Wider aspects of a career in entomology. 17. My introduction to Canada's fauna and environments

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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 and other entomological activities and some information about insects and their environments. This article recounts my introduction to the Canadian environment and to its insects—beginning with butterflies.

My arrival in Canada in 1968 exposed me to new landscapes, animals, and plants. The key to learning about them was being out in the field, and although much of my research on insect cold hardiness took place in the winter (see ESC *Bulletin* **50:** 25-29; **50:** 50–54; **53:** 186–194), the summer in particular allowed hiking and other activities in natural environments. Those experiences not only provided background information valuable for understanding the insect fauna, but also served as a means of relaxation from work and other responsibilities.

The first major explorations came during a camping holiday at Algonquin Park, Ontario, where I hiked along the park trails, and tried to catch fish from the shore. My angling technique proved to be better suited to observing insects than catching desirable fish!

Much freshwater angling in England targets "coarse fish" (mostly cyprinids, usually called minnows in Canada), using a bait suspended from a float that signals when to strike, or a bait on the bottom with an indicator on the line[1]. In contrast, the majority of target species in North America take large moving baits or artificial lures, and anglers move and re-cast frequently to try new places in the habitat. Float-fishing is commonly used to obtain panfish. In typical waters, bottom-fishing may catch suckers or catfish.

Ignorance of local angling practices had the benefit of introducing me to more than just minnows. Sitting still is an excellent way to see wildlife, because mammals, birds, and insects often come close to a stationary angler, but are scared away or overlooked by someone dashing about with a lure, or flailing the water with a float to snatch out sunfish. Indeed, one of my companions in England once declared that he wished the fish would stop biting, because they were interrupting his thoughts and observations of nature!

I decided to come to Canada partly because it has such a wide range of environments. That decision was validated by observations of the fauna whilst angling, and when hiking through various kinds of terrain—although unfamiliar mammals rather than insects impressed me initially.

[1]Common baits are earthworms, and blowfly maggots (called "gentles" by anglers), as well as such things as bread paste, cheese, and hempseed. Extreme fishing pressure means that older fish are very wary, including common carp, which in Canada are introduced pests easily caught should anyone want to do so. Opportunities in Britain to seek "game fish" (salmonids, originally reserved for the English gentry) are more limited.

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Figure 1. North American beaver. Length about 80 cm plus 25 cm tail.

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Figure 2. Dusk at Algonquin Park in 1969: a scene burned in my memory. It is also recorded in this old photograph, which includes a beaver swimming by (although in such low light only ripples were visible to the elementary camera).

During the first trip, a beaver (Figure 1) swam by as darkness fell (Figure 2). It thwacked the water in alarm with its tail when it noticed me. A few years later, interesting accounts of insects in beaver ponds were published by Canadian entomologists.

I had read about beavers and other mammals before actually sighting them. A day or two after the beaver encounter, noises at my campsite woke me at dawn. The tent (Figure 3) was a flimsy one with a separate groundsheet, allowing me to lift the side and peer out, expecting to see a raccoon raiding the garbage can. My eyes focussed, and the animal at the garbage can resolved into a black bear (Figure 4), which detected my movement, dropped down, and came towards me. I quickly pulled down the tent side and held it while the bear snuffled along the edge on the other side of the thin fabric, for what seemed like an eternity—prompting me to contemplate the fact that a half-awake camper inside a sleeping bag is defenceless …

Although the birds were more diverse than in the British Isles, most types were similar. For example, the white-breasted nuthatch (Figure 5), which eats mainly insects in the summer, has the same habits as the Eurasian nuthatch. The pileated woodpecker (Figure 6) feeds chiefly on carpenter ants, occupying the same ecological niche as its congener in Europe, the black woodpecker.

