A new biological control method for the common furniture beetle with *Spathius exarator*.

**Commercial use and monitoring procedure**

Since summer 2012 more than 50 *A. punctatum* infested objects were or are currently treated with *S. exarator*. Between May and October six treatments at intervals of about one month were conducted. Concomitant to the treatments a monitoring of success, based on the intensity of infestation and the effectiveness of the parasitoids, was performed. Already existing exit holes of *A. punctatum* and *S. exarator* were counted on exactly defined areas before the first treatment started and a basic parasitization rate was calculated as the proportion of parasitized *A. punctatum*:

\[
\text{Parasitization rate} = \frac{\text{no. of } S. \text{ exarator exit holes}}{\text{no. of } S. \text{ exarator exit holes} + \text{no. of } A. \text{ punctatum exit holes}} \times 100\%
\]

During each treatment, the number of newly appeared exit holes of *A. punctatum*, representing a surviving beetle, and *S. exarator*, representing a killed beetle, were documented at the monitoring area. Parasitization rates were recalculated for each treatment year. After a two to three years period of intensive treatment, monitoring was continued and, if necessary, further single treatments were conducted.

We present here the results of the monitoring of 29 buildings treated with *S. exarator* for two to three years by comparing the pooled basic parasitization rate before the first treatment with the pooled parasitization rate found during the last monitoring (Figure 2). Moreover, we show the mean cumulative increase of newly appeared exit holes of *S. exarator* (Figure 3) and the decline of newly appeared *A. punctatum* exit holes (Figure 4) in objects treated over a period of two or more years.

**Results from five years of practical application**

The monitoring of success in *S. exarator* treated objects reveals *S. exarator* as an efficient and sustainable biological control method against the furniture beetle. Parasitization rates in treated objects are significantly higher compared to untreated objects. Concurrently with the increase in the parasitization rates and the corresponding number of newly *S. exarator* exit holes, the number of annually newly appeared exit holes of *A. punctatum* decreased. After three years, an average of 92.61 % less furniture beetle exit holes of *S. exarator* were counted on exactly defined areas before the first treatment started and a basic parasitization rate was calculated as the proportion of parasitized *A. punctatum*:

\[
\text{Parasitization rate} = \frac{\text{no. of } S. \text{ exarator exit holes}}{\text{no. of } S. \text{ exarator exit holes} + \text{no. of } A. \text{ punctatum exit holes}} \times 100\%
\]

However, in the fourth and fifth year with no or only single treatments, the number of new *A. punctatum* exit holes slightly increased. This slight increase demonstrates the requirement of an elaborated application program adapted to the respective conditions in the treated objects, since the type of wood, the strength of infestation, paintings or prior insecticide treatments might influence the parasitization success of *S. exarator*.

**Efficient by Nature: Spathius exarator versus Anobiidae.**

The common furniture beetle *Anobium punctatum* (Coleoptera, Anobiidae) is the most frequent wood pest in historical buildings in middle, north and eastern Europe, causing devastating damage disintegrating the wooden interior. We present here a new biological control method of *A. punctatum* using its most frequently found antagonist, the braconid wasp *Spathius exarator* (Hymenoptera, Braconidae).

The *S. exarator* larvae pulate and adult wasps hatch through a 0.5 mm wide exit hole which can be easily distinguished from the 2 mm wide holes caused by *A. punctatum*.