STURMIA BELLA (MEIGEN) (DIPT.: TACHINIDAE) AND THE STRAND THAT IS NOT SILK

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Abstract

Tests conducted on strands left hanging from Lepidoptera pupae from which larvae of the parasitoid tachinid fly *Sturmia bella* have egressed show that this substance is best regarded as mucous containing glycoproteins, and that it should not be referred to as silk.

Introduction

The tachinid fly *Sturmia bella* (Meigen), which is an internal parasitoid especially of vanessine nyphalid butterflies, is widespread and often common in continental Europe. Since it was first recorded as British (Ford *et al.*, 2000) it has been found in a wide span of counties in the southern half of England and has been reared several times (Rowell, 2001; Raper – Tachinid Recording Scheme website at http://tachinidae.org.uk). It parasitises the larval stage of its host, but the usually solitary parasitoid larva does not kill the host until the latter has pupated, whereupon the fully fed *S. bella* larva vacates the host pupa to pupariate elsewhere. Pupae of vanessines are usually formed hanging above ground, and as the *S. bella* larva drops from its host pupa it leaves a strand, apparently an "escape line", attached to the host pupa (Rowell, 2001 and Plate F). It seems likely that the parasitoid larva lets itself down gently by this means, though we are not aware of precise observations having been made and nor is it clear whether the strand is of host or parasitoid origin. However, several people (*in litt.*) who have reared *S. bella* have remarked on it, sometimes referring to it as a silk-like thread or even as silk.

Silk is a fairly general term for particular forms of large structural proteins that include a number of chemically different types (fibroins, collagen-type and alpha-helical: Rudall & Kenchington, 1971). However, they all have in common that they are large molecules with molecular weights of ca. 50 kda but often polymerised further to 200-300kda (1 da is approximately the mass of a hydrogen atom) composed largely of repeated motifs of short side-chain amino acids, and are durable and very difficult to dissolve (as might be expected, given their biological functions). Indeed, dissolution of silks requires special chaotrophic solvents (which prevent reaggregation of incompletely denatured proteins) such as calcium chloride in ethanol at low temperature (Ayub *et al.*, 1993), calcium nitrate in methanol (Mathur, 1997) or N-methyl morpholine N-oxide (Freddi *et al.*, 1999).

In order to clarify the nature of the material concerned, and to provide an appropriate descriptive term for it, we have conducted limited investigations on the strand from one of the parasitised pupae of *Aglais urticae* (L.) kindly provided by John Rowell (see Rowell, 2001 and Plate F).

Plate F. Artificially suspended *Aglais urticae* pupae, two of which have produced larvae of *Sturmia bella* leaving characteristic proteinaceous strands.

Results and discussion

In the present study samples of the strand dissolved completely in a 5% aqueous solution of sodium dodecyl sulphate (SDS) at 40°C overnight (ca 12 hours). This demonstrated clearly that the strand certainly does not contain silk. The strand stained permanently and intensely with Coomassie Blue R-250, demonstrating that it is protinaceous, and absorbtion of the solution in 5% SDS onto Hybond P, followed by standard periodic acid-Schiff staining, gave a very weak positive reaction, suggesting that at least some glycoprotein was present, but perhaps as a low proportion of the total protein.

We conclude that the material is probably mostly composed of low molecular weight proteins containing some glycoprotein, and that high molecular weight proteins such as silks are certainly absent. As silk formation by Tachinidae has not (as far as we know) been found to occur elsewhere, and it would be wrong to furnish literature statements erroneously implying its presence, it is to be hoped that people will now refrain from referring to the structure associated with *S. bella* as "silk" (or even as a "thread", as this might be taken to imply silk) and instead refer to it as a proteinaceous strand.

Acknowledgements

We are grateful to John Rowell for providing the material we studied, and also for permission to publish his photograph as Plate F.

References

Ayub, Z. H., Arai, M. & Hirabayashi, K., 1993. Mechanism of the gelation of fibroin solution. *Bioscience Biotechnology and Biochemistry* **57**: 1910-1912.

Ford, T. H., Shaw, M. R., & Robertson, D. M., 2000. Further host records of some West Palaearctic Tachinidae (Diptera). *Entomologist's Record and Journal of Variation* **112**: 25-36.

Freddi, G., Pessina, G. & Tsukada, M., 1999. Swelling and dissolution of silk fibroin (*Bombyx mori*) in N-methyl morpholine N-oxide. *International Journal of Biological Macromolecules* **24**: 251-263.

Mathur, A. B., 1997. The dissolution and characterisation of *Bombyx mori* silk fibroin in calcium nitrate methanol solution and regeneration of films. *Biopolymers* **42**: 61-74.

Rowell, J., 2001. Small tortoiseshells attacked by parasites. *Hampshire and Isle of Wight Butterfly and Moth Report* **2001**: 16-19.

Rudall, K. M. & Kenchington, W., 1971. Arthropod silks: the problem of fibrous proteins in animal tissues. *Annual Review of Entomology* **16**: 73-96.

Five micro-moth species new to Glamorgan

During 2002, a number of moth species were recorded new to Glamorgan (VC 41). The author was responsible for the capture and identification of five of these. On 4 May, I netted a number of micro-moths flying in strong sunshine in an abandoned quarry fringed with oaks within Clyne Wood, between Swansea and Gower. Amongst them were several fresh, strikingly-marked examples of *Lobesia reliquana* (Hb.). A second tortricid species, *Ancylis uncella* (D. & S.), was disturbed in numbers from birch trees growing amongst heather on Kilvey Hill, on the eastern side of Swansea, a week later on 12 May. On 31 May, while awaiting the arrival of other members of the Glamorgan Moth Recording Group for a field event, VC 41 recorder Barry Stewart and myself swept several moths from rough grassland on Hirwaun Common, between Hirwaun and Treherbert in the north of the county. Among these were the distinctive yellow females of *Elachista subalbidella* Schlager, a species that will probably prove to be common and widespread in upland areas of the county. On 20.August, I visited Cwmllwyd Woods, a nature reserve between Swansea and Gower, to assist my girlfriend in collecting moss samples for her degree dissertation project. Purely out of habit, I took a net with me and as we left the site at dusk, had the luck to net a moth that proved to be *Elachista bisulcella* (Duponchel). A week later, on 26 August at Afan Argoed Country Park north of Port Talbot, I swept a specimen of *Phaulernis fulviguttella* (Zeller) from an urnbellifer flower-head. According to the burgeoning data-set held by Barry Stewart and the GMRG, none of these apparently widely-distributed species had previously been recorded from Glamorgan.– MARTIN J. WHITE, 58 Victoria Quay, Maritime Quarter, Swansea, SA1 3XG.