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Laboratory-rearing of *Hylesinus varius* (Col.: Scolytidae)

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Laboratory rearing of *Hylesinus varius* was performed during 1990, 1991 and 1992. Cut branches from infested trees were found to induce reproduction of the scolytid. The choice of these branches depended on the distribution of the insect. The optimal dates for collection of material and optimal environmental conditions for rearing the insect were determined. Rearing efficiency was 33.1 ± 17.3 ind/dm² and 22.1 ± 12.9 ind/gal.

Keywords: Rearing, *Hylesinus varius*, Scolytidae, Coleoptera, olive.

INTRODUCTION

Scolytids are considered to be the most economically important insect pests in silviculture (WOOD, 1982; MENDEL, 1986). The majority develop in the twigs, branches and trunk of forest and fruit trees. They are also dangerous because they can transmit plant pathogens (HARDE & SEVERA, 1984).

Hylesinus varius is a bark-beetle that attacks mainly ash (*Fraxinus excelsior*) and olive trees (*Olea europaea*). Other plant species attacked by *H. varius* are *Pirus malus*, *Robinia pseudoacacia*, *Quercus pedunculata*, *Fagus sylvatica* and *Ailanthus* sp. (CHARARAS, 1958).

On olive trees, the beetle reproduces during the spring, when average temperatures are above 11°C and there is a photoperiod above 12 hours of light, in log piles obtained from pruning, that are in or close to olive groves. The resulting adults disperse to olive trees where they feed and eventually overwinter (LOZANO & CAMPOS, 1991a). The period of feeding is most harmful because the construction of the feeding galleries decreases the sap-pressure (CHARARAS, 1960) with adverse physiological consequences for the plant.

There has been much discussion concerning the number of generations of *H. varius* per year. EICHHOFF (1881) and BARBEY (1913) cited two generations per year, while RATZEBURG (1837) and BALACHOWSKY (1949) cited only one. LEMPERIÈRE & MALPHETTES (1983) mention a sister generation. In our area, in the south of the Iberian Peninsula, we have observed only one generation per year; when the offspring of the overwintering adults dispersing from logs to the trees in the summer, logs and cut branches in the olive grove are not attractive to the insects. Nevertheless, we have observed that if a branch from an infested tree is cut (thus stopping the flow of sap), the bark beetles present in this branch, and only this, start to construct reproduction galleries if the temperature is favourable. Thus, the only possibility to induce successive reproductive cycles is from infested branches.

Until now, the control of olive bark-beetles has consisted fundamentally of preventive practices such as removal of logs, but the farmer does not always perform these practices.

At present, the potential for using pheromones and natural enemies in the control of the pest is being studied (CAMPOS *et al.*, 1990; LOZANO & CAMPOS, 1991b). Such studies require the constant availability of biological material for laboratory bioassays of different potential pheromone substances and for the analysis of host-parasitoid interactions.

Thus, it is very important to develop rearing techniques for *Hylesinus varius* under laboratory conditions. This is the main objective of this paper.

MATERIALS AND METHODS

In order to rear *H. varius*, branches infested by the beetle were transferred weekly from the field to the laboratory.

Scolytids are distributed mainly in the trunk and major branches from the north-facing parts of the olive trees (LOZANO & CAMPOS, unpublished), and these branches are the best for inducing reproduction.

When a branch is cut, it is possible to remove the twigs in the field since *H. varius* does not attack them. Thus, transportation of the branches is easier due to the smaller size and the efficiency of rearing is unaffected.

It is also necessary to decide which olive trees are the best to take branches from. The distribution of scolytids in olive groves close to an infestation centre (woodpile) is dependent on two parameters: distance from the centre and wind direction (LOZANO & CAMPOS, 1991a). Thus, olives trees placed close to infestation centre in the line of predominant winds are the most suitable.

