

Comparison of *Orius niger* with *Orius laevigatus* biological control efficiency to Western flower thrips (*Frankliniella occidentalis* Pergande) on Sweet Pepper in Greenhouses

Mehmet KEÇECİ  
M. Oktay GÜRKAN

Inonu University, Faculty of Agriculture, Department of Plant Protection, Battalgazi, Malatya, Turkey

Ankara University, Faculty of Agriculture, Department of Plant Protection, Dışkapı, Ankara, Turkey

# 1. Introduction

Protected vegetable cultivation

- located mainly the Mediterranean and Aegean Regions having 93% share within the total greenhouse in Turkey.
- -Major vegetable crops are tomato, sweet pepper, eggplant and cucumber



# 1. Introduction

## Sweet Pepper Pests

Cotton whitefly (*Bemisia tabaci*),  
Aphids (*Aphis gossypii*, *Myzus persicae*)  
Carmine spidermite (*Tetranychus* spp.),  
Thrips (*Thrips tabaci*, *Frankliniella occidentalis*)



Synthetic insecticides have been and are still used to control of this insect.

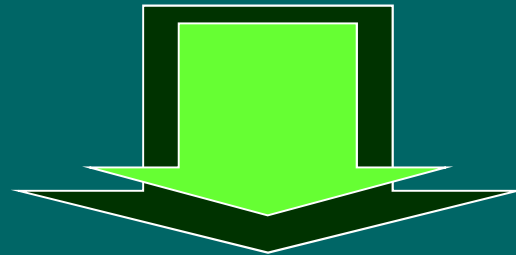
Chemical control

# 1. Introduction

## Difficulties in controlling of Western flower thrips, *Frankliniella occidentalis*



- Very small thin insects,
- its rapid developmental cycle and high reproductive rate
- Some part of the their life cycle found in soil
- its tendency to inhabit protected areas of the plant, such as growing tips and flower buds



Intensive spray application



Pesticide Resistance



# 1. Introduction

- ➡ Biological control possibilities of WFT using *Orius* species on major vegetables such as pepper, eggplant, cucumber, tomato and strawberry, which are important in protected cultivation
- ➡ This concept has been investigated by the researchers since 90's years on  
**sweet pepper**  
(Van de Veire and Degheele, 1992, 1997; Chamber et al., 1993; Dissevelt et al. 1995; Sanchez et al., 2000; Tommasini and Maini, 2001; Tavella et al., 2003),  
**eggplant**  
(Tommasini et al., 1997; Chiappini, 1993),  
**cucumber**  
(Dissevelt et al. 1995),  
**tomatoes** (Shipp and Wang, 2003) and  
**strawberry** (Dissevelt et al. 1995).

# 1. Introduction

Aim of the study was

- (i) to compare *O. laevigatus* and *O. niger* as biological control agents of WFT and,
- (ii) to see the *O. niger* performance in winter months,
- (iii) to determine the most convenient release rate and frequency under the protected crop conditions during the growing season in Turkey

## 2. Material and Method

### Material

- *Orius niger* was collected on faba bean.
- *O. laevigatus* was also obtained from Koppert Biological Systems Ltd (Turkey).

- *Predator rearing*

Both *Orius* species used in trials were reared at a temperature of  $26\pm 1^{\circ}\text{C}$ , relative humidity of  $70\pm 10\%$  and 16:8 L:D conditions.

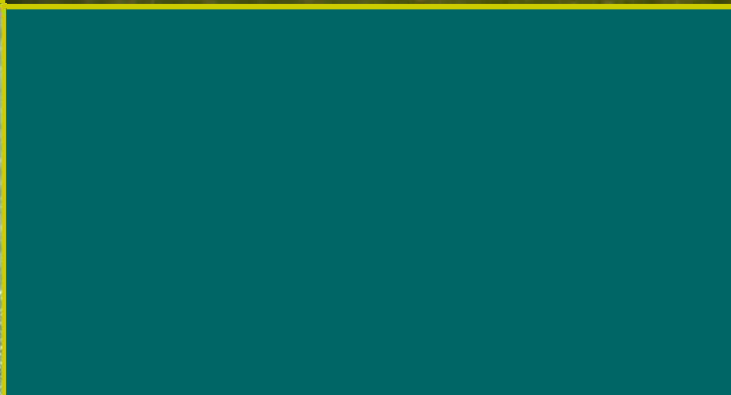
20-30 individuals of newly mature *Orius* were left in plastic jars of 10\*6\*6 cm covered by net.

Frozen *E. kuehniella* eggs were given to predators as food. Bean pods were left in the jar as egg laying media.



