

The Lepidoptera Families and Associated Orders
of British Columbia

G.G.E. Scudder and R.A. Cannings
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Introduction

This final contribution to the families of insects in British Columbia, considers the remaining Orders of the Endopterygota. Those considered do not form a single natural group within the currently recognized phylogenetic classification of the extant insects (Kristensen 1991). However, included are the Section Neuropterida (= Neuropteroid Orders) namely the Orders Megaloptera (dobsonflies and alderflies), Raphidioptera (snakeflies), Neuroptera (lacewings and allies) and part of the Section Mecopterida (= Panorpid Orders), namely the Orders Mecoptera (scorpionflies), Siphonaptera (fleas) and Lepidoptera (moths and butterflies). We also include the Order Strepsiptera (stylops), the affinities of which remain enigmatic.

Figures in each family illustrate a representative species within the family.

Reference

Kristensen, N.P. 1991. Phylogeny of Extant Hexapods, pp. 125-140 (in) *The Insects of Australia*, Second Edition, Volume 1. Cornell University Press, Ithaca, NY.

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Order MEGALOPTERA (Dobsonflies and Alderflies) (Figs. 1 & 2)

Description

Megaloptera: from the Greek *megalo* = large, to fold, and *ptera* = wings.

Medium to large, soft-bodied insects. The head is prognathous, with mandibulate mouthparts. The antennae are slender, multisegmented, and filiform, moniliform, serrate, pectinate or flabellate. The head may or may not have ocelli. The pronotum is subquadrate in dorsal view. The wings are relatively large, are held roof-like over the abdomen when at rest, and are often pigmented. The longitudinal wing veins are normally unbranched at the wing margins, and the hind wings are characteristically broader than the fore wings and with a large anal area. The legs are cursorial and unmodified, with 5-segmented tarsi. The abdomen lacks terminal cerci.

Adults have a slow, clumsy flight, and either do not feed or at most feed on small quantities of nectar or fruit juices.

Larvae are aquatic and predaceous with biting mouthparts, a distinct labrum and maxillary palps. They are elongate, with characteristic lateral abdominal filaments, but they do not spin cocoons.

There are two extant families.

Key to families of MEGALOPTERA

1. Head with 3 ocelli; fourth tarsal segment cylindrical CORYDALIDAE
- Head without ocelli; fourth tarsal segment bilobed SIALIDAE

Description of Families of MEGALOPTERA

Family Corydalidae (Dobsonflies or Fishflies) (Fig. 1)

Large insects with wing span usually greater than 45 mm, but often up to over 140 mm. Generally grey or blackish in colour with mottled or banded wings. Head with three ocelli, and mandibles sometimes sexually dimorphic. Antennae filiform, moniliform or pectinate, and submentum and gula Y-shaped. Legs with unmodified, cylindrical fourth tarsal segment on each.

Adults are usually crepuscular, and often attracted to light. The ovoid eggs with prominent, knobbed micropyle (or projection), are laid in masses on objects near water. Egg masses may be one to five layered, and with 300 to 3000 eggs. Larvae are aquatic and aggressively predaceous.

Western species have larvae that live on the bottom of fast flowing streams. They characteristically have eight pairs of lateral abdominal projections that function as gills, and the

abdomen ends in a pair of two strong hooks. Evidently, most species take two to five years to complete the life cycle.

Worldwide there are some 16 genera with about 200 mostly temperate species. Seven genera and 19 species occur in North America, with five genera and five species in two subfamilies known from Canada.

The only representation of the Corydalinae, *Corydalus cornutus* (Linnaeus) in Canada is restricted to Quebec, and is easily recognized by the size (wing span 140 mm) and sexual dimorphism, with male possessing elongate, sickle-shaped and tusk-like mandibles that are about 40 mm long. Such males have been seen to “dual” with each other, and to prod the female during courtship. The larvae, commonly called “hellgrammites” feed on invertebrates, small fish, and amphibia, and are often used as fish bait.

Four genera in the subfamily Chauliodyinae, each with a single species, occur in Canada. *Nigronia serricornis* (Say) occurs in Manitoba and Saskatchewan, is 20 to 30 mm long, with serrate antennae, and wings blackish with white markings. The species is uncommon, and larvae live in stagnant water. *Chauliodes pecticornis* (Linnaeus), *Dysmicohermes disjunctus* (Walker) and *Protochauliodes spenceri* Munroe in Canada are confined to British Columbia.

Chauliodes pecticornis, reported so far only from Cloverdale and Cowichan, is a greyish, mottled species with characteristic pectinate antennae. The widely distributed *Dysmicohermes disjunctus*, recorded from Vancouver Island, the lower mainland, as well as Bella Coola, Ocean Falls, Oliver and Kaslo, is 50 to 60 mm long, and has the mesothorax and metathorax densely clothed with curly setae, which appear almost woolly. The gena are angulate, and the mandibles are prominent, while the fore wings have dark blotches on the costal and subcostal veins. *Protochauliodes spenceri* is mostly found on southern Vancouver Island, although there have been specimens collected at Cultus Lake. Adults are 30 to 35 mm long, with the mesothorax and metathorax at most with sparse, fine, grey setae. The gena are smoothly rounded, the mandibles are not prominent, and the fore wings are at most spotted on the costa and subcosta. All three species also have distinctive wing venation, but the differences are not easy to detect. *Chauliodes pecticornis* and *Protochauliodes spenceri* are considered to be rare in the province.

Family Sialidae (Alderflies) (Fig. 2)

Medium-sized insects, 10 to 15 mm long. Rather uniform in appearance, smoky to black in colour. The head with chewing mouthparts, may have orange to black markings, but lacks ocelli. The antennae are filiform to moniliform, and the submentum and gula are parallel-sided. The legs have the fourth segment of the tarsus bilobed.

Adults are diurnal, and have a slow and awkward flight. They rarely occur more than a few metres from water, and can often be found resting on alders near streams. Courtship involves communication by abdominal drumming in some species.

Eggs are laid in rows or masses on objects near water. The aquatic larvae are predaceous bottom-dwellers, and have been found burrowing into the mud and detritus of lake or stream bottoms, particularly where the floor is covered with vegetation, such as *Phragmites*. They feed

on aquatic arthropods, and characteristically have seven pairs of segmented lateral appendages, and an abdomen terminating in a long median process tapering to a fine point. There are no anal prolegs or abdominal tufts of gills. The life cycle is typically one or two years.

Worldwide there are four genera and 50 to 60 species. The Sialidae is a cosmopolitan taxon, well represented in the Holarctic and the Australian region. The only genus present in North America is the Holarctic *Sialis*, with 24 species reported from the Nearctic. Twelve of these species occur in Canada, with six known from British Columbia. Species are very difficult to tell apart, and identification depends on characters in the male genitalia.

The commonest and most widely distributed species in British Columbia is *Sialis rotunda* Banks, recorded from southern Vancouver Island, the lower mainland, and the Okanagan. *Sialis californica* Banks is less common, but occurs in the same areas. *Sialis veleta* Ross also occurs in the Okanagan Valley, having been collected at Osoyoos, Penticton and Salmon Arm, but it is also known from the Petitot River on the Liard Highway. The other three species in the province are quite rare. *Sialis hamata* Ross has only been recorded from Creston, and *S. joppa* Ross is known from only Cowichan Lake and Vernon. *Sialis concava* Banks also occurs in British Columbia, but the precise location is not recorded.

ORDER RAPHDIOPTERA (Snakeflies) (Figs. 3 & 4)

Description

Raphidioptera: from the Greek *raphid* = needle, and *ptera* = wings.

Small to medium sized, elongate and fragile insects. Head prognathous with large eyes and biting, mandibulate mouthparts. The antennae are long, slender and filiform, and the head may or may not possess ocelli. The prothorax is very characteristic, being slender, cylindrical and neck-like, being as long as or longer than the length of the pterothorax. This gives these insects a rather snake-like appearance, hence the common name.

The fore wings and hind wings are similar, lack an extensive anal fan, and are held roof-like over the abdomen when at rest. The fore wings possess a distinct pterostigma. The legs are not specialized, and have a 5-segmented tarsus. Cerci are absent, and females possess a long, slender, exserted ovipositor.

Adults can be found in early spring, and fly only a short distance. They feed actively on small bodied insects, including their own congeners if put together. They are also reported to take nectar.

Abdominal vibration is usually a component of the courtship behaviour. Females use the ovipositor to deposit eggs singly or in small batches in bark, crevices, debris or under the body of mature scale insects. The elongate larvae are terrestrial, with mandibulate, chewing mouthparts. They live in bark crevices, or in areas with dead leaves or debris. They are aggressive predators, feeding on small arthropods. Pupation takes place in dead leaves, debris or crevices. There is no cocoon. And the pupa is free-living, active and able to use its mandibles.

The group is primarily Holarctic, and in North America is confined to the west of the eastern slopes of the Rocky Mountains.

Worldwide there are two extant families.

Key to families of RAPHDIOPTERA

1. Head with ocelli; fore wing with pterostigma bisected by a veinlet..... RAPHIDIIDAE
- Head without ocelli; fore wing with pterostigma not bisected by a veinlet . INOCELLIIDAE

Description of Families of RAPHDIOPTERA

Family Inocelliidae (Inocelliid snakeflies) (Fig. 3)

Inocellids are typical snakeflies without ocelli. The antennal segments are cylindrical, and the pterostigma of the fore wing is dark and thick, and not bisected by a veinlet.

Worldwide there are two genera and 25 species. Only one genus *Negha*, with three species occurs in North America. There is only one species *Negha longicornis* (Albardi) in Canada, confined to British Columbia, and occurring only in the southern interior. It is relatively rare.

Family Raphidiidae (Raphidiid snakeflies) (Fig. 4)

Raphidids are typical snakeflies with ocelli. The antennal segments have a basal constriction, and the pterostigma of the fore wing is bisected by a veinlet.

Worldwide there are three genera and 75 described species. Only the genus *Agulla*, with 17 species, occurs in North America. Seven species occur in Canada, all of which occur in British Columbia, with three species, namely *Agulla adnixa* (Hagen), *A. assimilis* (Albarda), and *A. herbst* (Esben-Petersen) also known from Alberta. *Agulla adnixa* is the commonest species in British Columbia, reported from Vancouver Island, the lower mainland, and the whole of the southern interior. *Agulla bicolor* (Albarda) is confined to the South Okanagan, while *A. crotchi* Banks is rare, and recorded only from Summerland. *Agulla assimilis* and *A. herbst* occur on Vancouver Island and in the southern interior, while *A. unicolor* Carpenter seems to be confined to the latter.

ORDER NEUROPTERA (Lacewings and Ant-lions) (Figs. 5-16)

Description

Neuroptera: from the Greek *neuron* = a nerve, and *ptera* = wings.

Small to medium sized insects, 2 to 120 mm long. Body form and appearance quite varied. Head prognathous with mandibulate mouthparts. Lacking ocelli in families in British Columbia. Prothorax usually short, and shorter than combined length of the mesothorax and metathorax. If prothorax long, then forelegs raptorial. Fore wings and hind wings membranous, equal or subequal in size and narrowed at base, and held roof-like over the abdomen when at rest. Venation, if not reduced, with main longitudinal veins branched at wing margins, and wings with many cross-veins. If venation reduced, then insects either covered with a whitish powder (Aleyrodidae) or with an elongate pronotum and raptorial forelegs (Mantispidae). Legs usually cursorial, except in Mantispidae. Abdomen without cerci, and usually without a long ovipositor in the female (except in the Mantispidae).

Adults are primarily, but not exclusively crepuscular or nocturnal. They may have complex courtship and mating rituals.

Larvae are predaceous, usually with piercing and sucking mouthparts. Most spin silken cocoons.

Worldwide there are some 17 families, eight of which occur in British Columbia.

Key to families of NEUROPTERA

1. Wings with few veins and less than 10 closed cells; small to minute insects covered with white exudate CONIOPTERYGIDAE
- Wings with numerous veins, and more than 10 closed cells; body without white exudate ... 2
2. Forelegs raptorial; prothorax elongate MANTISPIDAE
- Forelegs not raptorial; prothorax subquadrate or slightly longer than broad 3
3. Antennae clubbed MYRMELEIONTIDAE
- Antennae not clubbed, but filiform, moniliform, or pectinate 4
4. Wings with numerous crossveins between vein R_1 and R_S , or R_5 arising from 2 or 3 stems. 5
- Wings with 1 to 4 crossveins between R_1 and R_S 6
5. Fore wings with some costal crossveins bifurcate; body and wings usually brown
..... HEMEROBIIDAE
- Fore wings without bifurcate costal crossveins; body and wings green or brown
..... CHRYSOPIDAE

6. Fore wings with about 15 parallel branches of R_5 ; wingspan at least 40 mm.....
POLYSTOECHOTIDAE
 - Fore wings with 4 to 7 branches of R_5 ; wingspan less than 30 mm..... 7
7. Fore wings with some costal crossveins bifurcate; gradate vein present BEROETHIDAE
 - Fore wings without bifurcate crossveins; graduate vein absentSISYRIDAE

Description of Families of NEUROPTERA

Family Berothidae (Beaded Lacewings) (Fig. 5)

Small to medium sized insects, with 15 to 30 mm wingspans. Head with moniliform antennae. Prothorax short, and forelegs simple and not raptorial in Nearctic species. Fore wings falcate, with concave outer margin. The wing venation of the fore wing has only a simple radial sector, with all branches of radial sector arising from the fourth vein. There are one to four crossveins between R_1 and R_5 . The costal vein is simple, with some costal crossveins bifurcate. The humeral crossvein is simple, and a graduate vein is present. Females characteristically have seed-like scales and long setae on the wings, usually with encrusted secretions on the setae. Scales are never present in males, which have an intricately coiled, protrusible intromittant organ within the abdomen.

Females lay stalked eggs on wood surfaces, often near wood termite nests. Larvae are inquilines in dry wood termite and ant nests, where they feed by injecting a paralyzing chemical into the termite or ant prey, and then suck out the body fluids of the immobilized insects.

Worldwide there are 25 genera and 57 described species, distributed throughout the warmer regions of the world. The family is very diverse in Australia, with six genera and 19 species.

There is only one genus *Lomamyia* in North America, with 10 described species, all of them relatively rare and little known. Only one western Nearctic species, *L. occidentalis* (Banks) occurs in Canada, restricted to British Columbia. It is only known from the Lytton area and Penticton.

Family Chrysopidae (Green Lacewings) (Figs. 6-8)

As the common name implies, most chrysopid adults are green with golden eyes. However, some genera are predominately brown or black. Green lacewings usually have red or dark markings, and the green colouration usually fades soon after death. Adults are 10 to 25 mm long, with long and filiform antennae. The prothorax is short, and the forelegs non-raptorial. The fore wings lack bifurcating costal crossveins, and the humeral crossvein is simple. There are numerous crossveins between veins R_1 and R_5 , or R_5 arises from two or three stems. The wing cells are glassy transparent, and without microtrichia.

Adults have a clumsy flight, and are often attracted to light at night. Many species can produce a noxious smelling fluid from their prothoracic glands. Mating is nearly always preceded or accompanied by abdominal vibrations, and this courtship song is species specific.

