

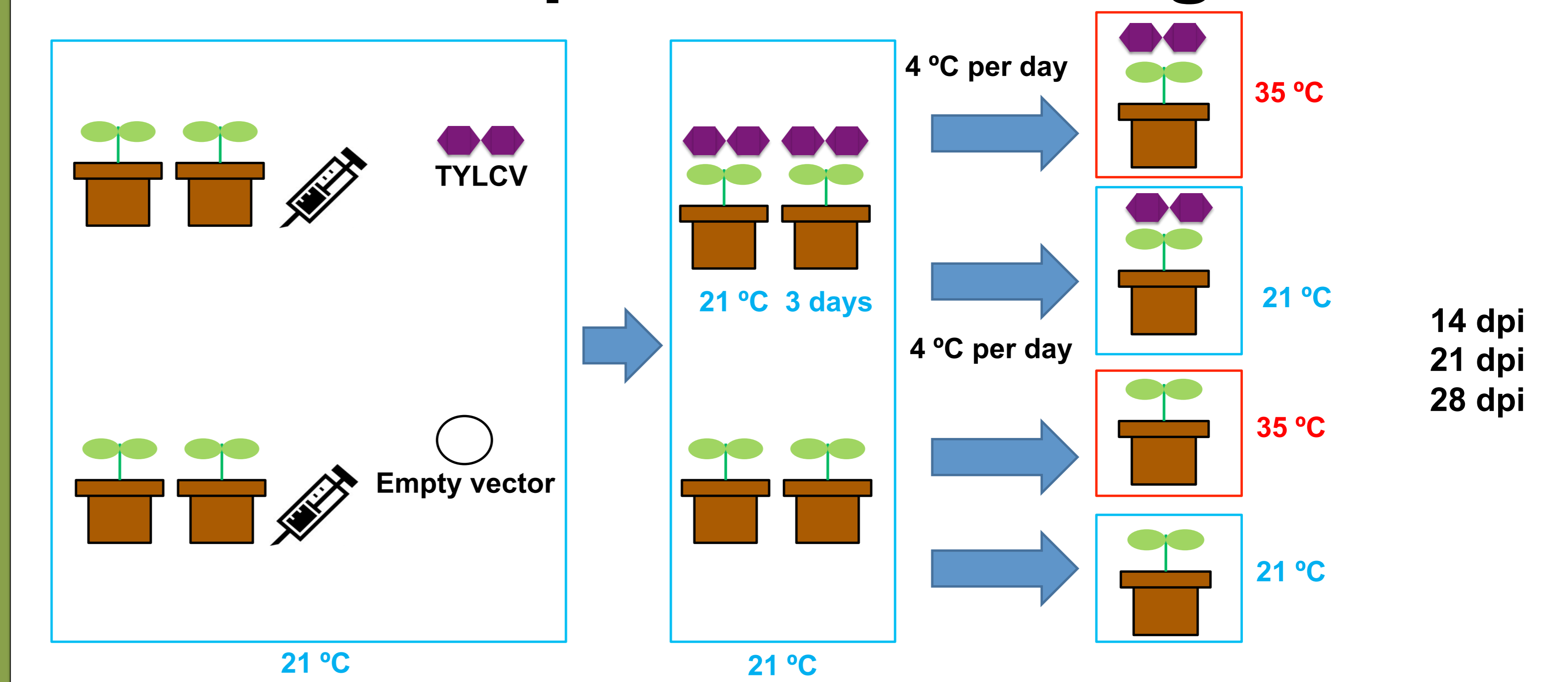
Introduction

Geminiviruses, named for their twinned icosahedral particles, are a large family of plant viruses with circular, single-stranded DNA (ssDNA). They infect food crops and cause substantial losses around the world (1). *Tomato Yellow Leaf Curl Virus (TYLCV)* is a member of the eight genera of the *Geminiviridae* family (2) and TYLCV isolates have been identified in crops around the world.

