Alternative Prophylactic Measure (Chlorantraniliprole, 0.4% G) for Integrated Management of White Grubs in Immature Tea Fields

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White Grubs (Chafers /Cockchafers)

- White grubs are the larvae of scarabaeid beetles
- Creamy white in colour with a brown head
- Live in the soil and feed on feeder roots resulting more casualties in new clearings
- Casualties can reach up to 40% if the control measures are not applied
- 4-5 grubs can destroy a single plant
- Seriously affecting replanting programmes

Occurrence of White Grubs

- More prevalent in tea lands bordering forests
- Forest provides a suitable habitat for beetles
- After the dispersal flight of Beetles, lay eggs in the neighboring tea fields
- White grubs that emerge from these eggs can cause damage to immature tea plants

Distribution of White Grubs

White Grub Prone Areas

Udapussellawa, Maturata and Dimbula areas are prone to white grub infestation

Infestation Reported Areas

Pundaluoya, Pussellawa, Kothmale, Dolosbage, Hewaheta, Maskeliya, Dickoya, Nuwara Eliya, Welimada, Haputale, Passara, Ratnapura, Galle

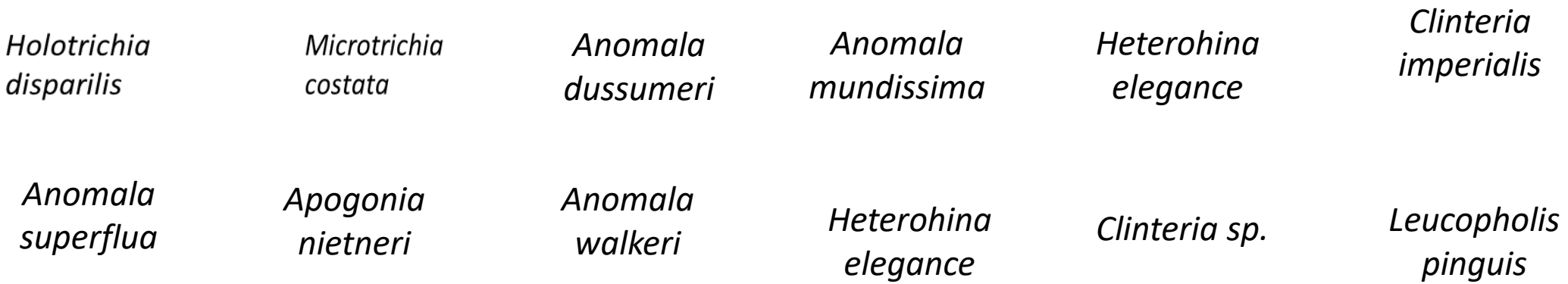
White Grubs and Organic Matter

- White grubs are closely associated with organic matter
- Adults/ beetles prefer to lay eggs in organic-matter rich soil
- Most species feed on partially decayed organic matter and grass roots
- High risk of white grub infestation through the compost
- Ensure the compost is free from eggs/white grubs before applying it to the fields

Scarabaeid Beetles Associated in Tea Fields

- 12 species of white grubs (Family: Scarabaeidae) in the tea fields
- Amongst only 2 species are damaging tea

