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CADDIS LARVAE AS A PEST OF WATERCRESS

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Watercress, Rorippa nasturtium-aquaticum (L.) is a common native plant throughout lowland Great Britain in flowing water in streams and ditches. It is cultivated in shallow watercress beds in southern England, mainly in Hampshire, Dorset and Surrey, fed by water from boreholes or springs. Since this water enters the beds at a fairly constant temperature of about 10°C, the cress continues to grow strongly through the winter and finds a ready market particularly at this time of year.

In February 1961 I received a letter from Mr S.W.H.Rolfe, entomologist in the Reading office of the National Agricultural Advisory Service, enclosing caddis larvae which had been causing serious damage to watercress near Abinger Hammer in Surrey. Some of these cases were of small stones and others of watercress leaves. They were limnephilids, but I was unable then to identify them to species. Later that month we went to Abinger Hammer where the main watercress beds and packing shed were situated in the valley of the Tillingbourne. There was no caddis problem here, but the grower, Mr R.B.Arminson, took us to the Ford beds in the valley of the Lawbrook, about 4 miles away. Here there was very extensive damage, with bare areas where the cress had been eaten and we found large numbers of caddis larvae feeding on the plants. These beds had been treated with pyrethrum four times through the winter. We collected larvae in small cases of sand grains which were Drusus annulatus Stephens, and others in larger cases of sand grains or watercress which were Limnephilus lunatus. It was only the L.lunatus larvae which were feeding on the cress.

Later that summer I visited other watercress beds, six in Hampshire, one in Oxfordshire and one in Hertfordshire. All the growers reported occasional damage by caddis larvae, but it was never of any consequence. Many of them had used pyrethrum, but only because the insecticide salesman had recommended it as an insurance against damage by caddis larvae. No tests had been carried out and no attempt had been made to identify the several species of larvae present.

Clearly there was a problem in the Ford beds which needed investigation. I was fortunate to secure a Research Studentship from the Department of Scientific and Industrial Research, which was taken up by Mr A.M.Gower who graduated that summer in our Department of Zoology. He made a detailed study of the life cycle of L.lunatus from regular samples of all stages throughout the year in the Ford watercress beds (Gower 1967). The larvae continued to grow steadily through the winter and nearly all had reached their final instar by March. They pupated from May to July, and adults emerged from June to August. Their ovaries were immature and they remained in diapause until the autumn, which was the normal time for the species to lay eggs. The larvae caused extensive damage by feeding on the leaves, stems and roots, and used the leaves in case-construction. He made a parallel study of the same species in a natural stream near Reading, which was subject to wide fluctuations in temperature and supported some wild watercress. Here the larvae grew very slowly through the winter, and the final instar was not reached by the majority until the end of July. Thus, in the Ford beds, it was the combination of constant temperature, abundant watercress, and the absence of effective biological control, that resulted in the damage. There was no opportunity for any further ecological study here or in other beds in these southern counties.

Gower (1965) also studied the life history of Drusus annulatus in watercress beds in Hampshire, at St Mary Bourne. The larvae fed on diatoms and filamentous algae, but not on cress. There was considerable overlap of larval stages, so that the species was bivoltine. He made the interesting discovery that the eggs were laid underwater on stones and the stems of the watercress. This is a departure from the normal habit in Limnephilidae of laying eggs above the water. In a later study (Gower 1973) he found that in a mountain stream in Wales D.annulatus had only a single generation in the year, with a flight period from May to September.

As a light-hearted diversion from this story I recall a letter I received from Dr Oliver Flint of the Smithsonian Institution in August 1962. I had written asking him if he had come across caddis larvae being a pest of watercress in America or elsewhere. He reported that most of the cress in the USA was grown south of the range of species of Limnephilus, but that he had received recently some caddis larvae found in watercress provided for airplane meals. He sent me two larvae of L.lunatus from a Pan-American flight from London. In a later note he reported on one more L.lunatus larva intercepted on a BOAC flight from London to New York. His comment was: ...'If you ever fly trans-Atlantic don't eat the salad !'. It is likely that the watercress for these flighjts came from the beds in Surrey ! We were able to send him a useful series of larvae from the Ford beds for his collection.