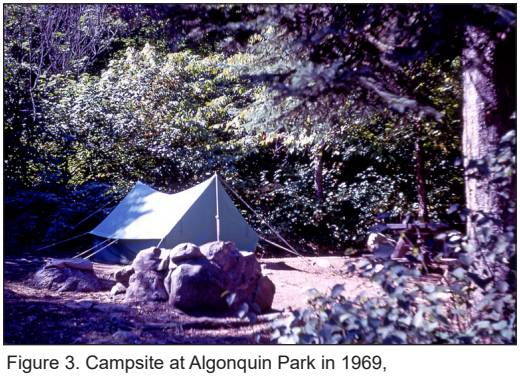

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Figure 3. Campsite at Algonquin Park in 1969, showing the tent referred to in the text.

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Figure 4. American black bear. Length about 1.5 m.


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Figure 5. White-breasted nuthatch. Length about 14 cm.


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Figure 6. Pileated woodpecker. Length about 45 cm.

Some other presumed correspondences were disappointing. The American "robin" is a hulking thrush with a reddish-orange breast, four times the weight of the European robin, a perky little bird that is more brightly coloured. Instead, characteristic of Canada to me, in the lakes and woods of the Canadian Shield that became so familiar, were the sounds of loons (Figure 7) and white-throated sparrows (Figure 8). Their calls sometimes helped to conceal the faint, but nonetheless unsettling, whine of mosquito wings.


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Figure 7. Common loon. Length about 80 cm.


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Figure 8. White-throated sparrow. Length about 17 cm.

Those early camping journeys and later more extensive travels in Canada introduced me to an array of different habitats. One striking trend, which would inform subsequent studies of the Canadian insect fauna, is the zonation from south to north as climates become colder (Figure 9).

I lived for a time near temperate deciduous forest in St. Catharines, Ontario, but my longest residence was in the boreal-deciduous transition (Great Lakes-St. Lawrence) forest around Ottawa. Experience of boreal habitats characteristic of northern Canada came at higher elevations, in northern Ontario, and in some eastern provinces; and arctic terrain was seen during fieldwork in 1969.

There are characteristic zonations from west to east too (Figure 10). They stem especially from differences in precipitation as westerly airstreams rise to cross the Cordillera, lose moisture, and then traverse the continent, and from differences in temperature governed by elevation and continentality. For example, temperate rainforest survives on the west coast where rain is abundant and temperatures are ameliorated by the ocean; prairie grasslands grow east of the

Figure 9 (right). A few characteristic habitats in Canada, from south to north. L and R from top to bottom: Deciduous (Carolinian forest); Boreal-deciduous transition (Great Lakes-St. Lawrence forest); Boreal (Balsam fir forest); Low Arctic (Tundra). High Arctic terrain is shown in ESC *Bulletin* **50**: 116–118; **50**: 174–177.

Figure 10 (below). A few other characteristic habitats in Canada, from west to east. L and R from top to bottom: Coastal (Old growth rainforest); Cordilleran (Mountain terrain); Prairie (Grassland); Eastern (Acadian forest).

Figure 11. A few characteristic aquatic habitats in Canada. L and R from top to bottom: Bog; Wetland; Boreal river; Canadian Shield lake.

mountains where rainfall is reduced; forests reappear still farther east as annual rainfall increases again.

Also striking, because much of Canada is well supplied with water, are many kinds of aquatic habitats that recur across huge areas. A few of them are shown in Figure 11.

My experience of all these different places was important for later attempts to characterize faunas in arctic, boreal, and other regions, analyze faunal patterns, and contribute to reviews of insects from bogs and other habitats. Normally, my hikes traversed established trails in parks, because exploring huge areas of similar terrain requires caution. Elsewhere, leaving trails or roads to enter areas of forest brings the risk of getting lost, because the trees are relatively homogeneous, and no distant landmarks are visible to help in navigation[2].

Bogs can be hazardous too, although the largest areas of muskeg were to the north. Beneath the thin floating layer of living sphagnum moss is a more or less deep foundation of decayed vegetation, water, and soil, sometimes with a water content exceeding 90%, even though the ground may look solid[3].

