Assessment of oil yield and quality in cinnamon (*Cinnamomum zeylanicum* Blume) leaves under different severity levels of two types of leaf galls

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Introduction

Leaf gall infestation in cinnamon, is one of the prominent pest damage found in cinnamon cultivations. In cinnamon, two conspicuous leaf gall types are available. They are upper leaf galls caused by jumping plant louse (Trioza cinnamomi), a homopteran and lower leaf galls caused by Eriophyes boisi, a mite belongs to family Eriophyidae. Two pests are plant sappers and form galls on leaf blade as their habitats. The feeding by Eriophyes boisi or Trioza cinnamomi causes abnormal cell development and formation of galls. Each gall type is identical and their dimensions are variable. The galls are solitary and widespread on the leaf blade but are not on the veins. These Gall forming pests generally do little damage to plants and its bark yield because the affected parts are able to carry out photosynthesis with near normal efficiency. But cinnamon leaf oil yield and its quality may be changed significantly due to gall forming (Perera et. al., 1985; Prematilaka and Dharmadasa, 1995). Therefore this study was conducted to determine the effect of two different leaf galls in cinnamon leaves under different severity levels on the leaf oil content and quality of oil.

Methodology

Cinnamon leaf samples infested with two types of galls, were collected from a field in Palolpitiya, Matara. Leaves only suffered from upper and lower gall infestations were harvested separately and categorized each of them into five pre-determined severity levels for oil extraction. Four severity levels of upper leaf gall infestation 1-50, 51 – 100, 101 – 150 and more than 151 galls per leaf and four severity levels of lower leaf gall infestation 1 -15, 16 – 30, 31 – 45 and more than 46 galls per leaf were compared with cinnamon leaves without galls separately. Five treatments were assigned in randomized complete block design with five replicates. 50 g of air dried cinnamon leaf sample taken from each severity level was weighed and all the galls in the sample were isolated and weighed. Weight of galls in each severity level was expressed as a percentage to the whole sample weight. Each sample was subjected to extract leaf oil by hydro distillation. Amount of the major chemical components present in the extracted oil samples were measured by performing Gas Liquid Chromatography (GLC). Oil content and quality were subjected to analysis of variance and regression analysis by SAS programme.

Results and Discussion

Thus it revealed that leaf oil contents were significantly different with the intensity of upper gall infestation (Table 1). It was observed that cinnamon leaf oil content had been lost from 10.48% at 25.62% severity to 74.26% at 97.26% severity. Same trend was observed in the case of lower

gall infestation (Table 2), but oil reduction due to this infestation had been occurred from 25.87% at 22.7% severity to 96.45% at 99.63% severity. Experimental results showed that mite galls (lower leaf galls) had reduced the oil yield in greater than the insect galls (upper leaf galls). Both upper and lower leaf gall infestations were caused to reduce the oil yield in cinnamon leaves and those infestations showed a strong negative significant relationship with the oil content in cinnamon leaves (Fig. 1 and 2). Prematilaka and Dharmadasa (1996) reported about 35% of oil reduction could be made due to upper leaf gall infestation, but the current study revealed that loss of oil content has been varied on severity of infestation.

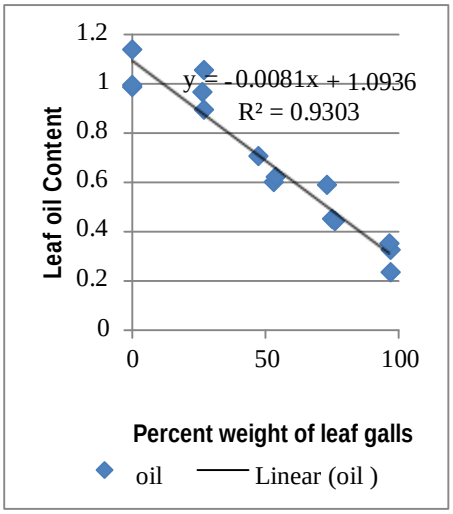

Figure 1: Correlation between leaf oil content under different infestation levels of upper leaf galls (proportion weight of leaf galls)

