

**Biology of *Ropalopus spinicornis*
(Abeille de Perrin, 1869)
(Coleoptera: Cerambycidae)**

Josef VLASÁK and Martin REJZEK

Abstract: Larval host plants and the development of *Ropalopus spinicornis* (Abeille de Perrin, 1869), (Coleoptera: Cerambycidae) are discussed and described in detail. Two parasitoids of this species, *Dolichomitus mesocentrus* (Gravenhorst, 1829) (Hymenoptera: Ichneumonidae, Pimplinae) and *Xorides (Gonophonus) corcyrensis* Kriechbaumer, 1894 (Hymenoptera: Ichneumonidae, Xoridinae), are recorded.

Zusammenfassung: Die Wirtspflanzen und die Entwicklung der Larve von *Ropalopus spinicornis* (Abeille de Perrin, 1869), (Coleoptera: Cerambycidae) werden behandelt und im einzelnen beschrieben. Außerdem wird über zwei Parasitoide dieser Art, *Dolichomitus mesocentrus* (Gravenhorst, 1829) (Hymenoptera: Ichneumonidae: Pimplinae) und *Xorides (Gonophonus) corcyrensis* Kriechbaumer, 1894 (Hymenoptera: Ichneumonidae: Xoridinae) berichtet.

Keywords: Cerambycidae, *Ropalopus spinicornis*, host plants, biology, parasitoides, Ichneumonidae, *Dolichomitus mesocentrus*, *Xorides (Gonophonus) corcyrensis*.

Introduction

In 1924 FAGNIEZ first reported the following about the biology of *Ropalopus spinicornis* (Abeille de Perrin, 1869): "Larvae of this species develop in *Quercus ilex* and *Quercus pubescens* (chêne vert and chêne blanc in the original paper). This at least applies for animals collected in La Bonde (France). The larvae were collected in the top regions of the host

trees in thin twigs with a diameter hardly exceeding the size of the little finger. FAGNIEZ reared the beetles from larvae several times successfully. The larvae mine under the bark of these twigs and before metamorphosis girdle the twig and create a pupal cell in the part distal to this girdle (the dead part)." FAGNIEZ (1924) compared this behaviour to the larvae of *Coroebus fasciatus* Villers (= *florentinus* Herbst), Buprestidae.

In 1929, PICARD cited this biology in his work Fauna of France (PICARD, 1929).

However, several years later DEMELT (1966) stated the following facts about the biology of *Ropalopus spinicornis*: "Larva feeds in *Quercus*, but also in fruit trees. It is a very rare species and its development and biology might resemble its closely related species *Ropalopus femoratus* (Linnaeus, 1758). The infrequent finds of this species can probably be explained by its development in the dead branches of the top region of host trees. It has often been found on grass under larger oaks. The adults emerge from late May till mid-July."

HORION (1974) has summarized the biology of *Ropalopus spinicornis* from literature as follows: "Development occurs in deciduous trees, especially in *Quercus*, but also in fruit trees, probably in the branches of the top region of host trees (this part obviously cited from DEMELT, 1966, but not stated). It is an acrodendric species. The adults emerge from late May till mid-July. In the Harz (Germany) it is possible to beat this species from oak shrubs until early September. After storms the adults can be collected by sweeping from vegetation growing under oaks. According to FAGNIEZ (1924) the larva feeds in the thin twigs of oaks. Before metamorphosis, it creates a girdle under the bark so that the top of the twig becomes dry. In the dead part of the twig the larva builds a pupal cell (similarly to *Coroebus fasciatus* Villers (= *florentinus* Herbst), Buprestidae)."

The larva of *Ropalopus spinicornis* was described by ŠVÁCHA and DANILEVSKY (1987). The authors state the following about the habits of this species: "Larvae feed subcortically and later in wood of dry, thin branches of *Quercus* and probably also in fruit trees. Adults from June to August." Their larval material was collected exclusively from *Quercus*.

From the cited literature it is evident that the data about the biology of *Ropalopus spinicornis* is rather variable and often even contradictory. Therefore, we decided to report on our experience with the biology of this interesting longhorn beetle.