On this large-scale canvas of habitat types came my introduction to the Nearctic insect fauna. I had collected several kinds of insects as an amateur in England, but in Canada gathered only material for research. Nevertheless, casual observations continued, supplemented later with photographs, revealing mainly species that are common, large, and conspicuous. This approach favours colourful species like butterflies, many of which can be identified relatively easily. Because identification is the key to further knowledge, the observations not only reinforced my

[2]Therefore, even short journeys need at least a map and a compass. People who do get lost should sit down and assess the situation, rather than rushing back to where they think—usually erroneously—they will find the trail. Nowadays, however (unlike years ago), cell and even satellite phones, GPS units, and recharging devices are readily available.

[3]Here too, difficulties have to be met without panic, but it is unwise to press on thinking the terrain will get better, because it usually gets worse! Backing out slowly with as little extraneous movement as possible is the best procedure.

general entomological education, but also led me into comparisons with the British fauna, and further details about individual species. Many taxa proved to be much more diverse than in the British Isles, and all of the species had a story to tell or a lesson to offer.

A few insects were the same. There were cosmopolitan or Holarctic species, along with species introduced from Europe. Some were recognizable to genus, but the species were different. However, other genera and even families were new to me, especially outside the Lepidoptera.

Early encounters with butterflies included species that are relatively common in Canada but are rare vagrants in the British Isles. Treasured by amateurs there, they were accorded almost legendary status in my books about British butterflies.

One such species is the mourning cloak (Figure 12). It overwinters as an adult (and so was of interest in the context of cold hardiness) and is one of the earliest butterflies to appear in spring, often while snow persists. Adults live much longer than typical butterflies, 10 or 11 months, and even up to a year, and may aestivate as well as overwinter. Males mate with multiple females, and females lay several successive egg batches. The gregarious larvae eat the leaves of a variety of trees and shrubs.

In Britain the mourning cloak is called the Camberwell beauty, exemplifying the frequency with which multiple common names arise for the same species, and even for the same genus. For example, members of the genus *Colias* (e.g., Figure 13) are called yellows in Europe, but sulphurs (or sulfurs) in North America. This genus is of particular interest because so many features are sex linked. In Lepidoptera, the female is the heterogametic (XY) sex, and each female acquires its X-chromosome from the male parent. In *Colias* spp., that chromosome carries genes for a particularly wide range of traits, including mate-selection by females.

Later in the season, another “extremely rare” British vagrant species appears: the monarch butterfly (Figure 14), which is celebrated in North America for its long-distance migration southward in the fall, and movement northward


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Figure 12. Mourning cloak butterfly, the nymphalid *Nymphalis antiopa*. Wingspan about 7 cm.

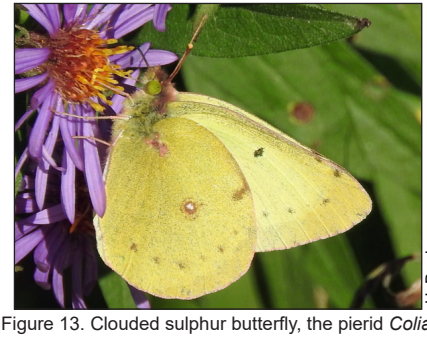
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Figure 13. Clouded sulphur butterfly, the pierid *Colias philodice*. Wingspan about 4.5 cm. The species is abundant and widely distributed in North America; larval foodplants are members of the pea family.


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Figure 14. Monarch butterfly, the danaine nymphalid *Danaus plexippus*: upperside (top); and underside. Wingspan about 10 cm. These individuals are taking salts and minerals from the substrate, as do many butterflies (including *Colias* spp.).

in spring through several generations. Warning colouration advertises to would-be predators that both larvae and adults are toxic from substances derived from milkweed, the larval foodplant.

A distinctive species is the painted lady butterfly (Figure 15). It is one of the most widely distributed butterfly species in the world, because it undergoes extensive migrations. Adults can live more than 2 months. Members of populations in southern Europe migrate seasonally thousands of kilometres to Africa, and then return to the north stepwise through multiple generations, in the same way as the monarch butterfly in North America. This itinerary is longer than the famous journey of the monarch. Larvae eat thistles and other plants in the same family. Adults fuel their constant activity by feeding avidly on nectar.