In the laboratory the infested material was placed under the optimal environmental conditions to allow beetle reproduction. We have shown that a temperature of 11°C is the lowest limit for inducing reproduction. Nevertheless, if the con-

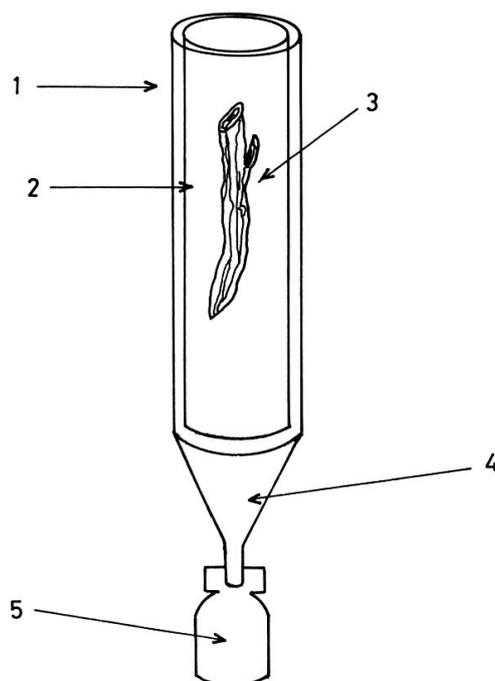


Fig. 1. Emergence trap. 1, opaque cylinder; 2, inner cylinder of fine metal mesh; 3, infested log; 4, funnel; 5, glass bottle.

struction of a reproduction gallery has already started, the adults continue its construction even at 5°C. Temperature is a fundamental factor in the inducement of reproduction and it is possible to induce the process with temperature as the only stimulus. Thus, in total darkness, at a temperature higher than 11°C, bark-beetles start reproduction. We have observed that the highest temperature that induces reproduction is 40°C and gallery construction continues at temperatures up to 45°C.

To collect the offspring the branches were put into emergence traps described by GONZALEZ & CAMPOS (1990) (Fig. 1). Individuals that emerge from the branches go to the bottle due to their phototrophic behaviour (CHARARAS, 1987)

RESULTS

Attack of logs and duration of development

Under laboratory conditions (T: 25°C±2°C, H.R.: 60%±5% and photoperiod 14 h. light- 10 h. dark) reproduction galleries in the branches are started for males and females on the first day after pruning. The maximum level of reproduction galleries started is on the third day. The process of the beginning of reproduction galleries lasts eleven days, although after the seventh day the number of new galleries is very low (fig. 2). In laboratory conditions the first descendents emerge 80 - 85 days after reproduction starts.

The period of emergences lasts two months. The maximum number of captures (2.5-3.0 emergences/dm²) being at the end of the first month.

