Effect of the green lacewing, *Mallada basalis* (Walker) on the spider mites, *Oligonychus coffeae* Nietner and *Tetranychus kanzawai* Kishida in tea plantation.

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Abstract

The green lacewings, *Mallada basalis* (Walker) were reared in the mass in laboratory for collecting the eggs. While the larvae had just hatched, the eggs and the hatched larvae were released to tea plantation immediately once a week. The test showed the effect of releasing 33.3 individuals of the larvae of green lacewings per tea tree was better than the effect of releasing 18.9 individuals on the red spider mite, *Oligonychus coffeae*. The control rate to the mites and eggs of the former was 85.2% and 88.9% after releasing twice of the green lacewing. After five times release, the density of the red spider mite was reduced from 7.61 individuals to 0.79 individuals per leaf and the control rate to the mites and eggs was 98% and 96.9% separately. The results of another test about kanzawai spider mite, *Tetranychus kanzawai* showed that the effect of releasing 80 individuals of the larvae of green lacewing per tea tree was better than releasing 40 or 20 individuals. So, the test showed the more green lacewing was released, the faster control effect achieved. When the density of the spider mites was high, more releasing times and individuals were needed.

Key words: green lacewing, *Mallada basali*(Walker), *Oligonychus coffeae* Nietner, *Tetranychus kanzawai* Kishida

Introduction

Recently the small pests such as spider mite, leaf hopper and citrus spiny-blackfly were more serious in tea plantation in Taiwan. Farmers paid many pesticides and much labor for control of the small pests every year. As we know, pollution by chemicals was a serious problem in the circumstance. Pesticide was one of them. Furthermore, if using wrong way, both the grower and the consumer were affected. In order to avoid the fault, reduce the usage of the pesticides was a choice. One of the substitutive methods was biological control. The reference showed that the green lacewing was a good prayer to spider mites, aphids and citrus spiny-blackfly. The fecundity of green lacewing was very high and mass rearing of it was easy. So, the experiment was studied.

Matrials and Methods

The larvae of the green lacewings were mass reared by the eggs of the moth, *Corcyra cephalonica* Stainton in the laboratory. The egg laid papers were collected for the test. The methods of field test were as follows:

1. Test on the red spider mite, *Oligonychus coffeae* by releasing the green lacewings

The first field test was progressed with nine rows of tea trees at Long Tan. There was 150cm between two rows and thirty tea trees per row. RCBD was designed with three duplicates and three treatments. Three treatments were 0, 18.9 and 33.3 individuals of larvae of green lacewing released per tree. The green lacewing was released every week for seven times. Before release, thirty leaves infested by the red spider mites were plucked randomly to investigate the survivals of egg, larva and adult by stereomicroscope. After release, investigation as the method above was progressed for four times. The second test was studied at Shi Tin. CRD was the choice with three duplicates and two treatments due to the garden in the slope. The two treatments were 0 and 332.2 individuals of eggs of green lacewing released per tea tree every week. Each treatment had six tea trees

and the sampling was fixed in five tea trees. Fifteen infested leaves were investigated and the method was same as above.

2. Test on the kanzawa spider mite, *Tetranychus kanzawai* by releasing the green lacewings

Kanzawa spider mite was inoculated to tea plantation in Taiwan Tea Experiment Station. After the population was built in, four blocks were separate and five tea trees of high population of mites in each block were choice for release and survey. Four treatments were 0, 20, 40 and 80 individuals in which 2-3days old larvae were released per tea tree. Chrysopid was released for every five days in the first test and seven days in the second test. Twenty tea leaves in the first test and thirty tea leaves in the second test were plucked for investigating the survivals of egg, larva and adult by stereomicroscope before and after release.

The third test was studied in natural outbreak tea garden. RCBD was designed with three duplicates and two treatments in which 106.6 individuals of eggs of chrysopids were released per tea tree every week to compared with the check. Thirty tea leaves in each treatment were plucked randomly for investigating the density of the mites. Chrysopids was released five times during testing period.

