Abundance and population of *Acaphylla theavagrans* Kadono (Acari: Eriophyidae) in some varieties of tea plants and a report on its new predator (*Amblyseius Womersleyi* Schicha).

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Summary

Abundance and variation of population density of the tea rust mite, *Acaphylla theavagrans* Kadono (Acari: Eriophyidae) in ten varieties of tea, *Camellia sinensis* were studied. The mite population density was higher on the lower surface than on the upper surface, and this tendency was greater on young leaves than on old leaves. The total number of mites per leaf was higher on young leaf than on old one. The mite density per unit area (4.7 cm sq.) of young leaf differed significantly among the different varieties.

Amblyseius womersleyi Schicha (Acari: Phytoseiidae) is found, as an effective predator of *A. theavagrans* in the laboratory and this is the first report from Japan on *A. womersleyi* as a predator of the tea rust mite.

Key words

Acaphylla theavagrans, *Amblyseius womersleyi*, abundance, tea plants, varietal difference.

Introduction

The tea rust mite, *Acaphylla theavagrans* Kadono, is an important pest causing considerable damage to tea plants in Japan (Ehara and Kadono, 1987). The high infestation of the tea rust mite results in the discoloration of tea leaves and debilitation of bushes leading to crop loss. This species so far regarded as *Acaphylla theae* (Watt) originally described from India or *A. steinwedeni* Keifer from California was described under the name *Acaphylla theavagrans* Kadono (Kadono, 1992). In this paper, the authors present the abundance of *A. theavagrans* per leaf, population variation in different tea varieties and a new report on *Amblyseius womersleyi* Schicha *as a predator of A. theavagrans.*

Materials and Methods

To study the abundance and population of *A. theavagrans* 3 Assam hybrid varieties as Izumi, Fujimidori and Benihikari, and 7 Japanese cultivars as Yutakamidori, Yamakai, Z-1, Okumidori, Sayamakaori, Ooiwase and Yabukita were selected at National Institute of Vegetables and Tea Sciences, Kanaya, Japan. Altogether 200 leaves, 20 from each variety taking 10 young leaves from the plucking surface and 10 old leaves from the inside leaf layer were collected by random sampling method. The total numbers of *A. theavagrans* on the lower and upper surfaces of a tea leaf were counted under a binocular microscope. This experiment was conducted from mid-May to late May in 1998.

For the varietal difference of the mite populations, five young leaves from each of the above mentioned 10 varieties were collected in a day. A round disk (4.7 cm sq.) from a central part of a leaf was separated and mites on the

lower surface were counted. This experiment was conducted with 7 replications in the first three weeks of June, 1998.

As *Amblyseius womersleyi* Schicha was observed to take *A. theavagrans* as food, an experiment was designed to find out the efficiency of *A. womersleyi* as a predator of *A. theavagrans*. One or two female adults of *A. womersleyi* were released on a tea leaf with known number of *A. theavagrans*. This experiment was conducted with the *A. womersleyi* collected from two sources, one from tea fields and another from culture where the spider mites was used as their food. In both cases, the control batches of *A. theavagrans* were maintained without predators. The number of preys and predators were observed after several days and the efficiency of predation is calculated by applying the following formula.

Efficiency (%) = 100-Growth rate of prey

Where,

$$\text{Growth rate of prey} = \frac{IPw}{IPpr} \times \frac{OPpr}{Opw} \times 100$$

Where, Ipw = Initial population of prey without predator
IPpr = Initial population of prey with predator
OPw = Population of prey without predator at observed day
Oppr = Population of prey with predator at observed day

Results and Discussion

The mean numbers of *A. theavagrans* on the lower and upper surfaces in young (surface) and old (inside) leaves and the population density of *A. theavagrans* in a unit area of 4.7 cm sq in different varieties of tea plants are presented in Table- 1.

The number of mites was higher on the lower surface than on the upper surface. For young leaves 97% of *A. theavagrans* was on the lower surface. Seventy-nine % of mites were on the lower surface in old leaves. The highest

Table 1. Mean number of *A. theavagrans* on the lower and upper surfaces of young and old leaves and in 4.7cm area in different varieties of tea plants.

