A Description of two *Magdalis* larvae (Col. Curc.) and a Comparison between these and the *Scolytus* larvae (Col. Scol.)

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When discussing the relationship of the bark beetles based on the morphology of the larvae, LEKANDER in press, the striking similarity between the *Scolytus* and *Magdalis* larvae was emphasized. In the publication mentioned the similarities could only be indicated, as a detailed description of a *Magdalis*-larva was lacking.

In a newly published detailed description of the developmental stages of the Middle European Curculionides SCHERF 1964 has pointed out that almost all larvae of the genus *Magdalis* are undescribed. A very summary description of the *armigera* and *carbonaria* larvae has been given, however, but the description, which is not accompanied by any pictures, is so general that it cannot be used for a thorough analysis.

My own material of *Magdalis* larvae is also scant; only two species have been at my disposal, viz. *Magdalis violaceus* L. and *ruficornis* L. In spite of the variation between these two species, which in some morphological details is considerable, they show such distinct and in many cases original common features, that there is a well-grounded reason to assume these to be characteristic of the genus.

Description of the Magdalis larva

(Concerning the morphological nomenclature, see LEKANDER)

Head capsule oblong, index about 1.20, retracted into prothorax. Frontal and coronal sutures indistinct. Epicranial setae short, on anterior part of the capsule. Frontal shield short and broad, cordate. On the shield 7—8 pairs of relatively short, often bent setae of the same length, concentrated to the anterior part of the shield. Epistoma with straight, continuous posterior border, lateraly only slightly bent backwards.

Antenna undifferentiated more or less pointedly conical, sometimes with an indication of double points. Antennal field orginally shaped with many short setae.

Clypeus short and broad with sides angularily bent outwards, considerably broader at the base. Clypeal setae of about the same length, in each pair placed far from each other. Labrum with evenly rounded anterior border.

The antero-medial setae consist of two pairs; the lateral bristle-like, the medial broader.

On epipharynx the three pairs of antero-lateral setae are of the same size, placed parallel to the anterior margin of epipharynx. The three pairs of medial epipharyngeal setae are also of the same size, placed far from each other. Between the second and third pair there are distinct epipharyngeal sensillae. The posterior sensillae are lacking.

Tormae long, of equal breadth, straight or slightly bent, converging backwards, extending far behind the posterior margin of epipharynx. Mandibles conical with a medial, long chisel-like tooth and a shorter medial one. The individual variation is, however, considerable. Mandibular setae parallel with the base of the mandible. Maxillae normal, relatively short and broad. On lacinia seven dorsal and five ventral setae, two of the latter shorter.

Mentum regularly or irregularly chitinized. Arms slender and not broadly attached to the axis which is free in its posterior part. Posterior sensillae doubled. Labial palpi with two articles. On the ligula the two pairs of setae are short and of eqal length. The distance between setae in each pair is equal. On submentum the three pairs of setae in triangle. On prothorax on the anterior part two large, faintly coloured chitin dots. On pedal lobes only two setae. Stigmata oval without air sacs.

Magdalis ruficornis L., fig. 1

Antenna broadly conical with indication of biconicalness. Antennal field pronounced convex with many short setae evenly spread over the field. Clypeus with strikingly outward bent sides. Epipharyngeal sensillae only two between second and third medial seta pairs. Tormae straight, converging backward. Mentum regularly chitinized with slender arms of equal breadth, obliquely attached to the axis.

Locality: Uppland, Eldgarn in *Ulmus* (B. Ehnström).

Magdalis violacea L., fig. 2

Antenna narrowly conical. Antennal field formed as a bowl in the bottom of which the antenna is situated, the top of which alone reaches above the edge of the bowl. The upper part of the bowl with numerous small, evenly distributed setae. Clypeus with less markedly outward bent sides than in foregoing species. Tormae only faintly bent, converging backward. Epipharyngeal sensillae in two groups each with three closely placed organs. Mentum irregularly chitinized with narrowly attached arms. Setae on ligula very short.

Locality: Södermanland, Västerljung in *Picea* (B. Ehnström).