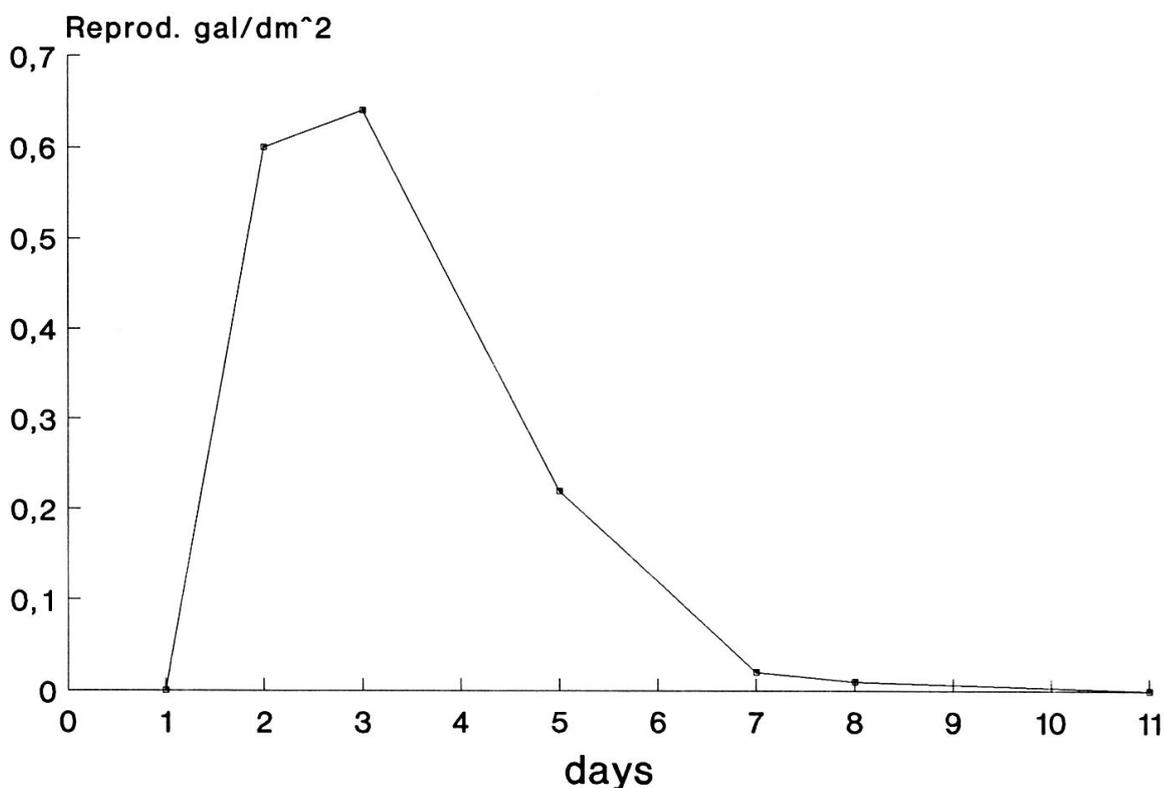


Fig. 2. Attack curve of *H. varius* in logs under laboratory conditions.

Rearing efficiency

Fig. 3 shows the number of reproduction galleries per dm^2 from branches that were put into a climatic chamber ($T: 25^\circ\text{C} \pm 2^\circ\text{C}$, H.R.: $60\% \pm 5\%$ and photoperiod 14 h. light- 10 h. dark) immediately after cutting, during 1991-92. From June until the end of September the gallery density increased during this period because adult offspring are emerging from the logs and moving to the trees. From October until February the number of galleries was constant and afterwards, during spring months, it decreased because adults move to logs at this time.

During 1991-92, the average number of individuals that emerged from logs which had a maximum attack-density, of 1.5 ± 0.5 pen./ dm^2 , was 33.1 ± 17.3 ind./ dm^2 and the average number of individuals per gallery was 22.1 ± 12.9 ind./gal.

