

TPL's Integrated Pest Management (IPM) approach

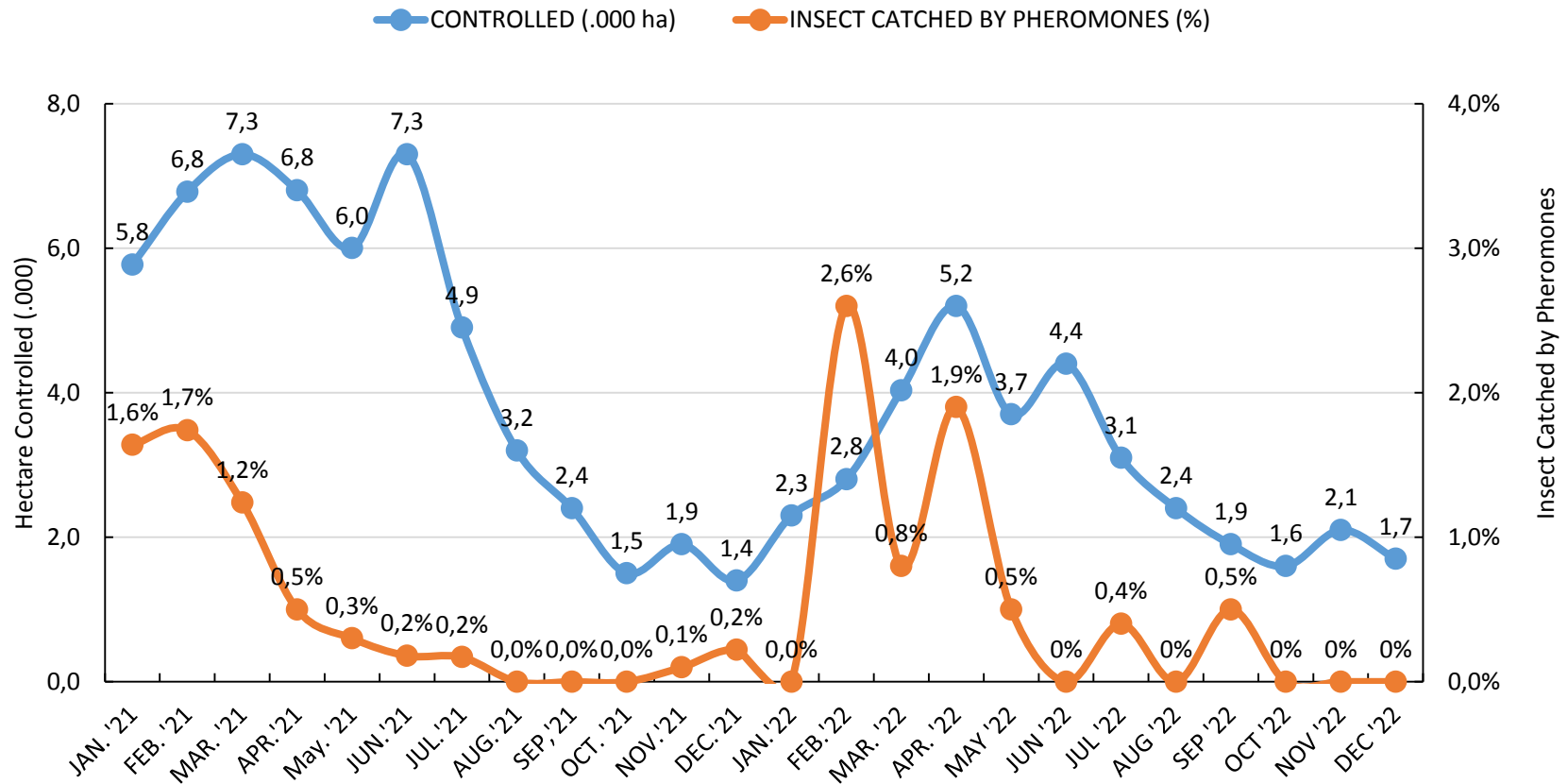
TPL are committed to adopting an integrated pest management program that prioritizes environmental friendly biological and non-chemical methods where possible and seeks to minimize or avoid the use of chemical pesticides and other materials. TPL also committed to implementing documented procedures for the use of pesticides and other materials so as to ensure compliance with legal requirements and user instructions.