Results and discussion

1. Effect on the red spider mite, *Oligonychus coffeae* by releasing the green lacewing

The density of the red spider mites in control area and check area was obviously significantly after releasing green lacewings. The density of red spider mite by releasing 33.3 individuals of the larvae of green lacewing was lower than 18.9 individuals of larvae of green lacewing. The density of the larvae and adults of the red spider mite was declined from 1.39 individuals per leaf to 0.74 individuals per leaf and the density of eggs was declined from 6.22 individuals per leaf to 0.5 individuals per leaf after releasing green lacewing twice. And the control rate of mites and eggs was 85.2% and 88.9% separately. Whereas the density of mites increased from 1.73 individuals to 2.86 individuals and the density of eggs declined from 5.62 individuals to 1.79 individuals per leaf in the treatment of releasing 18.9 individuals of green lacewings. The control rate of mites and eggs was only 53.3% and 60.9% respectively. After five times release, the density of mites and eggs was reduced to 0.2 and 0.59 individuals respectively per leaf and the control rate achieved 98% and 96.9% in the treatment of releasing 33.3 individuals of chrysopids. But it needed release seven times in the treatment of 18.9 individuals of chrysopids per tree to achieved a high control rate. Whereas in the check, the density of red spider mites was increased from 1.96 individuals to 11.52 individuals and the eggs of mites was increased from 6.29 individuals to 21.57 individuals. The data showed significantly different in each investigation. So the larvae of green lacewing could inhibit the density of the red spider mites. The more chrysopids were released, the faster control rate was achieved.

The results of another test showed that the density of the mites reduced from 14.56 individuals to 4.15 individuals per leaf and the density of eggs reduced from 16.62 individuals to 6.71 individuals per leaf after releasing 332.2 individuals of larvae and eggs of chrysopids twice per tea tree. The control rate was 47.9% and 50.1%. After four times release, the density of red spider mites and eggs in releasing area and check area was obviously significantly. The density of mites and eggs was 3.91 individuals and 2.58 individuals per leaf in releasing area and the density of mites and eggs was 12.85 individuals and 13.7 individuals per leaf in check area. The density of mites and eggs reduced to 1.14 and 2.93 individuals per leaf after six times release and the control rate was 87.9% and 80.3% respectively. Because the farmers did not harvest in summer, red spider mites were resurgent following the growth of tea shoots. But the density of mites increased obviously in check area after seven times release. While investigation, it was found that red spider mites on infested leaf in releasing area were less than in check area. After four times release, 46.7% of tea leaves was found without mites and 37.8% of

leaves was found with two spider mites above (including eggs) in releasing area. Whereas in check area, 91.1% of tea leaves were found with two spider mites above and only 4.47% of tea leaves was found without mites. Because the farmer harvested only in spring and winter, tea shoots grew as long as possible after spring tea. So, the red spider mites extended to new shoots. As surveying, the population density of the releasing area was obviously lower than the check area. After six times release, the damage of new shoots was 24.43% in releasing area and 98.9% in check area. After seven times release, the damage of new shoots in check area was also more serious than treatment area. That meant green lacewing could inhibit the density of red spider mites.

2. Effect on the kanzawa spider mite, *Tetranychus kanzawai* by releasing the green lacewing

The first test on the kanazawa spider mite showed that the density of the mites and eggs in treatment area was lower than in check area. After releasing eighty larvae of green lacewing once time per tree, the density of mite was declined from 15.92 individuals to 1 individual and the density of eggs was declined from 4.35 to 0.1 individuals per leaf. The control rate of mites and eggs was 84.41% and 94.49% respectively. But the control rate of mites and eggs in the treatment of releasing forty individuals of chrysopids was only 45.41% and 46.48% respectively.

The second test had higher population of mites but it also showed the same results. After releasing eighty larvae of green lacewing twice, the density of mites was reduced from 23.3 individuals to 1.67 individuals and the density of eggs was reduced from 18.5 to 0.33 individuals per leaf. The control rate of mites and eggs was 77.74% and 95.67%. After third times release, the control rate of the treatment of eighty larvae per tree was 100% and 97.7%. And the control rate of the treatment of forty larvae per tree was 96.31% and 97.55%. That meant the more green lacewing were released, the faster control effect achieved.