Variety	Young leaf			Old leaf			No. in
	Upper	Lower	Total	Upper	Lower	Total	4.7 cm
Izumi	56.8	988.1	1044.9	17.9	41.2	59.1	48.7
Fujimidori	4.9	196.6	201.5	12.9	50.7	63.6	6.1
Benihikari	8.4	251.3	259.7	16.4	35.7	52.1	36.8
Yutakamidori	8.2	316.8	325.0	11.1	35.5	46.6	26.8
Yamakai	10.3	447.2	457.5	40.9	123.8	164.7	16.5
Z - 1	7.8	102.0	109.8	12.2	41.5	53.7	38.2
Okumidori	1.9	120.3	122.2	14.3	37.7	52.0	31.2
Sayamakaori	4.7	351.7	356.4	16.1	38.0	54.1	20.5
Ooiwase	6.9	397.9	404.8	20.8	36.6	57.4	88.3
Yabukita	11.7	429.5	441.2	11.7	157.3	169.0	37.2

total number of mites on young leaves was 1044.9±124.1 in the variety Izumi but that on old leaves was 169.0±46.1 in the variety Yabukita. The lowest number of mites on young leaves is 109.8±17.5 in the variety Z-1 and that on old leaves is 46.6±6.6 in the variety Yutakamidori.

The population density, 88.3±28.41 in the variety Ooiwase was the highest and 6.1±1.03 in the Fujimidori was the lowest.

Amblyseius womersleyi was found as an active predator of *A. theavagrans*. The calculated efficiency of this predator along with the observed number in different days is presented in Table-2. The numbers of preys without predators increased after 3 days of rearing but those with predators decreased. The efficiencies after 3 days of *A. womersleyi* collected from fields were fluctuated from 12.8% to 81.1 The A and B treatments were conducted different days and the efficiencies after 3 days in the B treatment were lower than those in the A treatment. However, the efficiencies after 4 days in the B treatment increased to 55.8 - 73.5%. On the other hand, that of the culture population after 3 days was 47.7±4.2%, regardless of the number of predators.

The population of *A. theavagrans* was higher in young leaves collected from the plucking surface than in old leaves from the inside leaf layer. 97 and 77%

Table 2. Effect of *Amblyseius womersleyi* as a predator on the tea rust mite.

Experi-	Initial		After 3 days		After 4 days		Efficiency (%)
ment	Prey	Pred	Prey	Pred	Prey	Pred	after 3 days
A-1	103	1	44	1			66.60
A-2	155	1	74	1			62.70
A-3	71	1	39	1			81.10
A-Ctrl	61	0	80	0			
A-Ctrl	50	0	62	0			
B-1	94	1	89	1	64	1	13.87 (55.76)
B-2	89	1	85	1	42	1	13.14 (69.34)
B-3	216	1	207	1	88	1	12.83 (73.53)
B-Ctrl	54	0	63	0	83	0	
B-Ctrl	87	0	92	0	134	0	
C-1	70	1	37	1			56.22
C-2	107	1	71	1			45.02
C-3	185	1	140	1			37.32
C-4	65	2	29	0			65.60
C-5	85	2	65	1			36.66
C-6	98	2	65	2			45.07
C-Ctrl	58	0	72	0			
C-Ctrl	68	0	72	0			
C-Ctrl	67	0	86	0			

A & B: Predator from tea field, C: Predator from culture, Ctrl : Control.
The calculation methods of the efficiency of predator see text.
Percentage in the parenthesis indicates the efficiency of predator after 4 days.

of *A. theavagrans* were present on the lower surface of young and old leaves, respectively. Mulaleedharan *et al.* (1988) studied the vertical distribution of *A. theae* in South India and observed maximum number on the upper surface leaves. They also found 87% of *A. theae* on the lower surface of leaf. The distributional patterns of the two eriophyid mites are very similar. The preference of younger leaves by *A. theavagrans* can be explained with findings of Gibson (1974) who stated that the eriophyid mite *Abacarus hystrix* preferred youngest leave because their closer furling offers more protection.

Kuroda *et al.* (1993) investigated the population density of *A. theavagrans* in nine Japanese cultivars including Ooiwase, Yabukita, Sayamakaori and Yamakai and reported no significant difference in the population density among the different tea cultivars. In the present study, however, the population density of *A. theavagrans* was significantly higher in the variety Ooiwase than in the other varieties.

Amblyseius womersleyi is believed to be one of the most native predators with the most potential for suppressing the spider mite (*T. kanzawai*) because of its high predatory and reproductive ability (Hamamura, 1986), but it is the first report as a predator of *A. theavagrans* in Japan.

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