Wider aspects of a career in entomology. 9. An interest in entomology

Hugh V. Danks

This series of articles outlines some ancillary aspects of my entomological career, for the potential amusement of readers. It reports the sometimes unexpected challenges of working in new places and in the real world, an approach that serves also to expose some conclusions about research activities and some information about insects and their environments. This article outlines how my interest in entomology developed, with some things learned along the way.

Before the work in Canada described in previous articles in this series, I was an amateur entomologist in England, then an undergraduate specializing in entomology, and finally a graduate student. This article considers the first of these phases, which led to my career in entomology.

I was attracted to natural history at an early age, but developed a detailed interest only after finding a used compound microscope on the back shelf of an old and gloomy secondhand shop in London. The instrument was sold to me cheaply, but was of excellent quality. Its high-power lenses allowed examination of protozoans and other tiny creatures, both alive and preserved, using slides, coverslips, and mounting media obtained from the venerable English supplier of microscope equipment, Flatters and Garnett.

The microscope was put to use especially to study protozoans, diatoms, crustaceans, water mites, and other denizens of freshwater from a pond in the grounds of Hampton Court Palace—although the organisms there appeared to be no different than in habitats on more common ground!

I also examined plant tissue sections, preparing them with an impressively solid and finely honed cutthroat razor. Reading a book about biological staining methods prompted me to obtain various reagents and stains that would improve the contrast in material viewed with the microscope. My special orders from the local chemist[1] were highly unusual, but fortunately took place well before concerns about potential terrorists who might have more sinister plans. For example, one purchase was picric acid solution, a bright yellow liquid used as a fixative and stain; but the dry acid is a powerful explosive. On my campus years later, a long-forgotten bottle of picric acid that had dried up and crystallized around the stopper was discovered in the back of a laboratory cupboard. Immediately, the whole building was evacuated until the bomb disposal unit could complete its work.

The school system emphasized a series of increasingly difficult age-related examinations that were used to screen more and more students out of the academic pathway. Such a system worked better for some personalities than for others, but I wanted to progress academically and was a keen student[2] ... although few of the required subjects seemed relevant to my interest in biology.

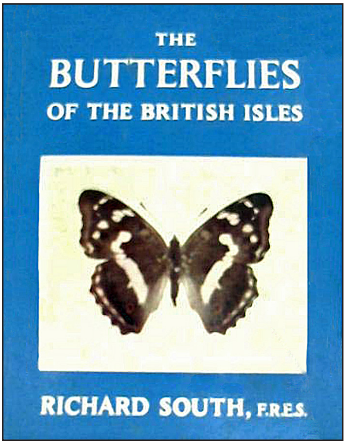
---

[1]Similar to a drugstore or pharmacy in North America.

Hugh Danks (hughdanks@yahoo.ca) retired in 2007 after many years as head of the Biological Survey of Canada. In that role, he helped to coordinate work on the composition and characteristics of the arthropod fauna of the country, and to summarize the results. In addition, his research studied cold-hardiness, diapause, and other adaptations to seasonality in northern regions.

English lessons paid full attention to spelling, and conveyed trite but useful mnemonics (e.g., "i before e, except after c"). Syntax, parts of speech, irregular verbs, and other elements of grammar were given priority too. Study of those patterns established my interest in language, and the tools to develop a style of writing that (usually!) was coherent. Mathematical instruction drilled in times tables and arithmetical techniques, facilitating rapid calculations and even quicker general checks. Basic algebra and trigonometry helped later with more advanced concepts, as well as with practical matters such as the design and construction of minor equipment, and the preparation of aqueous solutions. This structured approach to schooling is deemed unworthy by some modern educators, but learning core elements of the English language and of mathematics is still essential. It certainly helped my career.

A few classes had less impact on me. Early physics lessons treated magnetism and other topics, but the teacher's perjorative nickname was more memorable because I could not recall his real name when asked by another teacher. The textbook on inorganic chemistry was large and dense. It introduced the subject of heavy-metal toxicity by noting the signs of poisoning amongst 18th-century sailors on a vessel with a cargo of mercury, as reported by the ship's surgeon. Almost the only thing I remember from that hefty volume, apart from its dark blue cover, is a footnote to the story: "Ship's surgeons are invariably truthful."! It was just as well that I became an entomologist rather than a physicist or a chemist.

