



**HAL**  
open science

## Prospection of entomopathogenic nematodes in Tannourine cedars forest in Lebanon and evaluation of their pathogenicity on *Cephalcia tannourinensis*, a cedars pest defoliator

Martine Rehayem, Elise Noujeim, Nabil Nemer, Jean-Claude Ogier, Sylvie Pages, Jacques Olivier Thaler, Bernard Duvic

### ► To cite this version:

Martine Rehayem, Elise Noujeim, Nabil Nemer, Jean-Claude Ogier, Sylvie Pages, et al.. Prospection of entomopathogenic nematodes in Tannourine cedars forest in Lebanon and evaluation of their pathogenicity on *Cephalcia tannourinensis*, a cedars pest defoliator. 49. Annual Meeting of the Society for Invertebrate Pathology, Jul 2016, Tours, France. hal-02126101

**HAL Id: hal-02126101**

**<https://hal.science/hal-02126101>**

Submitted on 5 Jun 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

## INTRODUCTION

The natural reserve of cedars of Tannourine is characterized by the presence of *Cedrus libani* (A. Rich.), considered an endangered plant species (Gardner, 2013) that is suffering from the attacks of *C. tannourinensis* (Chevin, 2002). Due to the alarming situation of the forest, this study will look for a biological agent potentially capable of controlling the outbreak of *C. tannourinensis* populations.

However, before introducing any biocontrol agent in a natural and protected ecosystem, it is essential to search for the presence of natural parasites. Therefore, the first objective of the present study is to isolate endemic forest EPNs in Tannourine cedars forest in Lebanon. If any EPNs were to be found, the second objective will be to test *in vitro* and *in vivo* (jars placed in the forest) their efficiency against *C. tannourinensis* larvae.



Figure 1. Symptoms of the defoliation in Tannourine cedars forest

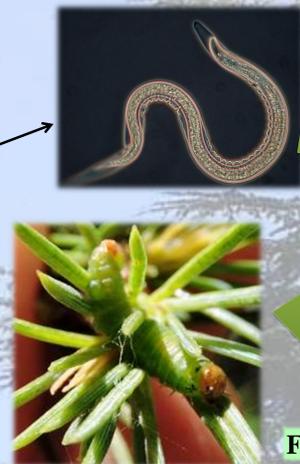


Figure 2. EPNs



Figure 3. *Cephalcia tannourinensis*

## MATERIAL AND METHODES

1. Survey of EPNs in cedars forest: Morphological and molecular identification

2. *In vitro* pathogenicity of EPNs

- 0, 40, 100 and 250 IJs / larvae of *C. tannourinensis* in eppendorf tube

- 3 repetitions

- 2 parameters : % of mortality, parasitic success (number of cadavers having EPNs emergence upon to the number of insect larvae total)

3. *In vivo* pathogenicity of EPNs in natural environmental conditions

- 625000 IJs / m<sup>2</sup>

- 10 larvae of *C. tannourinensis* / jar introduced in the soil

- 2 repetitions

- 2 parameters : % of mortality, parasitic success

## RESULTS AND DISCUSSION

### 1. Survey and identification of EPNs

EPNs found in Tannourine's forest belonged to *Steinernema feltiae* species according to morphometric results and molecular results (figure 4) and were named LIB132. They were found in a mixed dense forest stands of cedar and broadleaved trees habitat.

### 2. *In vitro* pathogenicity of EPNs

*S. feltiae* specie can effectively control *C. tannourinensis* larvae only at a concentration of 250 IJs / larvae (figure 5). However, its effectiveness is lower than the commercial strain of *H. bacteriophora* (Noujeim et al., 2015). That's why *H. bacteriophora* specie is used in the *in vivo* experiment of this study.