## 2. Material and Method

### Material

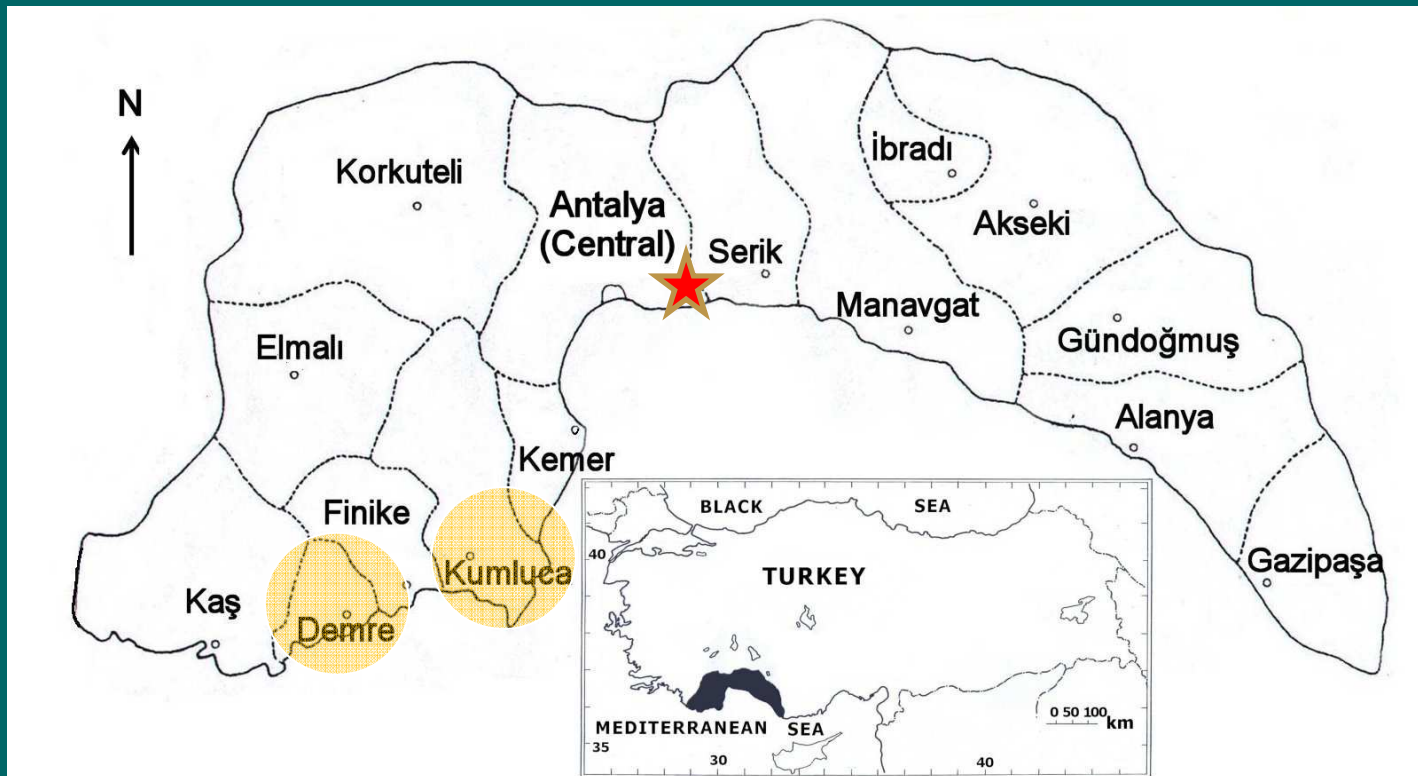




## 2. Material and Method

### Method

Trials was set up at Bati Akdeniz Agricultural Research Institute, Antalya



## 2. Material and Method

### Method

#### First year experiment (2003-2004 growing season)

The Balo sweet pepper variety was used in the trial.

Pepper seedlings were planted in the greenhouse on 2 October, 2003.

#### *Initial pest inoculation*

7-10 days after planting the plants in the greenhouse, the plant branches and leaves contaminated with *F. occidentalis* were homogenously distributed in the greenhouse to ensure settlement of the pest in the greenhouse.

Experiments were completely randomized block design with 3 replications. Each parcel was 10 square meter and there were 18 plants in parcels.

## 2. Material and Method

### Method

Each plot was separated from others with fine insect net (80 mesh) to prevent thrips and *Orius* movement among the plots.

Then, 1-3 day old *O. niger* and *O. laevisgatus* adults were released separately in plot assays against WFT on **27-29 October** 2003.



*Orius laevisgatus* release density of 1 (OL1), 2 (OL2), 4 (OL4), 6 (OL6) adult  $\text{m}^{-2}$ .

*O. niger* release density of 1 (ON1), 2 (ON2), 4 (ON4), 6 (ON6) adult  $\text{m}^{-2}$ .

The male: female ratio was 1:1 for both species.