Programs of Integrated Pest Management (IPM) :

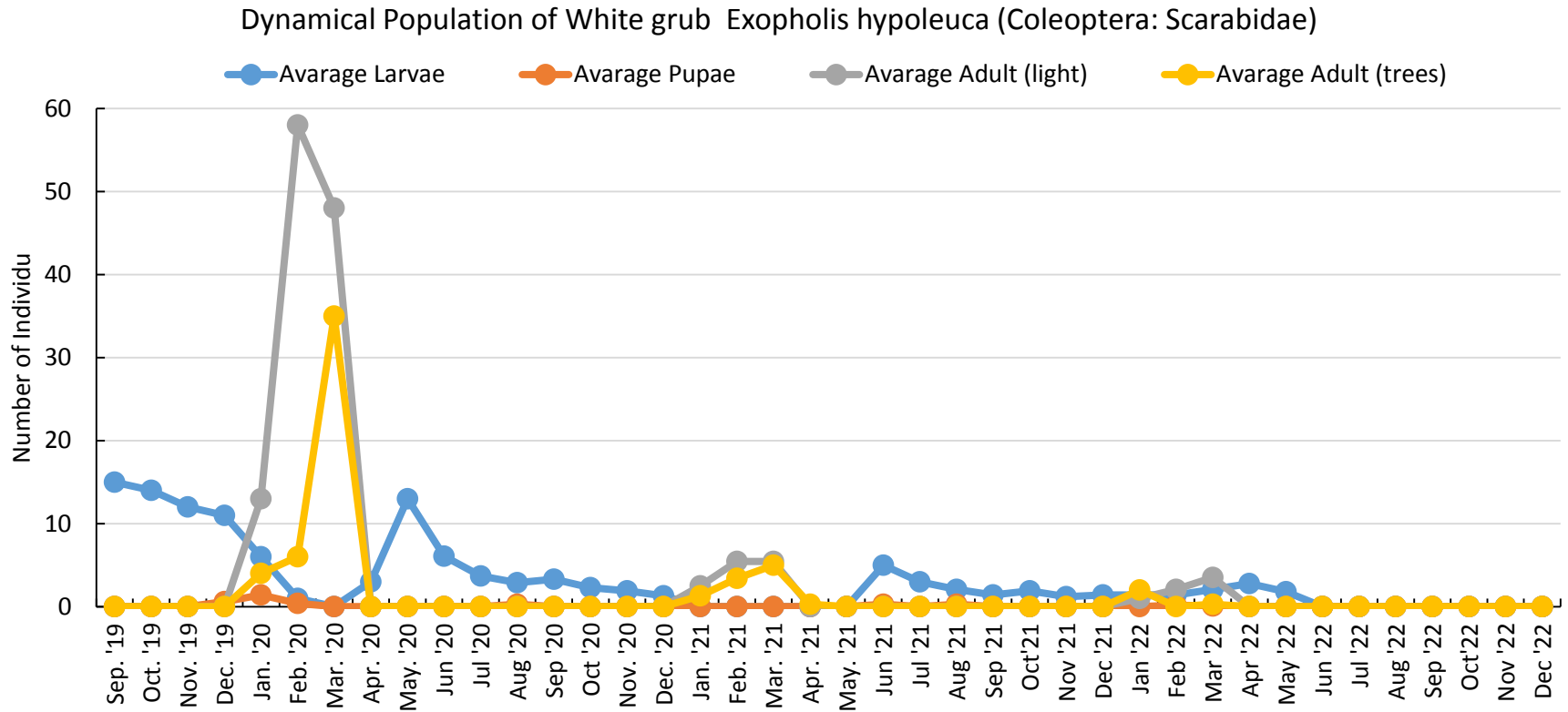
- A. Regularly P&D Monitoring
- B. Reducing chemical pesticides
- C. Genetic P&D Controlling Method
- D. Biological Controlling Methode