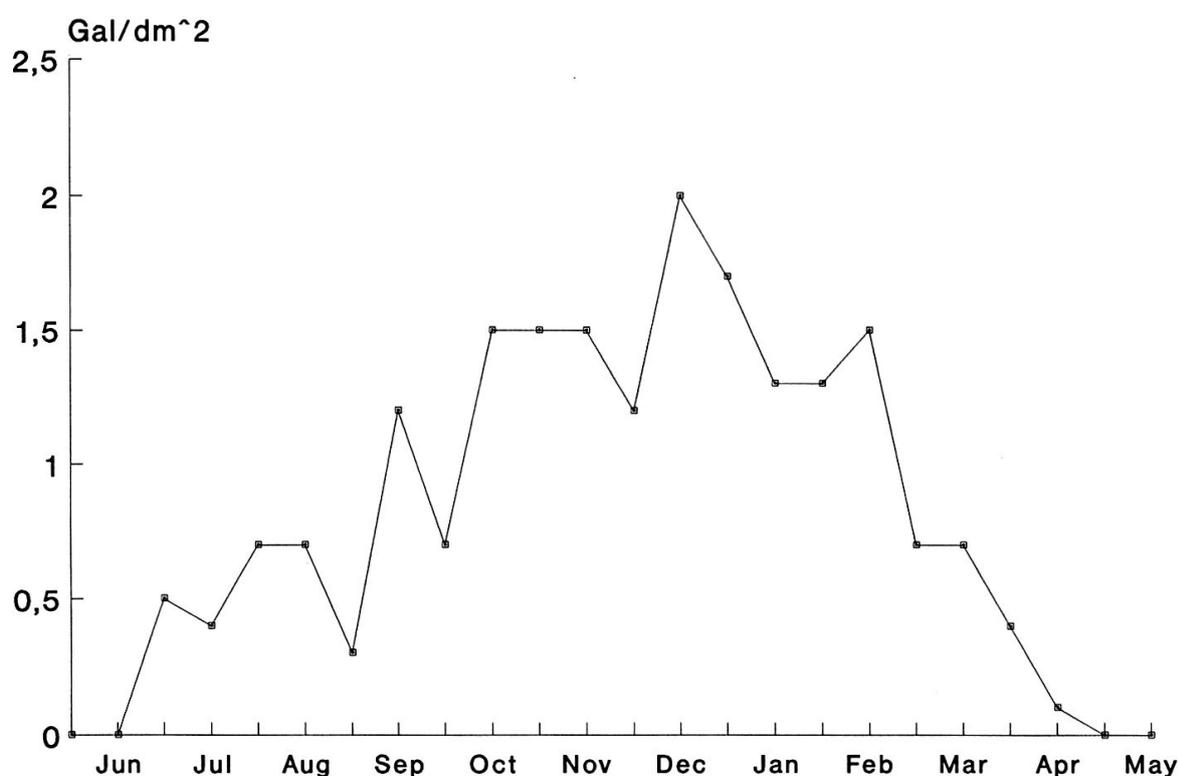


Fig. 3. Reproduction gallery density in branches cut and placed into climatic chamber between June 1991 and May 1992.

Rearing of re-emerging and emerging bark-beetles

We observed that after construction of the maternal gallery 98.4% of male and 86.1% of female parents re-emerged. In the field, these individuals do not reproduce again. We know this because we put logs, which could be attacked, in the woodpile during the re-emergence period and these logs were not attacked. Nevertheless, in laboratory 50% of the re-emerging beetles reproduced.

However, emerging beetles of the overwintering generation as re-emerging beetles do not reproduce in the field. Individuals go directly to the trees to feed when they emerge from the logs as mentioned before. In the laboratory, when emerging beetles were put into boxes with logs cut from overwintering olive trees, 77.1% of them reproduced. Nevertheless, we observed that if the logs were cut from olive trees in the period of flower and fruit formation (spring-summer), bark-beetles first made feeding galleries, and then less than half of them made reproduction galleries. Thus, there is evidence that the logs obtained in spring-summer contain more nutrients because of the phenologic state of the tree and the emerging beetles, if they are not stressed, have a feeding period before reproduction.

DISCUSSION

Rearing of *H. varius* in the laboratory requires prior knowledge of a number of factors.

It is essential to know the distribution of scolytids in the olive grove and in the olive tree in order to determine the infestation level of the potential branches from which to induce reproduction. Since individual beetles move to the logs from the trees during March-April, it is necessary to have logs in which first generation bark-beetles are developing, to have a continuous rearing.

However, considering the periods of emergence, the weekly induction of reproduction is enough to obtain a continuous source of individuals.

As far as the efficiency of rearing *H. varius* is concerned, this is inferior to that of another olive bark beetle *Phloeotribus scarabaeoides* (GONZALEZ & CAMPOS, 1990). The number of individuals emerging per gallery is similar in both scolytids, but not the number of individuals per dm² which is 159.6 ind./dm² in *P. scarabaeoides* and 22.1 ind./dm² in *H. varius*. This is due to the higher attack density of *P. scarabaeoides*.

Finally, it is not advisable to make rearings from re-emerging and emerging beetles because of their mortality but such insects can be used to increase attack density on already infested logs to maximize the efficiency of rearing.

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RÉSUMÉ

Une technique d'élevage en laboratoire de *Hylesinus varius* a été développée de 1990 à 1992. Le matériel idéal à partir duquel la reproduction du scolyte peut être induite est constitué de branches d'arbres infestées. La localisation de ce matériel dépend de la distribution de l'insecte. Les périodes idéales pour la récolte du matériel, ainsi que les conditions environnementales optimales ont été déterminées pour mener à bien les élevages. Dans notre étude, le rendement des élevages a été de 33.1 ± 17.3 ind./dm² and 22.1 ± 12.9 ind./gal.

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