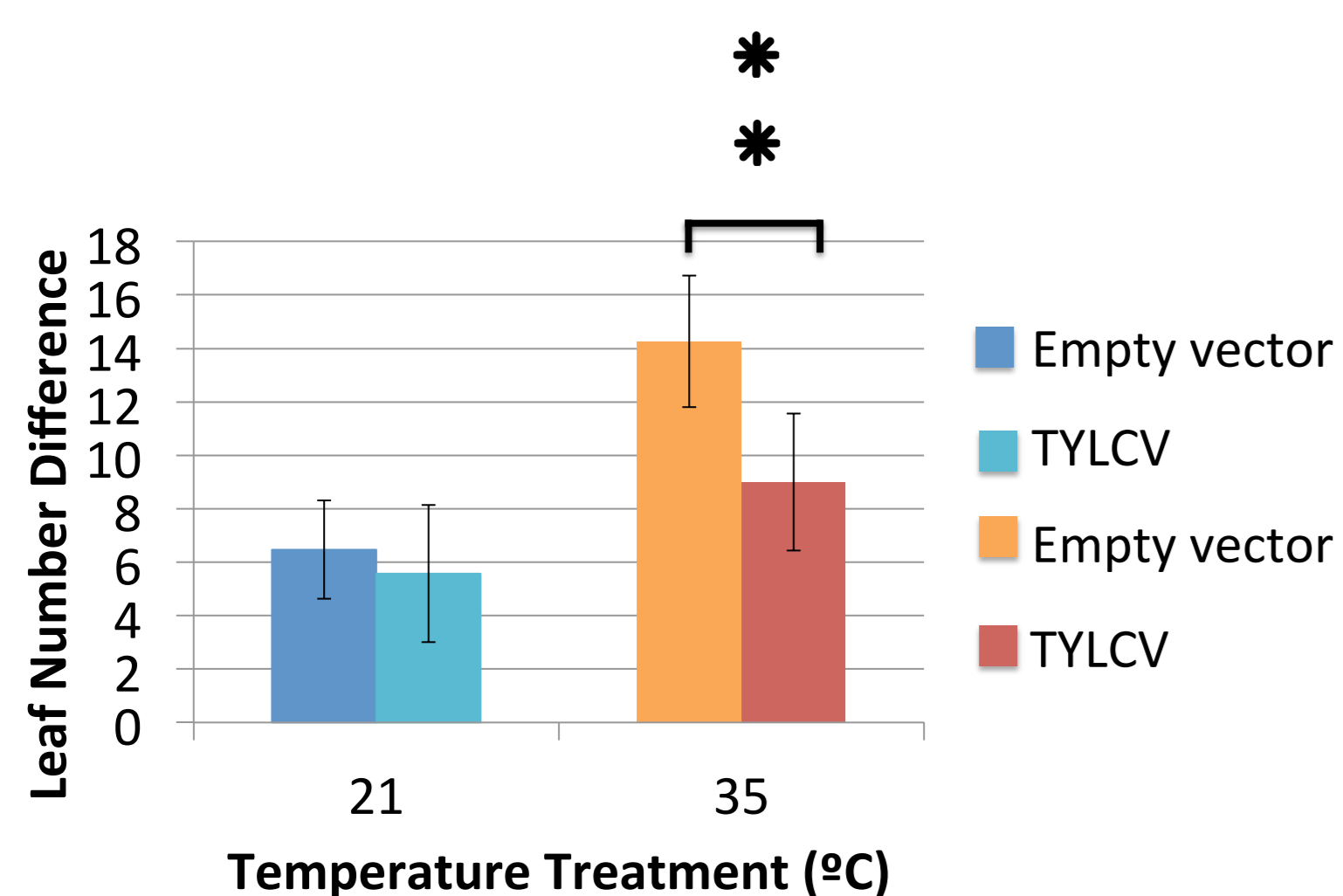
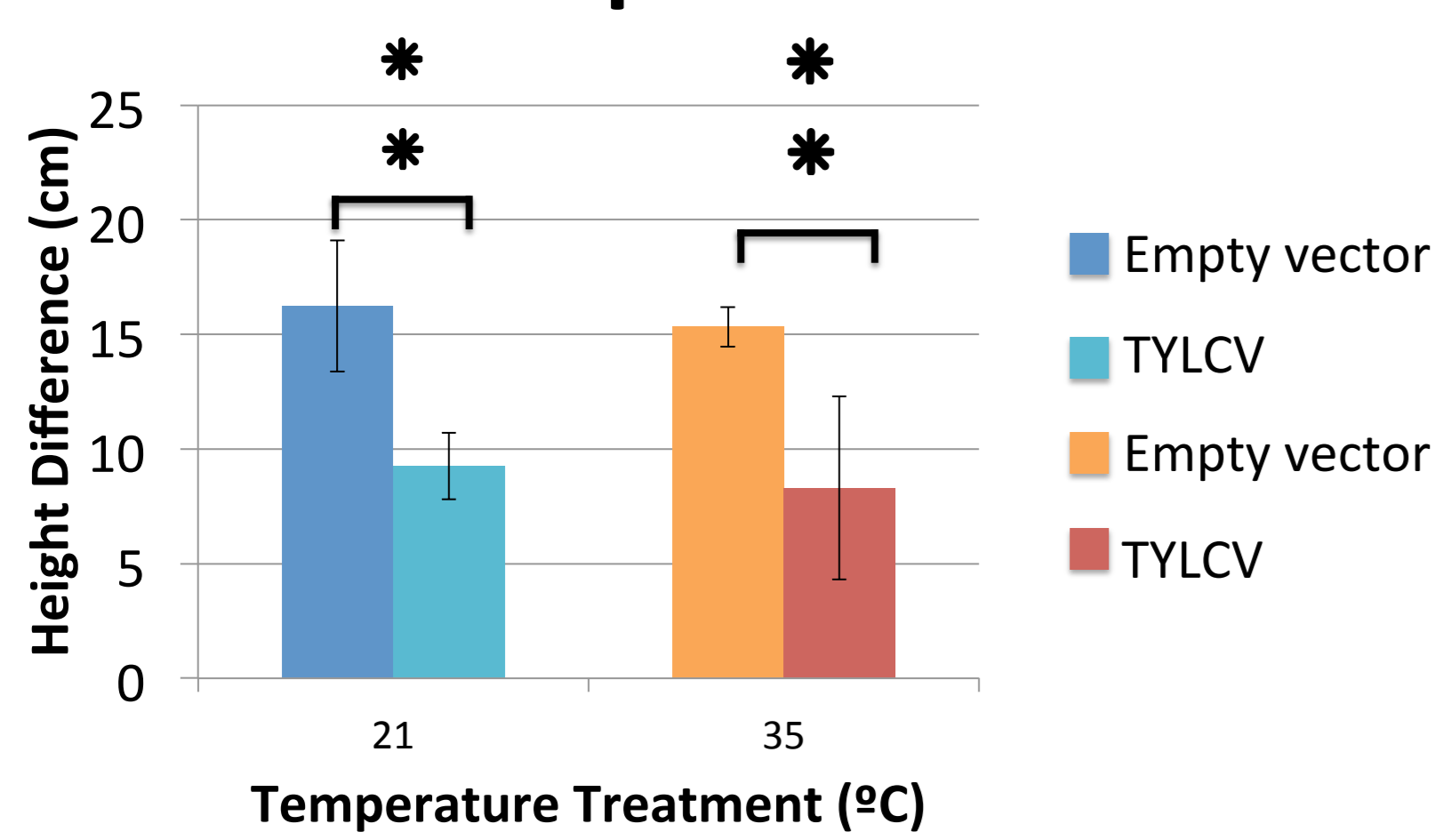
Global warming will affect abiotic and biotic stress relations. Several studies shows how changes of this relation could affect virus populations and virus resistance (3). Our previous results (4) shows that at high temperatures virus amounts decreases in *Nicotiana benthamiana*. With the aim to understand better the interaction between TYLCV infection and temperature we have designed experiments to expose at high temperature TYLCV infected plants.

