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Contribution to the bio-ecology of *Acrobasis consociella* (Hübner, 1813) (Pyralidae, Phycitinae) in Tunisia

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Abstract: *Q. coccifera* is the characteristic species present in the north-eastern forest (Jebel Abderrahmane) and the north-western forest (Sejnane). At the end of April of 2005, a complete defoliation of more than 500 ha of evergreen shrubs of Jebel Abderrahmane caused by larvae of *Orgyia trigotephras* was observed. At the beginning of April 2010, a severe defoliation of a shrub-forest was noted in Sejnane, where about 2500 ha of the forest were defoliated by larvae of *O. trigotephras*. However, on defoliated *Halimium halimifolium* trees we found in addition to larvae and pupae of *O. trigotephras*, larvae and pupae of *Anacampsis scintillella*. In March 2012, pupae of *Acrobasis consociella* were observed on *Q. coccifera* in Jebel Abderrahmane and Sejnane to compete with *O. trigotephras*. Preliminary investigations of bioecology of *A. consociella* were carried out in the two forests. To estimate host plant infestations', a direct counting was carried out on the host plant, yielding a mean number of shelters of 5.80 shelters for *A. consociella* and 0.24 for *O. trigotephras* at the two sites. About 30 shelters of *A. consociella* from *Q. coccifera* were collected to be analyzed in the lab. The mean number of larvae was 0.59 at Sejnane and 0.93 at Jebel Abderrahmane. Results show that the life cycle of *A. consociella* took 10 weeks. First instar larvae were observed in the beginning of February. Pupa was observed in mid-March, and it took about 3 weeks to become adult; the first adult was observed in the beginning of April. Life history of *A. consociella* was poorly studied, so far. In this paper, we present a contribution of its biological cycle, although further investigations must be done to deepen the knowledge of this pest.
Keywords: *Acrobasis consociella, Orgyia trigotephras, Quercus coccifera,* Tunisia

Tunus'ta *Acrobasis consociella* (Hübner, 1813) (Pyralidae, Phycitinae)'in biyo-ekolojisine katkılar

Özet: *Q. coccifera* kuzeydoğu (Jebel Abderrahmane) ve kuzeybatı (Sejnane) ormanlarının mevcut karakteristik bir türüdür. 2005 yılı nisan ayının sonunda Jebel Abderrahmane yöresinde *Orgyia trigotephras* larvaları tarafından 500 hektardan daha fazla herdem yeşil çalılarda yaygın bir zarar gözlenmiştir. Nisan 2010 başlarında Sejnane'de yaklaşık 2500 hektar orman alanında *O. trigotephras* larvalarının neden olduğu ciddi bir zarar kaydedilmiştir. Bununla beraber zarar gören *Halimium halimifolium* ağaçlarında *O. trigotephras* larva ve pupalarına ek olarak *Anacampsis scintillella*'nın larva ve pupalarına rastlanmıştır. Mart 2012'de *Acrobasis consociella*'nın pupaları *O. trigotephras* ile rekabet içinde olduğu görülmüştür. *A. consociella*'nın biyoekolojisine dair ilk araştırmalar, bu iki ormanda gerçekleştirilmiştir. Konukçu bitki istilalarını tahmin etmek amacıyla, konukçu bitki üzerinde doğrudan sayım yapılmış ve sonuç olarak her iki bölgede *A. consociella* için ortalama 5.80 yuva ve *O. trigotephras* içinse 0.24 yuva tespit edilmiştir. *Q. coccifera* üzerinden yaklaşık 30 adet *A. consociella* yuvası laboratuvarda incelenmek üzere toplanmıştır. Ortalama larva sayısı Sejnane'de 0.59, Jebel Abderrahmane'de ise 0.93 olarak tespit edilmiştir. Sonuçlar, *A. consociella*'nın yaşam döngüsünün 10 hafta sürdüğünü göstermiştir. Birinci dönem larvalar, şubat ayının başlarında gözlenmiştir. Pupa ise mart ayının ortalarında gözlemlenmiş ve yaklaşık 3 hafta içerisinde ergin döneme geçmiştir; ilk ergin böcekler nisan ayının başlarında gözlenmiştir. *A. consociella*'nın yaşam döngüsü şu ana kadar çok fazla araştırılmamıştır. Bu çalışmada, bu türün biyolojik döngüsünün katkısı sunulmaktadır ancak bu zararlı hakkında daha fazla bilgi elde etmek için başka araştırmalar yapılmalıdır
Anahtar kelimeler: *Acrobasis consociella, Orgyia trigotephras, Quercus coccifera,* Tunus

1. Introduction

Mediterranean oak forests are characterized by the presence of deciduous oaks (deciduous oak forests) and evergreen oaks (sclerophyllous oaks) (Hasnaoui, 1992). *Quercus* genus includes 500 species (El Toubi, 1996). In Tunisia, it's represented by five species: *Q. suber*, *Q. ilex*, *Q. canariensis*, *Q. afares* and *Q. coccifera* (Hasnaoui, 1992). *Q. coccifera* is the characteristic species present in the north-eastern forest (Jebel Abderrahmane) and the north-