A comparison between some morphological details in the Magdalis and Scolytus larvae

When discussing, LEKANDER in press, the mutual relationship between the different bark beetle genera it was stressed that there was no doubt whatsoever that the genus *Scolytus* should form a subfamily of its own, *Scolytinae,* as the larvae differed in several respects from the other investigated genera.

No valid arguments for a connection to either the Hylesinides or the Ipides could be found. On the other hand, my studies of the Curculionid larvae have surprisingly shown that the *Scolytus* larvae, which in several respects are very peculiarly built, correspond rather well in their morphology to the *Magdalis* larvae. The two *Magdalis* larvae described above may be a basis for a closer comparison of some morphological details which will elucidate this striking conformity.

Index of the head capsule: *Magdalis* c. 1.20, *Scolytus* 1.10—1.20. The index of bark beetle larvae can vary between c. 0.8—1.30. The highest figures, however, are exceptional and have apart from *Scolytus* been established only in *Hylesinus*. The extremely protracted shape of the head capsule results in its being retracted into the prothorax, and consequently particularly the posterior epicranial setae, but also the frontal ones, are situated on the anterior part of the capsule.

The shape of the frontal shield. The shield is in both genera extremely short and cordate-shaped. The number of frontal setae, which in bark beetles is normally five pairs, occur in both genera in an increased number; in *Magdalis* in eight pairs and in *Scolytus* usually six or seven. Further, they are all short and roughly equal in length. In bark beetles they are usually longer and often of strikingly different length.

The antenna is in both genera cone-shaped without differentiation, a characteristic common to several other genera. On the other hand, the antennal field is very interesting. In *Scolytus* there are two different types; one extremely convex and one bowl-shaped. The latter type has so far been observed only in *S. rugulosus*. The convex type is in principle common to the majority of bark beetle larvae, but an extreme convexity is only found in *Scolytus*. In this connection it is very interesting to establish that just these two types, which are characteristic of *Scolytus*, are represented in the two investigated *Magdalis* species. The peculiar bowl-shape is in this connection extremely interesting.

In *Magdalis* there is a large number of setae on the antennal field. In this respect the genus differs from *Scolytus*, but in this connection it is interesting to establish that among the bark beetle larvae hitherto investigated the *Scolytus* larvae have the greatest number, viz. seven.

The form of clypeus varies in *Scolytus* from types with pronounced convex sides to those with more rotund sides. The extreme type will be found e.g. in *S. pygmaeus* and *M. ruficornis* and the moderate one in *S. intricatus* and *M. violacea*. The extreme type is rare among the bark beetles.

The clypeal setae are in both genera short and of about equal length. In bark beetles they are often of different length. The same length, however, is found in e.g. *Xylechinus, Carphoborus* and also *Ernoporus*. There is a difference between *Scolytus* and *Magdalis*, however, in the distance between setae in each pair. In *Magdalis* they are situated far from each other, in *Scolytus* close together. The latter case is common among bark beetles and weevils. Setae placed far from each other has been established in only a few bark beetle genera, e.g. *Carphoborus*.

Also the mandibles show some similarities. In *Magdalis* there is a long chisel-like tooth and a smaller, apical one. In *Scolytus* there is as a rule only the chisel-like part. This shape of the mandible is as far as is known different among the bark beetles. As a rule there are three, sometimes two,

more or less sharp teeth. Thus the similarity in the peculiar shape of the mandibles in the two genera is great.

Setae on epipharynx have in both genera about the same location and appearance. In this connection it can be stressed that the three median pairs are placed far from each other and at the same mutual distance. In bark beetles as a rule the median pair is usually nearer one of the others.

The epipharyngeal sensillae agree insofar that the posterior ones are lacking. In *M. violaceus* the anterior ones are lying quite near each other in two groups with three organs in each. This is not the case in *Scolytus* but has been seen in e.g. *Polygraphus* and *Blastophagus*.

The tormae in both genera are long and of equal breadth stretching far beyond the posterior margin of epipharynx. In *Scolytus* they are as a rule faintly concave, diverging forward and backward, in *Magdalis* they are converging backward. In this respect there is a certain difference, but in my opinion this is not very important, as the orientation can vary between closely related species. Most significant, however, is the general morphology of the tormae, which in this case is quite the same in the two genera.