The third test was progressed in natural outbreak tea garden. After releasing 106.6 individuals of eggs per tea tree twice, the density of mites was declined from 16.87 individuals to 4.14 individuals and the density of eggs was declined from 20.4 individuals to 4.1 individuals per leaf. And the control rate of mites and eggs was 75.14% and 45.79% respectively. While investigation, many predators were found in both treatment and check area. After four times release, the density was low in both area. So, the test was affected by natural enemies especially no pesticide usage tea garden.

Anyway, test above showed that green lacewing could inhibit the density of kanzawa spider mite. The more chrysopids were released, the faster effect achieved. Kanzawa spider mite had the habit to distribute on the underside of tea leaves, pesticides did not have a good results. Furthermore, ovicides were seldom. So the usage of green lacewing to control red spider mite and kanzawa spider mite was a good method.

Table 1:Effect on the red spider mite by release different individuals of green lacewing in tea garden (Long-Tan)

treat	item	before release		after release							
				release twice		three times		five times		seven times	
		mites	eggs	mites	eggs	mites	eggs	mites	eggs	mites	eggs
A	No./leaf	1.73ab	5.62a	2.86b	1.79b	2.39b	7.28b	2.74b	2.40b	0.32b	0.62b
	control%	-	-	53.3	60.9	66.6	47.0	79.0	87.9	96.0	94.6
B	No./leaf	1.39b	6.22a	0.74c	0.50b	1.09b	2.04c	0.20c	0.59b	0.02b	0.09b
	control%	-	-	85.2	88.9	79.5	90.3	98	96.9	99.8	99.1
ck	No./leaf	1.96a	6.29a	7.14a	5.27a	8.21a	20.18a	14.56a	18.47a	11.52a	21.57a

*A: 18.9 ind./bush , B: 33.3ind./bush , mites include adults and larvae

**:means in the same column followed by the same letter are not significantly different at the 5% level by Duncan's

Multiple Range Test

Table 2: Effect on the red spider mite by release green lacewing in tea garden (Long-Tan)

treat	item	Before release		After release							
				release twice		four times		Six times		seven times	
		mites	eggs	mites	eggs	mites	eggs	mites	eggs	mites	eggs
Release area	No./leaf	14.56	16.62	4.15	6.71	3.91	2.58	1.14	2.93	3.42	6.71
	control%			47.9	50.1	75.5	82.3	87.9	80.3	74	79.7
ck	No./leaf	11.87	15.38	4.13	11.27	12.85	13.7	6.85	13.4	12.14	25.42

* 332.2 ind./bush, mites include adults and larvae

Table 3: Effect on the kanazawa spider mite by release different individuals of green lacewing in tea garden (TTES)

No.of chrysopid released /bush	stage	No. of mites before release	First release after		Second release after		Third release after		Fourth release after		Fifth release after	
			No.	control %	No.	control %	No.	control %	No.	control %	No.	control %
20	mites	29.93	9.43	36.78	5.43	43.58	2.23	48.13	0.23	85.95	0.1	75.33
	egg	16.96	6.3	2.67	6.2	10.97	1.23	0	0.07	93.72	0	100
40	mites	31.73	9.83	37.83	5.17	49.34	0.17	96.31	0	100	0.1	76.82
	eggs	16.67	6.93	0	5.33	22.13	0.03	97.55	0	100	0.07	87.04
80	mites	23.3	3.3	71.59	1.67	77.74	0	100	0	100	0.03	91.03
	eggs	18.5	5.63	20.25	0.33	95.67	0.03	97.7	0	100	0	100
Ck	mites	17.2	8.57	-	5.53	-	2.47	-	0.93	-	0.23	-
	eggs	14.86	5.67	-	6.1	-	1.03	-	0.97	-	0.47	-

Table 4: Effect on the kanzawa spider mite by release green lacewing in tea garden (Shin-Tin)

treat	item	Before release		After release			
				Two times after		Four times after	
		mites	eggs	mites	eggs	mites	eggs
Release area	No./leaf	16.87	20.40	4.14	4.1	0.12	0.15
	control%			75.14	45.79	32.43	52.12
ck	No./leaf	15.95	18.58	9.34	5.17	0.28	0.32

* 106.6 ind./bush ,mites include adults and larvae