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western forest (Sejnane). At the end of April of 2005, a complete defoliation of more than 500 ha of evergreen shrubs of Jebel Abderrahmane (2500 ha): *Q. coccifera*, *Pistacia lentiscus*, *Erica arborea* and *E. multiflora* caused by larvae of *Orgyia trigotephras* (Eribidae, Lymantriinae) was observed (Ezzine *et al*., 2010). At the beginning of April 2010, a severe defoliation of a shrub-forest was noted in Sejnane, where about 2500 ha from 3200 ha of the totality of the forest were defoliated by larvae of *O. trigotephras*. Defoliated shrub species were: *Halimium halimifolium*, *Q. coccifera*, *P. lentiscus*, *E. arborea* and *E. multiflora*. However, on defoliated *H. halimifolium* trees we found in addition to larvae and pupae of *O. trigotephras*, larvae and pupae of *Anacampsis scintillella* (Gelechiidae, Anacampsinae) (Ezzine et al., 2015). In March 2012, pupae of *Acrobasis consociella* (Pyralidae, Phycitinae) were observed on *Q. coccifera* in Jebel Abderrahmane and Sejnane to compete with *O. trigotephras*.

A. consociella is known from nearly all the European countries (Karsholt and Razowski, 1996), including Corsica, Sardinia and Sicily in the Mediterranean (Speidel, 1996). In North Africa known from Tunisia, Algeria (Lucas, 1914) and Morocco (Asselbergs, 1998). *A. consociella* feeds on *Quercus* (Capek and van Achterberg, 1992; Shaw *et al*., 2011; Huertas Dionisio, 2009; Mészáros, 1972). On *Q. cerris* and *Quercus petrae* (Csóka, 1991), on *Q. cerris* (Rossnev *et al*., 2009), on *Q. suber* (Huertas Dionisio, 2009). Larvae are gregarious (Perette *et al*., 2009), lives among *Quercus* host leaves spinning and attached with silk, containing 1to 4 larvae (Shaw *et al*., 2011) and build a very characteristic galleries (Huertas Dionisio, 2009). Life history of *A. consociella* has not been studied comprehensively in Tunisia, so far. In this work we aim at (1) investigating the bio-ecology of *A. consociella*, (2) studying competition between *A. consociella* and *O. trigotephras* and (3) determining the influence of infestation on host plant.

2. Material and methods

2.1. Study area

The study area includes Mediterranean maquis, distributed along the coast between north-western (Bizerte, site of Sejnane) and north-eastern Tunisia (Cap Bon, site of Jebel Abderrahmane). Investigations were done in only one infested station in Sejnane: Barrage Ziatine (48 m, 37°11´N, 9°11´E) and four infested stations in Cap Bon-Jebel Abderrahmane: Ftahiz (121 m, 36°.52’ N, 10°.45’ E), Jebel Ben Oulid (432 m, 36°52'N, 10°48'E), Delhiza (401 m, 36°51'N 10°47'E) and Guitoun (136 m, 36°.83’ N, 10°.82’ E) (Figure 1). We opted for a systematic sampling, materialized by two orthogonal transect lines (Nsibi *et al*., 2006). Each transect consisted of 12 plots, about 300 m long each, spaced 50 m. The plot was square shaped (25 m²) (Wikum and Frederick Shanholtzer, 1978). Vegetation was composed by Mediterranean maquis with shrubby vegetation, about 1-2 m high; main species were *Calicotome villosa* Poiret, *Cistus crispus* L., *Cistus monspeliensis* L, *E. arborea* and *E. multiflora*, *P. lentiscus*, *Phillyrea media* L. and *Q. coccifera*.

Figure 1. Study sites

2.2. Host plant infestation

In March 2014, in each plot, we identified and counted shrubby vegetation species. The plant preference of *A. consociella* and *O. trigotephras* for oviposition was evaluated in a field survey by counting the number of shelters on each *Q. coccifera* tree present in the study site.

2.3. Larvae development

Larvae of *A. consociella* feed gregariously in spun leaves of *Q. Coccifera.* In February, March and April 2014, 30 spun leaves, were collected and placed in plastic boxes (21 × 10 × 10 cm) at a temperature of 25°C. Under a binocular microscope (Leica, S42), 20x magnification, we observed and counted the number of larvae in each spun leaves. Each larva was individually collected, described and measured.

2.4. Statistical analysis

To compare the infestation by *O. trigotephras* and *A. consociella*, and the female fecundity of *A. consociella*, we used ANOVA and Student-Newman-Keuls test (5%). Statistical treatment of the data was performed using the software SPSS (Version 17.0). Body size is reported as mean ± standard deviation.

3. Results

3.1. A. consociella and *O. trigotephras* oviposition

The presence and absence of each defoliator on *Q. coccifera* was summarized in table 1. The number of shelters was significantly higher for *A. consociella* at sites ($p < 0.000$). It differed significantly among stations for *A. consociella* ($p < 0.01$) while it did not for *O. trigotephras* ($p < 0.319$). The mean shelters numbers’ of *A. consociella* and *O. trigotephras* at the two sites were 5.80 and 0.24. For *A. consociella*, the mean number was 1.72 at Sejnane and 21.05 at Jebel Abderrahmane. For *O. trigotephras* the mean number was consecutively 0.2 and 0.42 (Figure 2).