We used two groups of 30 plants. One group was infected with TYLCV and the other with the empty vector. After the infection, we maintained the plants at 21 °C for 3 days. Then, we divided each group in two groups of 15 plants. One group was grown at 35°C and the other at 21 °C. We measured the plant height, the leaf number and the symptoms throughout the infection and took samples of each plant at 14 dpi (days postinfection), 21 dpi and 28 dpi to measure the amount of virus. The data from three biological replicates is represented.

Experimental design



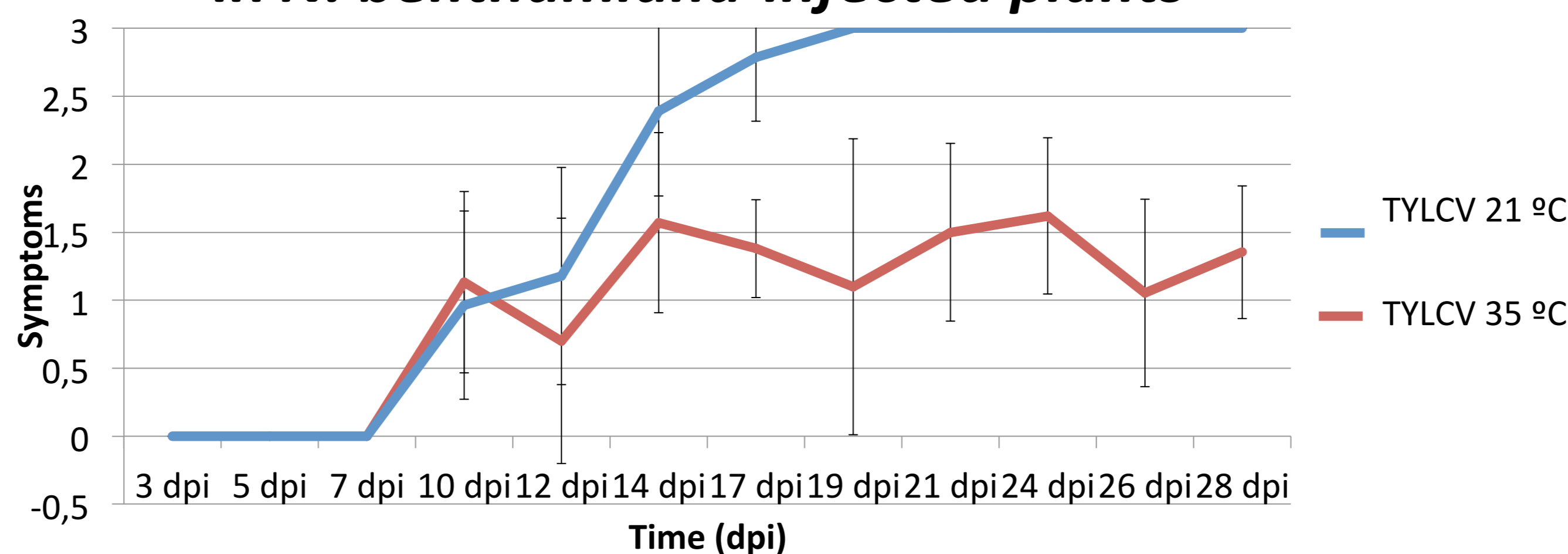
Plants height diminishes in TYLCV-infected plants, regardless of the temperature



The height difference between infected and uninfected group is similar in the two treatments. We observe a similar, but attenuated, trend in the leaf number difference.