Material and Methods

The following material was collected by the authors: **Croatia:** Rijeka env., VI.1994, 2 larvae (det. P. ŠVÁCHA, 1994) in a *Quercus* species, one of them was successfully reared (det. M. REJZEK, 1995); **Czech Republic:** Prague env., IV.1995, 13 larvae (det. P. ŠVÁCHA, 1995) in *Quercus petraea*, all of them successfully reared; Prague env., I. 1996, 5 larvae in *Quercus petraea*; Srbsko, I.1996, 10 larvae in *Quercus pubescens* and 2 larvae in *Quercus petraea*; Prague env., V.1996, 80 larvae in *Quercus petraea*; **Germany:** Boppard, VI.1996, 4 larvae in *Quercus petraea*; Cochem env., VIII.1996, 1 larva in *Quercus petraea*; and Bad Münster am Stein, I.1997, 2 larvae in *Quercus petraea*. Adults are in the collections of the authors and two of them in the collection of M. NIEHUIS (Albersweiler, Germany). The larval material is in the collection of ŠVÁCHA (Č. Budějovice, Czech Republic).

The larvae of *Ropalopus spinicornis* were collected on a seashore, on a slope with low vegetation and only sparsely occurring oaks (Croatia). Larvae were also collected along Vltava, Berounka, Rhein, Nahe, and Mosel rivers on steep valley slopes with a southern exposition. In these locations the vegetation is only sparse and trees are extremely exposed and of a rather low growth. Larvae were also collected in forest regions near these slopes (Czech Republic and Germany).

Twigs containing the larvae were placed into a glass container containing wet sand for moisture control which was then covered with a thin cloth. Rearing was performed according to ŠVÁCHA and DANILEVSKY (1986).

An experiment was performed to discover the number of surviving larvae. Attacked twigs containing approximately one-year-old larvae were labelled in May, 1995 and the twigs were then collected in September of the same year. The number of surviving individuals was evaluated.

The mating and oviposition were observed in laboratory conditions. One adult male and two females were allowed to copulate and oviposit on a small living oak growing in a pot covered with a net.

Results

In May or June (according to the climatic conditions) the females of *Ropalopus spinicornis* lay their eggs on the thin living twigs of the host

trees. The diameter of the twigs at the place of oviposition was found to vary from 0.5 to 1.5 cm. The eggs are ellipsoid, of a clear yellow colour and measure 1.2 mm (length) and 0.4 mm (diameter). They are laid on the surface of the bark in all sort of crevices. In contrast to some other species (e.g. *Oberea linearis* Linnaeus, 1761), the ovipositing females do not prepare any special apertures in the bark for the oviposition and do not interrupt the phloem continuity as discussed by FORCELLA (1982). Infested twigs were found both in the top and lower regions of extremely exposed trees but also in the low regions of trees growing in more dense forests.

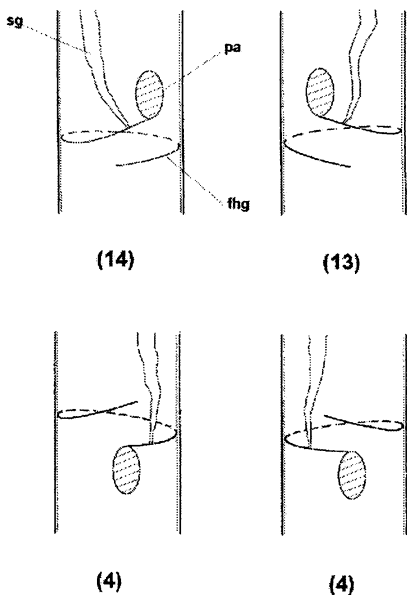


Fig. 1: Four possible spatial arrangements of the first girdle, **pa** - phloem area filled with white feed, **fhg** - the first helixlike girdle, **sg** - subcortical gallery; the numbers express the frequency of the particular pattern among examined examples.

After 3-4 weeks, the newly-hatched larvae start to feed subcortically, exclusively on the phloem where they create a very small area (up to 0.5 cm²) in it (further referred to as the phloem area, fig. 1, pa). In this area the bark was very thin and regularly perforated with tiny apertures. Sometimes this bark breaks showing the white feed. After two months the larvae reach a length varying from 1.5 to 2 mm.

