BIBLIOGRAPHY

LEGASPI, JENNYLYN A. APRIL 2013. Life Cycle and Predation Rate of Predatory Mite (*Amblyseius longispinosus* Evans) on Cyclamen Mite of Strawberry. Benguet State University, La Trinidad, Benguet.

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ABSTRACT

The study was conducted at the Mites Predatory Rearing House from October 2012 to February 2013 to know the duration and morphological characteristics of the different growth stages of predatory mite, determine the effectiveness of predatory mite in reducing the population of cyclamen mite of strawberry, generate information on the rate of consumption of the different growth stages, fecundity and host preference of the predatory stages of the predatory mite (*Amblyseius longispinosus* Evans) on cyclamen mites of strawberry.

The duration, development and morphological characteristics of the different growth stages of predatory mite (*Amblyseius longispinosus* Evans) were: male egg: 2.60 ± 0.21 days while the female: 2.76 ± 0.24 days, male larva: 0.75 ± 0.09 days while the female larva: 0.75 ± 0.18 days, male protonymph: 1.83 ± 0.10 while female protonymph: 1.85 ± 0.13 days, male deutonymph: 1.82 ± 0.53 days while the female: 2.68 ± 0.55 days, adult male: 17.60 ± 7.75 days while the female: 21.94 ± 8.29 days. The total life span of

male was 24.64 ± 8.25 days while the female was 30.35 ± 8.50 days.The egg was oval and white. The larva was translucent in and had six-legs.

Protonymph was white and tear- drop shaped. The deutonymph was light orange and have a shaped like a protonymph. The adult male was smaller compared to adult female. It was reddish and also tear-dropped shaped like protonymph and deutonymph.

The predatory mite was effective in reducing the number of cyclamen mite of strawberry up to 75 %.

The daily average consumption of the different growth stages of the predatory mite were protonymph: 3.72 eggs, 2.28 larvae and 2.98 adults, deutonymph: 3.42 eggs, 2.5 larvae and 2.42 adults, adult: 6.8 eggs, 5.12 larvae and 5.08 adults per day of the cyclamen mites.

A female predatory mite could lay as many as 12 to 50 eggs.

The predatory mite protonymph, deutonymph and adult preferred feeding on the eggs of cyclamen mites.

RESULTS AND DISCUSSION

Duration of the Different Growth Stages
Of *Amblyseius longispinosus* Evans

The mean duration of the different growth stages of *Amblyseius longispinosus* Evans is shown in Table 1.

Egg. The egg was oval and white. The male developed from 2.40 to 2.92 days with a mean of 2.60 ± 0.21 days while the female developed from 2.37 to 2.99 days with a mean of 2.76 ± 0.24 days.

Larva. The larva was translucent and had six-legs after emerging from the egg. The male larva developed from 0.60 to 0.85 days with a mean of 0.75 ± 0.09 days while the female developed from 0.40 to 0.90 days with a mean of 0.75 ± 0.18 days.

Protonymph. The larva molted become fully developed protonymph. Protonymph was white and tear- dropped shaped also. The duration of development of the female was longer than that of male protonymph. It ranged from 1.61 to 2.13 days with a mean of 1.85 ±0.13 days while the development of male ranged from 1.70 to 1.97 days with a mean of 1.83 ± 0.10.

Deutonymph. The deutonymph was light orange and tear-drop shaped like deutonymph. The male developed from 1.14 to 2.46 days with a mean of 1.82 ± 0.53 days while the female developed from 1.97 to 3.42 days with a mean of 2.68 ± 0.55 days.

Adult. The adult male was small compared to female, brownish and tear-drop shaped also like protonymph and deutonymph. It ranged from 16.18 to 29.1 days with a mean of 17.60 ± 7.75 days. The female adult has bigger body size, appears shiny and reddish in color. It ranged from 2.19 to 31.9 days with a mean of 21.94 ± 8.29 days. The

pre-reproductive of the female ranged from 1.40 to 2.65 days with a mean of 2.07 ± 0.37 days. The reproductive period ranged from 15.61 to 29.13 days with a mean of 21.59 ± 3.50 days and the post reproductive period ranged from 0.44 to 9.17 days with a mean of 2.40 ± 2.57 days.

The total life cycle of male predatory mite ranged from 12.53 to 36.74 days with a mean of 24.64 ± 8.25 days while the female ranged from 10.14 to 35.59 days with a mean of 30.35 ± 8.50 days. From the results shown, it shows that the duration of development of female was longer as compared to male.