Members of the subfamily Chrysopinae characteristically have a tympanal receptor for detecting the ultrasound signals of bats, so are somewhat protected from bat predation.

Adults lay stalked eggs singly on vegetation, and larvae are active, searching predators, especially on aphids. Most exhibit trash-carrying behaviour, which is accomplished by having dorsolateral setigerous tubercles and hooks, and glandular setae on the body. Most larvae are associated with plants, but a few species live in terrestrial leaf litter. When mature, larvae spin a compact, very closely woven silky cocoon, that may incorporate debris and broken setae in the trash-carrying forms.

Recently, in many parts of the world, green lacewings, particularly members of the *Chrysoperla carnea*-group, have been used in biological control of plant lice on agricultural crops. While most species of green lacewing can readily be recognized and identified by colour pattern and markings, wing venation, and genitalia characteristics, there are a number of cryptic species in the genus *Chrysoperla* that are morphologically indistinguishable, but really are good biological species as judged by their mating behaviour and courtship songs. Of course, such sibling species cannot be identified from dead and preserved specimens. Without having live sexually receptive insects, it is not possible to recognize these species. Furthermore, it is now known that there is convergent evolution of courtship songs among many of the species in the *Chrysoperla carnea*-group. Thus, in this account, the *C. carnea*-group is considered as a single entity, namely *C. carnea* (Stephens) *sensu lat.*

Worldwide the family Chrysopidae contains 75 genera and about 1200 species. Identification of some of the genera depends on genitalia characters, this requiring dissection. The North American fauna consists of 15 genera and 81 described species, of which nine genera and 24 species are listed for Canada. So far, seven genera and 17 species are recorded from British Columbia, if the *Chrysoperla carnea*-group is taken to be a single species. Eight of the Canadian species occur only in British Columbia, five being rare.

The composition of the British Columbia chrysopid fauna is *Chrysopa* (7 sp.), *Chrysoperla* (1 sp.), *Dichrochrysa* (1 sp.), *Eremochrysa* (2 sp.), *Meleoma* (4 sp.), *Nineta* (1 sp.) and *Nothochrysa* (1 sp.). *Eremochrysa punctinerius* (McLachlan), *Dichrochrysa perfecta* (Banks), and *Meleoma schwarzi* (Banks) known only from the southern interior, or the South Okanagan in the case of the latter two species, are regarded as rare. Likewise, *Nineta granda* (Banks) and *Nothochrysa californica* Banks, confined to Vancouver Island in the case of the former, and Vancouver Island, the Gulf Islands and the lower mainland in the case of the latter, are also rare.

Family Coniopterygidae (Dustywings) (Fig. 9)

Very small, 2 to 3 mm long, slender pale insects, with legs, wings and body covered with whitish or light greyish powder, secreted by hypodermal glands in the terga and sterna. Head hypognathous, with relatively large eyes, but lacking ocelli. Antennae filiform with from 16 to 57 segments.

Prothorax weakly sclerotized, pterothorax well sclerotized. Wings with venation reduced, consisting of few longitudinal veins and crossveins. Costa of fore wing much reduced and visible

only at its base. Subcosta running parallel with fore margin distally furcate, with posterior branch resembling a crossvein, and apically looking like terminal part of radius. Radial sector at most forking once. Wing-coupling involving hamuli-like hooks. Legs slender with 5-segmented tarsi. The abdomen is only weakly sclerotized.

Adults are quite active around dawn and dusk, but have a low dispersal ability, although they are fairly long-lived. They are mostly found on bushes or trees, and some are associated with particular types of vegetation or even single species of bush or tree, such as conifers. Some are attracted to light.

Eggs are laid usually singly, but sometimes in twos or threes, on bark or leaves. The larvae are fusiform in shape, widest anteriorly. They have straight, needle-like jaws, and like the adults feed on adults and larvae of small, relatively inactive arthropods, such as aphids, scale insects, and mites. They thus may be useful in the biological control of such invertebrates.

Worldwide there are 23 genera and 423 described species, with these insects occurring in all regions of the world. So far eight genera and 55 species are reported in North America, with four of these genera and 10 species known from Canada. To date, four genera and nine species have been recorded from British Columbia, namely *Conipteryx* (2 sp.), *Conwentzia* (3 sp.), *Helicoconis* (2 sp.) and *Semidalis* (2 sp.). Five species, *Conwentzia californica* Meinander, *C. psociformis* (Curtis), *Helicoconis californica* Meinander, *H. similis* Meinander, and *Semidalis angusta* (Banks), in Canada only occur in British Columbia. At the moment, *Helicoconis similis* is listed as endemic, known only from the top of Moyie Mountain in the Kootenays.

Family Hemerobiidae (Brown Lacewings) (Figs. 10 & 11)

Adults, typically 6 to 12 mm long (rarely 2 to 3 mm), are predominantly brown or blackish in colour, although some species appear golden or even iridescent. The head possesses filiform antennae and the prothorax is short. The forelegs are non-raptorial. The wings are usually rather broad, and the fore wings typically have some costal crossveins bifurcate. Veins R₅ and MA characteristically are fused with R in the fore wing to give the appearance of having multiple radial sectors.

Adults are largely crepuscular or nocturnal, often attracted to light. They are mostly associated with trees or bushes, where they feed on aphids, mealy bugs and mites. Eggs are unstalked and laid in small batches. The larvae are elongate, small-headed, and lack prominent setose tubercles. They are to be found on trees and low herbage, preying on the same food as the adult. When mature they pupate having formed a loosely constructed, double-walled cocoon.

Worldwide there are about 80 genera and over 800 described species. So far six genera and 61 species have been reported in North America, with all six genera and 41 of these species known to occur in Canada. So far all six North American genera are known from British Columbia, containing 33 species, six of which are confined to this province. The provincial fauna consisting of *Hemerobius* (13 sp.), *Megalotomus* (2 sp.), *Micromus* (7 sp.) is little studied, but at least four species in the Okanagan, namely *Micromus subanticus* (Walker), *Symphorobius californicus* Banks, *S. killingtoni* Carpenter, and *Wesmaelius pretiosa* (Banks) appear to be rare.

Family Mantispidae (Mantidflies) (Figs. 12-13)

Mantidflies are distinctive, medium-sized insects (about 15 to 25 mm long in BC), often with colourful bodies and sometimes with marked wings. The most striking features are the mantid-like extension of the prothorax and the enlarged, raptorial forelegs. The head is mantid-like and triangular when viewed from the front, with the large eyes well separated. The antennae consist of many bead-like segments and are shorter than the prothorax. The ratio of least width to greatest width of the prothorax (in Canadian species) ranges from about 0.1 to 0.4. In the foreleg the coxa is enlarged and is at least as long as the swollen, spined femur; the tibia is curved, fitting tightly against the femur. The mid and hind legs are slender and unmodified. Unlike those of the mantids, the fore and hind wings are similar in size, shape and texture.

Adults of the Mantispidae, as their name suggests, resemble the mantids of the Order Mantodea. However, the two groups are only distantly related in the Insecta, the superficial resemblance is the result of convergent evolution. There are many differences, the most obvious is that mantispids have a pupal stage while the mantids do not. The adults are predators of other small insects. Canadian mantispid species belong to the Subfamily Mantispinae, whose larvae all apparently develop by feeding on spider eggs. The biology of most other mantispids is more poorly known, but at least some retain the original larval habit of general predation. Clutches of about 200 to 2000 stalked eggs are laid on leaves, branches and other objects. In the Mantispinae, the first stage larvae are active and find spider eggs by searching for, and penetrating, egg sacs or by boarding a female spider and entering the egg sac as it is constructed. In some species studied, one of these two behaviours is obligatory, although in two species known from eastern Canada, *Dicromantispa sayi* (Banks) and *D. interrupta* (Say), apparently either is possible. The larvae of the two BC species, *Climaciella brunnea* (Say) and *Leptomantispa pulchella* (Banks), board spiders and feed on their blood before entering the egg sacs. *Climaciella* usually attacks lycosid spiders; *Leptomantispa* boards spiders of several families, but mostly anyphaenids and salticids. Once inside the egg case, which is its sole source of food during development, the larva becomes grub-like. When feeding and growth is complete, pupation occurs inside the egg case.

The Mantispidae is a small family of about 488 described species in 39 genera worldwide. About 15 species are recorded in North America; two of these live in BC -- *Climaciella brunnea* (Say) and *Leptomantispa pulchella* (Banks). The former species is the more widespread in the province, ranging across the southern lowlands from Vancouver Island to the East Kootenays. It is also recorded east to Quebec and south to Costa Rica. In BC *Climaciella* is usually collected in grasslands or in the edges of dry Douglas-fir or Ponderosa Pine forests. The adult is patterned in brown, yellow and black; the front halves of the wings are brown. The similarity of its coloration is to that of the paper wasp. *Polistes fuscatus* is striking. The mantispid is probably a mimic of the wasp; in BC, at least, the ranges of the two insects are almost identical. *Leptomantispa pulchella* ranges from the Okanagan Valley of BC and extreme southern Ontario over much of the United States and south to Costa Rica. It is smaller and more delicate than *Climaciella*. Its body is yellow with black or brown markings; the wings are clear except for the orange pterostigma. *Leptomantispa* has seldom been collected in BC; it has usually been found in or near Ponderosa Pine woods.

Family Myrmeleontidae (Ant-lions) (Fig. 14)

Medium to large insects, 35 to 80 mm long, somewhat resembling damselflies. However, the antennae are short, about as long as the combined length of the head and thorax, and with a distinct, clubbed apex. The head lacks ocelli, the pronotum is short and broad, and the forelegs are not raptorial. The wings are narrowly elongate, transparent or mottled with brown or black. They have many crossveins and branches along the margin. Typically the wings usually have an elongate, narrow cell immediately behind the point of coalescence of veins. Sc and R₁. The abdomen is long and thin.

Adults have a weak, fluttering flight, and are thought to feed on small insects. Although some are day-active, most are crepuscular or nocturnal, and frequently come to light at night. Courtship and mating of adults evidently has never been described. Eggs apparently are laid singly, in soil or sand.

As a whole, the larvae in this family are quite variable in form and habit, but all have powerful curved jaws. The larvae of some tribes in the subfamily Myrmeleontinae, are the familiar “ant-lions”, that excavate conical pitfall traps for catching ants. Such larvae have a narrow dished head, and a peculiar vertically oriented neck area, both adaptations for throwing sand up and out of pits during their construction or for prey capture. Other larvae, that do not form pitfall traps, live under or on the soil surface, in debris, rock crevices, caves or tree-holes. Pupation occurs in sand or soil, inside spherical cocoons.

Worldwide there are 201 described genera and 1522 species. These occur in all the warmer, drier regions of the world, but also can be found in moist, forested regions. So far 17 genera and 93 species are known from North America, with four genera and six species reported from Canada. *Brachynemurus abdominalis* (Say), the commonest species in British Columbia, is found throughout the southern interior, and is also known from Manitoba and Ontario. The only other species in eastern Canada, reported only from Ontario is *B. nebulosus* (Olivier). The other four species in British Columbia, namely *Brachynemurus ferox* (Walker), *Dendroleon speciosus* Banks, *Myrmeleon exitialis* Walker, and *Scotoleon pregrinus* (Hagen) are confined to this province in Canada. All four occur in the southern interior, with *Dendroleon speciosus* and *Myrmeleon exitialis* also known from Vancouver Island, the latter being the commonest here and on the Gulf Islands.

Family Polystoechotidae (Giant Lacewings) (Fig. 15)

Large and distinctive lacewings, with wingspan from 35 to 75 mm. The head has long, filiform antennae, but no ocelli. The prothorax is short, but broad, and the forelegs are not raptorial. The wings are dusky with the costal and marginal areas provided with many forked veinlets. The humeral crossvein is recurrent and branched. The fore wing characteristically has the subcosta (Sc) fused to R₁ apically, and the wings have only one discal and one marginal series of distinct gradate veins.

Adults are predaceous and nocturnal, often attracted to light. However, little else is known about their biology. The larvae are evidently terrestrial and predaceous.

The family is confined to the New World, with only three described monotypic genera, namely *Fonticelia* from Chile, *Platystoechotes* from California, and *Polystoechotes* known from across temperate North America and as far south as Panama. *Polystoechotes punctatus* (Fabricius) occurs in Alaska, and in Canada is known from Alberta, British Columbia, Ontario, and Quebec. In BC it occurs on Vancouver Island and across most of the mainland.

Family Sisyridae (Spongilla-flies) (Fig. 16)

Adults are very similar to brown lacewings, and are 6 to 8 mm long. The head has long filiform antennae, and lacks ocelli. The prothorax is short and broad, and the forelegs are not raptorial. The wings are broad with relatively few crossveins, and with cells translucent and with microtrichia. The fore wings have only a few elongate radial and medial cells, and there is a small enlargement or expansion of the marginal vein between the ends of the veins. A gradate vein is absent.

Adults usually occur in late summer, and although frequently found near freshwater, can occur at light often far from water. Eggs are laid in small clusters above water, and larvae fall directly into water on hatching. The aquatic larvae live in and feed on freshwater sponges. They have very elongate and rather thin sucking jaws, which are very flexible and able to probe and suck out contents of cells of sponges. Second and third instar larvae have seven pairs of segmented, transparent, ventral abdominal gills for respiration. The legs are slender and always have a single claw. The first instar larvae lack gills. When matured and ready to pupate, larvae leave the water and spin a double silk cocoon on a tree trunk, or some other object near the water.

Worldwide there are three genera and 48 described species. The genus *Climacia* is confined to the New World and contains 11 species. *Sisyra* is cosmopolitan with 34 described species, while *Sisyrina* with just three species occurs in Africa, Asia, and Australia. The two genera, *Climacia* and *Sisyra* that occur in North America, occur in Canada. Although six species are known from North America, only three occur in Canada, with *Climacia areolaris* (Hagen) known only from Ontario and Quebec. The other two species, *Sisyra fuscata* (Fabricius) and *S. vicaria* (Walker) also occur in British Columbia.

Order MECOPTERA (Scorpionflies) and their relatives (Figs. 17 & 18)

Description

Mecoptera: from the Greek *mekos* = length, and *ptera* = wings. The wings of most mecopterans are long and rather narrow.

Mecopterans are small to large insects; boreids can be as small as 2 mm long and some bittacids are over 25 mm long with wingspans of over 50 mm. The body is usually slender and soft. Most species have a distinctive, down-turned, beak-like prolongation of the front of the head with biting mouthparts at the tip. In some Nannochoristidae the mouthparts are specialized for sucking. The compound eyes are large and all families except the Meropeidae and Apteropanorpidae have ocelli. The antennae are long and thread-like, usually about half the body length, with about 16 to 60 segments. Most mecopterans are winged, but some have the wings reduced or absent. Fully winged forms have two pairs of long, rather narrow, membranous wings, with the fore and hind wings similar in size, shape and venation. The venation is generalized, characterized by numerous crossveins. Dark spots and bands occur on the wings of many panorpid and some bittacids. The legs are long and slender; the tarsi are 5-segmented, the fifth bearing two claws in all but the Bittacidae. In this family, a single, enlarged tarsal claw, along with tarsal segment 5, folds back on segment 4, forming a raptorial tarsus.