## 2. Material and Method

### Method

#### Second year experiment (2004-2005 growing season)

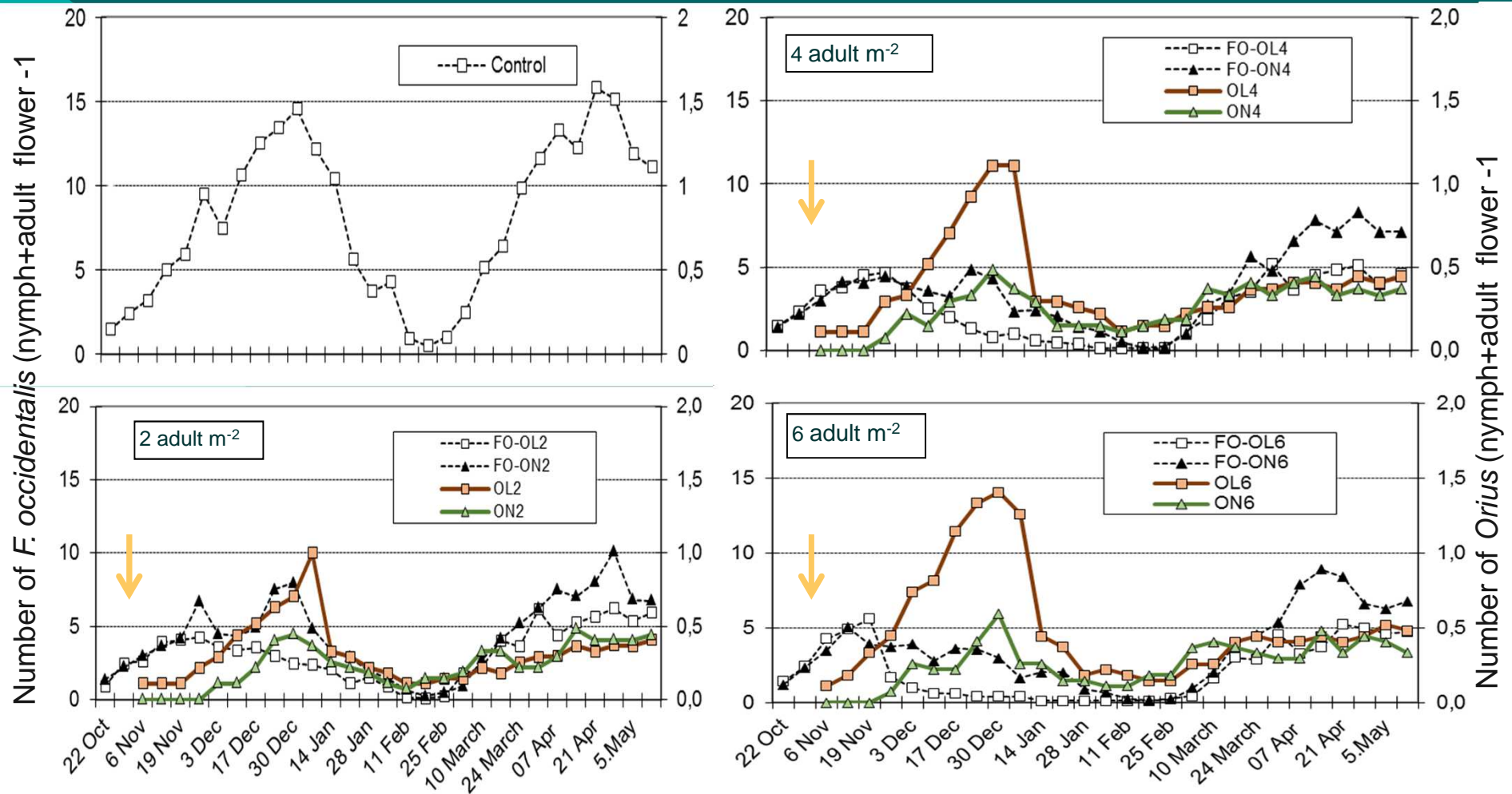
Balo sweet pepper was also used in the greenhouse trial of the second year.

Pepper seedlings were planted in the greenhouse on 17 September 2004.

Except the releases of beneficial insects, all other studies were done similar to the studies in the first year.

*Orius* releases were done **twice** on **21-22 October** 2004 and **10-11 March** 2005 with a same release doses.