Large fritillaries are also conspicuous as they take nectar from flowers (e.g., Figure 16). The genus *Speyeria* is represented by 11 species in Canada, although there is only one in the British Isles. Larvae eat violets (*Viola* spp.). Eggs are laid near these plants, but the first-instar larvae enter diapause as soon as they hatch, and then overwinter. They start to feed only as hostplants begin to grow in spring.

The white admiral butterfly (Figure 17) is widespread, and sometimes abundant, in forests with deciduous trees (larval foodplants are willow, birch, and other species), and in forest edges and clearings. Adults live for months and, as in many nymphalids, males are territorial. Like other species (including Milbert's tortoiseshell, see below), the butterflies consume liquids from sap, rotting fruit, animal dung, and other sources, and are not limited to feeding at flowers. The poetic view—that fragile

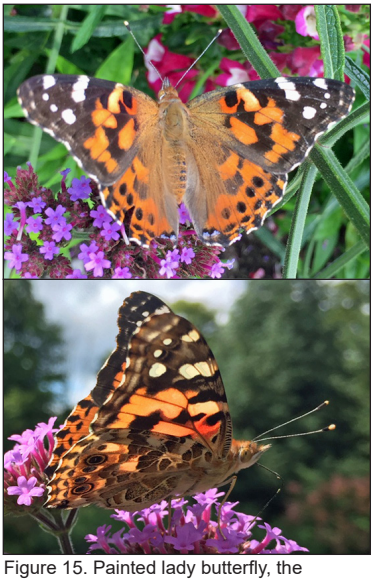

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Figure 15. Painted lady butterfly, the nymphalid *Vanessa cardui*, feeding on nectar: upperside (top); and underside. Wingspan about 6 cm.

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Figure 16. Aphrodite fritillary, the nymphalid *Speyeria aphrodite*: upperside (top); and underside. Wingspan about 6.5 cm.

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Figure 17. White admiral butterfly, the nymphalid *Limenitis arthemis*. Wingspan about 6 cm.

butterflies flit amongst attractive blossoms, fastidiously sipping nectar—is incomplete!

However, I was surprised to learn how much had been revealed about other ecological themes through research on species of the genus. Northern populations of *Limenitis arthemis* (the white admiral) are non-mimetic. Southern populations of the butterfly, a different subspecies (the red-spotted purple), mimic the pipevine swallowtail, *Battus philenor*. That poisonous and distasteful species is the model for a number of black-coloured harmless mimic butterflies (Batesian mimicry), including the red-spotted purple, and the black swallowtail. Furthermore, the two forms of *L. arthemis* interbreed where they overlap in Ontario, with complex implications that have assisted the understanding of both hybridization and the evolution of mimetic patterns. Another species of *Limenitis*, the viceroy (*L. archippus*) is one of a number of unpalatable species that mimic each other's warning patterns, to their mutual benefit (Müllerian mimicry)[4]. A pivotal member of that group is none other than the toxic monarch butterfly.

In Canada, Milbert's tortoiseshell (Figure 18) is widely distributed in moist areas, and represents the same genus as the small tortoiseshell butterfly that occurs throughout Eurasia. It is a strong flier, but regularly alights on the ground and basks with its wings spread flat, making it easy to observe, although it seldom permits a close approach. Adults survive the winter, sometimes in small groups. Larvae feed on nettles, and earlier instars make a communal silken web on the hostplant.

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Figure 18. Milbert's tortoiseshell butterfly, the nymphalid *Aglais milberti*. Wingspan about 5 cm.

There is only one species of swallowtail butterfly in England, the Old World swallowtail *Papilio machaon*, but Canada has 14 species, including *P. machaon*. The short-tailed swallowtail (Figure 19) is endemic to easternmost Canada. The species flies strongly, and often lives near the ocean: the butterfly shown in Figure 19 was on the shore in Newfoundland. Larvae feed on plants of the carrot and parsley family, and young larvae mimic bird droppings. The overwintering stage is the pupa.