Table 1. Presence/absence of *A. consociella* and *O. trigotephras* on *Q. coccifera* from 2010 to 2014

Site	2010/2011/2012		2013/2014	
	O. trigotephras	*A. consociella*	*O. trigotephras*	*A. consociella*
Cap Bon-Jebel Abderrahmane	1	0	1	1
Bizerte-Sejnane	1	1	1	1

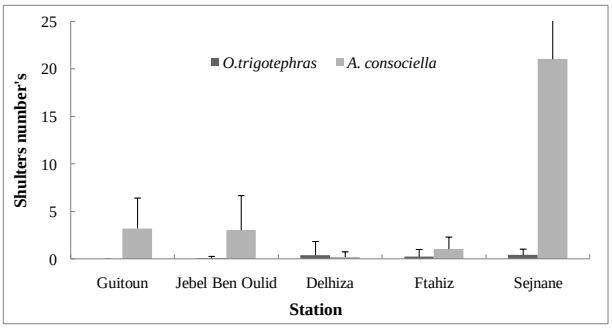

Figure 2. Host plant infestation in each station

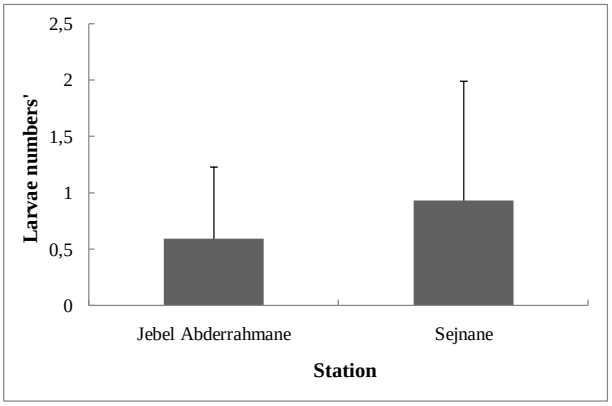

Figure 3. Number of *A. consociella* larvae in spun leaves of *Q. coccifera* at each station

3.2. Larvae and pupae

Figure 4. Larvae of *A. consociella*; a. first instar larvae, b. second instar larvae, c. third instar larvae

3.3. Life cycle of A. consociella

In the study area *A. consociella* had univoltine life cycle (one generation a year), which took 10 weeks. First instar larvae were observed in the beginning of February. Pupa was observed in mid-March, and it took about 3 weeks to become adult; the first adult was observed in the beginning of April.

4. Discussion

In the literature *A. consociella* is reported to have one generation a year, with the larva feeding during February (Huertas Dionisio, 2009), Mai (ISF, 2006), being full fed towards the end of the month or beginning of July, and from the July (Huertas Dionisio, 2009) to August (Perette *et al.*, 2009) the adult appears. In Tunisia, larvae were observed from mid-February to the beginning of April. This period coincides with the emergence of larvae of *O. trigotephras* (Ezzine *et al*., 2010). In 2010, in Sejnane, *O. trigotephras* was found in higher abundance, mainly feeding on shrub species: *H. halimifolium*, *Cistus sp.*, *Q. coccifera*, *P. lentiscus*, *Erica arborea* and *E. multiflora*. In this ecosystem only *A. scintillella* was found to compete in numbers on *H. halimifolium* with *O. trigotephras*. A lack of competitors may have favoured the higher abundance of *O. trigotephras* in this ecosystem (Ezzine *et al*., 2014) and the damage of *A. scintillella* seemed to be weak. From 2012 to 2014, the situation has changed, in addition to *O. trigotephras*, *A. consociella* was observed not only in the North-west but also in the North East and it competed on *Q. coccifera* with *O. trigotephras.* First instar larvae of *O. trigotephras* feeds on fresh foliage of *Q. coccifera* (Ezzine *et al.*, 2010). If fresh foliage is attacked by *A. scintillella*, neonate larvae of *Orgyia* will die by starvation. The competition between *O. trigotephras* and *A. consociella* for the same part of the host plant will influence the dynamic of competitors, and in our case it has negatively affected *Orgyia* dynamics. Infestation

by *A. consociella* and larvae numbers' in each shelter were correlated, leading to two groups, one homogenous group of Jebel Abderrahmane (Ftahiz, Jebel Ben Oulid, Delhiza and Guitoun), and a second group in Sejnane. This result confirms that the outbreak site of *A. consociella* is Sejnane, may depend on the quantity of host plant foliage. The presence of *A. scintillella* in Jebel Abderrahmane is lower compared to Sejnane and it can be explained by the decrease of the *O. trigotephras* population in these sites (Ezzine, pers. observ.), due to the cyclic outbreaks of *O. trigotephras* (Ezzine *et al*., 2010).

This work is a contribution to the life history of *A. consociella* in Tunisia and it opens the way to future studies on the influence of temperature on its dynamic.

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