The Mecoptera is a minor insect order of about 500 described species arranged in nine families. There are about 83 species known in North America. Although small, the order is diverse and is of great evolutionary interest, because it is closely related to the stem groups of the Diptera, Siphonaptera, Trichoptera and Lepidoptera ("Panorpid Complex"). The Mecoptera possibly contains the sister group of the Diptera. The order originated in the Permian.

There are five families in North America. The Boreidae (snow scorpionflies) is a family of small, flightless insects that are active as adults mainly in the winter. This is BC's only mecopteran family. The Panorpidae (common scorpionflies) contains most of the species in the order -- about 300 worldwide, living mainly on the northern continents. The genitalia of the male give the family its name -- these structures are large, bulbous and often flexed forward over the abdomen, looking something like a scorpion's sting. In North America, the 54 described species are placed in the mainly eastern genus *Panorpa*. The five species of Panorpididae (short-faced scorpionflies) live in the southern Appalachian Mountains. Members of the Bittacidae (hangingflies) look a little like a large, four-winged crane fly (although one western US species is wingless); they hang from vegetation by their front or middle legs and capture insect prey with the hind pair. There are about 145 known species; the family is especially diverse in South America and Australia and contains the only African mecopterans. The Meropeidae are called earwigflies because the male has long, terminal abdominal appendages that resemble the pincer-like cerci of earwigs. There are only two species, one in eastern North America and the other from western Australia.

Most scorpionflies live in moist, shady habitats, especially among vegetation in broad-leaved forests, where the adults are herbivores, scavengers or predators, depending on the group. Many feed on fluids such as nectar and honeydew. They usually lay their eggs in the soil and the

larvae, which are mostly caterpillar-like, feed on a wide range of dead and decomposing animal matter. The most obvious exceptions are the aquatic Nannochoristidae of South America, Australia and New Zealand, whose larvae prey on chironomid and other fly larvae; the flightless Boreidae of the Northern Hemisphere, which feed on mosses in both the larval and adult stages and whose adults are often active on snow; and the Tasmanian Apteropanorpidae, which resemble the Boreidae in form and habits. Adults and larvae of the Panorpidae are typical practitioners of the scavenging life, feeding on dead insects – often stealing prey from spider webs. Males offer an insect carcass to females as an inducement to mate; if a carcass is unavailable, a pile of saliva is used instead. Larval Bittacidae also often eat dead insects, but the adults are predators, snaring small flying prey with their hind legs while hanging from twigs or leaves.

Description of Family of MECOPTERA

Family Boreidae (Snow Scorpionflies) (Figs. 17 & 18)

Boreids range from yellow and rust to brown and black in colour and from about 2 to 7.5 mm in length. The body is usually clothed in a variety of short hairs, bristles and denticles. The head is prolonged into a rostrum composed anteriorly of the clypeus and labrum, laterally of the genae and posteriorly of the maxillae and labium. The mandibles are slightly longer than the short labrum and taper, bearing six teeth near the tip; the maxillary palps are 5-segmented. In life the large, oval eyes are purple to black; there are three ocelli. The thread-like antennae are 18 to 25-segmented; the two basal segments are thickened. The pronotum is saddle shaped and often has bristles on the front and back margins. The mesoscutellum frequently bears two crossed bristles. The legs have large, conical coxae, long femora and tibiae and slender, 5-segmented tarsi bearing two claws. The front wings of the female are reduced to flaps covering smaller hind wings, which are reduced to small, irregular folds. The male's wings are modified as thin hooks. The front pair extend to about abdominal segment 4 and bear spines on the inner and outer margins; they cover the hind wings, which are thin and cylindrical. The female abdomen consists of 11 segments -- the sternum of 8 is elongate, forming the lower part of the ovipositor. The terga of segments 9 and 10 form the top of the ovipositor and segment 11 and the cerci fuse to form the short triangular tip. The cerci are fused in *Boreus* but incompletely joined in *Hesperoboreus*. The male's sternum 9 is elongate triangular and sometimes deeply notched.

Snow scorpionflies live mainly in mosses, especially those that are low, compact and matted. Larvae eat mosses and adults do also, although there is speculation that the latter may also feed on springtails. *Caurinus dectes* Russell feed on liverworts. In most areas, adults are found from November to April, although at high altitudes and latitudes adult emergence may occur later. For example, *Boreus borealis* Banks, living on the Pribilof Islands in the Bering Sea, has been collected only from May through August. In BC, *Boreus* specimens are usually collected on snow when the temperature is at, or slightly above, 0°C. Their dark colour may help them absorb heat. Especially when the snow is soft or if they are disturbed, individuals will hop, using their long hind legs, and often land, legs tight to their body, looking like nothing more than a bit of detritus. There can be considerable activity on sunny, warm days, but evidently most mating and dispersal occurs in still, cloudy weather.

The Family Boreidae consists of small scorpionflies so distinctive that they are sometimes placed in their own suborder, or even order – the Neomecoptera. It is a small holarctic family of 28 described species divided into three genera. *Boreus* contains 26 species – 14 in Eurasia and 12 in North America. Two species of *Hesperoboreus* live in western North America from Washington to California and *Caurinus dectes* is known only from Oregon. Two of the Nearctic species of *Boreus* are eastern and 10 are western; six of the latter occur in BC. Perhaps the most striking is *B. elegans* Carpenter, which inhabits low elevations on the south coast of BC and in western Washington. The largest species in the family (big females can reach almost 8 mm in length) and a rusty red colour, it is the symbol of the Entomological Society of British Columbia. Also strictly coastal is *B. insulanus* Blades, known only from southern Vancouver Island. The most widespread species in the province, *B. californicus* Packard, ranges from the Yukon and northern BC south to Arizona and California. *Boreus nix* Carpenter, *B. pilosus* Carpenter and *B. reductus* Carpenter also are recorded in the province.

Reference

Penny, N.D. 1977. A systematic study of the genus *Boreus* (Mecoptera: Boreidae). University of Kansas Science Bulletin 51(5): 141-217.

Order SIPHONAPTERA (Fleas) (Figs. 19-30)

Description

From the Greek *siphon* = a tube, and *aptera* = without wings.

Fleas are small wingless insects, as adults, laterally flattened, blood-sucking and capable of jumping. The body has numerous setae, is shiny and yellowish brown to black in colour. The head has short antennae that lie in deep grooves, and can be raised and used for grasping the female during mating. The mouthparts are adapted for piercing and sucking and consist of three elongated, sharp piercing elements. Eyes may be present or absent, but ocelli are always absent. Genal and or thoracic combs may be present or absent. The legs are rather long and stout, adapted for clinging with large coxae, and long 5-segmented tarsi. The hind legs are especially important for jumping.

Segment X on the abdomen in both sexes bears a dorsal sensillum, which is rather like a pincushion in appearance. Cerci are absent. The female may have one or two spermatheca, and the male genitalia are the most complex in the entire animal kingdom.

The life cycle consists of egg, larva pupa and adult, with the pupa in a cocoon. Eggs laid by the female fall free from the host, usually accumulating in the nest, den or home of the host. The larvae, which are rather elongate, whitish and rather maggot-like, lacking both eyes and legs, but normally rather setose, feed on the organic debris and faecal droppings of the parents that collect in dens, nests and the like. There are three larval instars. Pupation takes place in a cocoon, and the newly formed adults can remain for many months in this cocoon without food. Such pre-emergence adults are sensitive to both warmth and vibration, and can emerge quickly to infect the host or any other warm-blooded animal causing a disturbance. This phenomenon is well known to many cat-loving owners when they return to a cottage or home after a winter or vacation.

It is only the adult flea that sucks blood from warm-blooded vertebrates. Most fleas are host specific, or restricted to a particular family or Order of birds or mammals. In some species, the breeding cycle of the flea is very closely linked to that of the host. For example, it has been shown that the hormones that circulate within a pregnant rabbit also induce ovary maturation in rabbit fleas.

Most fleas regularly move from one host to another. They are capable of serving as vectors of a number of microorganisms. The best known disease transmitted by fleas is plague, and infectious disease caused by the bacillus *Pasteurella pestis* (Lehman and Neumann). Endemic typhus caused by a *Rickettsia* can also be spread to people from rats by fleas. Fleas can also serve as intermediate hosts of tapeworms, such as the tapeworm of dogs and cats.

Of the eight families of fleas known from North America, only seven occur in Canada and British Columbia. The family Rhopalopsyllidae is absent.

Key to families of SIPHONAPTERA

1. Outer internal ridge of middle coxae absent; mesonotum lacking pseudosetae under the collar; metanotum and abdominal terga lacking marginal spinelets; spiracles circular; abdominal terga II-VII with at most one row of bristles; sensillum with 8 or 14 pits per side; hind tibia lacking an outer apical tooth.....PULICIDAE
- Outer internal ridge of middle coxae usually present; apical tooth on hind tibia present and pointed; sensillum usually with 16 or more pits per side..... 2
2. Combs, spinelets, antepygidae bristles, spiniform bristles on inner surface of hind coxae, and anal stylet of female all absent VERMIPSYLLIDAE
- Some or all of these structures present 3
3. Metanotum lacking marginal spinelets; female sensillum usually more or less convex; anal stylet usually with a long apical bristle or 1 or 2 small to minute subapical ones..... 4
- Metanotum with marginal spinelets; dorsal surface of sensillum straight; anal stylet of female with 1 or 2 long lateral bristles in addition to apical one 5
4. Antennal club of male usually extending onto prosternosoma; female with two spermatheca HYSTRICHOPSYLLIDAE
- Antennal club of male not usually extending onto prosternosoma; female with one spermatheca CTENOPHTHALMIDAE
5. Head with a complete transverse interantennal groove connecting antennal fossae and dividing frons from occiput; genal comb composed of two broad spines which may be pointed or obtuse, arising immediately behind oval angle ISCHNOPSYLLIDAE
- Combination of characters not as above 6
6. Genal comb present or absent; arch of tentorium present and usually clearly visible; interantennal suture variable; eye often sinuate or vestigial..... LEPTOPSYLLIDAE
- Genal comb absent; without arch of tentorium in front of eye; interantennal suture absent; eye circular or vestigial CERATOPHYLLIDAE

Description of Families of SIPHONAPTERA

Family Ceratophyllidae (Fig. 19)

Fleas with no tentorial rod in front of eye, but with three setae present in the ocular row, the uppermost one inserted in front of the eye. The head lacks a genal comb, but is always entire with no trace of an interantennal suture. The club of the antenna in the male extends onto the prosternosoma. A pronotal comb is present. The metanotum and some of the abdominal terga have apical spinelets, and terga II-VII have two or more rows of setae. The sensillum has more

than 14 pits on a side. The hind coxae are without spiniforms. Sternum VIII is narrow or vestigial in the male, and sternum IX has an apodemal rod or tendon. A single spermatheca is present in females.

Worldwide there are some 68 genera and 760 species and subspecies. So far 24 genera and 132 species are reported in North America. Twenty genera occur in Canada, and 18 of these are found in British Columbia. To date, 73 species are recorded from Canada, with 42 of these known from the province. Most species live on small rodents, but a few are ectoparasites of birds.

Ceratophyllus vision Baker is the common flea of the Red Squirrel (*Tamiasciurus hudsonicus* (Erxleben)) east of the Coast Mountains, while *C. ciliatus* Baker is an ectoparasite of Townsend's Chipmunk (*Tamias townsendii* Backman), Douglas' Squirrel (*Tamiasciurus douglasii* (Backman)) and other rodents on the Pacific Coast, including Vancouver Island.

Dasypsyllus perpinnatus (Baker) which has more than 24 spines in the pronotal comb, is the common flea in the nest of numerous birds, especially Passeriformes, west of the Coast Range and on offshore islands.

Foxella ignothus (Baker) is common on the Northern Pocket Gopher (*Thomomys talpoides* (Richardson)).

Malaraeus telchinum (Rothschild) is a small flea common on the Deer Mouse (*Peromyscus maniculatus* (Wagner)) on the Queen Charlotte Islands, Vancouver Island and the southern half of British Columbia. *Thrassis acamantis* (Rothschild) is the common flea on the Yellow-bellied Marmot (*Marmota flaviventris* (Audubon & Backman)) throughout its range in the Interior Dry Belt.

Family Ctenophthalmidae (Figs. 20 & 22)

The interantennal suture is usually present, but the anterior branch of the tentorium is present or absent. The antennal fossa is open ventrally, but the club does not often extend onto the prosternosoma. Genal and pronotal combs are usually present. The ventral margin of the pronotum is bilobed or straight. The hind coxae lack spiniform setae on the inner side, and the hind tibia has an apical tooth on the outside. The male sensillum is strongly convex or has a posterior collar. There is one spermatheca in the female.

Worldwide there are 41 genera and 630 species and subspecies. To date, 22 genera and 114 species are reported in North America. So far 20 genera and 50 species are recorded in Canada, with 13 genera and 35 species known from British Columbia. Species occur mostly on rodents.

The genus *Epitedia* has a frontal tubercle, *E. wenmanni* (Rothschild) being quite common on voles (*Clethrionomys* spp., *Microtus* spp.) and mice (*Peromyscus* spp.) across the province. In the genus *Corypsylla* which has apical spinelets on the anterior abdominal terga, *C. ornatus* Fox recognized by the apically asymmetrical third spine in the genal comb, is associated with moles in the genus *Scapanus* in the extreme southwest of British Columbia.

Family Hystrichopsyllidae (Figs. 23 & 24)

Fleas with interantennal suture well developed. The antennal club of the male often extending onto the prosternosoma. A genal and pronotal comb is present. The pronotum has at least two rows of setae, and its ventral margin is usually bilobed. The hind coxae lack spiniform setae on the inner side, but the hind tibiae have an apical tooth on the outside. Several terga have spinelets or ctenidia. The male sensillum has a posterior collar. The female sensillum is slightly convex dorsally, and females have two spermatheca.

Worldwide there are six genera and 42 species and subspecies. Two genera occur in the United States, Canada and British Columbia, with ten species known from North America, seven species recorded in Canada, and five of these in British Columbia.

Atyphloceras multidentatus (Fox) occurs on the Pacific Coast, in the lower Fraser Valley and around Okanagan Lake on species of *Microtus* and *Peromyscus*. *Hystrichopsylla dippiei* Rothschild is a large flea with six spines in the genal comb and occurs on a number of rodent species across the province. *H. schefferi* Chapin which is probably the world's largest flea with four antensensilial setae and six spines in the genal comb, is recorded from Mink (*Mustela vison* Schreber) and the Spotted Skunk (*Spilogale pictorus* (L.)) in the lower mainland.