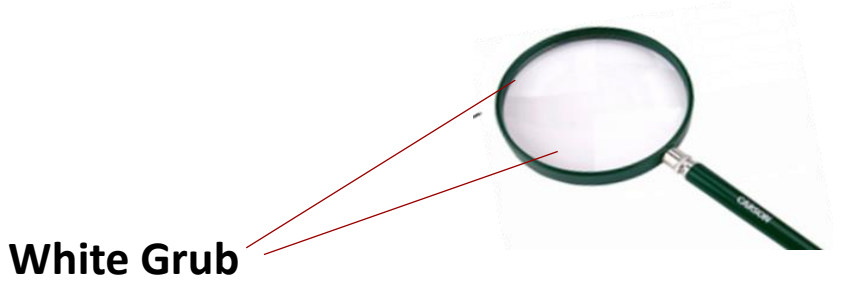
Images of the white grub species



Major Species Attacking Tea

- 2 species mainly damaging the roots

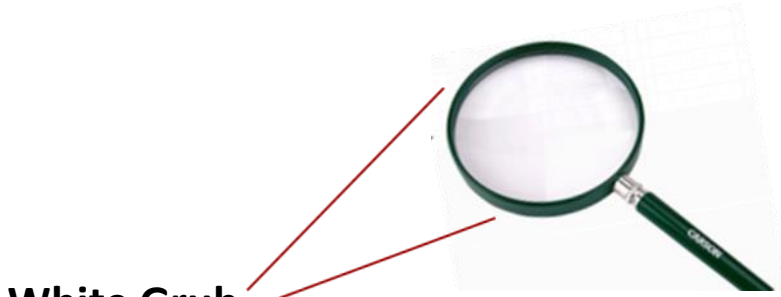
Holotrichia disparilis



Raster pattern

Beetle

Microtrichia costata



Raster pattern

Adult

Damage Symptoms

- Due to the damage to the root system, nutrients and water uptake are disrupted severely
- Exhibits yellowing, flowering, fruiting , wilting **as above ground symptoms**
- Both spp. feed on feeder roots resulting a bare root system with no feeder roots **as below ground symptoms**
- Lead to the plant's death

Holotrichia disparilis

Microtrichia costata

Yellowing, flowering , wilting fruiting Above ground symptoms

Bare root system Below ground symptoms

Microtrichia costata

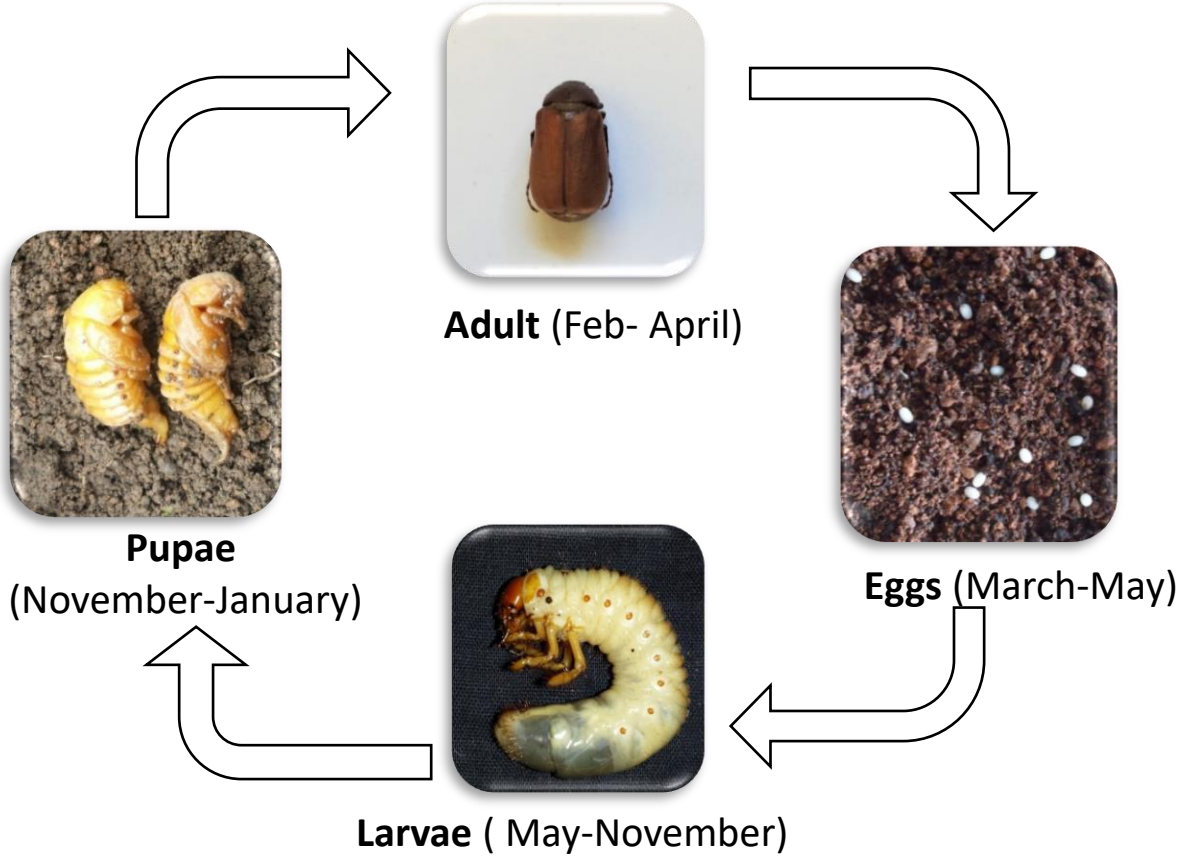
- *Microtrichia costata* can damage to the collar region resulting ring barking