A. Regularly P&D Monitoring

Male Helopeltis Caught by Pheromone Trap vs. Large Controlling



2. Monitoring Pest Beetle, *Exopholis hypoleuca*

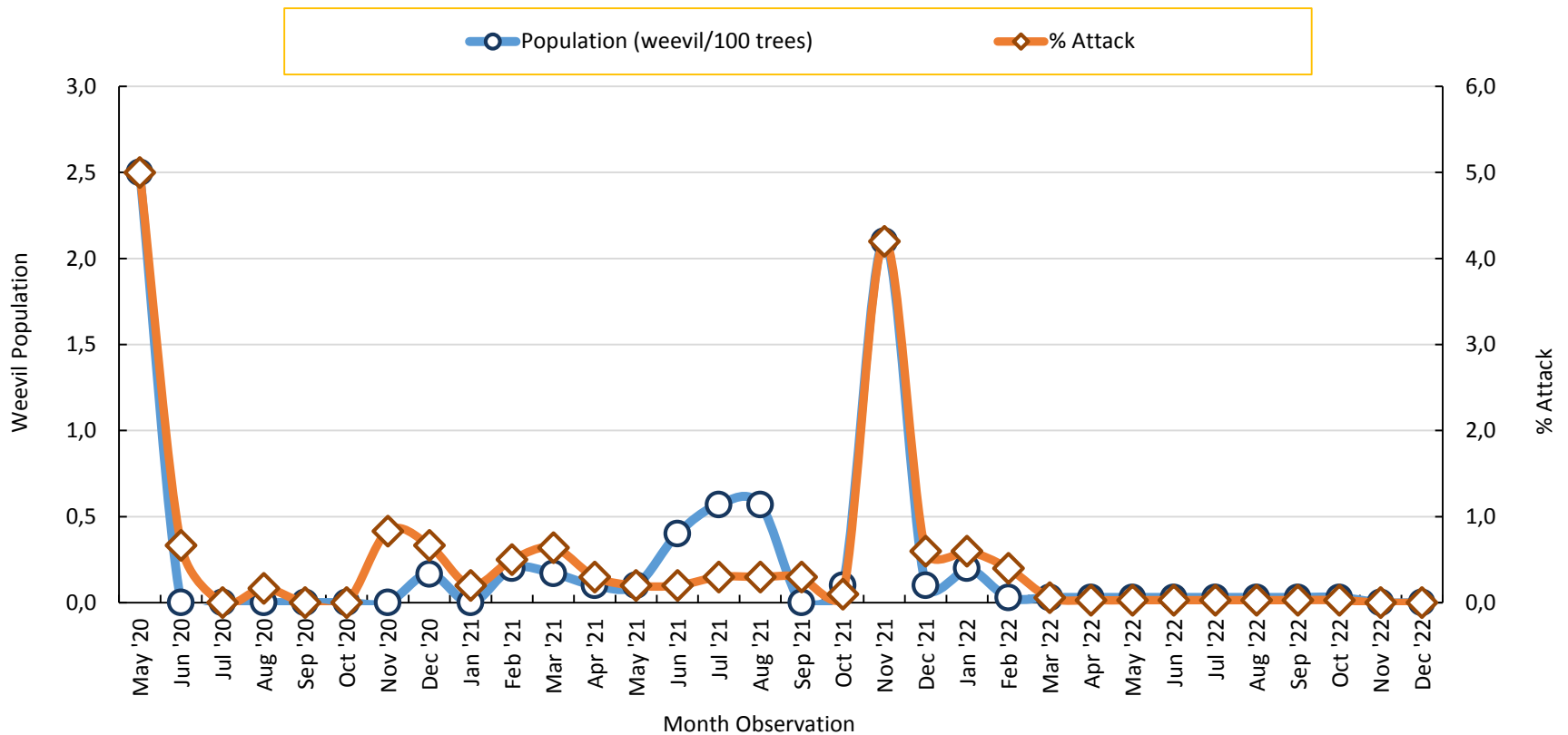


1. Average Larvae (insect per 1x1x0.3 meter plot per month)
2. Average Pupae (insect per 1x1x0.3 meter plot per month)