Table 1. Mean duration (days) of the different growth stages of *Amblyseius longispinosus* Evans

GROWTH STAGES	RANGE	MEAN
Egg		
Male	2.40 - 2.92	2.60 ± 0.21
Female	2.37 - 2.99	2.76 ± 0.24
Larva		
Male	0.60 - 0.85	0.75 ± 0.09
Female	0.40- 0.90	0.75 ± 0.18
Protonymph		
Male	1.70 - 1.97	1.83 ± 0.10
Female	1.61 - 2.13	1.85 ± 0.13
Deutonymph		
Male	1.14 - 2.46	1.82 ± 0.53
Female	1.97 - 3.42	2.68 ± 0.55
Adult		
Male	16.18 – 29.1	17.60 ± 7.75
Female	2.19 – 31.9	21.94 ± 8.29
Pre-reproductive period	1.40 – 2.65	2.07 ± 0.37
Reproductive period	15.61 – 29.13	21.59 ± 3.58
Post-reproductive Period	0.44 – 9.17	2.40 ± 2.57
TOTAL LIFE SPAN		
Male	12.53 – 36.74	24.64 ± 8.25
Female	10.14 – 35.59	30.35 ± 8.50

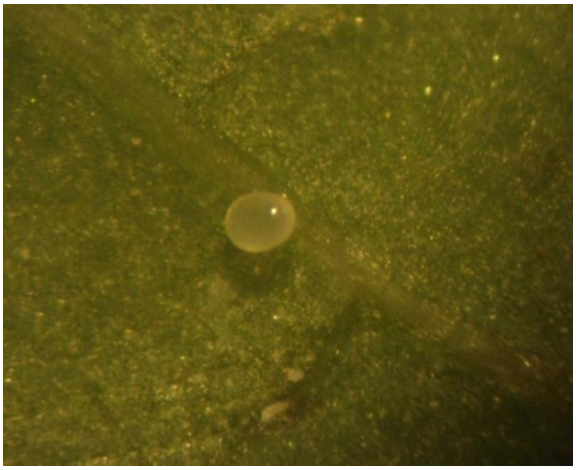

Figure 5. Egg of predatory mite

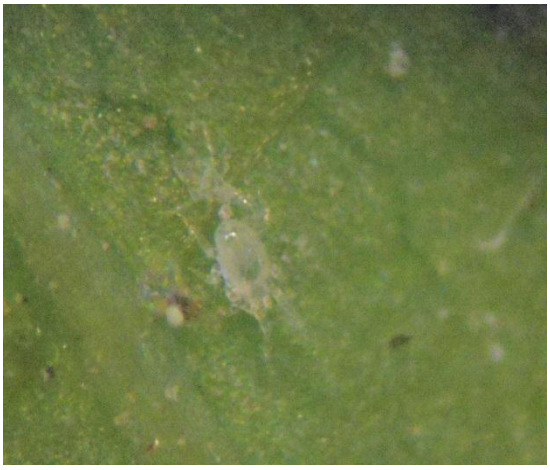

Figure 6. Larva

Figure 7. Protonymph

Figure 8. Deutonymph

Figure 9. Adult

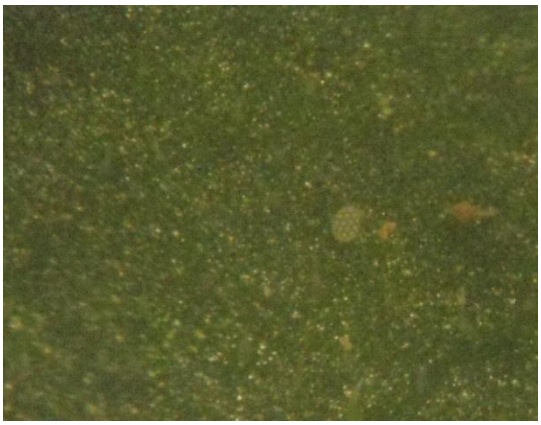

Figure 10. Cyclamen mite egg

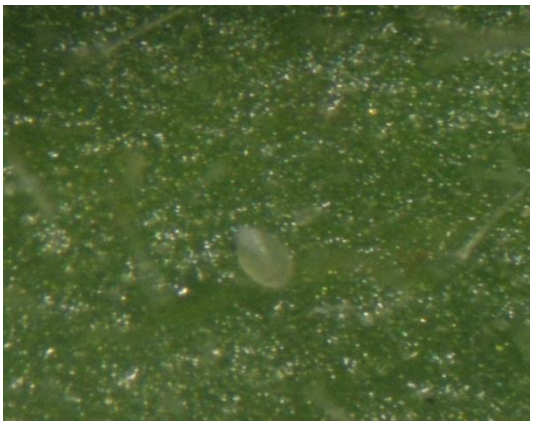

Figure 11. Cyclamen mite larva

Figure 12. Quiescent stage

Figure 13. Female adult

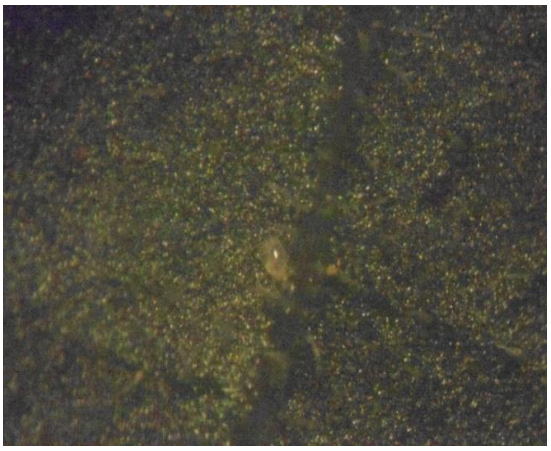

Figure 14. Male adult

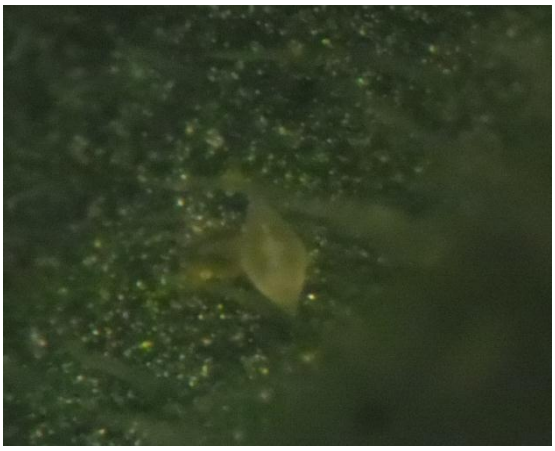

Figure 15. Male adult carrying immature female

First Introduction of Cyclamen Mites
and Release of Two Predatory Mites

The different stages of cyclamen mites consumed on the first release of two predatory mites is shown in Table 2.