Family Ischnopsyllidae (Fig. 25)

Fleas with eyes vestigial. Head with a genal comb of two flap-like structures located anteriorly on either side of oral margin. A clear, unsclerotized area is present in the preantennal region in some genera. The preantennal and postantennal regions are separated by an interantennal groove. Pronotum with comb of true spines. Mesonotum with pseudosetae under collar. Metanotum with apical spinelets. Anterior abdominal terga with short apical spinelets, or with "false combs" of thickened setae. Typical abdominal terga with two or more rows of setae. The sensillum is flat, and antensensilial setae are present or absent. Females have a single spermatheca.

Worldwide there are 19 genera and 115 species and subspecies. So far four genera and 11 species are recorded from North America. Four species in two genera are known from Canada, with all of these reported from British Columbia.

Species of Ischnopsyllidae are ectoparasites of bats. *Nycteridopsylla vancouverensis* Wagner, which has the head pointed anteriorly, genal spines somewhat pointed, and a distinct "false comb" on tergum VII, has been recorded from the Silver-haired Bat (*Lasionycteris noctivagans* (LeConte)) in Vancouver. *Myodopsylla insiguus* (Rothschild) which is rounded on the head anteriorly, and has a "false comb" on tergum VII is the commonest and most widely distributed bat flea in North America, and occurs in central British Columbia on the Little Brown Myotis (*Myotis lucifugus* (LeConte)). The related *M. gentilis* Jordan & Rothschild has also been recorded across the province from this same host, while *M. palposus* (Rothschild) has been collected on the Big Brown Bat (*Eptesicus fuscus* (Beauvois)) and appears to be restricted to the southern part of the province. The latter flea lacks false combs on the metanotum and abdomen.

Family Leptopsyllidae (Fig. 26)

Head with eyes often minute or vestigial. Arch of tentorium clearly visible in front of eyes. Ocular row of setae with most dorsal seta above the level of upper margin of eye. Genal comb present or absent, but pronotal comb always present. Metanotum with marginal spinelets. Male with sternum VIII not greatly reduced. Wagner's gland absent. Female with anal stylet provided with one or two long sublateral setae in addition to apical setae. Only one spermatheca present in female.

Nine genera and 21 species are noted from North America. Seven genera and 17 species are so far reported from Canada, with five of these genera and eight species recorded from British Columbia.

Leptopsylla segnis (Schönherr) is an alien species that evidently was introduced with domestic rats and mice. With a genal comb with four spines arranged vertically, *L. segnis* has been collected on the House Mouse (*Mus musculus* L.) in Kelowna, and elsewhere in Canada is only known from St. John's and Conception Bay, Newfoundland.

Family Pulicidae (Fig. 27-29)

Eyes large and pigmented, without an internal sinus. The antennal fossae are closed. Genal and pronotal combs are present or absent. The mesonotum is without pseudosetae under the collar. The metanotum and abdominal terga lack marginal spinelets. The outer internal ridge of the middle coxae is absent. However, the inner surface of the hind coxae has a row or patch of spiniform setae. The hind tibia lack an outer apical tooth. The spiracles are circular, and that on the metepimeron is larger than those behind. The sensillum has eight or 14 pits on each side. The female has an anal stylet.

Worldwide there are 24 genera and 190 species or subspecies. Eleven genera and 19 species occur in North America. Five genera and seven species are reported from Canada, with four of these genera and five species recorded from British Columbia.

The Human Flea (*Pulex irritans* L.), which lacks both genal and pronotal combs, is the only flea associated with man and other primates. Although humans are a common host, this flea occurs on a large number of other hosts, including pigs. The Human Flea is well established in the lower mainland and on Vancouver Island, but also has been collected in Kamloops.

However, the fleas most often encountered by humans is not the Human Flea, but either the Dog flea (*Ctenocephalides canis* (Curtis)) or the Cat flea (*C. felis* Bouché). These two closely related species have both genal and pronotal combs, and both occur on both cats and dogs. The two species frequently get established in homes, where they can become a nuisance because of their painful bites. Although both the Cat flea and the Dog flea are not uncommon on domestic rats, they have also been collected on the Spotted Skunk (*Spilogale putorius* (L.)) and the Dog flea has been collected on the Red Fox (*Vulpes vulpes* (L.)) in Ladner and Mission. In the Dog flea, the first spine on the genal comb is shorter than the second, whereas in the Cat flea, these two are more or less equal in length.

Family Vermipsyllidae (Fig. 30)

Eyes present with an internal sinus. Anterior portion of tentorium conspicuous just in front of the eyes. The club of the antenna is segmented all round, and the antennal fossae do not meet in the interior of the head, the central tuber being absent. The labial palps have five or more segments. The head and pronotum is without either well developed combs or spinelets representing vestigial combs. The metepimeron has long setae, and the spiracle on this sclerite is very near its dorsal margin. The fore femora has the outer seta of the dorso-apical pair shorter than the inner seta. The tarsi of all the legs have four pairs of plantar setae. The second abdominal tergum has two or more rows of setae. The sensillum is transverse, and antesensilical setae are not differentiated in either sex. Females are without an anal stylet.

Species of Vermipsyllidae are ectoparasites of carnivores. Worldwide there are three genera and 31 species. Only the genus *Chaetopsylla* is reported from North America, with six species on record. Five species are recorded from Canada, with two of these present in British Columbia.

Chaetopsylla tuberculaticeps (Bezzi) is a large flea with a distinctive permanent frontal tubercle on the head, is associated with the Grizzly Bear (*Ursus arctos* L.) and has been collected from this host at Azure Lake and Wigwam. The abdomen of egg laden females of this flea can swell until the terga and sterna become widely separated by the greatly expanded lateral intersegmental membranes, such that the fleas appear maggot-like, and may be 9 mm in length.

The other species of Vermipsyllidae recorded in British Columbia is the smaller *Chaetopsylla setosa* Rothschild. This species has a deciduous frontal tubercle on the head and occurs on bears, coyotes, lynx and sometimes cougars and wolverines. Records in British Columbia include specimens from the Coyote (*Canis latrans* Say) at Eagle River, Sicamous, from Black Bear (*Ursus americanus* Palles) at Mable Lake, from Lynx (*Lynx canadensis* Kerr) at Gray Creek, and Wolverine (*Gulo gulo* (L.)) at Parson.

Order LEPIDOPTERA (Moths and Butterflies) (Figs. 31-102)

Introduction

From the Greek *lepidos* = scale and *ptera* = wings. Moths and butterflies are clothed in flattened scales.

Members of the Lepidoptera are distinguished in the adult stage by the dense covering of overlapping scales on the head, body and appendages, including the two pairs of membranous wings. Wingspans range from about 3 mm to 280 mm. A few species have reduced, non-functional wings; these are usually females, but in some species both sexes are flightless. The scales are coloured and arranged in innumerable patterns, from the subtle and cryptic to the bright and showy.

The compound eyes are large, often with hairs between the facets; ocelli are absent (in butterflies and many moths) or are present, one above each eye. Antennae are long and slender, usually partly clothed with scales and composed of two basal segments and a flagellum of 20 to 60 units. The flagellum variable in structure and is often more complex in males than in females. Thread-like, saw-toothed and clubbed forms are included and comb-like or plumose antennae are common. Mouthparts are almost always sucking. A proboscis formed from the elongate, grooved galeae of the maxillae (held together by minute interlocking spines) is usually present. This feeding tube is normally long and coiled under the head when not in use. Mandibles are nearly always vestigial or lacking. Labial palps, usually 3-segmented, are normally well developed and conspicuously extended in front of the face; maxillary palps are normally reduced or absent. The mouthparts are reduced and functionless in some moth groups.

The prothorax is usually small, the mesothorax large; the metathorax is a little smaller than the mesothorax in the very old lineages but is much smaller in the Heteroneura. Families of the Noctuoidea have tympanic organs in metathoracic cavities. Legs are developed for walking and perching. Forelegs are reduced in some butterfly families, the hind legs in some hepialids and geometrids; all legs are vestigial in some female Psychidae. The fore tibia has one apical spur or none; the inner surface of this tibia usually bears an epiphysis, a basally articulated, spur-like appendage used for cleaning the antennae and proboscis. The mid tibia usually has a pair of apical spurs and the hind tibia two pairs – an apical pair and a medial pair. The tarsi are 5-segmented and bear a pair of claws, which can be simple, toothed, bifid or reduced.

The wings are the most prominent lepidopteran attribute. They are usually covered on both the veins and membrane with two layers of minute, socketted, flattened setae (scales), which normally contain colour pigments and are finely ridged and usually hollow and microscopically perforated. Iridescent colours are the result of scale structure. Many males have specialized scent scales that help to spread pheromones produced by associated glands. These scales may be scattered among other scales or are concentrated in patches, tufts or wing folds. The venation is relatively simple, with few cross-veins. The most ancestral groups have similarly shaped fore and hind wings and the venation in both wings is similar (homoneurous), resembling that of the Trichoptera. Vein Rs has four branches, Sc and R1 may have two branches, M is almost always three-branched, CuP is present and normally there are three anal veins. The venation of the Heteroneura (“different veins”) shows variable simplification through fusion and

loss of veins, especially in the hind wing. The radius in the fore wing usually has five branches but Rs in the hind wing is unbranched and R1 is fused with Sc. The stem of the media is lost in most groups, resulting in the formation of the large discal cell in the centre of both wings and in the most advanced superfamilies CuP is absent in both wings.

Wing coupling allows the fore and hind wings to beat together. Moths with homoneurous venation lock the wings with a jugum, a lobe on the inner margin of the fore wing near the base. Most moths in the Heteroneura use a hook and eye mechanism composed of a frenulum at the base of the hind wing and retinaculum on the underside of the fore wing. In males the frenulum is a single, composite bristle; the retinaculum is a membranous lobe. Females have two or more bristles that mesh with a row of bristles in the fore wing. Butterflies and some moths lack a frenulum, but have an expanded humeral area at the base of the hind wing grips the underside of the fore wing. Butterflies usually rest with the wings held together above the body; moths hold the wings outstretched against the substrate, overlapped and flat over the body, roof-like or rolled around the body.

In the abdomen, the top of segment 1 is significantly desclerotized; segments 7 to 11 may be highly modified to form the genitalia. A pair of tympanal organs may be present (e.g., in Pyraloidea, Geometroidea, Drepanoidea) near the base of the abdomen. The cerci are lost. Pheromone glands may occur at various places on the abdomen.

Lepidopterous larvae are commonly called caterpillars. Usually cylindrical, they have a well-developed head, thorax (the top of the prothorax is usually sclerotized) and a 10-segmented abdomen. There are three pairs of 5-segmented thoracic legs and usually five pairs of abdominal prolegs (segments 3 to 6 and 10). Prolegs are short and fleshy; the tips usually have tiny hooks (crochets). In some groups the thoracic legs and/or prolegs may be reduced or lost. Larvae lack compound eyes but there are usually six ocelli on each side of the head. Larvae mainly feed with chewing mandibles, although these are modified in some sap-feeding, leaf-mining forms. Many larvae are hairy or spiny in characteristic ways; sometimes these projections are stinging. Silk is spun from modified salivary glands that open under the mouth; the silk is used mainly to make cocoons or other shelters. Many larvae pupate in cocoons; others make none. Moth pupae are usually smooth and brown. Butterflies usually do not make a cocoon and the naked pupa is often called a chrysalis – it can be sculptured or brightly coloured and frequently is fastened to a plant with a silken girdle.

About 150,000 species of living Lepidoptera have been described in approximately 124 families. At the species level, this is about 17 % of the world's known insect fauna. However, estimates suggest that there may be two or three times this number of species in the order. The Lepidoptera is the largest lineage of plant eating organisms, rivalled only by the huge clade of phytophagous beetles that includes the weevils, leaf beetles and longhorned beetles, a group of at least 125,000 named species. Angiosperm plants are the main hosts. The fossil record is sparse and is best represented by amber inclusions and leaf mines in fossil leaves. Although the first known moth fossils are from the early Jurassic, 190 million years ago, the order largely diversified in the Cretaceous Period and early Tertiary with the flowering plants. Thus, of all the orders of insects, the Lepidoptera have radiated most recently.

The approximately 200 species of the Micropterigidae, of all living Lepidoptera, are the most similar to the original Jurassic forms. Along with two small families from the Southern Hemisphere, these moths still use mandibles for eating pollen and have not evolved a proboscis for sucking fluids. Many micropterigid larvae feed on plant detritus and fungi, likely the original diet of the ancestors of Trichoptera and Lepidoptera. The huge group Glossata, the “tongued” Lepidoptera, which arose in the early Cretaceous, comprise the rest of the order. Adult mandibles in these species have been lost or reduced and a proboscis used to feed on fluids has evolved from the maxillae; the structure of this feeding tube is unique in the insects. The Glossata also show another major innovation, the spinnerets under the larval mouth that dispense silk. And all but the most primitive glossatan moths have hollow wing scales. Most of the oldest families of Glossata have larvae that feed in leaf mines or are otherwise concealed.

The vast majority of Glossata are included in the Heteroneura where the hind wing veins are reduced and have a different pattern than those of the fore wing. Another critical innovation in this group is the frenulum that links the hind wing to the fore wing. Within the Heteroneura, over 100 families and almost 99% of lepidopteran species belong to the *Ditrysia*, a lineage whose females have separate genitalic openings for receiving sperm and laying eggs and where these two ducts are linked internally. The larvae of some early lineages (e.g., Gracillariidae) retain the leaf-mining and plant-boring habits or hide in cases or webs, but most feed exposed on plants.

The Macrolepidoptera, a ditrysiian group containing the butterflies, skippers and 26 moth families (including most of the more familiar ones) arose around the Cretaceous-Tertiary boundary. Macrolepidopteran species comprise about 60% of the order although most of the thousands of undescribed species will certainly come from earlier lineages, the so-called microlepidoptera. The Macrolepidoptera is distinguished by traits such as the complete loss of wing vein CuP and the crescentic arrangement of the crochets on the inner edge of the end of the larval proleg. Contrary to the popular belief that butterflies and moths are two separate groups that comprise the Lepidoptera, butterflies are simply relatively recently derived, colourful, day-flying moths in the Macrolepidoptera consisting of the superfamilies Hesperioidea and Papilionoidea. The most closely related moths are in the small neotropical family Hedylidae (about 40 species in the genus *Macrosoma*), which many authorities consider to be butterflies because they share some ancestral butterfly characters, including a girdled pupa, upright eggs and a pouch on abdominal segment 1.

In diurnal species males are initially attracted to females by visual stimuli; in nocturnal forms males respond to sex pheromones from receptive females. Mating may be encouraged by the emission of male pheromones from special glands on the abdomen, legs and wings. Eggs are usually laid on or near the foodplant, singly or in batches. Some insert eggs into plant tissue with cutting ovipositors (e.g., Incurvarioidea, Eriocraniidae) or into grass leaf sheaths (some Noctuidae).

