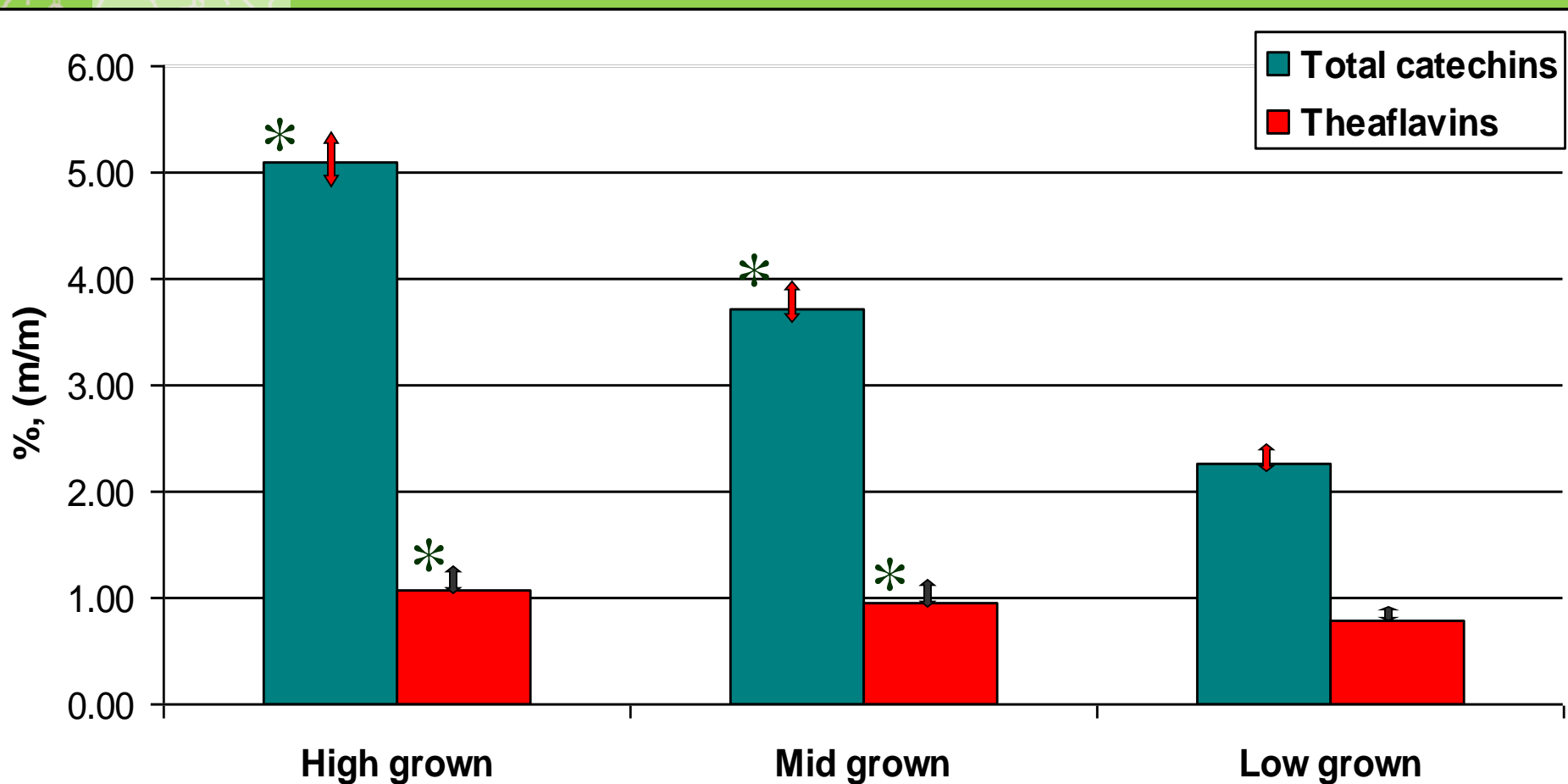
# Major tea polyphenol compounds in different geographical elevations, the composition specific to 'Ceylon tea'