It is now time to look back one hundred years. In 1897 Eleanor Ormerod published a note of five pages entitled: Watercresses: Caddis worms, larvae of caddis flies or water moths, in her 20th Report of observations of injurious insects. Before dealing with this note, I feel it is of interest to give some details about this remarkable woman, who was a pioneer in Economic Entomology.

Eleanor Ormerod was born on 11 May 1828 at Sedbury Park in Gloucestershire. She was the youngest of the ten children of George and Sarah Ormerod, who had moved there two years previously from Lancashire. Sedbury Park was an extensive estate lying between Chepstow on the River Wye and the estuary of the Severn. Her father was a historian and antiquarian, and also a local magistrate, but they were not deeply involved in the sporting and social life of the landed gentry. He had a good library, workshop, and gardens with greenhouses, and his daughters would help in writing and copying for him. Thus the family had a self-contained life, with summer outings to places of interest and an annual visit to London where George Ormerod would work in the British Museum and they had connexions with the artistic and musical worlds. The three girls were taught at home by their mother and also had lessons in painting and music. Both Eleanor and her sister Georgiana developed a great interest in natural history, surrounded as they were by beautiful parkland and countryside. Eleanor dated her particular interest in Entomology from 1852 when a locust with rose-coloured hindwings appeared among a crowd of people in Chepstow; it was captured and given to her. She started then by dissecting beetles with the help of the Manual of British Coleoptera by J.F.Stephens (1839). She helped her brother William to prepare botanical and other material for his microscope; he later became a surgeon. Eleanor bought her own microscope in about 1866. Thus she was a self-taught naturalist, with no formal teaching in school or university.

In 1869 the Council of the Royal Horticultural Society decided to start a collection of useful and injurious insects and asked for help. Eleanor's offer was accepted and so she began sending specimens from the park and countryside.

After the early death of their mother, the three daughters, who never married, continued to live at Sedbury looking after their father until his death in 1873 at the age of 87. Eleanor, now 43, with her sister Georgiana, 5 years older, took a house in Torquay for three years. Their next move was to Isleworth, next door to Kew Gardens, where they were friends of Sir Joseph Hooker, Keeper of the Gardens. In the spring of 1877 Eleanor published a 7-page pamphlet, Notes for observations of injurious insects, calling for information from agriculturists and entomologists on dates and details of damage, appearance of larvae, etc. From the encouraging replies she compiled the first of her Annual Reports of injurious insects, which appeared every year until 1901. She had an immense correspondence from all over Britain and from other countries as she developed a worldwide reputation as an economic entomologist. In addition to the Reports, and other books, she published 4-page leaflets on the commonest farm pests, which were given away free. The drawings in her publications were from Curtis's Farm Insects, by professional artists such

as H. and E.C.Knight and others, and also by herself and her sister Georgiana - always carefully acknowledged.

By 1901 she felt that the time had come to dicontinue her Annual Reports as she had covered the essential details of the major pests. As she wrote: 'But the work was hard; for many years for about five or six months all the time I could give to the subject was devoted to arranging the contributions of the season for the Annual Report of the year, with the addition of the best information I could procure from other sources (in every case, whether of contributors or otherwise, fully acknowledged).' One honour of the many she received, which gave her great pleasure, was the award of the Honorary Degree of LL.D from the University of Edinburgh in 1900, before an assemblage of about 3000 people. She was the first lady to be awarded this degree. Sadly, her health was now failing, and she died on 19 July 1901 at the age of 73. These details come from her autobiography and correspondence which were edited in 1904 by Robert Wallace, Professor of Agriculture and Rural Economy in the University of Edinburgh. The Board of Agriculture was established in 1889, and started publishing advisory leaflets on pests and other topics in the 1890's, but for 24 years Eleanor Ormerod was in effect the independent Economic Entomologist for the country.

I must now come back to Eleanor Ormerod's note on caddis in her 1897 report. In January 1896, she received caddis larvae from a watercress grower in Hampshire where three-quarters of the area of his beds had been eaten. She reproduced drawings of three cases of Limnephilus flavicornis from McLachlan's Monograph which seemed to agree very well with her specimens, but she was careful not to say that they were this species. In a letter to one of her correspondents she wrote:

> '... that formerly there were numbers of trout in the water, but lately the landlord's wife had a fancy to encourage herons, and so came the curious sequence. The herons cleared off the insect-loving trout, so the vegetable-eating insects got ahead, and the watercress grower could not pay the rent of his half acre of cresses. I suggest that as the herons were encouraged by the lady, perhaps she, if applied to, might to some degree make good the damages !'