Lepidoptera species utilize all parts of plants -- roots, trunk, bark, branches, twigs, leaves, buds, flowers, fruits, seeds, galls and fallen material. Larvae feeding in concealed situations -- wood borers, leaf and bark miners, casebearers, leaf tiers and leaf rollers -- usually belong to more primitive families; exposed feeders, especially those that feed by day, are from more recent lineages. The mainly phytophagous habit of the Lepidoptera means that the order does not show

the tremendous trophic diversity of the Coleoptera, Hymenoptera and Diptera, although there is some diversity in food other than that of fresh plant matter. Some caterpillars are carnivorous and eat egg masses of other Lepidoptera (some Pyralidae) or spiders (some Oecophoridae); others kill ant larvae (some Lycaenidae) or scale insects (some Batrachedridae, Oecophoridae, Noctuidae). Still others (Epipyropidae) are ectoparasites on planthoppers and leafhoppers and some groups (e.g., Tineidae) feed on material of animal origin such as wool and keratin. The family Pyralidae is especially diverse in its diet. In addition to plants, fresh and decaying plant material of all sorts, foods range from the wax combs of bees to caterpillar spines and processed grains, from scale insects to sloth and bat dung. In the Crambidae, several hundred species have aquatic larvae that feed on waterplants. Adults feed mainly on nectar and other liquid food such as fermenting tree sap, insect honeydew and food-rich fluids in mud and dung. Moths in the Southeast Asian noctuid genus *Calyptra* have tearing hooks on the proboscis; they suck juice from thick-skinned fruit and blood from mammals. In some lepidopteran groups, adults do not feed.

The natural enemies of Lepidoptera are many and varied. Eggs are parasitized by wasps in the Chalcidoidea and Platygastroidea; larvae are killed by mites, spiders, wasps (especially Vespidae and Sphecidae) and vertebrates, mainly birds. Larvae and pupae are heavily parasitized by nematodes, hymenopterous parasitoids in the Chalcidoidea, Braconidae and Ichneumonidae and by flies of the Tachinidae. Bacterial and viral diseases kill huge numbers. Humans feed on a few species; for example, some large cossid larvae are eaten by Australian aborigines and larvae of the saturniid genus *Coloradia* are used as food by American natives in the western United States. Adults are preyed on by predaceous plants, insects and spiders, birds, bats and many other organisms.

To defend against many of these attacks, members of the order are masters of concealment and deception. Some larvae live in silken cases or webs, others roll or tie leaves and hide in them. Many adults and immatures are amazingly camouflaged as bark, lichen, leaves and twigs. Some even mimic dangerous vertebrates, such as snakes, using eyespots and other startling markings. Many species feign death when attacked; others emit noxious chemicals. Sesiids, especially, can be convincing mimics of stinging wasps. The characteristic scales of adults are dense, dust-like and slippery; they detach easily from the body and wings, sometimes allowing an attacked insect to escape a predator or a sticky spider web. Dense hairs and spines on caterpillars act as barriers to some parasites and, especially those projections that irritate, deter some vertebrate predators. Many larvae and adults sequester distasteful or poisonous chemicals, discouraging vertebrate predation. Hundreds of diurnal species, distasteful or not, gain some protection from predators by mimicking poisonous species or by flaunting bright, warning colours. Most adult moths avoid bird predators by flying at night, but bats pose a serious problem for them. Many groups have tympanal organs that allow moths to hear bat sonar pulses and take evasive actions; some tiger moths emit counter pulses to confuse attacking bats.

The Lepidoptera is a major group of plant eating organisms and thus is immensely economically important in agriculture, horticulture and forestry. Agricultural pests of grains and vegetables are numerous and include the armyworms and cutworms of the Noctuidae. This family also contains *Heliothis zea* (Boddie), the Corn Earworm, a serious pest of a long list of crops. The list of orchard crop pests is headed by the tortricid *Cydia pomonella* (Linnaeus), the Codling Moth. Forest defoliators are also legion. Among the most damaging are the,

Choristoneura fumiferana (Clemens) (Spruce Budworm) and its western relative *C. occidentalis* Freeman, the geometrid *Lambdina fiscellaria lugubrosa* (Hulst) (Western Hemlock Looper), *Orgyia pseudotsugata* (McDunnough) (Douglas-fir Tussock Moth) and the tent caterpillars of the Lasiocampidae. Several introduced, cosmopolitan moths are serious pests of stored goods in households and warehouses – the clothes moths of the Tineidae and the meal moths of the Pyralidae are the most obvious. Wax moths (Pyralidae) sometimes are economically destructive to honey bee colonies. From the economic perspective, any negative role of Lepidoptera as predators and parasites is minor. They have little medical or veterinary importance although the larval hairs and adult scales may be allergenic and the irritating hairs and spines of some larvae cause pain and skin rashes.

Unlike flies and beetles, Lepidoptera play only a small role in the decomposition of organic material. Some groups are detritivores and fungivores and, to some extent, help in the breakdown of animal and plant remains; for example, the tineid clothes moths recycle wool, feathers and other animal products. Lepidoptera species are overwhelmingly herbivorous but only a few have been used successfully in the biological control of weeds. Examples include *Tyria jacobaeae* (Linnaeus) to control Tansy Ragwort and the South American pyralid, *Cactoblastis cactorum* (Berg), brought to Australia to control the introduced *Opuntia* cactus. Many moths and butterflies frequently visit flowers for nectar and they are probably important pollinators. In some cases the relationship is so specific that some plant species can be pollinated by only certain moths; yucca species and yucca moths of the Prodoxidae are examples.

The Lepidoptera species have played important roles in biological science. The complex patterns on wings provide an excellent base for study of genetics and embryology. Many of the early triumphs in insect physiology came from experiments on Lepidoptera and the order has played a vital role in studies on mimicry, adaptive coloration and geographical and seasonal variation. Because the habitat requirements and population fluctuations of many rare species are so well known, Lepidoptera, especially butterflies, have had an important place in the development of invertebrate conservation strategies. Art and literature are full of references to the beauty, elegance and symbolism of the Lepidoptera.

Perhaps the single biggest economic and cultural contribution of the order is silk. Mainly a product of *Bombyx mori* (Linnaeus), this material has been economically important for at least 4000 years and its early importation to Europe opened up connections between eastern and western civilizations.

Structure

We use the terminology of Kristensen (1999) when describing the structure of the Lepidoptera.

Glossary of Terms

Apodeme	In growth of exoskeleton to which muscles attach.
Aposematic	Having warning colouration.
Chaetosema (pl. chaetosemata)	A cluster of sensory bristles on the head.
Conjunctiva	In tympanal organ of Noctuoidea a soft pale membrane separated from tympanum by a sclerotized ridge.
Endodont	Internal projection.

Ephphysis	A leaf-like or spur-like, basally-articulating process on the inner aspect of the fore tibia of some Lepidoptera, used to clean the antennae.
Falcate	Hooked, when there is a deep excavation below apex of wing, so as to have the latter acute and a little curved.
Flagellomere	One part of a multiannulated antennal flagellum.
Flagellum	The third segment, or terminal part of an antenna, beyond the basal scape and subbasal pedicel segment.
Patagium (pl. patagia)	Paired articulated dorsal plates of prothorax.
Pecten (as in cubital pecten)	A basal fringe of piliform scales.
Piliform	Seta-like in shape or form.
Praecinatorium	A ventrally expanded, median flap.
Scape	Anterior to tympanal organs the first or basal segment of the antenna.
Vertex	Top of head capsule between the eyes.

Classification and keys

We use the phylogeny and the synoptic phylogenetic classification presented in Kristensen (1999). The families and their order of presentation in that publication, which are used here, are derived from this phylogeny. As in Kristensen (1999), formal categories such as suborders and infraorders are omitted but some high-ranking clades are named.

The identification keys used are modified from those in Kristensen (1999).

References

- Duncan, R.W. 2006. Conifer defoliators of British Columbia. Natural Resources Canada, Canadian Forest Service, Victoria, BC. 359 pp.
- Guppy, C.S. and J.H. Shepard. 2001. Butterflies of British Columbia. Royal British Columbia Museum and University of British Columbia Press, Victoria and Vancouver, BC. 414 pp.
- Kristensen, N.P. (ed.). 1999. Lepidoptera: moths and butterflies. Vol. 1. Evolution, systematics and biogeography. 491 pp. *In* M. Fischer (ed.). Volume IV, Arthropoda: Insecta, Part 35. Handbook of Zoology: a natural history of the phyla of the animal kingdom. Walter de Gruyter, Berlin.
- Lafontaine, J.D. and J.T. Troubridge. 1998. Moths and butterflies (Lepidoptera). *In* I.M. Smith and G.G.E. Scudder (eds.). Assessment of species diversity in the Montane Cordillera Ecozone. Ecological Monitoring and Assessment Network. On internet at http://www.naturewatch.ca/eman/reports/publications/99_montane/lepidopt/intro.html
- Lafontaine, J.D. and D.M. Wood. 1997. Butterflies and moths (Lepidoptera) of the Yukon. Pp. 723-785, *In* H.V. Danks and J.A. Downes (eds.). Insects of the Yukon. Biological Survey of Canada (Terrestrial Arthropods), Ottawa, ON 1034 pp.

Layberry, R.A., P.W. Hall and J.D. Lafontaine. 1998. The butterflies of Canada. University of Toronto Press, Toronto, ON. 280 pp.

Llewellyn Jones, J.R.J. 1951. An annotated check list of the macrolepidoptera of British Columbia. Entomological Society of British Columbia Occasional paper No. 1. 148 pp.

Key to families of LEPIDOPTERA

1. Wings absent or rudimentary..... 2
- Wings well developed 6
2. Legs absent; females in case.....Psychidae (in part)
- Legs present 3
3. Females in casePsychidae (in part)
- Females not in case 4
4. Ocelli presentNoctuidae (in part)
- Ocelli absent 5
5. Abdomen closely scaled or spined, or with bristling, dark gray setae.. Geometridae (in part)
- Abdomen smoothly clothed with fine, wooly setae..... Noctuidae (Lymantrinae) (in part)
6. Hind wing vein Rs with 3 or 4 branches; fore wing almost always with jugal lobe markedly produced 7
- Hind wing vein Rs unbranched; fore wing with jugal lobe not markedly produced 8
7. Maxillary galea forming a proboscis, usually spirally coiled in repose, sometimes secondarily reduced or absent; mandibles often strongly reduced, articulations with head capsule undeveloped Hepialidae
- Maxillary galea unmodified, not forming proboscis; mandibles large; articulation with head capsule well developed..... Micropterygidae
8. Wing membranes usually with more or less extensive cover of microtrichia; sternum II without anterior apodemes; female with a single genital opening..... 9
- Wing membrane devoid of microtrichia; sternum II with paired anterior apodemes; female with copulatory opening on segment VIII separate from more posterior ovipore..... 13
9. Antennal scape with eye-cup; hind tibia with prominent spines Nepticulidae
- Antennal scape without eye-cup; hind tibia without spines 10
10. Labial palps with lateral bristles on second segment..... 11
- Labial palps without lateral bristles Tischeridae

11. Hind wing with discal cell open..... Heliozelidae
 - Hind wing with discal cell closed 12
12. Antennae longer than fore wing..... Adelidae
 - Antennae shorter than fore wing..... Prodoxidae
13. Proboscis scaled 14
 - Proboscis unscaled or absent 17
14. Labial palps recurved, apical segment may exceed vertex, usually tapering
 Superfamily Gelechoidea (*see note at end of key)
 - Labial palps porrect, beak-like or ascending 15
15. Labial palps ascending; fore wing with CuP present; tympanal organs absent.... Choreutidae
 - Labial palps porrect, beak-like or ascending; fore wing with CuP usually present; tympanal
 organs present at base of abdomen 16
16. Praecinctorium present; tympanal case “open” anteromedially; tympanum meeting
 conjunctiva at a distinct angle..... Crambidae
 - Praecinctorium absent; tympanal case “closed” medially, and open anteriorly only;
 tympanum and conjunctiva in same plane..... Pyralidae
17. Antennae gradually or abruptly clubbed, tip sometimes hooked..... 18
 - Antennae filiform or tapered, often ciliate, pectinate or plumose 24
18. Ocelli present and large Sesiidae
 - Ocelli absent 19
19. Antennae widely separated at base, with subapical thickening Hesperidae
 - Antennae approximated at base, with apical thickening 20
20. Fore tibia epiphysis present Papilionidae
 - Fore tibia epiphysis absent 21
21. Foreleg fully developed, bearing distinct bifid claws Pieridae
 - Number of foreleg tarsal segments usually reduced at least in males; if tarsi of males not
 reduced in number, then claws simple or only bearing a basal endodont 22
22. Antennal base adjacent to margin of eye, and usually indenting it; antennae lacking carinae
 Lycaenidae
 - Antennal base usually displaced from margin of eye; antennae tricarinate 23
23. Male with foreleg considerably modified, with fore coxae extended..... Riodinidae
 - Male with foreleg not greatly modified, fore coxa at most only slightly extended
 Nymphalidae

24.	Tympanal organs present in metathorax or ventrally in base of abdomen.....	25
-	Tympanal organs absent	30
25.	Tympanal organs in metathorax, counter-tympanal cavities usually at base of abdomen...	55
-	Tympanal organs in abdomen.....	26
26.	Chaetosemata present	27
-	Chaetosemata absent	28
27.	Abdomen with sexually dimorphic tympanal organs, those in female lying in sternum II, those in male lateral at junction of tergum 2 and 3.....	Uraniidae
-	Abdominal tympanal organs situated on sternum II in both sexes	Geometridae
28.	Fore wing broad often falcate	Drepanidae
-	Fore wing narrow, not falcate.....	29
29.	Fore wing reddish-brown, with silvery marks	Cossidae (in part)
-	Fore wing grey	Tineidae (in part)
30.	Wings more or less deeply cleft into two or more plumes	31
-	Wings not cleft	32
31.	Hind wing divided into 3 plumes.....	Pterophoridae
-	Hind wing divided into 6-7 plumes.....	Alucitidae (in part)
32.	Fore wing with CuP well developed, at least near margin, as a tubular vein.....	42
-	Fore wing with CuP absent as a tubular vein	33
33.	Head vestiture of piliform scales	34
-	Head vestiture of lamellar scales	36
34.	Antennae spindle-shaped; body spindle-shaped; ocelli absent; male antennae ‘prismatic’, with ventral, unscaled part of each flagellomere laterally concave, and anterior and posterior margins with long, fine setae	Sphingidae
-	Antennae not spindle-shaped; body not spindle-shaped; ocelli present or absent; male antennae not ‘prismatic’	35
35.	Hind wing with costal margin greatly expanded basally, and supported by 1 to 3 short, stout humeral veins	Lasiocampidae
-	Hind wing with costal margins not broadened, without humeral veins	Saturniidae
36.	Fore wing often with raised scales; hind wing vein CuA with pecten.....	37
-	Fore wing without raised scales; hind wing vein CuA without pecten.....	38
37.	Hind wing with all three M branches	Copromorphidae (in part)
-	Hind wing with M ₂ absent	Carposinidae (in part)

38. Abdominal terga with anterior band of spines..... Alucitidae (in part)
 - Abdominal terga without spines 39
39. Robust medium-sized and relatively narrow-winged moths with aposematic colours.....
 Thyrididae (in part)
 - Not as above 40
40. Distinctly narrow-winged and delicate moths 41
 - Wings broad..... Thyrididae (in part)
41. Wings entire; wingspan less than 15 mm; body and legs not unusually long
 Schreckensteiniidae
 - Wings often cleft; wingspan well over 15 mm; body and legs unusually long
Pterophoridae (in part)
42. Usually small delicate moths, without raised scales on fore wing 43
 - Usually robust, small to very large moths, sometimes with raised scales on fore wing 49
43. Abdominal segment VIII in male with prominent lobes; fore wing with vein R5 often
 extending to outer margin of wing, and vein M usually absent from discal cell..... 44
 - Abdominal segment VIII in male without lobes; fore wing with vein R5 often extending to
 costa; vein M usually present in discal cell Tineidae (in part)
44. Ocelli present, if rudimentary then maxillary palp normally 3 or 4-segmented, porrect and
 fore wing pterostigma extending to R3 45
 - Ocelli absent 47
45. Head smooth-scaled; labial palps often with transverse pale and dark bars; fore wing often
 with metallic markings Glyphipterigidae
 - Head rough-scaled; labial palps without transverse bar pattern; fore wing usually without
 metallic markings..... 46
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*Note: Superfamily GELECHOIDEA - Kristensen (1999) lists eight families that occur in British Columbia, namely Batrachedridae, Chimabachidae, Coleophoridae, Cosmopterygidae, Elachistidae, Gelechidae, Oecophoridae, and Scythrididae. At the present time, there is debate amongst the experts concerning the validity of these taxa, and there is no workable key for easy identification: most characters are internal genitalic features only recognizable by expert lepidopterists. Hence, no key to the families in this Superfamily is included.