Statistical analysis revealed that treatment 5 significantly reduced the number of introduced cyclamen mite Adult predatory mites fed more on different stages of cyclamen mites when there are more cyclamen mites introduced as compared to cyclamen mites with lower number of introduced. In treatment 1, the predator consumed less.

The adult predator consumed an average of 3.05 eggs, 2.20 larva and 2.70 adult of cyclamen mites in treatment 5. From treatment 1 to 4, the adult consumed lesser number of the prey. As the number of the cyclamen mites increased, the predation also increases.

Second Introduction of Cyclamen Mites
and Release of Two Predatory Mites

Table 3 shows the different stages of cyclamen mites consumed on the second release of two predatory mites.

Statistical analysis revealed that Treatment 5 shows a highly significant number of consumption. Treatment 5 has the highest number of consumed cyclamen mites and treatment 2 has the lowest number of consumed cyclamen mites. Findings observed that, predatory mites consumed more prey if they were greater in number and consumed less if the prey were few. The reason could be that if there are more number of prey, it would consumed more.

As compared in Table 2, the first introduction and release of both cyclamen and predatory mites had the highest number of consumption as compared to the second introduction and released of cyclamen mites and predatory mites.

The findings would suggest that before releasing predatory mites in the field, the number of cyclamen mite pests would range from a mean average of 2.00 to 2.87 as shown in Table 2.