<i>Name of compound</i>	<i>Results</i> (Black tea, BOPF; mean $\pm$ SEM, n = 12; *significant at $p \leq 0.05$ )		
	<i>High Grown</i>	<i>Mid Grown</i>	<i>Low Grown</i>
<b>Caffeine, % (m / m)</b>	<b>2.93 <math>\pm</math> 0.256</b>	<b>3.02 <math>\pm</math> 0.040</b>	<b>3.82 <math>\pm</math> 0.369*</b>
<b>Total catechins, % (m /</b>	<b>5.10 <math>\pm</math> 0.12*</b>	<b>3.72 <math>\pm</math> 0.11*</b>	<b>2.27 <math>\pm</math> 0.18</b>
<b>(-)Epigallocatechin gallate (EGCG), % (m / m)</b>	<b>2.28 <math>\pm</math> 0.20*</b>	<b>1.34 <math>\pm</math> 0.12</b>	<b>0.72 <math>\pm</math> 0.15</b>
<b>(-)Epigallocatechin (EGC) ), % (m / m)</b>	<b>0.28 <math>\pm</math> 0.02</b>	<b>0.42 <math>\pm</math> 0.03*</b>	<b>0.12 <math>\pm</math> 0.02</b>
<b>(-)Epicatechin gallate (ECG) ), % (m / m)</b>	<b>1.62 <math>\pm</math> 0.13*</b>	<b>0.43 <math>\pm</math> 0.06</b>	<b>1.31 <math>\pm</math> 0.14*</b>
<b>(-)Epicatechin (EC) ), % (m / m)</b>	<b>0.61 <math>\pm</math> 0.09*</b>	<b>0.68 <math>\pm</math> 0.11*</b>	<b>0.23 <math>\pm</math> 0.04</b>
<b>(+)Catechin (C) ), % (m / m)</b>	<b>0.13 <math>\pm</math> 0.04*</b>	<b>0.19 <math>\pm</math> 0.03*</b>	<b>0.04 <math>\pm</math> 0.01</b>
<b>Total polyphenols content, % (m / m)</b>	<b>21.12 <math>\pm</math> 0.17</b>	<b>22.05 <math>\pm</math> 0.25</b>	<b>19.53 <math>\pm</math> 0.20</b>
<b>Theaflavins, % (m / m)</b>	<b>1.06 <math>\pm</math> 0.15*</b>	<b>0.95 <math>\pm</math> 0.16*</b>	<b>0.79 <math>\pm</math> 0.08</b>
<b>Thearubigins, % (m / m)</b>	<b>13.26 <math>\pm</math> 0.13</b>	<b>13.67 <math>\pm</math> 0.22</b>	<b>14.86 <math>\pm</math> 0.14</b>
<b>Thearubigins /Theaflavins ratio</b>	<b>13.31 <math>\pm</math> 0.18</b>	<b>15.13 <math>\pm</math> 0.08</b>	<b>19.74 <math>\pm</math> 0.83</b>

(Abeywickrama, 2013)