### 3. Results

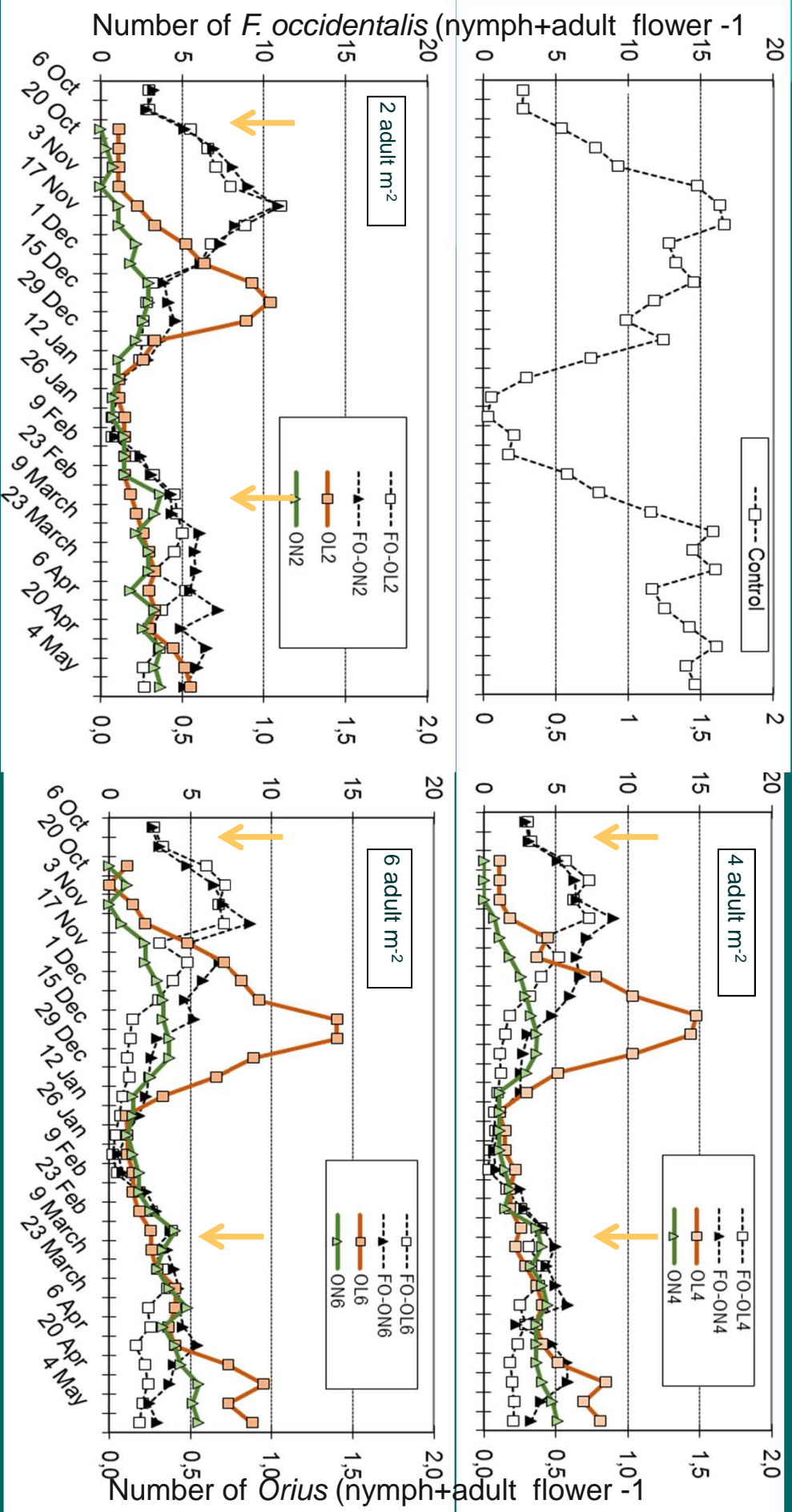


First year experiment

Shipp (1995) and Yücel et al. (2011)



### 3. Results



Second year experiment



### 3. Results

**Table 1.** *Frankliniella occidentalis* population densities (nymph+adult flower<sup>-1</sup>) in the control and *Orius* release parcels in pepper greenhouse in **first year**