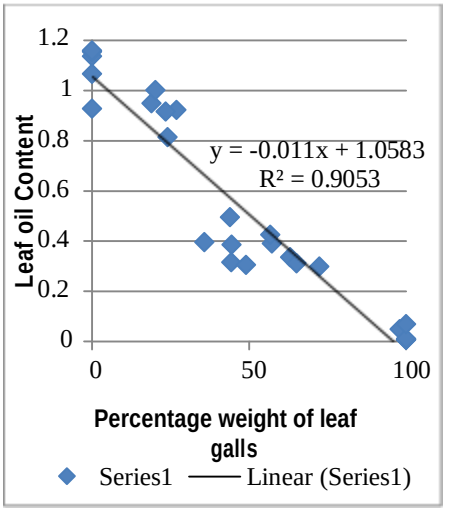

Figure 2: Correlation between leaf oil content under different infestation levels of lower leaf galls (proportion weight of leaf galls)

Table 1: Changes of cinnamon oil contents and its major components under different severity levels of upper leaf galls infestation made by *Trioza cinnamomi*

Severity level (No. of galls)	Percent Weight of galls	Oil content (%)	Eugenol	Acetyl Eugenol	Cinnamaldehyde
1(no)	00.00 ^{e}	1.05 ^{a}	85.44 ^{cb}	5.47 ^{c}	1.88 ^{c}
2 (< 50)	25.62 ^{d}	0.94 ^{b}	86.80 ^{ab}	4.91 ^{c}	2.09 ^{bc}
3 (51 – 100)	51.43 ^{c}	0.68 ^{c}	84.29 ^{c}	7.61 ^{a}	2.04 ^{bc}
4 (101 – 150)	74.41 ^{b}	0.49 ^{d}	87.23 ^{a}	7.75 ^{a}	2.72 ^{ab}
5 (> 151)	97.26 ^{a}	0.27 ^{e}	82.34 ^{d}	6.31 ^{b}	3.48 ^{a}
P value	0.0001	0.0001	0.0007	0.0001	0.006
CV	3.038	10.103	1.14	7.11	17.69
LSD (α=0.05)	1.99	0.09	1.77	0.83	0.79

Mean values in each column followed by the same letters are not significantly different (p>0.05)

While there was a significant reduction of eugenol content in cinnamon leaf oil, upper leaf gall infestation significantly increased an acetyl eugenol and cinnamaldehyde contents which are minor components in cinnamon leaf oil (Table 1). Significant reduction of eugenol content and

increment of cinnamadehyde content were observed when intensity of lower leaf gall infestation was increased (Table 2).

Table 2: Changes of cinnamon oil contents and its major components under different severity levels of upper leaf galls infestation made by *Eriophyes boisi*

Severity level (No of galls)	Percent weight of galls	Oil content (%)	Eugenol	Acetyl eugenol	Cinnamaldehyde
1(no)	00.00^{e}	1.09^{a}	87.4867^{a}	3.627^{c}	1.068^{b}
2(<15)	22.70^{d}	0.92^{b}	83.2140^{b}	9.482^{ab}	1.950^{ab}
3(16-30)	43.49^{c}	0.38^{c}	78.7500^{c}	12.230^{a}	2.495^{ab}
4(31-45)	62.93^{b}	0.25^{d}	76.3150^{d}	8.436^{b}	4.717^{a}
5(46<)	99.60^{a}	0.03^{e}	73.5320^{e}	6.770^{bc}	4.640^{a}
P value	0.0001	0.0001	0.0001	0.0087	0.0775
CV	9.114	13.160	0.94	22.492	53.59093
LSD(α=0.05)	5.59	0.09	1.411	3.434	2.3244

Mean values in each column followed by the same letters are not significantly different ($p>0.05$)

This is clear evidence that leaf gall infestation may change the chemical physiology of leaf oil in addition to leaf oil content. It may be happened due to disturbance or blocking shikimic acid pathway in some extent at a point before producing eugenol in the leaf, so it is yet to be investigated detail in future.

Conclusions

Both leaf gall infestations have an ability to change the leaf oil content and quality significantly in cinnamon and there was a strong negative significant relationship with intensity of infestation and cinnamon leaf oil content. In term of oil quality, there was a negative correlation between intensity of gall infestation and eugenol content, but positive correlation with cinnamaldehyde contents and acetyl eugenol as well.

Acknowledgement

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References

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