# Tea Catechins and Theaflavins in different geographical elevations:

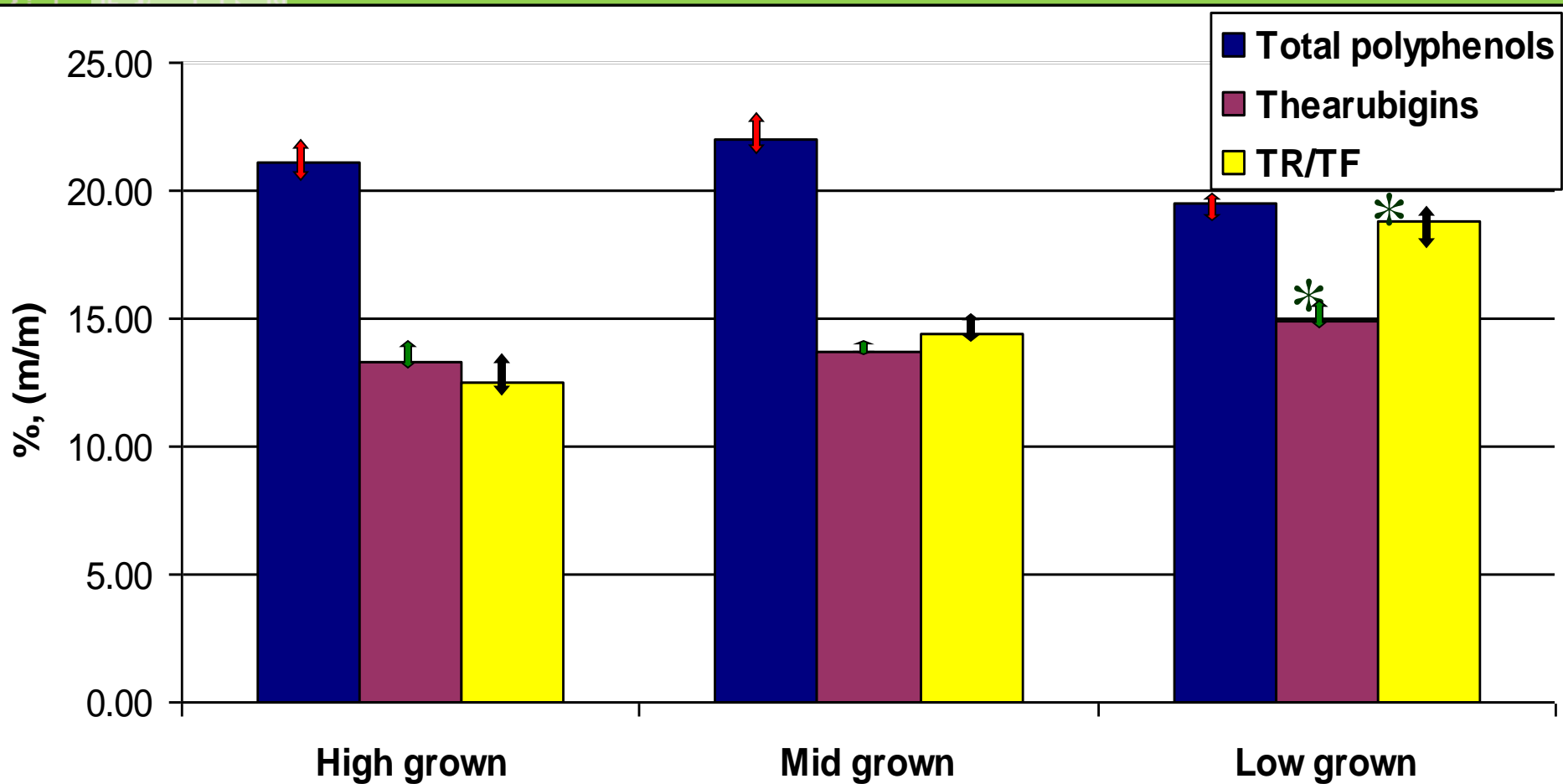
(Black tea, BOPF; mean  $\pm$  SEM, n = 12; \*significant at  $p \leq 0.05$ )