Butterflies in the *P. machaon* group, which includes the short-tailed swallowtail, show extraordinarily complex variations[5]. The complexity evidently stems from differences in the historical composition of populations—chiefly reflecting the change and fragmentation of ranges during the Pleistocene—as well as from current gene flow. Separation, ecological and morphological divergence, and renewed contact created opportunities for hybridization, with a range of outcomes.

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Figure 19. Short-tailed swallowtail butterfly, the papilionid *Papilio brevicauda*. Wingspan about 6.5 cm.

Canada is an ideal place to investigate these phenomena because of its history of glaciations.

[4]The viceroy butterfly was once believed to be a palatable mimic, but more recently was shown to be relatively unpalatable.

[5]I was fortunate to be able to learn in real time about research on this variation (by Felix Sperling) during my travels on behalf of the Biological Survey.

Data about morphological characters, molecular markers, and ecological traits have been integrated to yield key insights into how hybridization may influence speciation. For example, the short-tailed swallowtail (*P. brevicauda*) resembles males of the black swallowtail (*P. polyxenes*), a species known for underside and female upperside mimicry of the pipevine swallowtail. In fact, however, *P. brevicauda* is more closely related to *P. machaon* and appears to be of hybrid origin.

Despite the great extent of similar terrain in Canada, many insects live only in particular subhabitats. The weakly flying eyed brown (Figure 20) is restricted to bogs and marshes, where its larvae feed on sedges. It overwinters in middle instars. Adults feed at sap, bird droppings, and so on, but less often at flowers, repeating a theme already noted for several species of nymphalids. A similar species with sedge-feeding larvae is virtually confined to adjacent woodland habitats.

Many of the species already mentioned are easy to recognize, giving me confidence that my knowledge of the fauna was increasing—but then I looked in more detail at skipper butterflies. About 50 species have been reported from Ontario alone! Species identification is exceptionally difficult in certain genera, and may even require dissection of the genitalia. Several native species are common (e.g., Figure 21), and so is the introduced European skipper[6], which overwinters in the egg stage (other skippers overwinter as larvae). A few species are rare vagrants. Many skippers feed on grasses, but some eat leguminous or other plants. Taxonomic advances continue to be made in this group—and also in other butterflies. For example, among the "blues" is the widespread northern azure (Figure 22). Larvae feed on the flower buds and flowers of various shrubs. After overwintering in the pupal stage, the species emerges in spring. However, it has a second generation in summer with a different phenotype, often treated (until recently) as a different species. Some larvae develop in eriophyid mite galls on cherry leaves, but these butterflies too appear to be northern azures rather than a separate taxon.

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Figure 20. Eyed brown butterfly, the satyrine nymphalid *Lethe eurydice*. Wingspan about 4.5 cm.

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Figure 21. Hobomok skipper butterfly, the hesperiid *Poanes hobomok*. Wingspan about 3 cm.

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Figure 22. Northern azure butterfly, the lycaenid *Celastrina lucia*. Wingspan about 2.5 cm.

[6]The European skipper (*Thymelicus lineola*), introduced more than a century ago into Ontario from England (where it is known as the Essex skipper), is now widespread as a pest of timothy grass in pasture and hay crops.

A species distinguished relatively recently from a similar one is the northern crescent butterfly (Figure 23), which overlaps widely in southern Ontario with the closely related pearl crescent; both species are quite variable. Caterpillars eat the leaves of asters, and overwinter half-grown. Adults are widespread in a variety of habitats, and often visit flowers. They have a characteristic flap and glide style of flight.

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Figure 23. Northern crescent butterfly, the nymphalid *Phyciodes cocyta*. Wingspan about 3.5 cm.

These explorations of Canadian butterflies showed how much could be learned about the fauna by simply paying attention. Everything I saw or followed up taught me something interesting about larval foodplants, habitats, behaviour, adult feeding, mimicry, variation, ranges, or other topics. The overwintering stage, although fixed in a given species, might be the egg, larva (in early, middle or late instars), pupa, or adult. It was surprising that even for a group as well known as the butterflies, and even among common and conspicuous species, ongoing taxonomic updates are required.

Many insects in addition to butterflies were noticed on my camping and hiking expeditions, of course. Some of them will be referred to in the next article in this series.