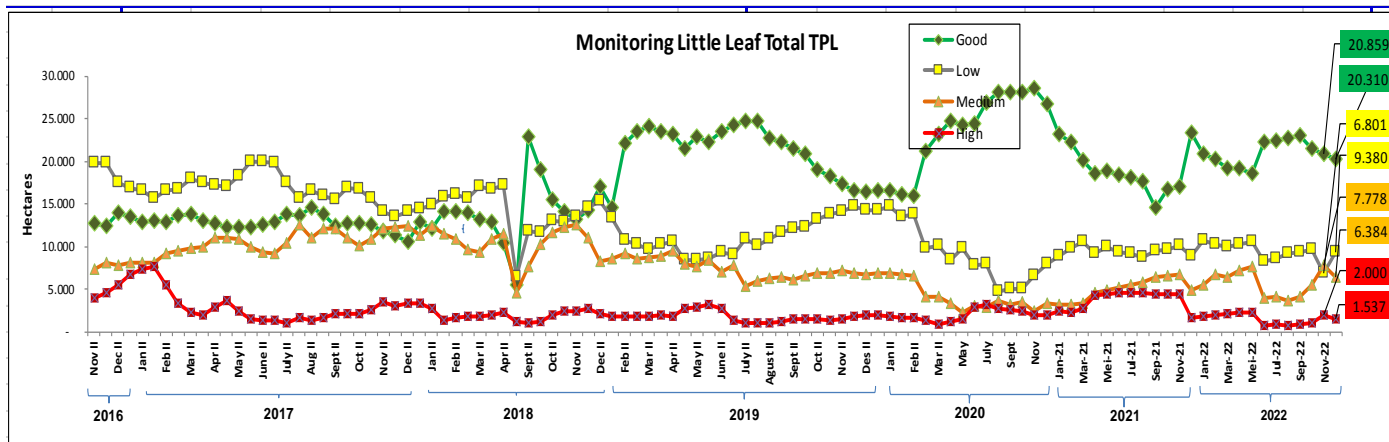
3. Average Adult by Light Trap (beetle per day trapped)
4. Average Adult by plot sample 1x1x0.3 m, (beetle per plot per month)

3. Monitoring Pest Weevil, *Haplorhyncitis* sp.

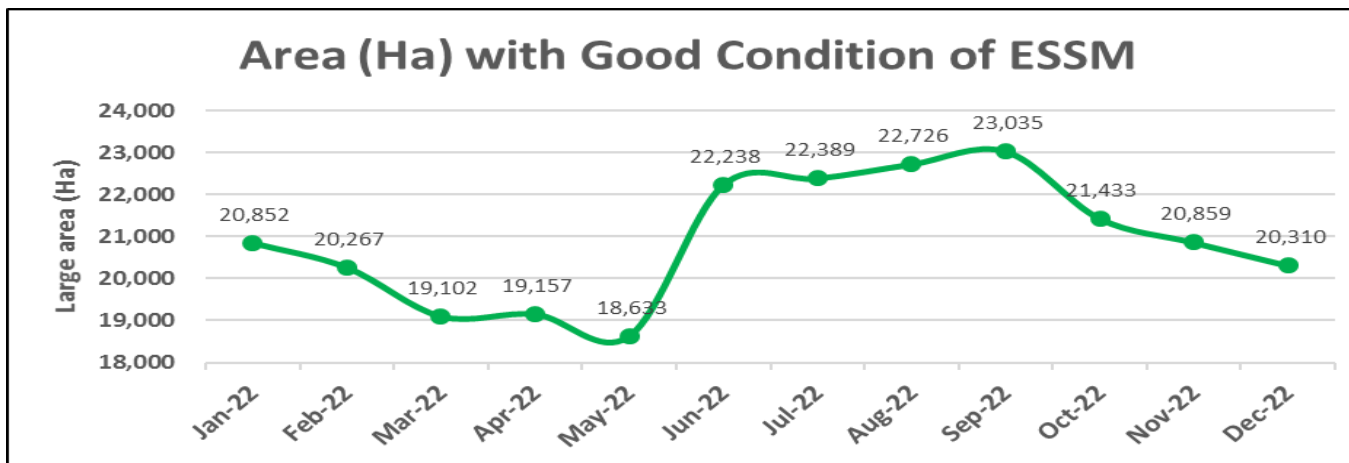
Population and Attack Intensity of Pest Weevil *Haplorhyncitis*