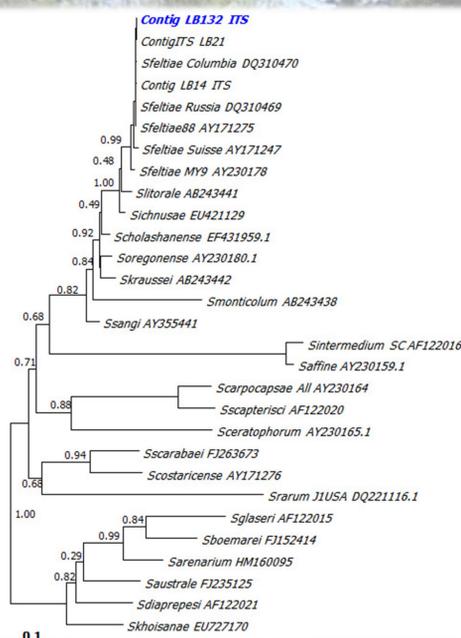


Figure 4. Phylogenetic tree of EPNs

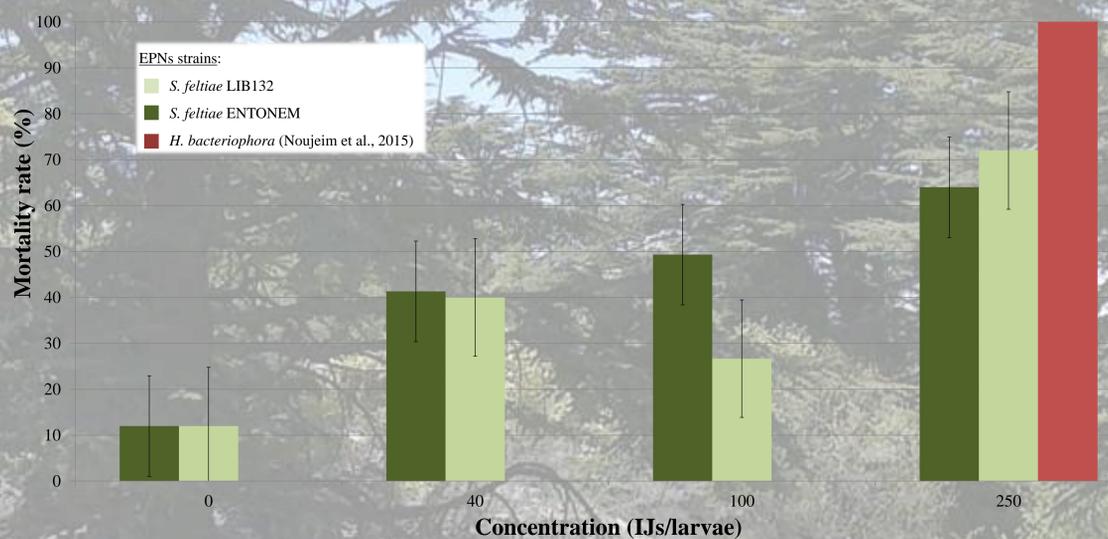


Figure 5. *In vitro* pathogenicity of EPNs against *C. tannourinensis* larvae

### 3. *In vivo* pathogenicity of EPNs

The table 1 shows the mortality rate caused by the commercial strain of *H. bacteriophora*. IJs of *H. bacteriophora* emerged from *G. mellonella* cadavers only but not from *C. tannourinensis* cadavers. This means that an EPNs treatment on *C. tannourinensis* in natural conditions can be effective against the cedars pest without impacting the protected environment of the forest.

Table 1. *In vivo* experiments

Insect	Treatment	Mortality rate (%)	Parasitic success of <i>H. bacteriophora</i> (%)
<i>C. tannourinensis</i>	No	18.33 <sup>a(1)</sup>	0
	Yes	85 <sup>b</sup>	0
<i>G. mellonella</i>	No	16.67 <sup>a</sup>	0
	Yes	86.67 <sup>b</sup>	78

<sup>(1)</sup> Measured parameters followed by the same letter in one column show non-statistical significance at P<0.05 level.

## CONCLUSION AND PERSPECTIVES

Entomopathogenic nematodes belonging to the *S. feltiae* specie were found in Tannourine cedar forest. *In vitro* experiments showed a lower pathogenicity of the *S. feltiae* specie against *C. tannourinensis* larvae than *H. bacteriophora* specie when compared to previous published results (Noujeim et al., 2015). *In vivo* experiments showed promising results since EPNs were able to kill *C. tannourinensis* larvae without finishing their cycle and emerging from the cadavers. This means that once this specie is used in an integrated management program against *C. tannourinensis* in the forest, it might have less impact on the ecosystem of this protected environment. Further studies need to be conducted *in situ*, in order to evaluate the effectiveness of such a treatment against *C. tannourinensis* on a large area of the forest. A monitoring of the population of *C. tannourinensis* will help in establishing a long term strategy aiming to control the outbreaks of this cedars pest.

### References:

- Chevin, H., 2002. *Cephalcia tannourinensis* n. sp., nouveau ravageur du Cèdre du Liban (Hyménoptère Pamphiliidae). L'entomologiste 58 (5-6), 241 – 242.
- Gardner, M., 2013. *Cedrus libani*. The IUCN Red List of Threatened Species. [www.iucnredlist.org](http://www.iucnredlist.org)
- Noujeim, N., Rehayem, M., Nemer, N. (2015). Comparison of indigenous and exotic entomopathogenic nematode strain for control of the cedar web-spinning sawfly, *Cephalcia tannourinensis* *in vitro*. *Journal of Biocontrol Science and Technology*.