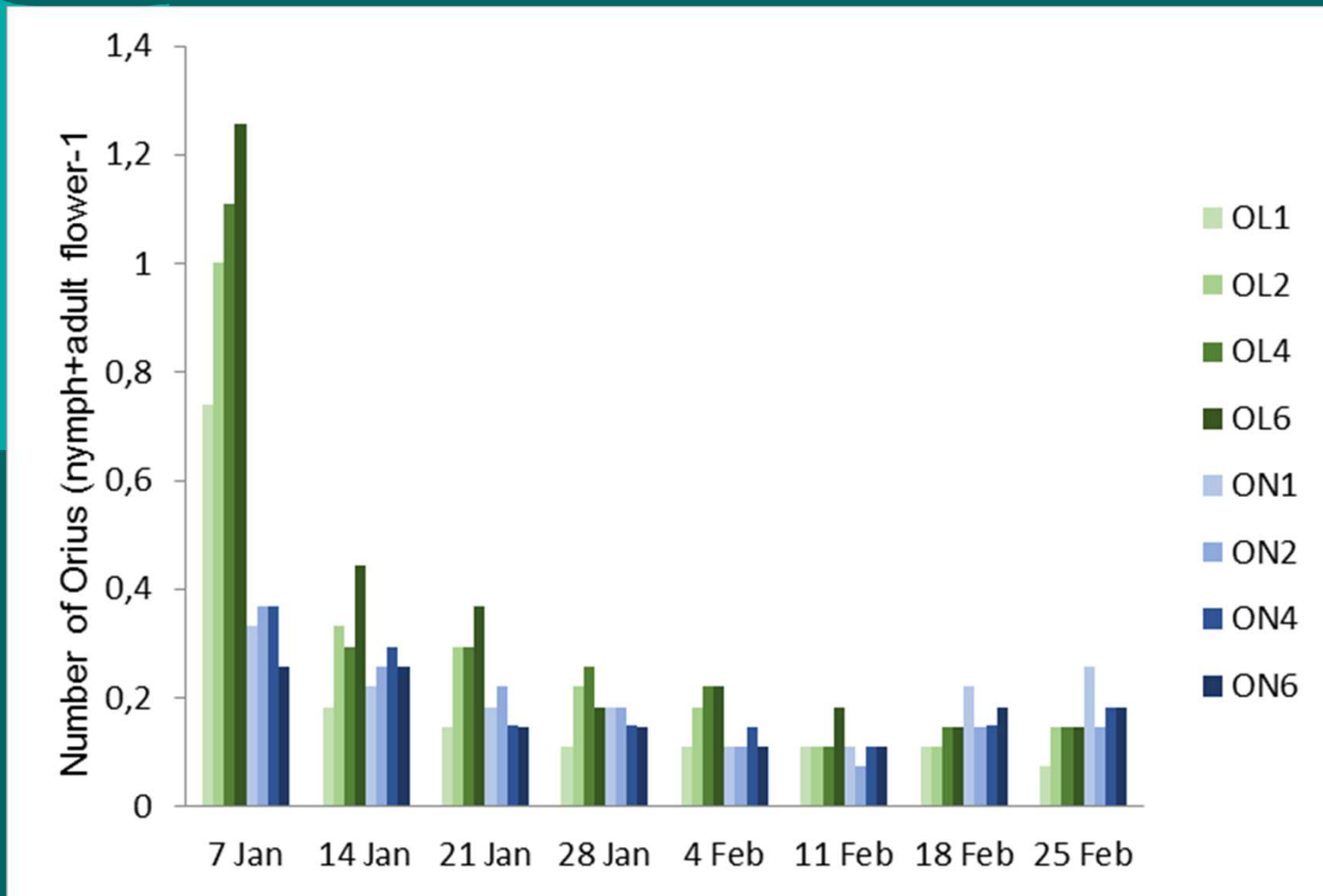
Dates	Control		OL1**		OL2		OL4		OL6		ON1		ON2		ON4		ON6	
22 Oct	1,48	a	1,48	a	0,93	a	1,44	a	1,41	a	1,55	a	1,37	a	1,41	a	1,18	a
31 Oct	2,44	a	2,11	a	2,48	a	2,30	a	2,44	a	2,41	a	2,22	a	2,19	a	2,33	a
⋮																		
19 Nov	5.96	a	4.93	ab	4.07	ab	4.48	ab	5.59	ab	4.00	ab	4.15	ab	4.07	ab	3.89	b
26 Nov	9.54	a	3.81	bc	4.26	bc	4.67	bc	1.70	c	5.96	b	6.70	ab	4.44	bc	3.74	bc
3 Dec	7,46	a	5,37	ab	3,59	bc	3,74	bc	0,96	c	5,00	ab	4,48	b	3,85	bc	3,89	bc
10 Dec	10,61	a	6,19	ab	3,37	bc	2,55	bc	0,63	bc	6,30	ab	4,33	bc	3,55	bc	2,78	bc
17 Dec	12,57	a	3,67	cd	3,55	cd	2,00	de	0,59	e	6,56	b	4,89	bc	3,22	cde	3,59	cd
24 Dec	13,44	a	4,22	cd	3,00	cde	1,30	de	0,41	e	13,44	a	7,52	b	4,85	bc	3,56	cd
30 Dec	14,56	a	4,44	c	2,48	cd	0,81	d	0,41	d	9,70	b	7,96	b	4,30	c	2,96	cd
⋮																		
3 March	2,48	a	1,89	ab	1,78	abc	1,15	bc	0,44	c	1,56	abc	0,93	bc	0,96	bc	0,96	bc
10 March	5,17	a	2,67	bc	2,19	bc	1,89	bc	1,63	c	3,89	ab	2,74	bc	2,74	bc	2,04	bc
17 March	6,39	a	5,78	ab	4,04	ab	3,18	b	3,00	b	5,59	ab	4,15	ab	3,37	b	3,96	ab
24 March	9,87	a	6,89	ab	3,63	b	3,52	b	2,89	b	7,11	ab	5,19	b	5,63	b	4,52	b
31 March	11,65	a	6,04	b	6,15	b	5,15	b	4,55	b	7,30	b	6,22	b	4,78	b	5,33	b

### 3. Results

**Table 2.** *Frankliniella occidentalis* population densities (nymph+adult flower<sup>-1</sup>) in the control and *Orius* release parcels in pepper greenhouse in **second year**