Description of Families of LEPIDOPTERA

Superfamily Micropterigoidea

Family Micropterygidae (Mandibulate Moths) (Fig. 31)

Small moths, with wingspan usually less than 10 mm. Head with rough vestiture of scales; head capsule only moderately extending above upper margin of compound eyes: dorsally with two prominent ocelli; antennae moniliform; labrum large, movable and extensively desclerotized; mandibles large and functional, with well developed articulation on head capsule; maxillae with long, folded, 5-segmented palps, erect and sclerotized lacinia, and with galear not long and forming a proboscis; labial palps short and 2-segmented. Wings narrow and lanceolate, held roof-like over body when at rest; upper surface usually with iridescent scale patches; fore wing with Sc forked near middle and M4 absent; hind wings with three or four branches to Rs,

and without a produced jugal lobe. Middle tibia without spurs, but with apical tuft of setae; hind tibia with four apical spurs.

Adult moths, which emerge in the spring, are usually diurnal, but nocturnal activity is reported in some species. Adults are attracted to flowers and feed on pollen, which they crush with the mandibles. Larvae feed on moss and liverworts, and can occur in soil. They pupate inside a silk cocoon.

Worldwide there are 121 species in eight genera, but there are many new species undescribed. Only one genus (*Epimartyria*) occurs in North America, with two reported species, both of which occur in Canada. A new species close to *E. pardella* Walsingham occurs in British Columbia, having been collected at Fraser Mills in 1921 and 1922. It is rare, has a 8 mm wingspan, and has a large yellow iridescent spot on each fore wing. The other species in Canada, *E. auricrinella* Walsingham is an eastern species.

Superfamily Hepialoidea

Family Hepialidae (Ghost or Swift Moths) (Fig. 32)

Small to large, bronze or ash-grey moths, with wingspan in North American species of 25 to 100 mm. Head without ocelli; both mandibles and maxillae present; maxillary palps minute, 1 to 5-segmented; proboscis reduced; labial palps short, 2 or 3-segmented, and strongly united to labium. Wings aculeate, with normal scales only, and narrow fringe; markings varied, but those on fore wings tend to be veticulate, and sometimes with metallic spots or patches; the hind wings are usually plain. Venation typically with R4 and R5 separate or short-stalked; an intermedian crossvein is present, but an anal loop is either present or absent. The legs lack tibial spurs, but a fore tibial epiphysis can be present or absent.

Adult moths are fast flying, diurnal, crepuscular or nocturnal. Some species form mating swarms with oscillatory flight. Eggs are small and very numerous, and are broadcast over the ground by flying females. Larvae bore into stems or roots, or tunnel in the ground. Pupae are object and usually found in larval burrows.

Worldwide there are about 80 genera and 500 species. They are widely distributed, but most numerous in Australia. Some species are pests of grasslands in Australia, New Zealand and South Africa. There are 20 species in four genera in North America. All four genera and 12 of the species occur in Canada. So far three genera and six species are reported from British Columbia, namely *Gazoryctra* (2 sp.), *Phymatopus* (2 sp.) and *Sthenopsis* (2 sp.). The commonest seems to be *Sthenopsis purpurascens* (Packard), a large moth with 95 to 100 mm wingspan, that occurs in the Okanagan.

Superfamily Nepticuloidea

Family Nepticulidae (Minute leaf miners) (Fig. 33)

Very small moths with wingspan typically 3 to 5 mm. Head with erect seta-like scales; vertex rough; lower portion of frons and clypeus bare; ocelli absent; compound eyes relatively

small and cornea naked; antennal scape enlarged and covering eye; maxillary palps long, 5-segmented and folded down; proboscis very short or rudimentary; labial palps usually 3-segmented and drooping. Fore wings slender and lanceolate, with reduced venation, usually faint and without crossveins; Sc extremely short and discal cell open; veins R and M branched, R with 1 to 4 branches, M with 1 to 2 branches; M anastomizing with R, and sometimes basally with Cu; Cu reduced or unbranched; 1A and 2A usually fused, rarely with anal fork. Hind wings lanceolate, with 3 to 6 major veins and no closed cells. Females with short, non-piercing ovipositor.

Moths are often attracted to light at night. Their flight is very rapid and irregular. Females lay eggs singly on host plants. Larvae are normally leaf miners, but can occur in woody twigs, fruit or galls. The leaf mines are typically slender, serpentine and with relatively broad median grass trails, which occasionally widen to form oval blotch mines. Hosts are usually members of the Betulaceae, Fagaceae, Rhamnaceae, Rosaceae or Salicaceae. Most nepitculid species are highly host specific. Pupation rarely occurs in mines, but most often the silk cocoons can be found attached to the outer plant surface, or in detritus on the ground beneath the host.

Worldwide, 11 genera and around 800 species have been described. So far eight genera and 94 species have been reported in North America, with four genera and 34 species noted from Canada. Only one genus (*Stigmelia*), with six species is recorded from British Columbia, *Stigmelia alba* Wilkinson & Scoble and *S. stigmaciella* Wilkinson & Scoble being confined to this province in Canada.

Superfamily Incurvarioidea

Family Heliozelidae (Shield bearer moths) (Fig. 34)

Very small moths with wingspan under 10 mm. Head with vertex typically smooth, and with broad, laminate, iridescent scales directed downward over smooth frons; compound eyes small; antennae shorter than wings and with scape entirely covered with iridescent scales; mandibles vestigial; maxillary palp reduced to one minute segment in species in British Columbia; proboscis coiled and scaled at base; labial palp moderately short, 3-segmented and drooping. Wings held roof-like in repose. Fore wing broadly laminate; R with 3 or 4 branches; M with 1 or 2 branches; CuA with 1 to 2 branches; 1A and 2A without basal fork. Hind wings slender and lanceolate, with discal cell open; crossveins absent; M with 1 or 2 branches; 1A and 2A fused. Female with elongate piercing ovipositor.

Adults are diurnal, and although they may fly in sunshine near the host, are seldom encountered. All larvae except the last instar are leaf miners, constructing a flat, oval case by cutting sections from the upper and lower epidermis of the mine and joining these together with silk, so forming a lenticular shaped case, which gives these moths their common name. Mature larvae usually lower themselves to the ground on a silk thread and pupate amongst leaf litter. Hosts are usually woody trees or shrubs.

Worldwide there are about 12 genera and over 100 species. Three genera and 30 species are reported from North America, with two of these genera and 13 species known from Canada.

Only one species *Coptodisca arbutiella* Busck is recorded from British Columbia, occurring on *Arbutus*.

Family Adelidae (Fairy moths) (Fig. 35)

Small moths with wingspan up to 14 mm. Head with vertex densely covered with seta-like scales; frons usually rough; compound eyes dimorphic in some species, in which case the males have eyes virtually meeting on the vertex, and usually with the facets in the upper two-thirds of the eye enlarged; the antennae are usually much longer than the fore wing, but can be short and less than the length of the wing; mandibles are less than the length of the wing; mandibles vestigial; maxillary palp 2 to 5 segmented; proboscis short or rudimentary; labial palps 3-segmented and usually upturned. Fore wings slender with 5 branches to R, and with base of M faint; 1A and 2A with short basal forks. Hind wing slender with M1 and M2 either separate or stalked, and with 1A and 2A having short basal stalk, with discal cell closed. Female with long, piercing ovipositor. Males of many species of *Adela* swam near host plant or oviposition site.

Eggs are inserted singly into plant tissue. Eggs of most species of *Adela* are inserted into the flower ovary of their host, wherein the first instar larva feeds on the developing seeds. The first instar larva of other adelids may mine leaves of the host, which usually is an angiosperm tree or shrub. Later instar larvae of adelids are case bearers, and feed on the lower or fallen leaves of the host. Pupation occurs inside the larval case, with the pupal exuvium partially extruded.

Worldwide there are about 300 described species. Three genera and 18 species are recorded in North America, with all three genera and 10 species occurring in Canada. Three genera also occur in British Columbia, with six species discovered so far, namely *Adela* (3 sp.), *Cawchas* (2 sp.) and *Elasmion* (1 sp.). *Adela purpurea* Walker (Willow fairy moth) is evidently the commonest species in Canada, occurring from British Columbia to Labrador. The males have antennae three times as long as the fore wings, and the latter are greenish to bronzy purple with a white bar, at the apical two-thirds, and with a narrow wavy apical lobe, both edged with black. Adult moths of this species are found on willow blossom in April.

Family Prodoxidae (Yucca Moths) (Fig. 36)

Small moths with wingspan from 3 to 33 mm. Head vestiture usually rough, with dense seta-like scales; ocelli absent; compound eyes either small or large, the cornea being bare or with scattered interfacetal microsetae; antennae shorter than fore wing and with scape usually smooth; mandibles vestigial and non-functional, but relatively prominent; maxillary palps elongate, 4 or 5-segmented, and folded against head; proboscis short, and not coiled when not in use; labial palps relatively short, either porrect or upturned, and usually 3-segmented. Fore wings slender, 1A + 2A with basal fork. Hind wings with intercalary cell, and with discal cell closed. Female with elongate, compressed ovipositor.

Moths are usually diurnal and often have white wings. Larvae are endophagous, boring into fruit, leaves or shoots. None are case-bearers. Species overwinter as larvae, with last instar larvae in some cases diapausing for many years.

Worldwide there are 12 genera and about 80 species, most in the Nearctic region, where nine genera and 43 species are recorded from North America. So far two genera and 16 species have been noted in Canada, with both genera and 12 species reported from British Columbia, namely *Greya* (7 sp.) and *Lampronia* (5 sp.).

The early instar of species of *Greya* bore into the seeds, fruit or peduncles of Saxifragaceae and Umbelliferae. They move to the ground to overwinter, and then in the following spring, complete their feeding and development in the flower buds or foliage of the host. In *Lampronia* species, eggs are typically inserted singly into young fruit of members of the Rosaceae or Saxifragaceae in late spring or early summer. The early instar larvae feed on the developing seeds. In mid to late summer larvae then enter diapause in hibernacula on the lower parts of the plant or in the soil. In the spring, larvae return to bore into the developing buds or shoots of the host. Pupation normally occurs in the shoot, with adults emerging in late spring.

The species of *Tegeticula* in the USA are the well-known Yucca moths, responsible for pollinating the yucca plant. Female moths have the basal segment of the maxillary palp specially modified to form a tentacle, which is used to scrape pollen from yucca anthers. This pollen is then formed into a ball by the forelegs, and the ball is then stored in a depression or pocket located beneath the head. On moving to another mature flower, the female bores into the ovary with the elongate, sclerotized ovipositor, depositing one or more eggs near an ovule. She then moves to the top of the pistil, and with her mouthparts, packs the pollen she has stored into the stigmatic cavity, using the tentacles to plunge the pollen into the stigmatic tube. This pollination results in seed development, the moth larvae feeding on such seeds although they usually do not consume all of them. When fully fed, the larvae leave the seed pod to pupate in the ground. Adults emergence is timed to coincide with the flowering time of the yucca.

Superfamily Tischerioidea

Family Tischeriidae (Tischerid Moths) (Fig. 37)

Small moths with 5 to 9 mm wingspan. Head with smooth frons; vertex somewhat rough with slender or broad scales which are directed forwards; the compound eyes are large, but ocelli are absent; antennae just over half length of fore wing, the scape being smooth with a prominent tuft of slender scales projecting over the eye; mandibles reduced to a pair of minute lobes; proboscis short, and with scales at base; maxillary palps reduced, with either one or three short segments; labial palps moderately short, 3-segmented, with smooth scales and drooping wings generally unicoloured. Fore wings lanceolate with microtrichia restricted to base; all 5 branches of R terminating on the costa; M with 2 branches, but with base distinct; CuA unbranched; 1A + 2A usually without basal fork; discal cell of fore wing closed. Hind wings slender, and usually narrower than fore wings; M and Cu usually unbranched, and discal cell open in hind wing. Females with short, non-piercing ovipositor.

The larvae of tischerid moths are leaf-miners, capable of spinning silk in all instars, and forming either tunnel-shaped or blotch mines in leaves of deciduous trees and shrubs. Pupation occurs within the mine, usually in a flimsy cocoon.

There is only a single genus, *Tischeria* in this family, with about 80 known species. Some 48 species are reported from the United States, with 10 species known from Canada. Only one species, *T. splendida* Braun is recorded from British Columbia.

Superfamily Tineoidea

Family Tineidae (Clothes moth family) (Fig. 38)

Very small to medium-sized moths, usually dull and brownish, with wingspan 8 to 14 mm. Head with erect piliform scales, and without visible ocelli; antennae filiform with scape smooth-scaled in most genera; maxillary palp strongly developed, 5-segmented and folded; labial palps 3-segmented, with stiff lateral bristles; proboscis very short or even absent, and never strongly sclerotized; galea short, disassociated, not strongly sclerotized, and if rolled, rolled haphazardly. Wings typically moderately broad, and generally subovate in shape; scales of fore wing often in rough or raised patches, and some taxa with sex scales; typically full complement of free veins in fore wing, with Rs4 terminating on costa; adults resting with wings held roof-like over body, and with body parallel to substrate. Hind tibia with erect and elongate scales on upper surface; adults moving with characteristic scuttling run.

Practically all tineid larvae are fungivorous, with a substantial part of their food being fungal tissue. Thus many larvae are found in rotten wood, or in plant or animal matter. Some detritophagous tineids are commensals in the nests of social insects, or are associated with human dwellings, where they can be pests of stored food products, furnishing or fabrics, feeding on wool, fur and feathers. Many tineid larvae, including the household pests, build portable cases from which they feed. Prior to pupation, the larvae move to a pupation site, usually well away from the food source.