At the end of the first summer the larvae begin to enter the wood. With a sudden turn downwards the larvae enter the xylem so that their

dorso-ventral axis is parallel to the twig's axis and they start to create a tiny helix-like girdle (further referred to as the first girdle, fig. 1 and 3, fhg). The first girdle completely interrupts the xylem (fig. 2) but does not destroy the phloem (an observation which differs completely from data published by FORCELLA, 1982). Sometimes, especially in the case of twigs with a larger diameter, the shape of the helix is a little more complex but the result is always a nearly complete interruption of xylem (fig. 2). The physiological activity of leaves is, therefore, presumably impeded due to interrupted flow of water and solutes through the xylem. However, the normal export of materials from leaves of twigs girdled in this way should not be much different from that of ungirdled twigs since the phloem is not severed. We found that the helix can be directed both up or down and can also be both left- or righthanded (fig. 1). After completing the helix the larvae turn around and mine back the same way, perhaps enlarging the already created gallery. The larvae then leave the first girdle when they reach the region close to the phloem area, and start to mine an apically directed subcortical gallery in the twig, clearly discernible on the xylem cylinder (fig. 1, sg).



(10)



(18)

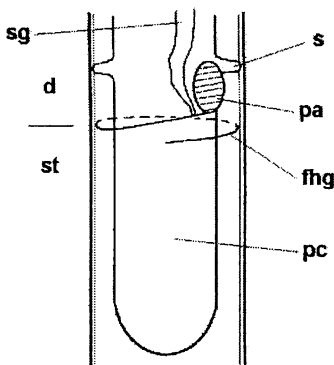


Fig. 2 (left): Two possible shapes of the first girdle when observed in a cross-section; the numbers express the frequency of the particular shape among examined examples.

Fig. 3 (right): The overall situation, **fhg** - the first helixlike girdle, **s** - second girdle, **sg** - subcortical gallery, **pa** - phloem area, **pc** - pupal cell, **st** - stump, **d** - the portion of the twig distal to the first girdle.

The first winter interrupts their activity and the larvae hibernate very close to the first girdle under the bark of the twigs in the subcortical gallery (fig. 1, sg). On breaking the attacked twigs in the first girdle during this winter, and the following spring, we could observe hibernated larvae reaching a body length up to 5 mm.

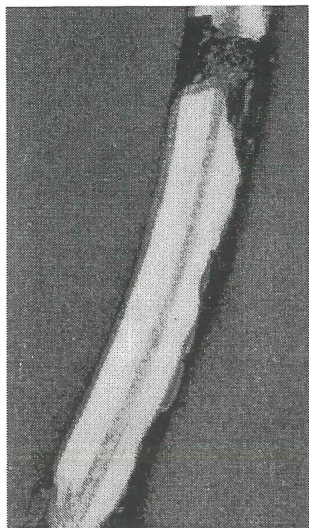


Fig. 4 (left): The cut off portion of the twig distal to the second girdle.

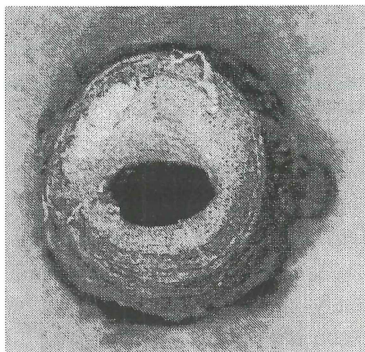


Fig. 5 (right): The stump left after cutting off the distal part by the second girdle, a subcortical gallery is clearly visible, in spring the central elliptical gallery is filled with splinters securing the larva in its pupal cell.

In the second year the larvae go on feeding, completely utilising the dying twig, in some cases only leaving the bark and a small part of the grain. In the vicinity of the first girdle the larvae create a little ellipsoid aperture that is used to expel the superfluous feed (analogously to other species like e.g. *Callidium aeneum* Deg., 1775 or species of *Monochamus* Guer.). The larvae empty the galleries regularly which ensures them the possibility of free movement. When they reach the top of the twig they turn back and approach the region of the first girdle again. Here, the larvae start to mine in the grain creating an elliptic gallery, then pass the region of the first girdle and create a deep pupal cell in the below-girdle portion of the girdled twig (further referred to as the stump, fig. 3, st) . Next, the larvae cut off the part of the twig distal to the pupal cell leaving only a thin layer of the dead bark (further referred to as the second girdle,

fig. 3, s). They then enter again into the pupal cell, and secure themselves there with a wad of non-fibrous feed and hibernate. We could observe that the second girdle was created regularly in the dead part of the twig approximately 1 cm above the first girdle. During the winter the twig usually breaks in the second girdle leaving a free way for the adult beetle to leave the pupal cell only by removing the wad of feed. No additional exit holes are created by the emerging adults.