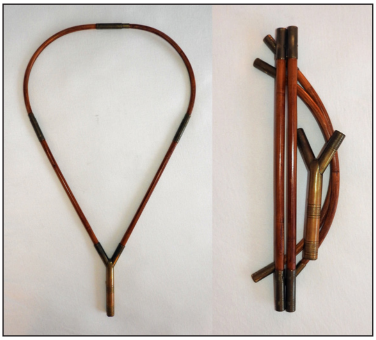


H. Danks

Figure 1. *The Butterflies of the British Isles*, by Richard South (1943 edition).

My interest in entomology was prompted by a book borrowed from the local library. *The Butterflies of the British Isles* (Figure 1) treated about 70 species, including known vagrants. This number of species was manageable and could be identified relatively easily by a beginning entomologist.

Totally isolated from other entomologists at first (and short of funds), I made many mistakes. For example, a few of my earliest specimens were mounted using dress-making pins with limited durability, excessive diameter, and incongruously large heads! However, studying the catalogue of Watkins and Doncaster[3], a firm that specialized in entomological supplies, allowed me to acquire proper entomological pins, entomological forceps, and other equipment. My kite net was finely made of brass and stained hardwood, and easily dismantled for portability (Figure 2); most modern equivalents are less elegant. Diligent searches



H. Danks

Figure 2. Frame of the kite net used for the author's early collecting; L, assembled; R, dismantled. Length assembled, 71 cm.

[2]Fortunately, scholarships allowed me to attend a well regarded school (King's College School in Wimbledon), and then university, that otherwise would have been too costly.

[3]Watkins and Doncaster, established in 1874, was run by Arthur Doncaster. He was completely deaf and speech impaired, communicating with customers through a slate, but he built up an extensive clientele. The firm still exists as a family business specializing in entomological equipment.

in secondhand-furniture shops eventually yielded an ancient but equally elegant mahogany insect cabinet with multiple drawers to house my specimens.

The firms that supplied my equipment for microscopy and entomology seemed locked in the Victorian era, which had ended 50 years earlier. Their letters were composed in an old and highly formal style and produced on well worn manual typewriters; generous applications of white-out concealed the many errors. The address on one package read "HStanks½", suggesting that staff biologists with limited typing skills handled shipping too.

The insect fauna of suburban England was limited by the high density of houses. Nevertheless, garden plants supported many kinds of insects, including cabbage white butterflies and other pests. The long-lived adults of vanessine butterflies were often observed too, especially red admiral (Figure 3) and peacock butterflies. Males of those two species hold territories and monitor them from patrols or perches. This trait favours repeated observation, so the species appealed to me. Their larvae feed chiefly on stinging nettle, a common weed.

Habitats inaccessible to the public (e.g., Figure 4) supported these and additional species even in suburbia. Further species occurred in some parks and other public areas that had not been regimented into lawns and formal plantings. One of my favourite collecting sites (Figure 5) was a grassland habitat thronged with butterflies (e.g., Figure 6). Many years later the butterflies were

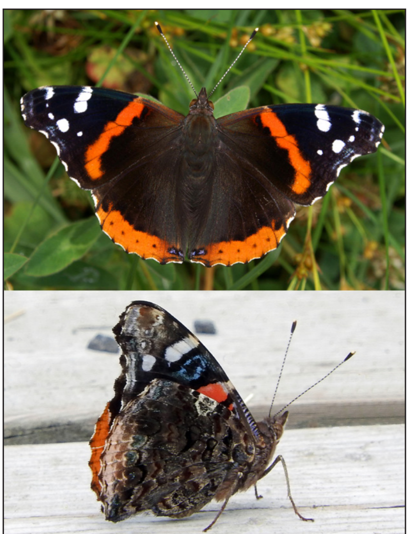

Kenneth Dwain Harrelson (CC BY-SA 3.0)
H. Danks

Figure 3. Red admiral butterfly, upperside (top) and underside. Wingspan about 5 cm.


H. Danks

Figure 4. A railway cut in England, which served to preserve habitats for some species of insects.


H. Danks

Figure 5. Grassy area in Richmond Park, Surrey, once a site rich in satyrid [satyrine], lycaenid, and other butterflies.

much less common there, apparently from general declines in the fauna as well as changes in vegetation.

Such impacts were inevitable in a densely inhabited country[4], and I developed an interest in conservation. Some of my zeal was directed against the mindless collectors of variation within butterfly species, who sought to amass hundreds of “vars” of the rarest species for the sole purpose of possessing varieties that others did not.