Worldwide there are about 3000 species in 320 genera. Fifty-one genera and 113 species are known from North America, and 18 genera 42 species from Canada, with seven genera and eight species so far recorded from British Columbia. Both of the introduced clothes moths, namely the casemaking clothes moth (*Tinea pellionella* (L.)) and the webbing clothes moth (*Tineola bisselliella* Hummel), can be household pests. The commonest species in homes is the Indian meal moth *Plodia interpunctella* (Hüber), a pest of stored products.

Family Psychidae (Bagworm moths) (Fig. 39)

Note: Species of this family in British Columbia are composed of only parthenogenetic, larviform females, so do not exhibit typical family characters. They are best recognized by the larvae cases. Because typical adults do not occur in the province, the family description below is much abbreviated.

Usually small to medium sized moths, with wingspan 8 to 25 mm. Head with moderately long, slender to piliform scales directed forward; ocelli usually absent; proboscis, maxillary and labial palps reduced or absent. Males fully winged; females winged, brachypterous, apterous or vermiform, with all body appendages vestigial or absent.

Larvae are lichen feeders, and form portable bags, a case made of pieces of twig, leaves or other material, which they carry around with them as they feed. Bags or cases are usually open at both ends, the top opening being used for feeding, and the lower for waste discharge. Pupation takes place in the larval bags or cases. Males leave the bag on emergence, departing from the lower end. Females spend their whole life in the bag or case, and if they leave, do so after egg laying. Males, if present, fertilize the female in the bag, through one end of the case.

Worldwide there are nearly 1000 known species, with 85% of these occurring in the Old World. So far 12 genera and 28 species are known from North America, and six genera and eight species from Canada. So far four species (*Apterona helicoidella* (Vallot), *Dahlica lichenella* (L.), *D. triquetrella* (Hüber) and *Hyaloscotes pithopoera* (Dyer)) are known from British Columbia. The first three species in the province are all parthenogenetic, apterous, larviform females only. *Dahlica triquetrella* is common in the lower mainland, while *Apterona helicoidella* with its gastropod-like case made of soil is commonly found on sage bushes, notices and buildings in the South Okanagan. *Dahlica lichenella* has so far only been recorded near the Alex Fraser bridge in Vancouver, while *Hyaloscotes pithopoera* has been reported 5 km SE of Okanagan Falls.

Superfamily Gracillarioidea

Family Bucculatricidae (Fig. 40)

Small to extremely small moths, with wingspan 4 to 11 mm. Head usually elongate, with frons smooth and projecting well below eye; vertex usually large, with erect tuft of piliform scales; ocelli absent; antennae filiform, with scape enlarged, flattened, and with a dense row of slender scales which partially cover the eye; vertex usually large, with erect tuft of piliform scales; ocelli absent; antennae filiform, with scape enlarged, flattened, and with a dense row of slender scales which partially cover the eye; maxillary palps vestigial, usually a minute, unsegmented lobe; labial palps usually extremely short and 1-segmented, drooping and without lateral bristles. Fore wings lanceolate, with apex usually acuminate.

Most species have larvae in which the first two instars are leaf miners, with the third instar emerging to feed externally on leaves. The fourth instar larva constructs a flattened moulting cocoon under the leaf used by the third instar. The fifth instar larva, prior to pupation, constructs a silken, longitudinally ribbed cocoon, which is typical for the family.

Worldwide there are about 25 species, most of which occur in the Nearctic. One genus *Bucculatrix* and 102 species are known from North America, with 31 species occurring in Canada and 11 species recorded from British Columbia.

Family Gracillariidae (Leafblotch miner moths) (Fig. 41)

Small to very small moths, with wingspan 4 to 21 mm. Head usually smooth-scaled; ocelli absent; antennae filiform with scape slender, usually smooth, and not covering eye; flagellomeres with a single annulus of scales; mandibles absent; maxillary palps rarely absent, usually short to minute, and 1- to 4-segmented; labial palps 3-segmented, usually upturned, and straight to drooping, the second segment sometimes with a ventral tuft of scales; proboscis length more than 2.5 times diameter of eye. Wings slender to lanceolate, with a broad fringe, the cilia

longer than width of hind wing; fore wings often brightly coloured, and in some genera having a contrasting, outward pointing V-shaped transverse band.

Larvae are leaf, bark or fruit miners, with a hypermetamorphosis. Larvae typically form blotch mines on leaves, hence the common name. Early larval instars are flattened sap feeders, while latter instars feed on parenchyma. Pupation takes place in the mines.

Worldwide there are about 2000 species in about 75 genera. Twenty-two genera and 288 species are known from North America, and 17 genera and 125 species from Canada. To date, nine genera and 26 species are recorded from British Columbia.

Superfamily Yponomeutoidea

Family Yponomeutidae (Ermine Moths) (Fig. 42)

Yponomeutids are small moths with rather narrow wings and wingspans of 5 to 30 mm. The maxillary palps are short, usually with only one or two segments; the ocelli are absent. The antennal scape usually bears a comb-like pecten and the proboscis is usually naked. The tibial spurs are 0-2-4. The fore wing is often brightly patterned and metallic, especially in *Argyresthia*; the abrupt narrowing at the front of the outer half of the hind wing characteristic of many species also occurs elsewhere in related families. Vein Cu₂ in the fore wing rises in the outer fourth of the discal cell. Veins R_s and M₁ in the hind wing are separate at their bases; R₄ and R₅ in the fore wing are separate, R₅ extending all the way to the apex or the outer margin of the wing.

Larvae are leaf-miners, leaf-tiers, solitary or colonial webbers, flower feeders, or borers in bulbs. For example, *Argyresthia* species mine in buds, fruits and leaves of many woody dicots and conifers and some are pests of forest and agricultural crops. The larvae of other family members such as *Yponomeuta* feed externally in communal webs on various trees and shrubs. The Old World genus *Prays* contains pests of citrus and olives.

Adults of *Argyresthia* and *Zelleria* characteristically rest with the head down at the substrate and the abdomen obliquely raised.

The family Yponomeutidae contains about 600 named species worldwide; about 80 species in 11 genera are known in North America. Twenty species in seven genera are recorded in BC. Representatives of two of the six subfamilies live in BC. The *Argyresthiinae*, sometimes separated into its own family, consists of *Argyresthia*, a nearly cosmopolitan genus of over 150 species; the *Yponomeutinae* holds the other BC genera. *Argyresthia* has 11 BC species, including *A. conjugella* Zeller (Apple Fruit Moth), originally from Europe but first recorded in North America on south coastal BC in 1896; it feeds on *Malus*, *Prunus*, *Amelanchier*, *Sorbus* and related plants. *Argyresthia cupressella* Walsingham (Cypress Tip Moth) is native to California but now ranges north to coastal BC; the larvae bore in the shoot tips of junipers and Leyland, Lawson and Monterey cypresses. Two European species now settled in the province are *A. goedartella* (Linnaeus), which attacks the terminal twigs and catkins of birch and alder and *A. pygmaeella* (Hübner), which feeds on willows.

Adults of *Yponomeuta* are white with minutely black-spotted fore wings; larvae feed socially in webs on plants of the rose and other families. *Yponomeuta padella* (Linnaeus) (Ermine Moth) larvae feed colonially inside a web on cherry and apple; *Y. malinellus* Zeller is also recorded in BC. *Swammerdamia caesiella* (Hübner), a European native, also eats rosaceous plants but is a solitary feeder. *Ocnerostoma piniariella* Zeller (European Needle Miner) was introduced from Europe to New York state in 1882 and is now a pest of white pines on BC's south coast. *Zelleria haimbachi* Busck (Pine Needle Sheathminer) attacks the needle fascicles and can stunt the growth of Lodgepole, Jack and Ponderosa pines; it ranges from California and southwestern BC east to Quebec and New York.

Family Ypsolophidae (Ypsolophid Moths) (Fig. 43)

Ypsolophids are small moths with rough-scaled heads and usually well-developed ocelli. The antennae are thread-like and the proboscis lacks scales. The forewings normally have no metallic markings and, in some *Ypsolopha* species, are hooked at the tip. Veins Rs and M1 in the hind wing are stalked or lie closely together. The fore tarsus has an epiphysis and the tarsal spurs are usually 0-2-4.

Ypsolopha larvae live in open webs on the leaves of plants, mostly woody ones. Larvae of the subfamily Ochsenheimeriinae, an Old World group, are leaf miners in grasses, sedges and rushes when young; later instars bore in the stems and seeds of these plants. The adults are diurnal. *Ochsenheimeria vacculella* Fischer von Roeslerstamm (Cereal Stem Moth), an Old World pest of agricultural grasses, has been introduced to eastern North America but is unknown in BC.

The family Ypsolophidae is a small family with about 150 known species from the temperate Northern Hemisphere and 38 from North America. The largest genus is *Ypsolopha*, Holarctic in distribution and containing more than 120 species, 35 of which are American. *Ypsolopha dentella* (Fabricius) feeds on honeysuckle species and *Y. ustella* (Clerck) on oak. Eight other species are recorded from BC: *Y. canariella* (Walsingham), *Y. cervella* (Walsingham), *Y. dentiferella* (Walsingham), *Y. dorsimaculella* (Kearfott), *Y. falciferella* (Walsingham), *Y. rubrella* (Dyar), *Y. senex* (Walsingham) and *Y. walsinghmiella* (Busck).

Family Plutellidae (Diamondback Moths) (Fig. 44)

Plutellid moths have wingspans of about 10 to 50 mm (under 30 mm our fauna); the wings are usually narrow and often oddly-shaped with the hind wing frequently as wide as the fore wing. The fore wings are often brightly patterned (the hind margin of the fore wing frequently shows a pale stripe) but normally are not metallic. The head bears ocelli and the antennae are thread-like with a basal pecten. An unscaled proboscis is present. Veins Rs and M1 in the hind wing are separate; M3 and CuA1 are also separate. In the fore wing R4 and R5 are not stalked. The tibial spurs are 0-2-4 and an epiphysis is present.

Larvae are solitary leaf-rollers or live in loose webs and skeletonize leaves; most pupate in a characteristic, open-mesh cocoon. Adult moths hold their antennae forward when at rest. *Plutella*, a cosmopolitan genus of over 40 species feeds largely on plants of the mustard family;

the Diamondback Moth, *P. xylostella* (Linnaeus), is a world-wide pest and one of the few micro-moths that migrates long distances.

The family Plutellidae is world wide but small, with fewer than 100 known species; seven genera and 18 species occur in North America. Two genera and six species are recorded in BC. The best known species in the family in BC is the European import, *Plutella xylostella* (Linnaeus), a pest of cabbage. It eats a wide range of crucifers, including garden ornamentals such as alyssum, stocks and wallflowers. It appeared in North America before 1850, reaching Vancouver Island by 1900 and the Okanagan Valley by 1914. *Plutella porrectella* (Linnaeus) and *P. vanella* Walsingham also live in BC. The genus *Rhigognostis*, represented by *R. interrupta* (Walsingham) and *R. poulella* (Busck), also occurs.

Family Glyphipterididae (Sedge Moths) (Fig. 45)

Sedge moths are mostly small; wingspans range from 4 to 30 mm, but most are about 10 mm. The adults are frequently strikingly marked, usually with transverse bands or lines and often with metallic marks. The fore wing is often rather square-tipped or even concave and is broader than the hind wing. The head is smooth-scaled; the labial palps are upturned and often banded in light and dark scales; ocelli are large and conspicuous. The antennae are thread-like and lack a pecten. In fore wing vein R5 is separate from R4, infrequently stalked, extending to apex or outer margin of wing. The tibial spurs are 0-2-4 and an epiphysis is present.

Larvae bore in stems and leaves, mainly in monocots such as grasses, rushes, sedges and arums. Adults are diurnal and are especially active in wet places; they often visit flowers. While at rest they rhythmically raise and lower the folded wings.

The family Glyphipterigidae contains about 384 described species in about 21 genera; the world-wide genus *Glyphipterix* holds about two-thirds of the species. In North America five genera contain 36 named species. BC has three species in two genera -- *Diploschizia impigritella* (Clemens) (known to feed on *Cyperus esculentus* Linnaeus), *Glyphipterix bifasciata* (Walsingham) and *G. sistes* Heppner.

Family Bedelliidae (Bedelliid Moths) (Fig. 46)

Bedelliid moths have usually placed in the Family Lyonetiidae. They are small grey moths frequently sprinkled with dark scales; wingspans are usually 10 mm or less. The face is smooth-scaled and there are no ocelli. The basal antennal segment has a dense pecten but this is not developed into a true eye cap. The narrowly lanceolate fore wing has Rs2, Rs3, Rs4 and a branch of M all arising from a common stem from the pointed tip of the discal cell. The upper margin of the hind tibia is strongly hairy.

The larvae mine the leaves of plants in the families Poaceae, Liliaceae, Urticaceae, and Convolvulaceae. Young larvae make a linear mine and later instars create blotch mines. A mature larva spins a loose silk web on the leaf surface in which to pupate.

The small family Bedelliidae contains about 20 species, all in the genus *Bedellia*, in all regions except the Neotropical. Only two species occur in North America and one of these, the

cosmopolitan *Bedellia somnulentella* (Zeller), is recorded in BC. Known as the Morning-glory Leaf Miner, it can be a pest of sweet potato (*Ipomoea batatas*) where that crop grows, but in BC it feeds on bindweed (*Convolvulus*) species.

Family Lyonetiidae (Lyonetiid Moths) (Figs. 47 & 48)

The Lyonettidae contains small moths, usually with wingspans of 10 mm or less. The face is smooth-scaled but the vertex often has a tuft of string-like scales. There are no ocelli. The base of the antenna forms an eye cap. The wings are very narrow with reduced venation; the forewing tip is often attenuate. In the fore wing Rs₂ rises before the apex of the long discal cell (or discal cell is not closed). Vein CuP is absent. Tibial spurs are 0-2- with epiphysis present; the hind tibia is hairy above. In the subfamily Lyonetiinae (e.g., *Lyonetia*) the ovipositor is piercing.

The larvae are leaf (and occasionally twig) miners, almost always in dicot families. Some species of *Perileucoptera* attack coffee plants; in Eurasia *Leucoptera malifoliella* (O.G. Costa) is an orchard pest and *Lyonetia clerckella* Linnaeus attacks *Prunus* and other fruit trees.

The family Lyonetiidae is cosmopolitan and consists of about 210 described species. There are ten genera and 22 named species in North America; BC reports three genera and four species -- *Lyonetia prunifoliella* (Hübner) attacks apple and other rosaceous trees; *L. saliciella* Busck mines the leaves of birches; *Leucoptera laburnella* (Stainton) feeds in the leaves of laburnum and *Paraleucoptera albella* (Chambers) mines in cottonwoods.

