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THE SILKWORM OF ARISTOTLE

BY WILLIAM T. M. FORBES

IN HIS discussion of the insects in the fifth book of the *History of Animals*, after a few words on other caterpillars, Aristotle writes:

Ἐκ δὲ τινος σκώληκος μεγάλου, ὃς ἔχει οἶον κέρατα καὶ διαφέρει τῶν ἄλλων, γίγνεται πρῶτον μὲν μεταβαλόντος τοῦ σκώληκος κάμπη, ἔπειτα βομβύλιος, ἐκ δὲ τούτου νεκύδαλος· ἐν ἑξ δὲ μῆσι μεταβάλλει ταύτας τὰς μορφὰς πάσας. Ἐκ δὲ τούτου τοῦ ζώου καὶ τὰ βομβύλκια ἀναλύουσι τῶν γυναικῶν τινες ἀναπνιζόμεναι, κάπειτα ὑφαίνουσιν· πρώτη δὲ λέγεται ὑφήνη ἐν Κῶ Παμφίλῃ Πλάτew θυγάτηρ.

From a certain large *scolex*, which has things like horns, and differs from the others, there is produced by transformation of the *scolex* a caterpillar, then a cocoon, and from this a *necydalus*; and it transforms through all these forms in six months. And some of the women unravel the cocoons of this animal by combing them out, and then spin them; and they say that Pamphile the daughter of Plateus in Cos was the first to weave [the resulting fiber].¹

It is of interest to an entomologist to try to connect this account with the known life-history of one or another silkworm. The famous Chinese silkworm is obviously barred; nothing is said of foreign origin,² and the process of "combing out" implies such a treatment as is given to the "Tusseh" type of cocoons (*Antheraea* and *Philosamia*) rather than the reeling off of a Chinese cocoon.³ Aristotle's silkworm

¹ *Hist. Anim.* v. 19. 6.

² Pauly-Wissowa in the article "Bombyx" (III, 678) state on the presumed authority of Pliny that the silk comes from Assyria. This is a pure error. Pliny had things mixed badly enough, for he describes the *bombyx* as another kind of bee, immediately following the wall-bee, which he follows Aristotle in crediting to Assyria; but Pliny says nothing about the provenance of the *bombyx*, and may therefore be presumed to consider it a native creature. The account of Pauly-Wissowa is curiously confused, adding to Pliny's errors some new ones, but is a very useful source of references. In using it care should be taken to distinguish between references to *bombyx*, *serica* (discussed more largely in the second series, IIA, 1724), and mere citations of transparent textiles. *Serica*, of course, does not come into Aristotle's world at all.

³ Pliny also distinguishes *bombyx* from the Chinese silk (*serica*), which was in fact not then recognized as silk, but supposed to be a vegetable fiber. By the second century *serica* was known to be a silk—the product of a silkworm which is noted by Pollux as resembling the *bombyx*; but *serica* is, I think, nowhere in ancient literature, actually confused with *bombyx*. Pollux also describes cotton (*βύσσος*) recognizably. Pausanias in our text has a passage recognizing that *serica* is silk, but it is so out of keeping with its context that it may well be an interpolation (vi. 26. 6).

was something apparently familiar to him locally, and a thing which he expected to be familiar to his readers of Western Asia Minor, Greece, and the islands between.

Note that there are at least two words he uses that are technical, or at least were so used by him, *σκόληξ* and *νεκίδαλος*. The first is used in Homer of the earthworm, in later times (Aristophanes, e.g.) of the maggot-like larvae of the wasps. Aristotle's use corresponds to this in a way, but is more strictly defined. It is not a "grub" in general as usually translated, and never a "worm" (*vermis* or *vermiculus*). He writes: *καὶ τὰ μὲν ζωοτόκα, τὰ δ' ὄφοτόκα, τὰ δὲ σκωληκοτόκα . . . σκόληξ δ' ἔστιν ἐξ οὗ ὄλου ὄλον γίνεται τὸ ζῶον διαρθρούμενον καὶ ἀξαναομένου τοῦ κήματος*. ("Some animals are viviparous, some oviparous, some scoleceparous [if we may coin the corresponding word] . . . a *scolex* is that from the whole of which an animal is produced whole, by segmentation and growth of the embryo [i.e., the *σκόληξ*])¹ And in the next paragraph, *καὶ τῶν σκωλήκων οἱ μὲν εἰθὺς κινητικοὶ οἱ δ' ἀκίνητοι*. (Some of the *scoleces* can move from the beginning, others are immovable.") He also says that it may be hard shelled and soft inside. From this and numerous other passages for which we may consult the index under *σκόληξ* or *vermes*, we may conclude that Aristotle intends the *scolex* to be the first stage of the life-history of an insect or other creature which he did not recognize as produced by birth or hatching from a real egg. Sometimes he actually had an egg in mind (when he refers to it as hard shelled but soft inside),² while in other cases it is obviously the first-stage larva.

In the present case the unusually large *scolex* provided with horns must be the young caterpillar, as all the plausible eggs would be smooth.

The second word, *νεκίδαλος*, is more of a puzzle, as Aristotle uses it only here and does not define it. Aside from a late grammarian, or two, who certainly was merely guessing from the context, we have the following appearances of the word:

1. In Aristotle, here only.
2. Athenaeus, in Aristotle's identical words (352 F).

¹ *Hist. Anim.* v. 19. 1.

² We may remark that many caterpillars on hatching eat the eggshell for their first meal, so that an observer who had missed this operation might well think that the tiny caterpillar he finds is produced by mere transformation of the egg that was there a few hours before.