# Total polyphenols, thearubigins and its TR/TF ratios in different geographical elevations:

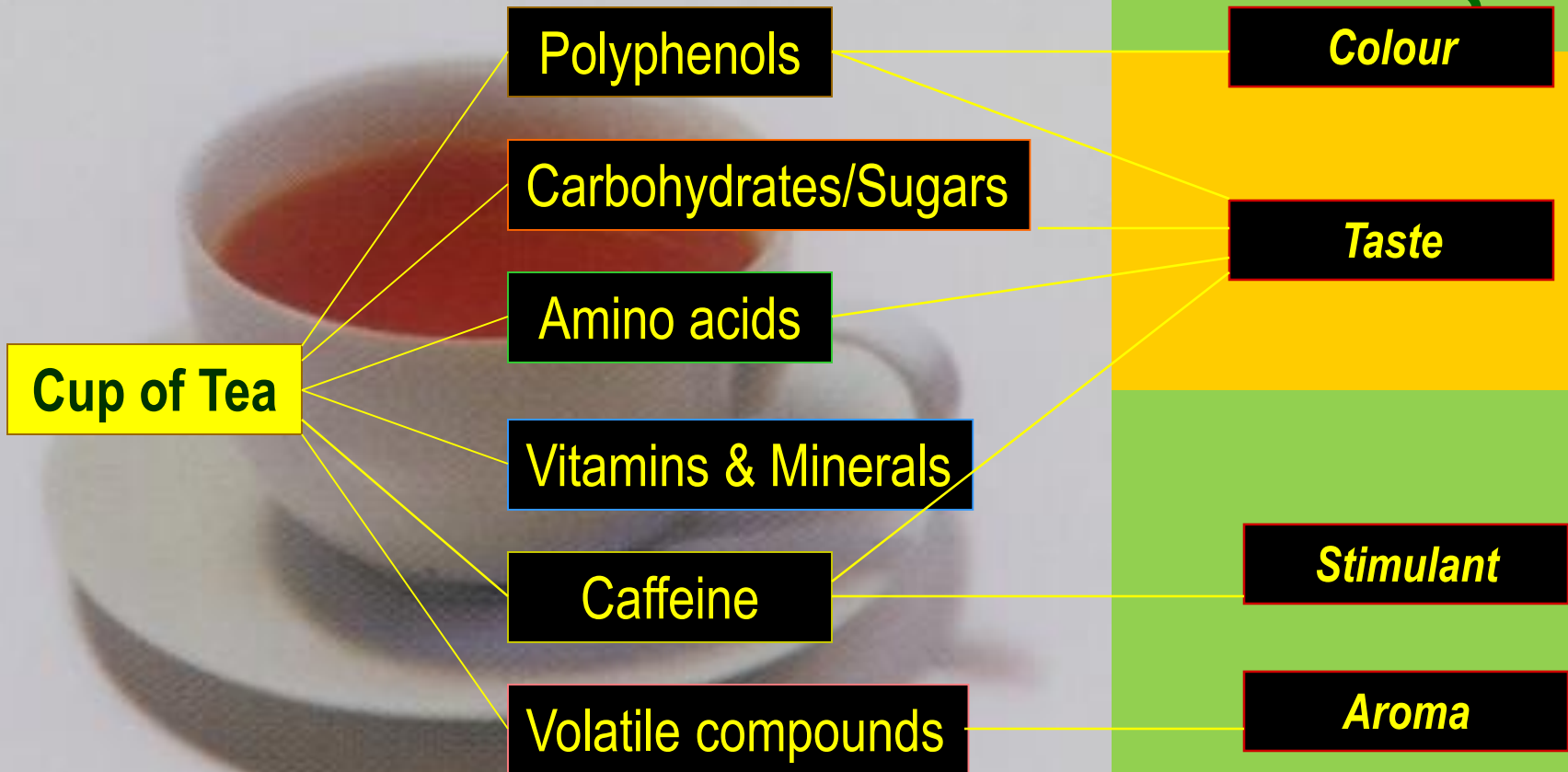
(Black tea, BOPF; mean  $\pm$  SEM, n = 12; \*significant at  $p \leq 0.05$ )



# What components in your tea cup ?

Subjective assessment Vs Objective assessment support for 'Ceylon tea'

'tea tasting'



# Diversity of 'Ceylon tea' in terms of sensory evaluation (subjective evaluation) as per the major GI regions

Subjective evaluation of liquor colour of tea brew of Sri Lankan black tea of different agro-climatic regions assessed by experienced tea Tasters .

(Black tea, BOPF; mean  $\pm$  SEM, n = 12; \*significant at  $p \leq 0.05$ )

**High grown**

**Mid grown**

**Low grown**

**Sensory evaluation**

**Light bright**

**Fair colour**

**Coloury**





Thank You.

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# Discussion on Chemical Quality

Continued to:  
**2/. 'Maintenance of the Quality of  
Artisanal Tea'**