Table 2. Different stages of cyclamen mites consumed on the first release of two predatory mites

TREATMENT	GROWTH STAGES OF PREY		
	Egg	Larva	Adult
T0	0^{d}	0^{c}	0^{d}
T1	2.14^{c}	1.38^{b}	1.56^{c}
T2	2.20^{c}	1.38^{b}	1.74^{c}
T3	1.91^{a}	1.91^{a}	2.38^{b}
T4	2.00^{a}	2.00^{a}	2.42^{b}
T5	2.20^{a}	2.20^{a}	2.70^{a}

*Means with the same letter in column are not significantly different at 5 % level by DMRT

Table 3. Different stages of cyclamen mites consumed on the second release of two predatory mites

TREATMENT	GROWTH STAGES OF PREY		
	Egg	Larva	Adult
To	0^{e}	0^{d}	0^{c}
T1	1.79^{d}	1.34^{c}	1.67^{b}
T2	2.17^{c}	1.40^{c}	1.75^{b}
T3	2.50^{b}	1.85^{b}	2.13^{a}
T4	2.76^{ab}	2.15^{ab}	2.42^{a}
T5	2.92^{a}	2.26^{a}	2.45^{a}

*Means of the same letter in column are not significantly different at 5% level by DMRT

Predation Rate of *Amblyseius longispinosus* Evans

Using cyclamen mite as prey food, the consumption capacities of the different stages of the predatory mite is shown in Table 4. It shows the number of consumed mites per day by the different growth stages of predatory mite.

This study showed that cyclamen mites have the following developmental stages: male egg developed from 1.98 to 2.78 days with a mean of 2.49 ± 0.33 days while female egg developed from 2.41 to 2.83 days with a mean of 2.68 ± 0.18 days. The development of male larva ranged from 0.75 to 1.98 days with a mean of 1.10 ± 0.50 days while the female larva developed from 0.98 to 1.99 days with a mean of 1.51 ± 0.44 days. The duration of the quiescent stage for male ranged from 0.36 to 1.13 days with a mean of 0.57 ± 0.24 days while female ranged from 0.41 0.91 days with a mean of 0.72 ± 0.15 days. The development of male adult ranged from 6.71 to 19.71 days with a mean of 14.79 ± 5.4 days while the female adult ranged from 6.33 to 24.06 with a mean of 18.55 ± 5.63 days. The total life span of female adult ranged from 11.82 to 29.68 days with a mean of 22.96 ± 5.32 days while the male adult has a total life span of 10.7 to 22.85 days with a mean of 19.04 ± 5.15 days.

The protonymph consumed an average of 3.72 eggs, 2.28 larva and 2.98 adults per day of the cyclamen mites. And the deutonymph consumed an average of 3.42 eggs, 2.5 larva and 2.42 adults per day of the cyclamen mites. On the other hand, the adult predator consumed an average of 6.8 eggs, 5.12 larva and 5.08 adults per day of the cyclamen mites. The adult is more active in searching its prey than the protonymph and deutonymph for the reason that it has bigger body and fast moving as compared to protonymph and deutonymph.

The implication of this was that predatory mites was effective predator of cyclamen mite pests because it consumed most on the egg stages that eventually turn into adult that causes damaged to crops.

Fecundity

A female *A. longispinosus* could lay as many as 12 to 50 eggs. Table 5 shows the total number of eggs laid by the female *A. longispinosus*.

Since adult predatory mites can lay as much as 12 to 50 eggs, one predator was enough to reduce the population of cyclamen mite pests due to the reason that predatory mites could lay much eggs.

Table 4. Mean total of consumed mites per day by the different growth stages of *Amblyseius longispinosus* Evans on cyclamen mites

GROWTH STAGES OF PREDATOR	GROWTH STAGES OF PREY			
	Egg	Larva	Adult	Mean Total
Protonymph	3.72	2.28	2.98	8.98
Deutonymph	3.42	2.05	2.42	8.34
Adult	6.08	5.12	5.08	17
Mean Total	13.94	9.9	10.48	

Table 5. Total Number of eggs laid by the female *Amblyseius longispinosus* Evans

SAMPLE NO.	TOTAL NO. OF EGGS LAID
1	21
2	39
3	18
4	16
5	50
6	19
7	50
8	39
9	12
10	40

Host Preference

Table 6 shows the host preference of the predatory stages of the *A. longispinosus* Evans on the different stages of cyclamen mites.

Results show that the most preferred prey of protonymph was egg with a mean of 1.64 and the least preferred was the larva with a mean of 0.64. The deutonymph prefers also the egg stage with a mean of 1.36. The adult also prefers the egg stage of cyclamen mites like protonymph and deutonymph stages.

