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Number of mandibulae in larval galleries filled with powder post, as a tool for determination of the number of larval instars in bark beetle species (Coleoptera : Scolytidae)

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Summary

By studying the mandibulae in the larval galleries of three bark beetle species, six larval instars in **Scolytus intricatus** (Ratz.), five instars in **Pityogenes chalcographus** L. and three instars in **Ips typographus** L. were determined. The morphologies of the mandibulae were studied.

Introduction

For long time many studies have been done on the biologies of bark beetles. But most of those studies has not had any information on the numbers of their larval instars. Kamp (1918) studied the biology of **Scolytus intricatus** (Ratz.) and Thomas (1965) on the immature stages of the genus **Dendroctonus** Erichson without giving any data about the number of larval stages.

Hitherto, the knowledge about the number of larval instars in bark beetles has been limited. For the first time, Blackman (1915) mentioned five instars in **Pityogenes hopkinsi.** Later, five larval instars have been recorded from **Dendroctonus pseudotsugae**, (Bedard, 1933); from **Hylurgopinus rufipes**, (Kaston and Riggs, 1937) and four instars from **Dendroctonus simplex**, (Prebble, 1933); **D. pseudotsugae**, (Vite and Rudinsky, 1957) and from **Blastophagus piniperda**, (Lekander, 1959). Besides those studies, Lekander (1968) determined the number of larval instars of 23 bark beetle species including **Ips typographus** L. and **Pityogenes chalcographus** L., from both of which three instars were stated by measuring the breadth of head capsule of their larvae. However, Lekander stated that in the species with oblong head capsule,

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such as **Scolytus** spp., viz. **Laevis intricatus**, and **Phthorophloeus spinulosus**, it is difficult to determine the different stages of larvae by measuring the head capsule. He also used the ratio of the head capsule width of the last instar to that of the first instar for estimation tne number of instars in some bark beetle species. Following the last Lekander's work Weber and McPherson (1983) estimated three larval instars in the ambrosia beetle, **Xylosandrus germanus** by using measurements of head capsule width and by defining the ranges of the peaks of the average head capsule width.

In all those works, only some estimations have been made on determination of the number of larval instars in bark beetle species unless a good useful method on this manner has not been reported yet.

In order to find a useful way in determination of the number of larval instars of bark beetle species, this work was done in the Institut für Forstzoologie der Universität Göttingen, West Germany.

Material and Methods

This work was conducted on the bark samples containing larval galleries of some bark beetle species cultured in the laboratories of the Institute mentioned above. The species were **Sintricatus** on **Quercus** spp., **I. typogarphus** and **P. chalcogrophus** on **Picea** spp.

The barks including the larval galleries were carefully removed from branches by using a sharp knife. Then, the undamaged galleries on the barks were chosen for the examination under stereoscobic microscope. During this works, the oak barks having the galleries of **S. intricatus** were kept in a petridishes containing 70 % ethyl alcohol. The spruce bark contaning galleries of **I. typographus** and **P. chalcographus** were studied in petri-dishes containing 40 % xylol as a solvent for resinous substance sticking the powder post in the galleries.

In order to find the larval mandibulae, the powder post were seperated from each other by using an insect pin. These works were done through out the larval galleries. The mandibulae found during studies were taken and stuck on a card (0,5 × 1,5 cm size) with secotine glue. The number of larval instars of the species were obtained by counting the number of the paired mandibulae in the galleries with ten replicates.

The mandibulae belonging to different stages were drown from lateral view under stereoscobic microscope with the aid of camera-lucida. Length and width of the mandibulae were measured with the aid

of a micrometer scale in stereoscobic microscope.

Results and discussions

The number of larval instars and the morphologies of the larval mandibulae from different stages in some species of bark beetles are as follow:

Scolytus intricatus (Ratz.)

By examining the galleries from different brood systems six paired larval mandibulae of different instars were obtained from every gallery. The result shows that there are six larval instars in the species. The avarage measurements (length: width in mm) of the mandibulae of different instars are as follows: Ist 0.16: 0.18; 2nd 0.17:0.20; 3rd 0.22: 0.25: 4th 0.27:0.31; 5th 0.31: 0.36; 6th 0.38:0.34.

The mandibulae of the larvae from lst to 5th instars conical and slightly wider than long; that of 6th instar ventrally concaved and slightly longer than wide. All mandibulae without tooth (fig 1 A).