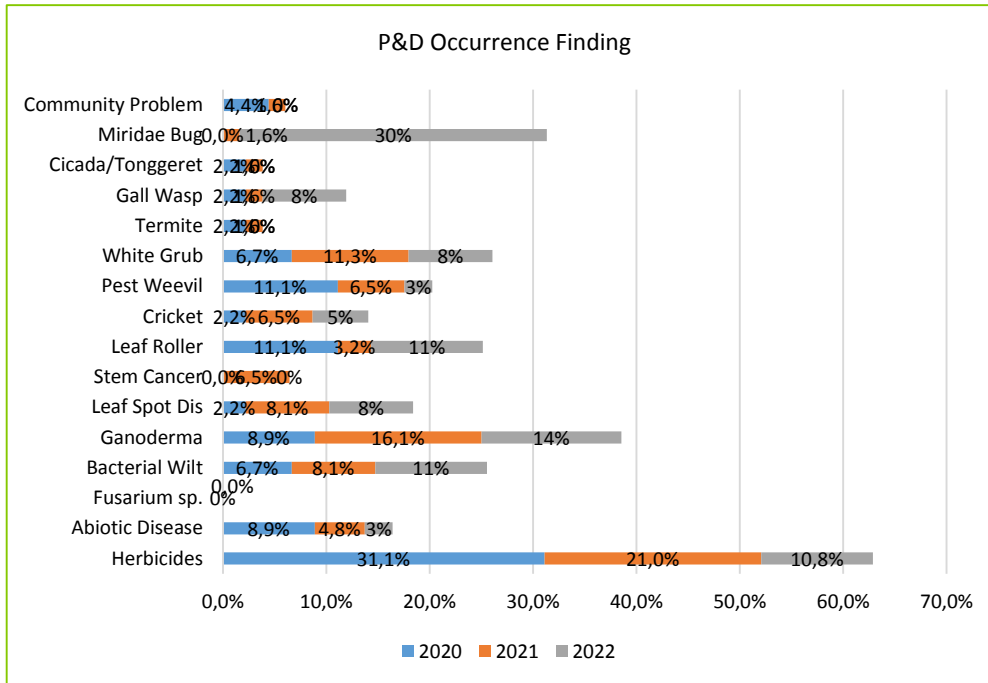
4. Monitoring Eucalypts Scab Shoot Malformation (*Elsinoe necatrix*)



ESSM severity During January to December 2022



5. Monitoring and Solving Plant Pest, Diseases and Disorder.



This graph show that the 5 most common problems are:

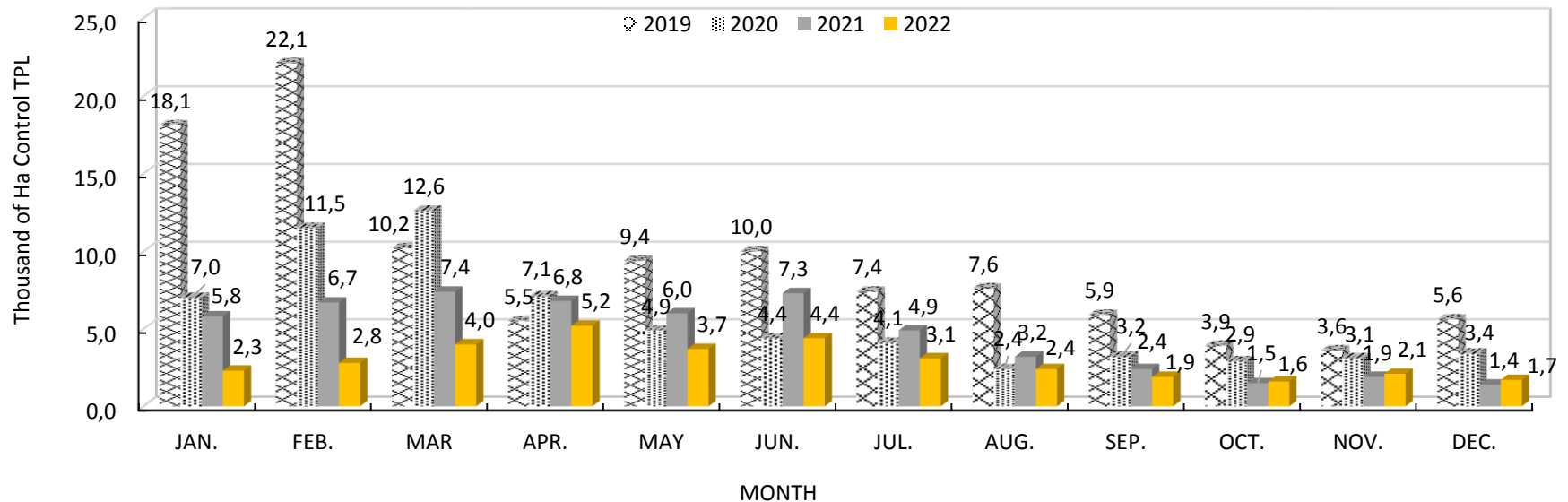
1. Abiotic Diseases due to Herbicides exposure (13 findings)
2. Plant infected by *Ganoderma* sp. (10 findings)
3. Plant wilting attacked by White Grub (7 findings)
4. Bacterial Wilt and Leaf Spot Diseases (5 findings)
5. Cricket, Pest weevil and Stem Cancer (4 findings)