Microtrichia costata

Bare root system with Ring- barking

Life Cycle of White Grubs

Essential to know about the life cycle of beetle



- **Beetles emerge during February – April and attend to dispersal flight**
- **Lay eggs in the soil (March -May)**
- **Larvae appear in May and continue development up to November**
- **Pupation occur in November-January**
- **If the planting season is overlap with the May – November, it is essential to apply prophylactic treatment in prone areas**

Requirement for an Alternative Prophylactic Treatment

- Due to the ban of Carbofuran, it was recommended the Chlorantraniliprole 200 g/l SC to control white grubs
- Efficacy persists in the field for about 14-21 days
- The larval period is about 6-7 months
- Need for a granular formulation with greater persistence in the field
- Literature survey revealed that Chlorantraniliprole 0.4% G is a potential insecticide for controlling white grubs

Chlorantraniliprole 0.4 % G

- Granular insecticide, belong to the Anthranilic diamide group
- Design for controlling larvae of moths and beetles
- Toxic to pests through stomach and contact action
- Use to control white grubs in groundnut and sugarcane
- Potential granule for testing against white grubs in tea

Objectives

- To evaluate bio-efficacy of Chlorantraniliprole 0.4% G against white grubs
- To recommend it as an alternative prophylactic measure to control white grubs in immature tea fields

Methodology : Laboratory Bioassay

- Evaluation of Bio-efficacy of Chlorantraniliprole 0.4% G using following treatments,
  - **T1**: 1.5 g/600 g soil (10 g/plant basis)
  - **T2:** 3 g/600g soil (20 g/plant basis)
  - **T3:** 4.5 g/600 g soil (30 g/plant basis)
  - **T4:** Chlorantraniliprole 200 g/l SC (current recommendation)
  - **T5:** Untreated Control (water)
- Design: CRD with 4 replicates

- 10 white grubs (*Holotrichia disparilis* and *Anomala* sp.) were introduced to each replicate
- Tea roots and grass roots were supplied as food
- Mortality was recorded at 3 time intervals

Results: Laboratory Bioassay

- There is no significant difference among the 3 test concentrations at 21 days after treatment applications
- All 3 concentrations were selected for the pot trial

Treatment	% Mortality of white grubs (Mean)±SD		
	7 DAT	14 DAT	21 DAT
T1-10 g/ plant basis	28.25± 6.43^{ab}	76.00± 6.93^{b}	83.75± 9.58^{a}
T2-20 g/ plant basis	53.00± 11.4^{a}	91.25± 5.91^{ab}	100.00± 0.0^{a}
T3- 30 g/ plant basis	43.25± 4.15^{a}	100.00± 0.00^{a}	100.00± 0.0^{a}
T4- Chlorantraniliprole (200 g/l SC)	27.50± 12.5^{ab}	88.75 ± 5.15^{ab}	100.00± 0.0^{a}
T5- Untreated control	2.50± 2.50^{b}	7.50± 4.79^{c}	10.0±4.08 ^{b}