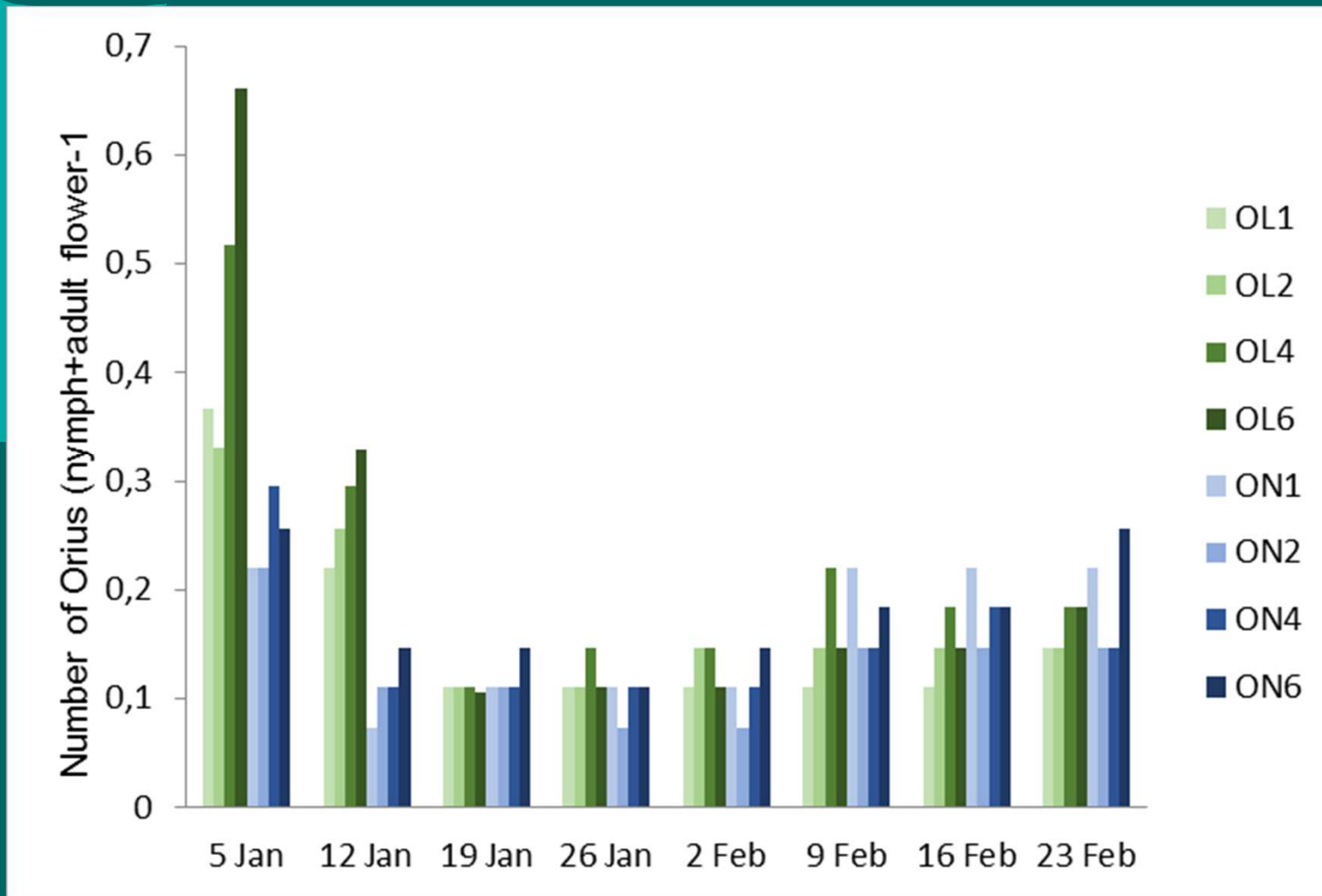
Dates	Control		OL1**		OL2		OL4		OL6		ON1		ON2		ON4		ON6	
6 Oct	2.76	a**	2.34	a	2.92	a	3.08	a	2.77	a	2.68	a	3.23	a	2.90	a	2.65	a
13 Oct	2.72	a	2.83	a	2.93	a	3.27	a	3.27	a	2.90	a	2.83	a	3.17	a	3.05	a
⋮																		
11 Nov	14.71	a	10.36	ab	7.97	b	7.31	b	7.04	b	10.95	ab	9.04	b	9.04	b	8.71	b
17 Nov	16.27	a	12.03	ab	11.04	abc	4.03	de	3.06	e	13.10	ab	10.87	abcd	7.13	bcde	4.96	cde
24 Nov	16.60	a	10.02	bc	8.89	bc	5.22	c	4.82	c	12.25	ab	8.20	bc	6.43	bc	6.77	bc
1 Dec	12.78	a	7.01	bc	6.74	bc	4.01	c	3.90	c	9.18	ab	7.29	bc	6.67	bc	5.75	bc
8 Dec	13.28	a	5.80	bc	6.10	bc	3.23	bc	3.00	c	7.92	b	6.10	bc	6.03	bc	4.70	bc
15 Dec	14.54	a	4.02	bc	3.14	bc	1.80	bc	1.42	c	6.29	b	3.89	bc	4.78	bc	5.22	bc
22 Dec	11.75	a	3.82	bc	2.79	bc	1.49	bc	1.30	c	5.80	c	4.11	bc	3.07	bc	2.96	bc
⋮																		
16 March	15.81	a	5.84	b	4.99	b	4.07	b	3.29	b	6.28	b	6.03	b	4.40	b	3.97	b
23 March	14.43	a	6.00	b	4.51	b	3.81	b	3.57	b	5.66	b	5.75	b	5.00	b	4.25	b
30 March	15.97	a	4.04	b	3.20	b	2.50	b	2.37	b	7.33	b	5.81	b	5.81	b	4.29	b
6 Apr	11.67	a	5.70	b	5.18	b	2.92	b	2.51	b	5.44	b	5.44	b	2.25	b	4.55	b
13 Apr	12.46	a	5.22	bcd	3.74	cd	2.33	d	1.62	d	8.66	ab	7.18	bc	4.74	bcd	5.44	bcd