P&D Problem	Occur. during '20	Occur. during '21	Occur. during '22
Herbicides	14	13	4
Nutrient Disorder	1	1	1
Abiotic Dis.	3	2	0
Bacterial Wilt	3	5	4
Ganoderma	4	10	5
Leaf Spot Dis	1	5	3
Stem Cancer	0	4	0
Leaf Roller	5	2	4
Cricket	1	4	2
Weevil/Beetle	5	4	1
White Grub	3	7	3
Termite	1	1	0
Gall Wasp	1	1	3
Cicada	1	1	0
Miridae Bug	-	3	11
Community Problem	2	1	0

B. Reducing chemical pesticides

TPL are committed to developing operational procedures and standards related to monitoring, evaluation and review of pesticides and other materials, control of use, storage, handling, transportation / transfer and disposal. In graphic below show the reduction of pesticides to control pest in Eucalyptus trees (2019 – 2022).

Comparison Helopeltis Control 2019, 2020, 2021 & 2022



1. Controlling Sap Sucking Pest (*Helopeltis* sp.) based on Economic Threshold Level
2. Number on table shown decrease controlling of *Helopeltis* year to year (2019-2022)
3. For example, on January 2019 *Helopeltis* control was 18.100 ha, but controlling on 2020 decreased 159% (7.000 ha)
4. Overall, controlling In 2022 was lower than controlling 2019, 2020, & 2021

C. Genetic P&D Controlling Method

Clonal Resistance Screening to Gall Wasp



Procedure Clonal Screening Resistance to Gall Wasp, *Ophellimus eucalypti* in the Screening House.
Some pathogen screened directly in the field according to endemic area, such as, ELLS, Kirramyces, Ganoderma etc.

- a. The objective of this screening is to find the clone resistance to Gall Wasp
- b. Plant Protection has target for screening, 100 clones in 2020, 150 clones in 2021, and 156 clones in 2022
- c. Plantation only planting the resistance clone

D. Biological Controlling Method

1. Mass Rearing of Sting Bug, *Sycanus* sp. (insect predator-generalist)



Predator Generalist; Adult Stage of *Sycanus*. Successfully developed at the Rearing House.



Sycanus Preying *Tenebrio molitor* at the Rearing House Entomology Laboratory, Porsea.

We use *Sycanus* species as natural predators

Sector	Numb. Insect Release
Nursery	330
Aek Raja	200
Padang Sidempuan	1.600
TOTAL	2.130

2. Developing Entomopathogen Fungus, *Cordyceps* sp.



White Grub attacked by *Cordyceps* sp. We brought this insect and purification in the Laboratory



Cordyceps sp. growing in the Artificial Media. Experiment on going progress.



We use *Entomopathogen fungus* species as natural predators of white grub pests, to reduce white grub attack on the roots of Eucalyptus plants.