Evaluation of Bio-efficacy of Chlorantraniliprole 0.4% G : Pot Trial

- **Treatments**
  - **T1:** Chlorantraniliprole 0.4% G 10 g/pot
  - **T2:** Chlorantraniliprole 0.4% G 20 g/pot
  - **T3:** Chlorantraniliprole 0.4% G 30 g/pot
  - **T4:** Chlorantraniliprole 200 g/L SC (current recommendation)
  - **T5:** Untreated Control (Water)
- Design: CRD with 6 replicates
- 6 White grubs (*Holotrichia dispailis* and *Anomala* sp.) were introduced to each replicate after treatment application
- Mortality was recorded at 3 time intervals

Results - Pot Trial

- There is no significant difference among T2 & T3 compared with present recommendation
- Selected the 20 g of test insecticide (Chlorantraniliprole 0.4G) as the potential dose for recommendation

Treatment	Percentage (%) Mortality of white grubs (Mean) ± SD		
	14 DAT	28 DAT (D2)	42 DAT (D3)
T1 - 10 g/plant	13 ± 6.7^{bc}	13 ± 6.7^{b}	40 ± 0^{b}
T2 - 20 g/plant	60 ± 11.5^{a}	80 ± 11.5^{a}	87 ± 6.7^{a}
T3 - 30 g/plant	33 ± 17.6^{ab}	73 ± 17.6^{a}	100 ± 0^{a}
T4 – 200 ml/plant	53 ± 13.3^{a}	73 ± 13.3^{a}	93 ± 6.7^{a}
T5 - Untreated (water)	0^{c}	7 ± 6.7^{b}	13 ± 13.3^{c}

Non-Target Effects

- Pot trial to study the effects of test insecticide on earthworms
- **Treatments**
  - T1: Chlorantraniliprole 0.4% G, 20 g/pot
  - T2: Untreated Control (Water)
- Ten earthworms were introduced to each replicate
- Assessments were done 45 days after treatment application

Treatment	Live (45 DAT)	Dead (45 DAT)	Mortality Percentage (%)
T1	10	0	0
T2	10	0	0

- According to the results, there are no harmful effects on earthworms
- Safe insecticide that can be maintained the soil health

Comparison of Chlorantraniliprole 0.4% (W/W) G *Vs.* 200 g/L SC

	Chlorantraniliprole 0.4% (w/w) G	**Chlorantraniliprole 200 g/L SC**
1	Easy for handling and application	Comparatively difficult application
2	Greater persistent period (01 ½ - 02 months)	Lower persistent period (14 -21 days)
3	Cost per hectare Rs.332,000.00	Cost per hectare Rs.336,000.00
4	No application cost	Application cost Rs. 4050.00

Conclusion

- **Chlorantraniliprole (0.4 % G), at 20 g/plant has the potential for recommendation to control white grubs**

IPM Strategies for White Grub Control

1. Application of 20 g of Chlorantraniliprole 0.4% G –at the planting as a prophylactic measure
2. Thatching of agriculture mulch instead of live mulch in the field to restrict egg laying. It should be thatched before **February and continue up to May**
3. Light traps could be used to monitor the beetle population that helps for decision making to adopt control measures (7 beetles/trap/day)
4. Exposure of white grubs through forking to predators such as birds during land preparation
5. Ensure compost is free from white grubs/eggs when introducing compost

Future Works

- To reduce the cost, it was planned to incorporate biopesticide (*Metarhizium* sp.) to the IPM
- Isolated from the soil
- Developed as a biopesticide
- In the process of commercialization
- Laboratory bioassay was carried out to study the bioefficacy of *Metarhizium* sp.

Results Laboratory Bioassay

Treatments	% Mortality of white grubs (Mean) ± SD		
	14 DAT	21 DAT	28 DAT
Biopesticide (Metarhizum sp.)	26.19 ± 8.9[a]	38.1 ± 15.8[a]	57.14 ± 18.8[a]
Untreated control	4.76 ± 8.1[b]	4.76 ± 8.1[b]	11.9 ± 8.1[b]

- 57% mortality at 28th DAT and significantly different from the untreated control
- **Potential to mix with the test insecticide (½ dose) to incorporate planting hole**

Thank you…