Mentum is in the *Scolytus* larvae irregularly chitinized, i.e. the borders are diffuse. The arms are either broadly or narrowly attached to the axis. In *M. violacea* the mentum is of exactly the same shape as in *S. ratzeburgi* or *intricatus*. This »irregular» type is rare in bark beetles and is up to now described only from *Scolytus*. The position regarding the weevil larvae is to a great extent still unknown, but as far as I know this type has not been described from any other genera.

The most characteristic feature in the *Scolytus* larvae, which distinguishes them from all other bark beetle larvae investigated to date, is the four large, faintly coloured dots on prothorax. In the *Magdalis* larvae there are two dots in the same place. In the weevil larvae such dots seem to be quite common.

The number of setae on pedal lobes is of great systematical value when characterising the different bark beetle groups. In both *Scolytus* and *Magdalis* there are only two, which is also the case in the Ipin-orientated genera. The position as regards the weevil larvae is unclear. From SCHERF's pictures 1964 it seems as though the number can vary.

Stigmata, finally, also show some similarities. In *Magdalis* there are no air sacs. In *Scolytus* they are either absent or faintly developed. In both genera stigmata with air sacs might be the most common.

Discussion

As relatively few Curculionid larvae have been thoroughly investigated the above comparison is fraught with considerable weaknesses. A comparison has been possible only between bark beetles and *Magdalis,* not in the same degree with other weevil larvae. The possible value that this comparison may have is to stress the morphological conformity that exists between a bark beetle genus, *Scolytus,* and a weevil genus, *Magdalis*.

As has been pointed out when discussing the systematics of the bark beetles based on larval morphology, LEKANDER op.c., the genus *Scolytus* is isolated among the bark beetles. This is quite evident from the summary where the distribution of some morphological details have been accounted for in a table. If the corresponding data from *Magdalis* are inserted into this table,

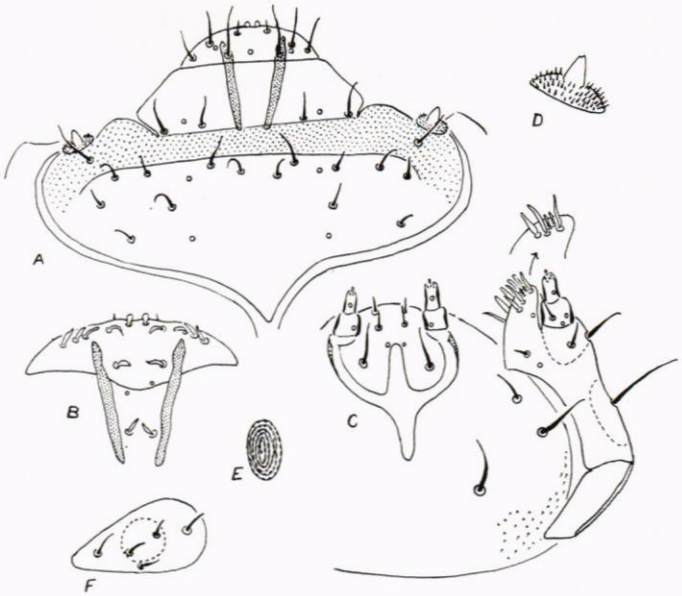

Fig. 1. *Magdalis ruficornis* L. A: Frontal shield with clypeus and labrum, 100×. B: Epipharynx, 155×. C: Maxilla, mentum and submentum, 100×. D: Antenna with antennal field, 175×. E: Stigma, 105×. F: Pedal lobe.