Results

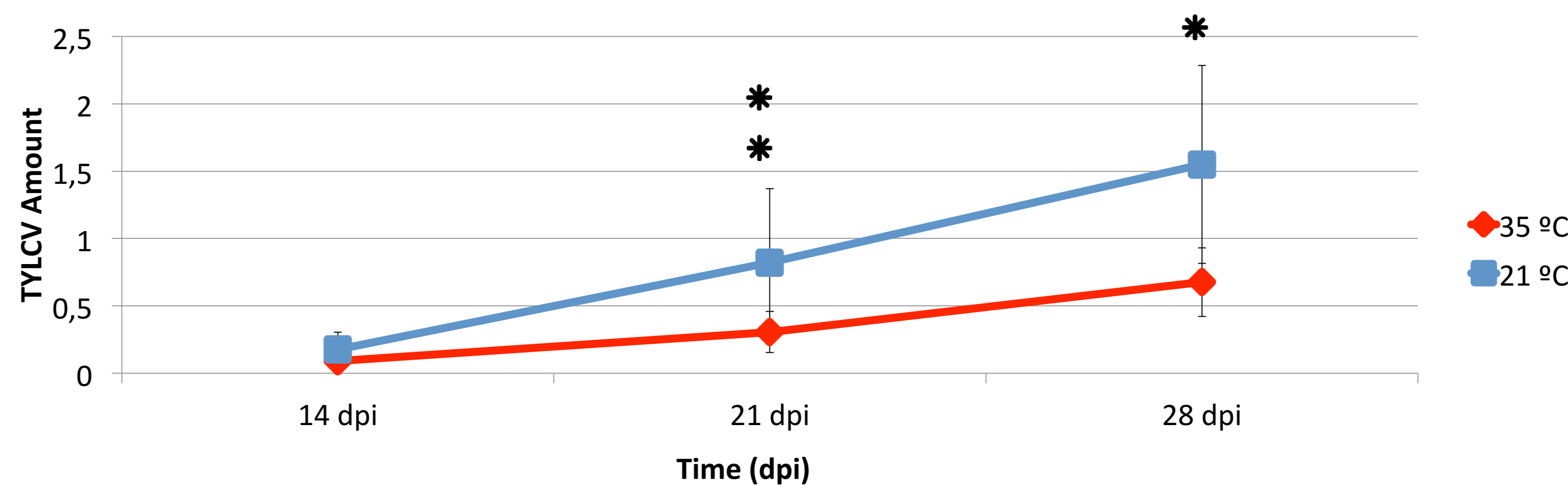
Symptoms decrease at high temperature in *N. benthamiana*-infected plants



- Symptom Index**
0. Symptomless.
 1. Slight curvature of leaf.
 2. Leaf curling.
 3. Size reduction and yellowing of the leaf.