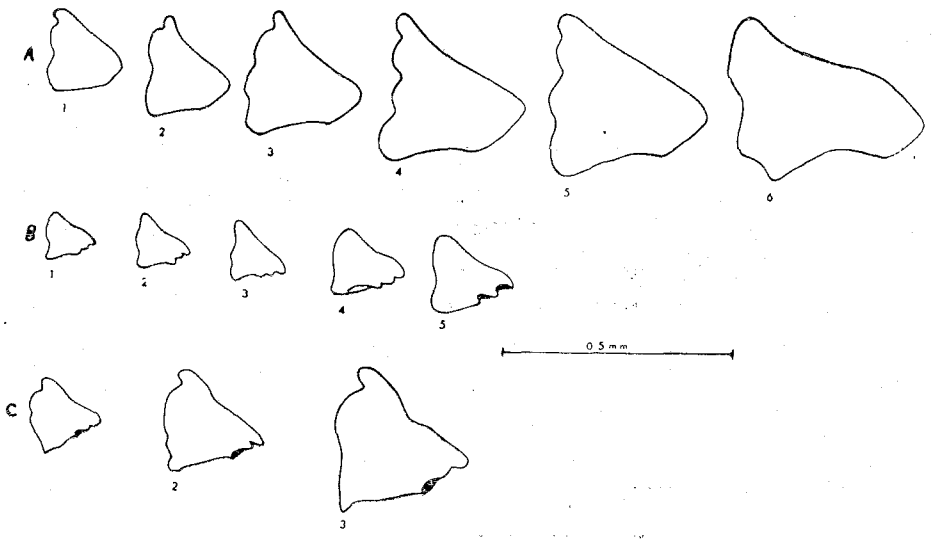

Fig. 1. Mandibulae of larval instars; A- **Scolytus intricatus** (Ratz.); B- **Pityogenes chalcographus** L.; C- **Ips typographus** L.

Hitherto, there has been no record on the number of larval instars of **S. intricatus.** Only Lekander (1968) stated that the measurements of larval head capsules do not suitable for determining larval instars of **Scolytus** spp.

Pityogenes chalcographus L.

In the galleries from different brood systems, five, paired larval mandibulae were found from every gallery. It shows that there are five larval instars in the species. The average measuremants of the mandibulae of different instars are as fallows: Ist 0.10: 0.10; 2nd 0.11: 0.12; 3rd 0.12:0.12; 4th 0.16:0.15; 5th 0.18:0.16.

The mandibulae of the larvae from lst to 3 rd instars as long as broadth; 4th slightly and 5 the distinctly longer than broadth, with three sharp teeth (fig. 1 B).

Blackman (1915) recorded five instars in **P. hopkinsi** but later Lekander (1968) stated three instars in **P. chalcographus** by using the measurements of larval head capsules. The results of this work is same with the Blackman's finding and these two results show that there are probably five larval instars in this genus. The Lekander's statement is not the case with this species. Due to this, head capsule measurements are not useful way for finding larval instars in this species.

Ips typographus L.

In the galleries from several brood systems three paired larval mandibulae were found from every gallery and according to this result there are three larval instars in this species. The average measurements of mandibulae of different instars are as follows: Ist 0.15:0.17; 2nd 0.21:0.22; 3rd 0.26:0.31. All of the mandibulae with two teeth, conical; that of the first and third instars distinctly, that of the second instar slightly broader than long (fig 1 C).

Lekander (1968) obtained three larval instars in this species. His finding is same with the result of this work and the measurements of larval head capsules can be used for determining the larval instars in this species.

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Özet

Scolytidae (Coleoptera) familyasına giren türlerin larva dönemlerinin sayısını bulmada, larva'nın açtığı galeri içinde bulunan mandibula sayısının kullanılması ve bunlardan üç türün mandibula morfolojisi

Larva'nın açtığı galeri içinde bulunan çeşitli dönemlerdeki larva'nın değiştirdiği gömlek üzerinde bulunan mandibula çıkartıldıktan sonra yapılan çalışmalarda altı larva dönemi **Scolytus intricatus** (Ratz)'da, beş dönem **Pityogenes chalcographus** (L.)'da ve üç dönem de **Ips typographus** (L.)'da saptanmıştır. Ayrıca bu türlere ait mandibula'nin morfolojisi çalışılmış ve çizimleri yapılmıştır.

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