3. In Pliny's *Natural History*, in a paraphrase of this very passage. Pliny writes:

Ex grandiore vermiculo *gemino protendens* sui generis cornuum urica fit, dein quod vocatur bombylis, ex ea *necydallus*, *ex hoc* in sex mensibus *bombyx*. Telas *araneorum modo* texunt ad vestem *luxumque feminarum* quae bombycina appellatur. Prima eas redordiri rursusque texere invenit in Coo mulier Pamphile, Plateae filia, *non fraudanda gloria excogitatae rationis ut denudet femina vestis*.¹

It is hard to say how much of the difference between our Aristotle and the Pliny adaptation goes back to a difference of text, and how much is merely muddled on Pliny's part. He goes on in the next paragraph to details that are mainly fantastic and certainly not derived from Aristotle, but from which we can recover at least a list of plants on which the silkworm may be found. As to *necydallus*, Pliny does not help us, for he sees in it a stage intermediate between the cocoon and the moth (which latter he calls *bombyx*). There is no such stage, and we may assume that Pliny was merely guessing. He also puts it among the bees, doubtless deceived by the resemblance of the words *bombus*, *bombylius*, and *bombyx*; and he adds some moralizing, as might perhaps be expected of a Roman of his time. Of his food-plants—cypress, terebinth, ash, oak flowers—there is more below.

4. We find a note to a sermon by Clement of Alexandria, which is so out of place that we may be safe in calling it an interpolation, which may be of any date and perhaps of no authority. The annotator of Clement thinks *necydalus* is a synonym of "cocoon" (*Paedagogus II*, cap. X, 107, 4 [ed. Hinrichs]; [B 86, l. 47]).

5. There are two definitions in Hesychius, the first perhaps merely guessed from the context in Aristotle, the second inapplicable either to Aristotle or Pliny: *Νεκυδάλαος* (read *νεκυδάλλος*)· τὸ ἐκ τοῦ βόμβυκος ζῶον. ἢ ὁ σκώληξ τῆς κάμπης.

We may sum up these passages as indicating that the *νεκύδαλος* is something that comes out of the cocoon (Aristotle, Pliny, Hesychius), but that later it was imagined to be either the cocoon itself (as in our text of Clement), the first-stage larva or egg (Hesychius' second definition), or something that produces the moth but is not the cocoon (Pliny). I venture to define *νεκύδαλος* as the moth itself; note that

¹ *Op. cit.* xi. 76. The italicized parts are not represented in Aristotle.

νεκύδαλος is related to *νέκυς* (a ghost) rather than to *νεκρός* (a corpse) and so might well be a moth, as *ψυχή* is a butterfly. If we make *νεκύδαλος* a moth we at least make good entomology of Aristotle's passage though at the cost of the interpolation(?) in Clement. Pliny is of course beyond saving by any mere definition.

Translating, then, *σκόληξ* as first-stage larva, and *νεκύδαλος* as moth, what did Aristotle know as the silkworm? There are two silkworms in Southeastern Europe which could have been his species, though neither of them is used, I believe, at the present day. First there is *Saturnia pyri*. It would have the unusually large and spiny first-stage larva, and spins a great amount of strong and glossy silk, but the silk is dark brown.¹ It feeds on a variety of plants, among them ash, though it perhaps prefers apple, and it might become abundant. It is easily bred. The second is *Pachypasa otus*. It also feeds on a variety of plants and is not rare in Southeastern Europe; among its foods are the cypress and oak, which Pliny mentions. The silk would presumably be better than that of *S. pyri*, being paler and finer, but might be more difficult to card, and the caterpillar is certainly more difficult to rear, as this species winters in the caterpillar stage, and would need attention at that time.² My guess is that both were used by the Greeks of Cos and thereabout, for silk, and that our accounts are a mixture of the two. Possibly then the *gemina* of our text of Pliny, and the *ῥῶν ἄλλων* of Aristotle, may be the last traces of an original account which discussed and compared the two species. More visibly, Pliny's list of plants, which I judge did not come from Aristotle, includes the foods of both species. If this is the case, *βόμβυξ* (the hummer) might be the heavy-flying moth of *Pachypasa otus*, while *νεκύδαλος* (the ghost) would be the soft and silent moth of *Saturnia pyri*.³

Finally, the name of the discoverer, Pamphile, suggests a name

¹ Some would derive the French word *bis*, "dark gray," from *bombycina* (presumably with the Greek rather than the Latin accent) (Hatzfeld and Darmesteter, *Dict. Gén. langue française; traité*, 8).

² Possibly Pliny's curious remark about putting the *bombyx* in a jar and feeding it bran may be a garbled version of the treatment of hibernating larvae.

³ Dr. Gisela M. A. Richter (*Amer. Jour. Arch.*, XXXIII, 27) suggests that the *ἀμοργίς* of Aristophanes is also silk. I would further suggest that the *ἀμοργίς* which Lysistrata's friend was in a hurry to comb out were cocoons that she had bred there at Athens, and wanted to care for before the moths emerged and cut up the fibers.

from the heroic age of Greece. We seem to have no other reference to this particular Pamphile, the daughter of Plateus or Plateas. Her name is by no means unprecedented in Aristotle's time, yet it seems to recall the days of Omphale and Eriphyle, and her father's name re-echoes Proteus, Perseus, and Theseus. So she may well have lived in the immemorial past of Greece, and the spinning of silk in the Western world may well go back to that time. In any case the evidence is strong that it was wholly independent of Eastern contact.

I am indebted to my more classical colleagues for numerous references, comments, and corrections; but they are not responsible for any of the perhaps reckless conclusions which are reached here.

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