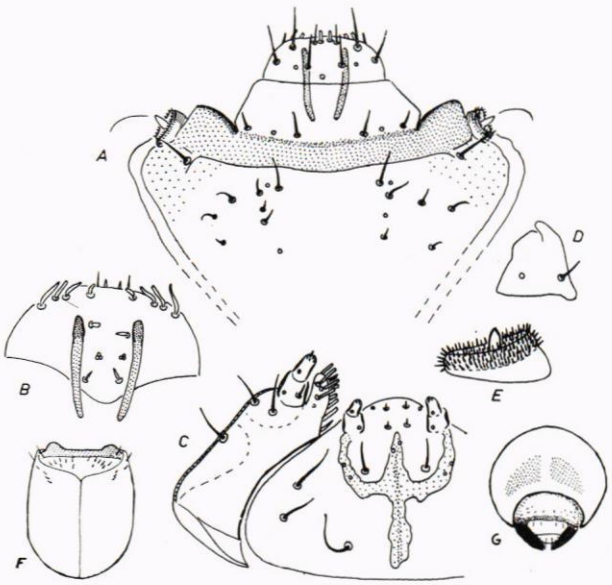

Fig. 2. *Magdalis violacea* L. A: Frontal shield with clypeus and labrum, 65×. B: Epipharynx, 100×. C: Maxilla, mentum and submentum, 90×. D: Mandible. E: Antenna and antennal field, 180×. F: Head capsule, 18×. G: Head and prothorax.

the resemblance with *Scolytus* is complete but for one exception, viz. the orientation of the tormae. Therefore it is quite obvious that *Scolytus* shows a considerably greater morphological conformity with *Magdalis* than with other bark beetle genera.

As has been pointed out earlier, few weevil larvae have yet been investigated; for this reason it is impossible to state at present that *Magdalis* is the most nearly related genus to *Scolytus*. In the paper mentioned above, the similarities have been pointed out which may exist between *Scolytus* and the larva of *Phylaitis greviae* Mshl., which has been described by GARDNER 1934. To clarify these systematical problems it is necessary to investigate a large number of weevil larvae as the imagines, particularly the structure of their copulation organ.

The striking similarity in the morphology of the larvae from two genera, which by the systematists have been placed far from each other in different families, gives rise to interesting aspects. Without doubt the two families *Curculionidae* and *Scolytidae* are closely related, and in the work of CRAWSON 1955 the latter family has been struck out and joined with *Curculionidae*, as it has been impossible to establish any fundamental differences. CHARARAS 1957 has investigated thoroughly the morphology of the larvae and the imagines of some representatives from the both families, and he obtained the same result, namely that no principal differences exist. Serological examination of some Scolytidae and Curculionidae, THOMAS and KRYWIENCZYK 1966, failed also to prove any differences.

Investigations on the morphology of the bark beetle larvae have shown that some genera are without doubt closely related. As a rule the creation of genera groups and tribus has not been too complicated. On the other hand, however, it has in some cases been difficult to find any valid connections between separately delimited groups.

The foregoing description is an attempt to show that a fundamental morphological resemblance exists between a bark beetle genus and some weevils. When the weevil larvae have been more thoroughly investigated I would not think it unlikely that other bark beetle genera such as *Crypturgus* and *Trypodendron*, the systematical position of which is at present doubtful, will perhaps be found to have a closer relationship to some weevil groups. In other words, I think it likely that *Scolytidae* should not be considered as a monophyletic family but as a polyphyletic one, which has perhaps arisen from different groups of weevils. Weevils living in wood are to be found in several genera. One of the principal differences between bark beetles and weevils is that when laying eggs the weevil sits on the hostplant and lays its eggs in the plant through a gnawn hole. In the bark beetles, on the other hand, the parental animals gnaw themselves in under the bark and lay their eggs in small egg niches in the walls of the galleries. From the point of view of the mother animal the latter method of egglaying doubtlessly offers great advantages; the animal is better protected during the critical egglaying period, further the eggs and larvae might get more suitable conditions for the development as control of the humidity, inplantation of blue stain fungi as food.

For that reason it is not inconceivable that this probably more favorable method of egglaying has begun to be practiced in various weevil groups. A life under bark or in wood has gradually necessitated a certain form of

the body of the imagines as a cylindrical body with some arrangements for the removal of boring dust, in other words what we associate with the appearance of a bark beetle. It is well known that a body form similar to a bark beetle has been developed in several quite different beetle families, such as *Anobiidae, Bostrychidae, Lyctidae*. It is not impossible that the same line of development has been followed by different weevil groups.

Literature

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