In a wider conservation context, ecological relationships intrigued me. For example, I had collected at Box Hill (Figure 7), part of an extensive area of chalkland known as the North Downs. Two attractive butterfly species in this habitat were the chalkhill blue (Figure 8) and the adonis blue; larvae of both species feed on horseshoe vetch, a plant of dry chalk and limestone soils. As in many species of lycaenids, the caterpillars are protected by ants, which thrived among the short vegetation on the dry, sunny slopes favoured by the butterflies. In the 1950s, rabbit populations were devastated by the myxomatosis virus, and the short turf could not be maintained without their heavy grazing pressure. The habitats were now shaded and cooler, so that ant populations declined. In turn, the blue butterflies, their life cycles dependent on well insolated slopes and on the ants, became much less numerous too.

Ecological interactions and the impacts of humans were confirmed in other ways. Taxation in the United Kingdom included estate duty (inheritance tax, death duty, or capital transfer tax), which served to reduce the assets of some of the long-established wealthy families. The rate varied, but increased during the 1960s to take as much as 80% of the

Figure 6. Small copper (top) and small heath butterflies. Wingspans about 3 cm.

Figure 7. Chalk downland at Box Hill, Surrey (shown in 2014).

Figure 8. Chalkhill blue butterfly, male. Wingspan about 3.5 cm.

[4]Currently, six species of British butterflies are considered extinct.

largest holdings. A number of country estates had to be sold to settle debts from these levies, and therefore additional land became available for development. One unforeseen result was the local elimination of some habitat-specific arthropods, as long-undisturbed old-growth woodlands were replaced by housing.

My activities soon expanded to encompass moths. I stayed outside throughout twilight to allow my eyes to adapt fully to the diminishing light, and could see noctuids and other moths at dusk as they whirred above the plants. There is no substitute for spending significant time on detailed field observations to understand the species under study.

After a time I also ran a light trap every night in the family garden. It used a mercury-vapour lamp supplied by Watkins and Doncaster, but the rest of the trap was home-made. Some creativity was required to make a strong, sealed, and weatherproof structure with cheap materials (although egg cartons provided cost-free refuges inside it for captured moths). The device was effective, but by no means elegant.

Observation of moths as they flew to the trap reinforced my understanding of the need to watch carefully for nuances of behaviour, including differences among species in how they reacted to the light. Moreover, some individuals attracted overnight would rest near the trap without entering it, but depart as the day grew brighter. Therefore, I began to check the surrounding area before sunrise to prevent the loss of prized specimens, and would wake up at dawn (before 5 a.m. for most of the summer!) without the need for an alarm. This manipulation of my biological clock had an unexpected benefit: the next hour or two could be used to prepare for the examinations important for progress in school and admission to university, and subsequently to digest university course material.

Insects were reared as well as captured. Eggs of exotic silkmoths (Saturniidae) were available from entomological suppliers, and the species favoured by amateurs had acquired popular names. The first species I reared (Figure 9) was called the “the squeaking silkmoth” because when larvae are handled they force air through the spiracles with a loud squeak, evidently to deter predators.

Rearing silkmoths exposed me to many new facts. Most striking were changes in the appearance of successive instars in some species (e.g., Figure 10), and increases in size as newly hatched larvae grew to thousands of times the volume before pupation.

Figure 9. The first species of saturniid reared by the author, the squeaking silkmoth (*Rhodinia fugax*, native to Asia): final-instar larva (top), about 7 cm long; and adult, wingspan about 10 cm.

Figure 10. The striking difference in size and appearance among instars of a silkmoth (the robin moth, *Hyalophora cecropia*, native to North America [known there as the cecropia moth]): top to bottom, first-instar larva (length about 0.5 cm); large larva; and fully grown final-instar larva (length about 11 cm).

Most caterpillars thrive when left alone to feed as much as possible, but do less well when fussed over or "helped" to transfer to new leaves. However, a few species—reared successfully especially by amateurs!—seem to profit from such fussing, including the "robin moth" (the larva shown in Figure 10), named after the red body of the large adult. Caring for many kinds of larvae taught me to pay attention to detail, and to consult references widely to find out the best ways to proceed. Plants in the garden, especially the lilac bush and the plum tree, suffered greatly as leaves were harvested to feed my larvae. Perhaps this abuse was tolerated because it meant that I was not getting into worse mischief elsewhere!