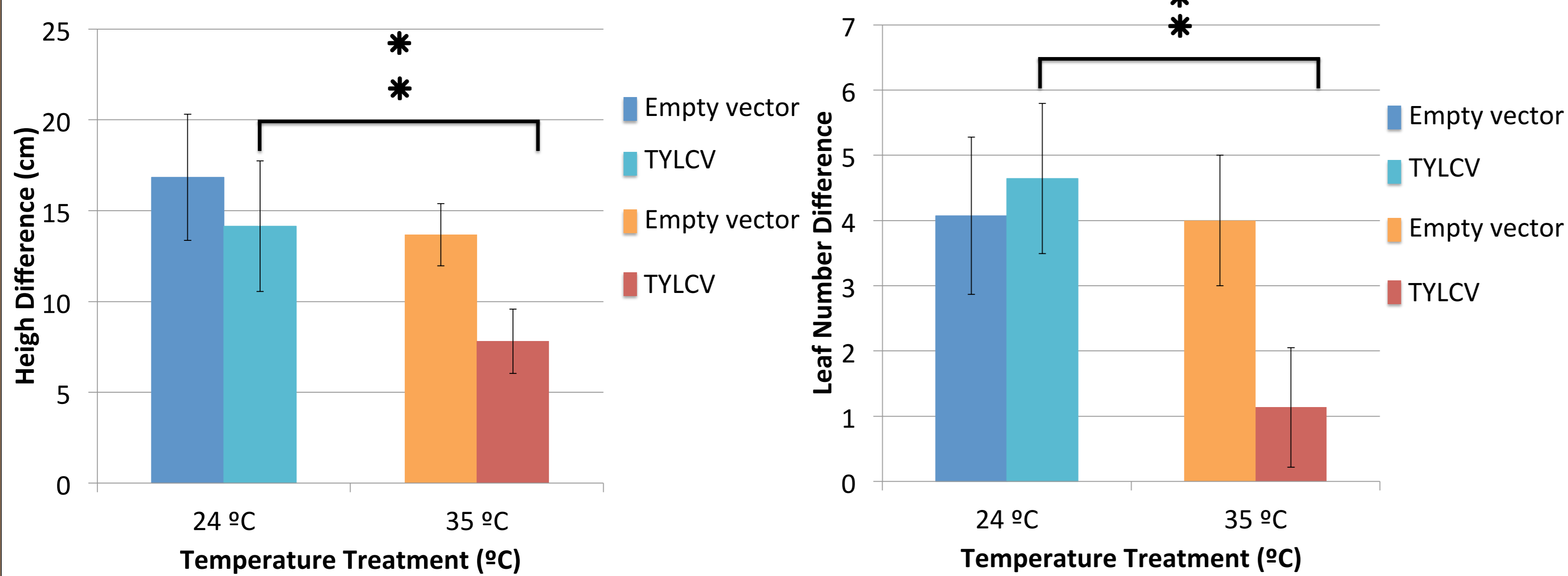
We observe symptoms between 5-10 days postinfection (dpi). When we treat plant with temperatures of 35 °C we observe a diminution of the severity of symptoms in comparison with control at 21 °C.