### 3. Results



First year experiment

### 3. Results



Second year experiment

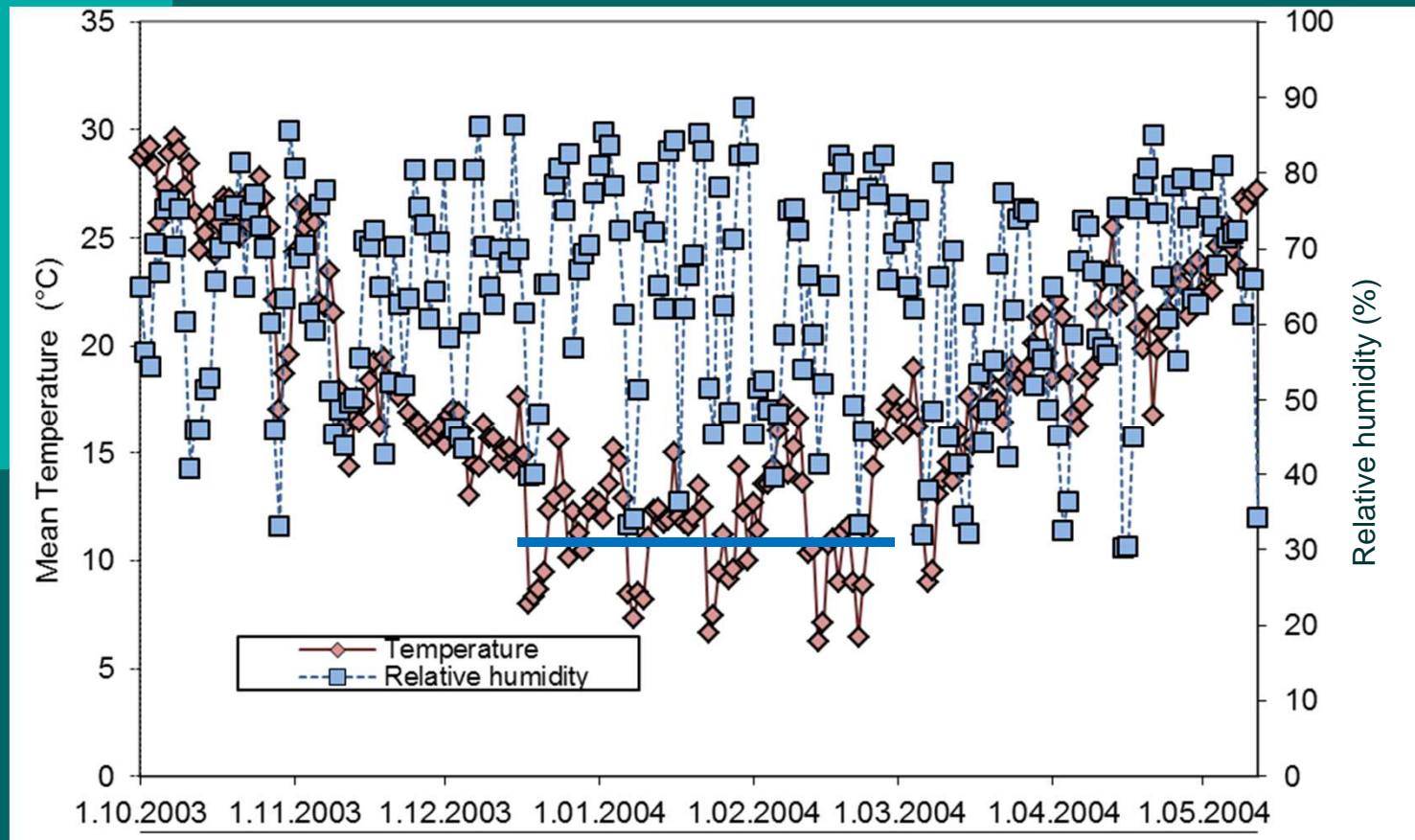
## 4. Discussion

Releasing of *Orius* species was done once with the specified doses in the beginning of **the first year** growing season.

The thrips population declined to economic threshold in the...

*O. laevigatus* parcels of 6 adult  $\text{m}^{-2}$  after the 5<sup>th</sup> week and 4 adult  $\text{m}^{-2}$  after the 6<sup>th</sup> week.