Eleanor was already an ecologist - before her time !

Later that year she received, from Mr Richard Coe of Weston Farm, Albury, Surrey, a number of caddis cases, some of tiny pebbles, others mainly or entirely of leaves of duckweed (Lemna), and some with watercress leaves. Mr Coe reported that the pest, 'commonly called 'Cads' in this locality, gives us much trouble every season, though sometimes more than others.' Mr Coe and his brother John had taken over the beds near Abinger about 1870. The business did well, so that by the 1890's watercress was being cultivated for about six miles along the Tillingbourne from Abinger Hammer through Albury to Chilworth. They may also have set up beds in the Lawbrook which joins the Tillingbourne west of Chilworth. The Ford beds, where the serious damage of the 1960's took place, are on the Lawbrook. Since those days the business has contracted; the Ford beds were given up in the 1980's and are now used for trout rearing, while watercress is concentrated at Abinger Hammer. For this information I am indebted to Mr Richard Barrie Arminson, the great-grandson of Mr Richard Coe, who still trades as R.L.Coe & Co. The caddis damage of the 1890's was no doubt caused by the same species, Limnephilus lunatus.

I am informed by Mr Brian J.Emmett (February 1997) of the Agricultural Development and Advisory Service of the Ministry of Agriculture, Fisheries & Food that there is no present problem with caddis larvae. He is the entomologist responsible for watercress growing. Thus in Britain the Order Trichoptera may retain its present benign position in aquatic food chains !

A note for non-British readers: LL.D means the Honorary Degree of Doctor of Laws, awarded by Universities to people of distinction.

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Current Studies by Glenn B. Wiggins

In response to the Editor's request for information on current studies, the following is offered. It deals in large part, unfortunately, with delays in publication through constraints in funding and other uncertainties of life.

A. Published recently:

1. J.D.Kerr and G.B.Wiggins. 1995. A comparative morphological study of lateral line systems in larvae and pupae of Trichoptera. Zoological Journal of the Linnaean Society (1995), 115:163-184.

2. G.B.Wiggins. 1996. Trichoptera Families. Chapter 17 In An Introduction to the Aquatic Insects of North America, R.W.Merritt and K.W. Cummins (Eds.). Kendall/Hunt, Dubuque, Iowa (3rd edition).

3. G.B.Wiggins. 1996. Larvae of the North American Caddisfly Genera (Trichoptera). (2nd edition). University of Toronto Press. Based on earlier assurances by the publisher, the publication date for this book was cited elsewhere as 1995.

B. Publication expected in 1997/1998:

1. G.B.Wiggins and C.R.Parker. Trichoptera of the Yukon, with analysis of the Beringian and Holarctic species of North America. In Insects of the Yukon, J.A.Downes & H.V.Danks (Eds.). Biological Survey of Canada (Terrestrial Arthropods), Ottawa.
Changes in editorial responsibilities and delays in receipt of some of the contributions have held up publication of this multi-authored work for several years.

2. H.E.Frania and G.B.Wiggins. Analysis of morphological and behavioural evidence for the phylogeny and higher classification of Trichoptera. Royal Ontario Museum, Life Sciences Contribution 160.
This study was scheduled for publication in 1995 by the ROM Publications Office, and on that basis was cited accordingly elsewhere. However, because of budgetary constraints, the projected publication date was twice deferred between 1995 and 1997.

3. G.B.Wiggins. The Caddisfly Family Phryganeidae (Trichoptera). University of Toronto Press.
Publication of this study as a Life Sciences Contribution of the Royal Ontario Museum had to be abandoned when the ROM suspended its series of monographic works because of reductions in budget. Alternative funding was finally arranged with another publisher, supported by a grant from the National Research Council of Canada.

C. Publication deferred to later date:

R.N.Vineyard, G.B.Wiggins, H.E.Frania and P.W.Schefter. The caddisfly genus Neophylax (Trichoptera: Uenoidae).
Publication of this study by the ROM was also terminated, and an alternative has yet to be arranged.

D. New initiatives:

Amongst others, an interpretative book on caddisflies.

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