The importance of correct foodplants became evident not only for some of the large saturniids, but also during my attempt to rear silkworms (*Bombyx mori*) on lettuce rather than mulberry leaves. This trick had been noted in amateur circles, but in fact the alternative foodplant was barely capable of supporting growth, resulting in slow development and poor survival to the adult. Even so, those rearings showed how larvae spin their cocoons of commercial silk.

Many silkmoths emerge as adults over a protracted period, even in the wild, so that a male and a female seldom coincided to allow me to produce a subsequent generation. Another particular pairing difficulty is etched in my memory. *A Silkmoth Rearer's Handbook*, published in 1956, summarized relevant information for the African species *Cirina forda* as follows: "Both sexes emerge just before equatorial nightfall (1830 hrs), and fly within 2 hours. Male is very swift and dies within 48 hours. It will batter its wings to stumps and break its antennae in bullet-like flight against solid objects. Female will pour out eggs at first dawn whether paired or not." Nevertheless, I learned later that even some seemingly intractable species of insects are "easy to rear" once precisely correct artificial diets or culture conditions have been determined by a long series of exacting trials.

Native caterpillars collected out of doors were also reared to the adult stage—together with a disturbing array of braconid, ichneumonid, and chalcidoid parasitoids that emerged from some of them instead. To house caterpillars found during travel, I constructed a portable rearing cage that would collapse to fit easily into a pocket. It was used especially during the family seaside vacation as an alternative to simply sitting on the beach! More than once it was needed at home after too many caterpillars had been collected. Even when there were many caterpillars, however, maintaining them amidst the faint perfume of damaged leaves was a good deal more pleasant than the comparable chores my school friends complained about: looking after large mammalian pets that were substantially less fragrant...

The portable cage was made from recycled materials, and although it was effective (like my home-made light trap) it too was relatively crude. The collapsed cage fitted into a tobacco tin, and this container had a hole in the lid so that in an emergency it could hold a foodplant upright in water. The cage was covered by material sewn from a lightweight net curtain, and supported by tension in lengths of expanding curtain wire[5] that could be hooped over and hooked together. Years later, camping tents with flexible internal supports became available; these sophisticated structures were made of advanced materials, but even so relied on the same principle as my humble contraption.

The behaviour of bees and wasps in the garden eventually prompted me to study aculeate Hymenoptera too. Overwintered queen bumble bees searched assiduously for nesting sites in spring. Later, their workers joined butterflies and other insects on the flowers of a buddleia bush (Figure 11), while bees that had consumed too much of the copious nectar buzzed drunkenly

---

[5]Expanding curtain wire consists of a continuous, flexible, tightly coiled spring (about 0.5 cm in diameter) with a plastic outer covering.

on the ground below. Smaller mostly solitary bees, such as species of *Andrena* and *Halictus*, visited a range of other flowers. Solitary wasps searched for aphid prey on the plum tree that provided food for my silkmoth larvae[6]. Ripe fruits on that tree were chewed by yellowjackets, which earlier had scraped fibres from the wooden fence posts to masticate into pulp for their nests. The best way to see the adults of many small aculeates and other insects proved to be quiet observation of suitable habitats (where insects might arrive near the observer), rather than a frantic search.

One of my projects as a schoolboy (cf. Figure 12) was a synoptic collection of insects. The project earned a book prize, and my choice was Imms' *General Textbook of Entomology*. The most recent edition (1957) had been fully revised by O.W. Richards and R.G. Davies. At the time, I had no idea that those entomologists would be two of my lecturers at university, and one would supervise my PhD.

H. Danks

Figure 11. Buddleia bush in an English garden, its flowers commonly visited by butterflies, bumble bees, syrphids, and other insects.

I joined the Amateur Entomologists' Society (AES) and attended its annual exhibitions, which were consequential because many hundreds of amateur entomologists belonged to the society. I also submitted items for the AES Bulletin about conservation, the portable rearing cage, differences in size among larvae of the same cohort, and other subjects. An article on migratory flight tendencies in the small white butterfly, published in my final year at school (1962), might even qualify as "research": recording the flight directions of steadily flying individuals showed that the butterflies travelled mainly northward in June, but mainly southward after the beginning of August.

Given these pursuits, I decided to study entomology formally, and gained admission to the entomology department at Imperial College of the University of London, a setting recommended by friends of my parents. The next article in this series treats my period as an undergraduate there.

F. Woods

Figure 12. Author Hugh Danks, in a pose then in fashion among portrait photographers, when he was a 16-year-old amateur entomologist in England.

[6]In due course, my doctorate included work on aphid-hunting wasps.