During the next spring the larvae pupate, adults hatch and leave the twigs after two years of development.

In May 1995, on living trees growing on slopes with a southern exposition, we labelled 31 twigs containing one year old larvae and left them to develop in their natural way. In September of the same year, the labelled twigs with the larvae were collected. The majority (29) of the larvae, however, were already destroyed. Some of the larvae had been attacked by fungi, some had been killed by insectivorous birds, and the rest were parasitized. Only two larvae reached the last larval instar and created the pupal cells. However, later we found out that these larvae were parasitized too.

The experiment showed that the number of surviving larvae must be very low. This may be due to the high exposition of the thin twigs to all possible predators as well as to the fungi. It might also explain the fact that this species is considered to be very rare, even if the attacked first year twigs were relatively common in all localities mentioned. The twigs can be easily recognized in the spring of the second year after oviposition as semi-dry twigs with no young leaves. They often still have last year's dry leaves left, and big buds, often with several budding adventitious sprouts under the girdle zone. We have also shown that if young larvae are collected, it is possible to rear adult beetles easily in laboratory conditions with only a low percentage of non-surviving individuals.

The parasites were reared and identified in the Research Institute for Crop Production (Prague, Czech Republic) by Josef Šedivý. Both identified parasites belong to the hymenopteran family Ichneumonidae. The first one, *Dolichomitus mesocentrus* (Gravenhorst, 1829), has not been cited as a parasite of *Ropalopus spinicornis* yet. However, this species is known to be broadly polyphagous. The second one, *Xorides (Gonophonus) corcyrensis* Kriechbaumer, 1894, has not been cited as a parasite of *Ropalopus spinicornis* either and, moreover, has not been collected in Bohemia be-

fore. Therefore, this represents the first record from Bohemia (ŠEDIVÝ J., 1996 personal communication).

Conclusions

The variable literary data concerning the biology of *Ropalopus spinicornis* and our experience with collecting and rearing of more than one hundred larvae, led us to publish this critical review of the topic. We could generally confirm the observation published by FAGNIEZ (1924) and supplement additional data.

As for a host plant of this species we could only observe *Quercus pubescens* and *Quercus petraea*. Other host plants, however, may be found in the future. The commonly cited fruit trees were not confirmed as host plants, but are still probable especially under different climatic conditions.

As cited by FORCELLA (1982), adults of some cerambycids (e.g. *Onocideres cingulata* Say) girdle the stems of plants on which they subsequently feed and oviposit. Advantages gained by beetles through stem girdling are essentially unknown and remain largely unexplored. At least in woody twigs, girdling interrupts phloem continuity, so that organic products normally exported from leaves to stems and roots would thereby be trapped in the girdled twigs distal to the girdle (FORCELLA, 1982). Evidence was given that the larvae of twig-girdling beetles require supplementation by nitrogen containing compounds for survival. The transport of these nitrogen rich compounds is particularly active in autumn when the more labile nitrogen containing compounds are mobilized in senescing leaves. Further transport of these materials beyond the girdle of girdled twigs is impeded since the phloem is severed. These nitrogen-rich materials, as well as all other substances exported from senescing leaves, would be trapped in girdled twigs and be available for consumption by beetle larvae (FORCELLA, 1982).

In contrast to this observation, the larvae of *Ropalopus spinicornis* rather than the adults are active in girdling and, moreover, they interrupt the xylem continuity and leave phloem intact. Therefore, it seems that the reasons for girdling the twigs are completely different from species cited by FORCELLA (1982) but the explanation of this behaviour is beyond the scope of this article.

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Verfasser:

Josef VLASÁK, Department of Genetics and Microbiology, Charles University, Viničná 5, 128 40 Prague 2, Czech Republic.

Martin REJZEK, Institute of Organic Chemistry and Biochemistry, Czech Academy of Sciences, Flemingovo náměstí 2, 166 10 Prague 6, Czech Republic.

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