As observed, all stages of predatory mites preferred the egg stage of the prey. The adult predatory mites preferred the egg stage of the prey probably because it was immobile and easy to grasp as compared to larva and adult which are mobile.

Table 6. Different stages of cyclamen mites being preferred by the *Amblyseius longispinosus* Evans

GROWTH STAGES OF PREY	GROWTH STAGES OF PREDATOR					
	Protonymph		Deutonymph		Adult	
	Total	Mean	Total	Mean	Total	Mean
Egg	18	1.64	15	1.36	16	1.45
Larva	7	0.64	9	0.81	10	0.90
Adult	12	1.09	12	1.09	13	1.18

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The study was conducted at the Mites Predatory Rearing House from October 2012 to February 2013 to determine the duration and morphological characteristics of the different growth stages of predatory mite on cyclamen mite, determine the effectiveness predatory mite in reducing the population of cyclamen mite, generate information on the rate of consumption, fecundity and preference of predatory mite on cyclamen mite of strawberry.

The predatory mites undergo five developmental stages namely; egg, larva, protonymph, deutonymph and adult stages. The egg was oval and whitish. The incubation period of male egg was from 2.40 to 2.92 days with a mean of 2.60 ± 0.21 days while the female developed from 2.37 to 2.99 days with a mean of 2.76 ± 0.24 days. The larva was translucent and had six legs. The male larva developed from 0.60- 0.85 days with a mean of 0.75 ± 0.09 days while the female developed from 0.40 to 0.90 days with a mean of 0.75 ± 0.18 days. Protonymph was white and tear- drop shaped. The male protonymph ranged from 1.70 to 1.97 days with a mean of 1.83 ± 0.10 while female ranged from 1.61 to 2.13 days with a mean of 1.85 ± 0.13 days. The deutonymph was light orange and tear-drop shaped. The male deutonymph developed from 1.14 to 2.46 days with a mean of 1.82 ± 0.53 days while the female developed from 1.97 to 3.42 days with a mean of 2.68 ± 0.55 days. The adult was reddish and tear-drop shaped also like protonymph and deutonymph. The adult male ranged from 16.18 to 29.1 days with a mean of 17.60 ± 7.75 days while the female ranged from 2.19 to 31.9 days with a mean of 21.94 ± 8.29 days. The pre-reproductive of the female ranged from 1.40 to 2.65 days with a mean of 2.07 ± 0.37 days.

The reproductive period ranged from 15.61 to 29.13 days with a mean of 21.59 ± 3.50 days and the post reproductive period ranged from 0.44 to 9.17 days with a mean of 2.40 ± 2.57 days. The total life span of *Amblyseius longispinosus* Evans for the male ranged from 12.53 to 36.74 days with a mean of 24.64 ± 8.25 days while the female ranged from 10.14 to 35.59 days with a mean of 30.35 ± 8.50 days.

Statistical analysis revealed that treatment 5 significantly reduced the number of introduced cyclamen mite Adult predatory mites fed more on different stages of cyclamen mites when there are more cyclamen mites introduced as compared to cyclamen mites with lower number of introduced. In treatment 1, the predator consumed less.

The protonymph consumed an average of 3.72 eggs, 2.28 larva and 2.98 adults per day of the cyclamen mites. And the deutonymph consumed an average of 3.42 eggs, 2.5 larva and 2.42 adults per day of the cyclamen mites. On the other hand, the adult predator consumed an average of 6.8 eggs, 5.12 larva and 5.08 adults per day of the cyclamen mites.

A female *A. longispinosus* could lay as many as 12 to 50 eggs.

The most preferred stage of prey of protonymph was the egg with a mean of 1.64 and the least preferred was the larva with a mean of 0.64. The deutonymph prefers also the egg with a mean of 1.36. The adult also prefers the egg of cyclamen mites like protonymph and deutonymph. As observed, all stages of predatory mites preferred the egg stage of the prey.

Conclusion

It is therefore concluded that adult predatory mite is effective in reducing the population of cyclamen mites of strawberry under greenhouse condition. The adult predatory mite is an effective predator because it can consume at least 20 cyclamen mites in three days.

Recommendations

It is recommended to conduct again this study to verify the effectiveness of predatory mites in reducing the population of cyclamen mites of strawberry. It is also recommended to preserve the predatory mites in the field by minimizing the use of pesticides because it is an effective predator of cyclamen mites.

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