At 35 °C the amount of TYLCV is lower than at 21 °C



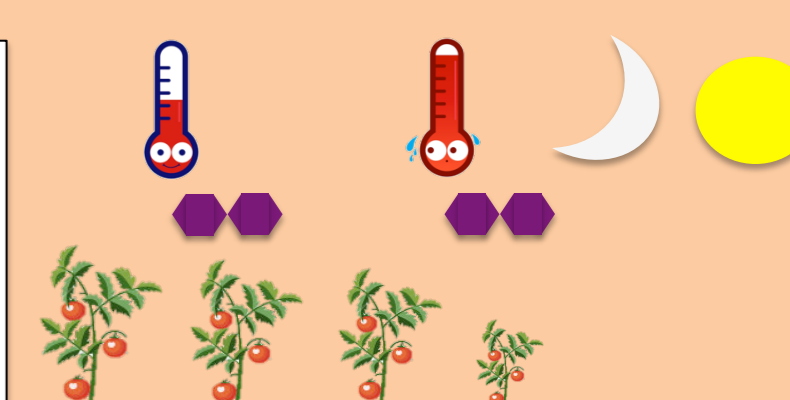
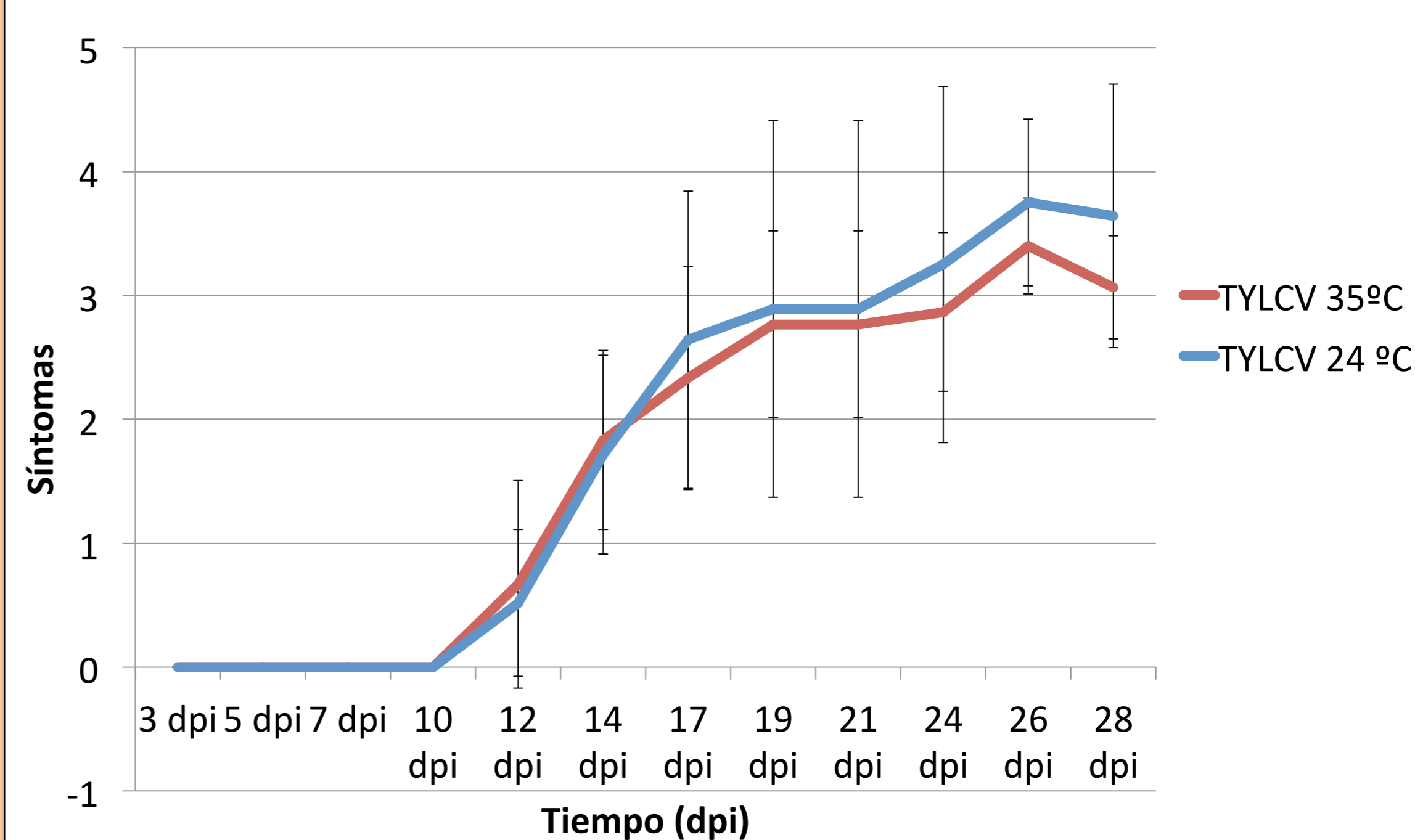
We measure TYLCV amount through qPCR. We observe that the amount of virus grow during the infection at 21 °C but it seems stable in infected plants at 35 °C

There is synergism between the TYLCV infection and high temperature in tomato



The infected group at 35 °C shows the lowest growing of all treatments, so the crosstalk between high temperature and TYLCV infections shows a different result in tomato and *N. Benthamiana*.

There is not effect of high temperature in symptoms severity in tomato-infected plants



- Symptom Index**
0. Symptomless.
 1. Slight curvature of leaf edges.
 2. Leaf curling and yellowing.
 3. Marked stunting, curling and cupping of leaves.
 4. Severe stunting, curling and cupping. Plant stops growing

The effect of temperature in symptoms severity is lower in *Solanum lycopersicum* than in *N. Benthamiana*, probably due to the fact that tomato resist better high temperatures.

Conclusions

N. benthamiana-TYLCV infected plants:

- 1.- show less severe symptoms at 35°C
- 2.- accumulate less virus at 35°C than at 21°C

Tomato-TYLCV infected plants:

- 1.- show similar symptom severity at 21°C than at 35°C
- 2.- show impaired growth at 35°C compared to 21°C

References

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