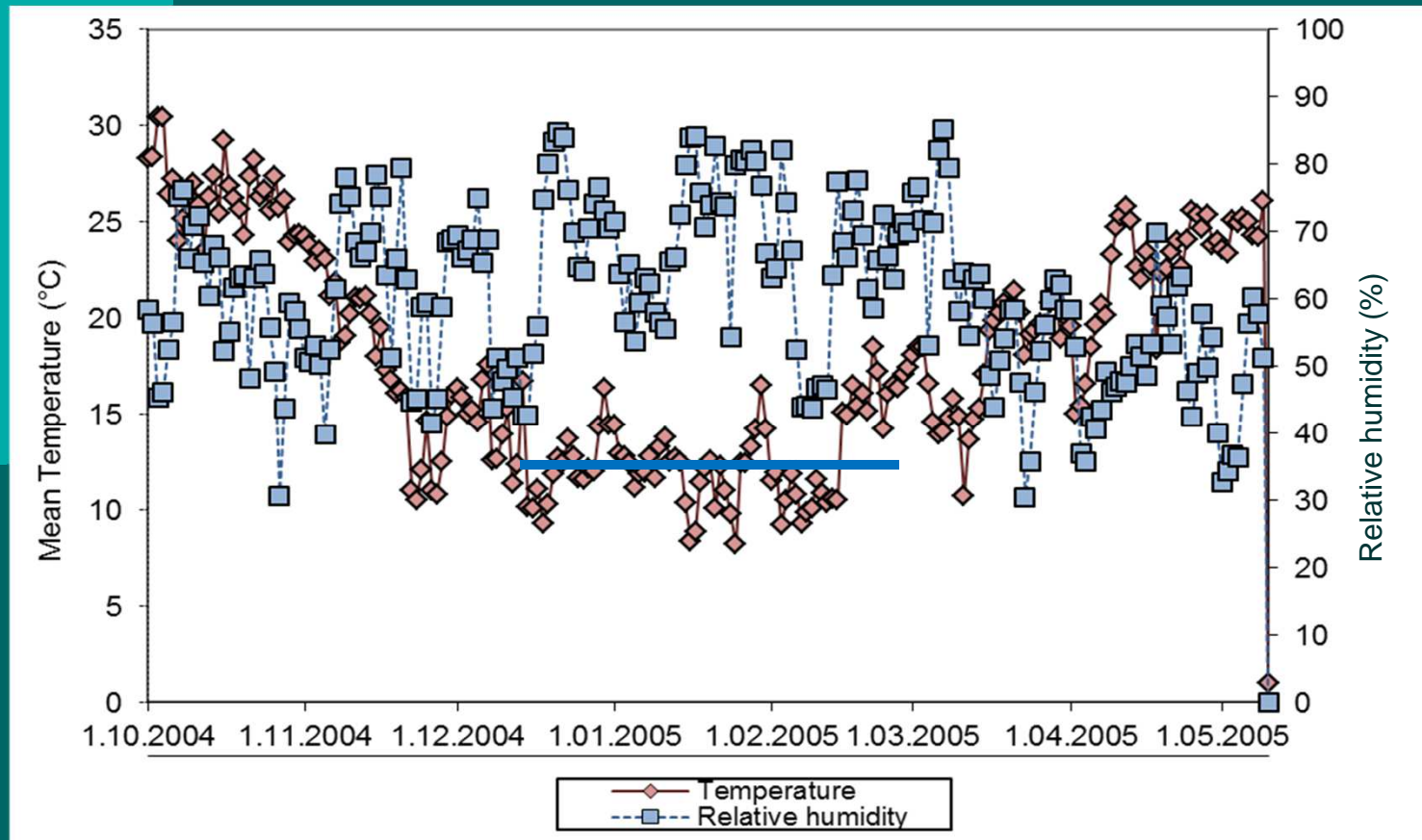
## 4. Discussion



After the drop of temperature, thrips and *Orius* population declined in all parcels including the control parcel especially in January and February that mean temperature was 11.9 in first year and



## 4. Discussion



..... and 12.7 °C in this term in second year experiment.

## 4. Discussion

Lower developmental threshold has been determined to be 9.4°C for *F. occidentalis* (Gaum et al., 1994) and 11.3°C for *O. laevigatus* (Sanchez and Lacasa, 2002).

These low temperatures are advantageous to *F. occidentalis* at the beginning of the spring season. Therefore, second release was done in this period in the second year study as well. Thrips population was under economic threshold in the 3rd week after this second release in spring term.

## 4. Discussion

Studies in some other countries revealed similar results. In many European countries, *O. laevigatus* is considered to be the most effective natural enemies against thrips in the greenhouses of sweet pepper cultivation.

Chambers *et al.* (1993) reported that 1 to 2 *Orius* release per one pepper plant provided a good thrips control in the greenhouses in England.

Similar results are also reported by Sanchez *et al.* (2000) in the greenhouses for pepper cultivation in South-eastern Spain.

Tavella *et al.* (2003) reported that 0.3 *Orius* per flower effectively reduced the thrips population. Dissevelt *et al.* (1995) also reported in their study on greenhouse pepper plant in Netherlands that *Orius* populations released at 0.5-1 adult m<sup>-2</sup> could be effective against thrips.

## 4. Discussion

The reason of the low release doses found effective in the studies mentioned previously may be related to different the growing season.

In Turkey sweet pepper growing, temperature has decreased in winter months in the middle of season. Therefore significant reduction in the *Orius* population was observed in that date. Thrips have a less lower development threshold compared to *Orius* species and its population increased faster. This situation required additional releases in spring months for thrips control.

Other reason,

In our study, *Orius* release were done to be curative. However, *Orius* releases were mostly done as preventetive in other studies.

## Conclusions

Although thrips population was under pressure in the beginning with one predator release in the beginning of the growing season, *Orius* populations could not increase rapidly and the pest could not be controlled in spring term. Therefore, second releases were done with the same dose in spring term in the second year study.

It was observed that the thrips population in sweet pepper was controlled with 2 releases of *O. laevigatus* in October and March with a dose of 4 adult m<sup>-2</sup>.

*O. niger* population increased more slowly and suppressed thrips population slower than *O. laevigatus*.



Thank you for your attention