Superfamily Gelechioidea

Family Elachistidae (Grassminer Moths and Relatives) (Fig. 49)

Small moths (wingspans about 6 to 14 mm), adults difficult to characterize externally. The wings are narrow to broad; the hind wings are often broadly fringed. The head is usually smooth-scaled; the ocelli can be present or absent but the latter case usually prevails. The antennae are normally thread-like and with or without a pecten. Hind wing with veins Rs and M₁ stalked (Elachistinae) or separate (Depressariinae). The most definitive characters of the family are pupal ones, especially the unusual lateral protuberances on the abdomen.

Larvae have a wide range of habits. Those of the Depressariinae (e.g., *Agonopterix*, *Depressaria*) are leaf-tiers, stem borers and seed feeders of many plant families, including Asteraceae and Apiaceae. The Elachistinae (e.g., *Elachista*) are leaf miners, mostly on monocots such as grasses, sedges and rushes. Species of Ethmiinae mainly feed beneath light webbing on Boraginaceae and Hydrophyllaceae.

The Elachistidae is distributed worldwide; there are more than 3270 described species placed in over 165 genera. The BC list has ten genera and 42 species. Some of the subfamilies (e.g., Depressariinae, Ethmiinae) are often given family status. The most diverse genera in the province are *Agonopterix* (10 species), *Elachista* (8), *Depressariodes* (6), *Depressaria* (5), *Ethmia* (4) and *Semioscopis* (3). Several native species of *Agonopterix* occurring in BC range transcontinentally -- *A. argillacea* (Walsingham) and *A. gelidella* (Busck) feed mainly on *Salix* and *A. canadensis* (Busck) eats species of *Senecio*. The strictly western *A. rosaciliella* (Busck)

and *A. antennariella* Clarke eat species of Apiaceae and *Antennaria* in the Asteraceae, respectively; the latter is known only from BC and Washington. *Agonopterix nervosa* (Haworth) is a European species introduced to southern Vancouver Island between 1915 and 1920, spreading to California since. The larva feeds on laburnum, broom and gorse. Another European moth, *A. alstroemeriana* (Clerck), defoliates the toxic weed, Poison Hemlock (*Conium maculatum* Linnaeus).

Perhaps the best known species of the large Holarctic genus *Depressaria* is *D. pastinacella* (Duponchel), the Parsnip Webworm. A European pest of the Apiaceae, it was first recorded in North America in Ontario in 1869; by 1927 it had arrived in BC at Victoria and by 1938 it was a pest of parsnip seed in Armstrong. Larvae feed on seed heads of a variety of native umbellifers such as *Heracleum lanatum* Mischaux and species of *Angelica*. *Depressaria daucella* (Denis & Schiffermüller) eats similar plants and is also probably introduced. The larvae of two western species restricted to the Interior in BC, *D. artemisiae* Nickerl and *D. artemisiella* McDunnough, are found on *Artemisia*. *Elachista* adults fly during the day. One of the more distinctive BC species, *E. subalbidella* Schläger, has uniform yellow fore wings; the larvae make a long narrow mine in the leaves of peatland grasses. The brightly coloured larvae of *Ethmia* feed externally with some webbing on foliage and flowers; two BC species are *E. albistrigella* (Walsingham) and *E. monticola* (Walsingham).

Family Scythrididae (Scythridid Moths and Relatives) (Fig. 50)

The Scythrididae is mainly defined by characters of the larva and the adult genitalia. North American species are generally dark, with narrow wings and wingspans of 10-18 mm. Antennae vary from thread-like to bipectinate. Vein R1 in the fore wing rises in the outer half of the discal cell and in the hind wing Rs and M1 are parallel.

Larvae feed externally on buds, flower heads and leaves or mine inside leaves. A great range of plants are used, from the Poaceae to the Asteraceae. Members of the genus *Areniscythris* live on the sand of shifting dunes in western North America and on warm days the adults run and jump over the sand-like pieces of windblown debris. The larvae live in silk tunnels attached to the host plants under the sand. Many Scythrididae, especially northern and montane species, fly in the daytime.

The Scythrididae ranges around the world; there are 86 genera containing over 1200 described species. In North America, the family is poorly known; about 42 species have been described in six genera, but the true diversity in this family in North America is probably close to 500 species. In BC the genus *Asymmetrura* is represented by a single species, *A. impositella* (Zeller), mostly collected in the Cariboo region but ranging transcontinentally. The larvae mine *Aster* leaves. *Scythris* contains four species in BC; the larvae often feed gregariously in loose silk webbing and skeletonize leaves, buds or flowers. *Scythris noricella* (Zeller) is a Holarctic species (Boreal in North America) that feeds on *Epilobium*, folding over a leaf with silk to make a feeding cell. Also a Holarctic species distributed across North America and feeding on Fireweed, *S. inspersella* (Hübner) has been collected in BC only in the northeastern boreal forest. *S. immaculatella* Chambers and *S. trivinctella* (Zeller) are both transcontinental. The former lives across southern BC and probably feeds on mosses; the latter, collected only in the southern Interior, has been reared from pigweed, *Amaranthus retroflexus* Linnaeus (Amaranthaceae).

Family Chimabachidae (Chimabachid Moths) (Fig. 51)

As a family, Chimabachid moths are difficult to recognize without dissection of the genitalia and other structures. The wings are rather broad and rounded and the ocelli, when present, are far from the eyes. Unlike in some related families, the tops of the abdominal segments lack spiny setae. In the larva the hind tibia and tarsus are swollen.

Larvae feed on a range of plant families from Betulaceae to Rosaceae and Ericaceae; they roll and tie leaves to make shelters. They eat the developing leaves, flowers and fruits.

The Chimabachidae is a small Palearctic group of two genera and six species ranging from Europe to Japan. In older literature it was usually placed in the Oecophoridae. One species, *Cheimophila salicella* (Hübner) (Blueberry Leafroller), has been introduced to North America, where it is known only from the Lower Mainland of BC. The male is heavy bodied and fully winged while the fat female has reduced, pad-like wings and is flightless; both are dark brown insects. The moth first appeared in Richmond in 1955 and is now a pest on blueberry farms in the Fraser Valley. It also commonly feeds on *Salix* and *Spiraea* species; other foodplants include alder, birch, maple and cherry.

Family Oecophoridae (Oecophorid Moths) (Fig. 52)

Oecophorids are mostly small to medium-sized, broad winged moths (wings narrow in Stathmopodinae). The hind wing is often as wide as the fore wing. Most characters are extremely variable. The head is usually smooth scaled; labial palps are often slender, upwardly curved and extremely long. Veins Rs and M1 in the hind wing are separate. The abdominal terga are with or without patches of spiny setae.

Larvae of the subfamily Oecophorinae feed on fungi and detritus in leaf litter and bark; some tie leaves or make cases from twigs or bits of leaves; some have become pests of stored food and household goods. The mostly tropical and subtropical subfamily Stathmopodinae feeds on flowers, fruits, decaying plant material, scale insects, aphids and spider egg sacs.

The family Oecophoridae is distributed nearly worldwide, with 326 genera containing about 3150 named species; 3000 of these are in the subfamily Oecophorinae. The family is especially well represented in Australia and South America. Many of the genera now placed in the Elachistidae were moved from the Oecophoridae. There are 10 species in 10 genera in BC. Most have larvae that feed in bark or fungus-infected wood. The colourful *Decantha boreasella* (Chambers) is dark with large orange-yellow spots. It ranges across the continent; the larvae feed under conifer bark. *Denisia haydenella* (Chambers) is distributed from BC and Alberta to Colorado and Oregon where the larvae have been collected from under the bark of dead trees. *Eido trimaculella* (Fitch), a transcontinental species, has been reared from bracket fungi. *Pleurota albastrigulella* (Kearfott) is the only Nearctic member of a large genus of 120 species; it ranges from BC to Arizona and northern Baja California. The boreal and montane *Polix coloradella* (Walsingham) is the only species in the genus; the larvae feed on dead and decaying wood, bark, galls and cankers of alder, pines and Douglas-fir. *Brymbilia quadrimaculella* (Chambers) has four yellow-white marks on each forewing; larvae have been found in the bark of dead Ponderosa Pines and in the same tree species infested by polypore fungi. Other species are originally alien. *Endrosis sarcitrella* (Linnaeus), the White-shouldered House Moth, and

Hofmannophila pseudospretella (Stainton), the Brown House Moth, are the only members of their genera and are found in most regions of the world. The former is a minor pest of cereals; the latter has broader tastes and feeds on grains, skins, cloth and dried foods. *Carcina quercana* (Fabricius), which feeds on various deciduous trees, including oak (*Quercus*) and beech (*Fagus*), was introduced from Europe to North America at Victoria about 1920; the adult is a pretty yellow and pink moth.

Family Batrachedridae (Batrachedrid Moths) (Fig. 53)

Often placed in the Coleophoridae, batrachedrids are small moths, in Canada mostly brown, with narrow wings and wingspans of 7 to 17 mm. The head is smooth scaled, the ocelli are absent and the antennae are thread-like. The linear hind wing has the discal cell open, veins M1 and M2 stalked, usually Rs and M1 separate and veins M3 and CuA1 fused. The abdominal terga have two longitudinal patches of spines.

Batrachedrid larvae feed on a wide variety of plant material, from fern sporangia to *Juncus* seeds. Some prey on scale insects. Canadian species live on aspen catkins and as inquiline in the galls of *Pontania* sawfly larvae on willow leaves.

A small but worldwide family, the Batrachedridae has about 100 named species placed in six genera. About 22 species in three genera are described from North America, but only one is recorded in BC. *Batrachedra praeangusta* (Haworth) is a Holarctic species found in a wide range of habitats; larvae feed on the leaves and catkins of poplars and willows.

Family Coleophoridae (Casebearer Moths and Relatives) (Fig. 54)

The Coleophoridae usually have narrow, strongly pointed wings and a wingspan of less than 20 mm. The hind wings are characteristic: veins Rs and M1 are separate and M3 and CuA1 are either separate or stalked. An antennal pecten is present. The subfamilies Momphinae and Blastobasinae are often given full family status in the literature.

Most coleophorid larvae are leaf miners in the first instar, then build cases out of silk, excrement, pieces of leaves or other plant parts. These cases are usually cryptic and resemble bits of rolled leaf, buds, seeds, twigs, thorns or bird droppings. Many larvae feed between the upper and lower surfaces of leaves without fully exiting their cases; others feed on seeds or flowers. *Coleophora laricella* (Hübner), the Larch Casebearer, makes a case from a section of a hollow, mined needle. Members of the subfamily Momphidae eat buds, seeds and flowers or are stem borers or gall makers; many species feed on the plant family Onagraceae. Blastobasinae are mainly scavengers; a few feed on aphids and scale insects.

The family Coleophoridae ranges worldwide; about 1420 species are described in 43 genera. In North America the family has 14 genera containing 300 named species. Three genera and 27 described species are recorded in BC; by far the most diverse is *Coleophora* (150 species in North America) with 21 species. Some are golden metallic, flower-visiting moths. *Coleophora laricella* (Hübner), the Larch Casebearer, is a severe defoliator of native and exotic larches. This Eurasian species was first recorded in Massachusetts in 1886 and appeared in BC in 1966 near Rossland. In BC Western Larch is mainly attacked from the Okanagan Valley east to the

Rockies. The moth is common in boreal forests where it feeds on tamarack. A pest of apple and other fruit trees in the province, *C. multipulvella* Riley, the Pistol Casebearer, feeds from the end of a pistol-shaped case. *Coleophora serratella* (Linnaeus), the Cigar Casebearer (also known as the Birch Casebearer), is a European import that attacks apples, birches, alders and other trees. It arrived in BC in the 1960s after first appearing in Canada in Ontario about 1885. *Coleophora pruniella* Clemens, the Cherry Casebearer, also damages the foliage of birch, alder, poplar, cherry and apple.

Mompha is represented by six species in BC – *M. albalpella* (Chambers), a northern and mountain species, feeds on Broad-leaved Willowherb (*Epilobium latifolia*); *M. idaei* (Zeller) larvae bore in the roots of Fireweed (*Epilobium angustifolium*). *Mompha eloisella* (Clemens) tunnels in the stems of Evening Primrose (*Oenothera* species).

Holcocera immaculella McDunnough attacks the cones and seeds of pines.

Family Cosmopterigidae (Cosmopterigid Moths) (Fig. 55)

Cosmopterigid moths are small or very small with a smooth-scaled head; the antennae are thread-like, sometimes haired and with or without a pecten. The long labial palps are upwardly curved. An epiphysis is present on the tibia and the hind tibiae have long hairs. The fore wing is narrow and often pointed; veins R4 and R5 are stalked and CuP is vestigial or absent. Veins M3 and CUA1 are almost always separate.

Adults fly by night or day. The larvae feed in mines in leaves or bark; bore in stems, roots and seeds, make galls, scavenge dead organic matter and parasitize homopterans. The eastern North American *Lymnaecia phragmitella* Stainton is a tiny moth but makes a big impression in fall and winter marshes -- the larvae burrow in cat-tail heads, fluffing them conspicuously.

The family Cosmopterigidae is distributed worldwide; it contains 106 genera and 1628 described species; 26 genera and 181 species are recorded for North America. The family is mainly southern in the Nearctic and only three species, each in a separate genus, are known in BC. *Cosmopterix fernaldella* Walsingham is mainly known as a species from eastern North America, but there are a few records from Alberta and BC; it lives around wetlands and mines in the leaves of *Carex*. Other *Cosmopterix* species in North America mine in plants of the families Cyperaceae, Poaceae, Asteraceae and Fabaceae. *Sorhagenia nimbosea* (Braun) ranges from southwestern BC to southern California; the larva ties the leaves of *Rhamnus purshiana* DC. (Cascara). The food of the other four North American *Sorhagenia* species is unknown, but is also probably plants of the Rhamnaceae. The genus is holarctic and the three European species also feed on *Rhamnus* there. *Walshia* is a New World genus whose species mainly make galls on the stems of legumes. *Walshia miscecolorella* (Chambers), the Sweetclover Root Borer ranges from BC to Ontario and is the only member of the genus in the West. It bores in the stems and roots of legumes such as *Lupinus*, *Astragalus* and *Melilotus*.

Family Gelechiidae (Gelechiid Moths; Twirler Moths) (Fig. 56)

Gelechiid moths, in North America, at least, are usually brown or grey, with wingspans of 6 to 25 mm. The fore wing is often narrowly rounded or pointed at the apex and the hind wing

often has the tip prolonged and the margin behind concave. The head is smooth scaled; the labial palps are frequently long and upcurved. Ocelli are often present.

The antennae are usually thread-like and there is usually no pecten. Vein CuP is absent in the fore wing. The hind wing has R1 and Sc united from the wing base or with R1 running into Sc beyond the base. The discal cell in the hind wing is closed perpendicular to the long axis of the wing or at 45° toward base of wing from M2.

Gelechiid larvae roll or mine leaves, bore in stems and roots, produce galls or feed on seed heads or dried seeds in over 80 plant families. Some are economically important including *Sitotroga cerealella* (Olivier), the Angoumis Grain Moth, a major cosmopolitan pest of stored grain. Its eggs are used as hosts for rearing *Trichogramma* wasps, microscopic egg parasites, for the biological control of various pests. *Pectinophora gossypiella* (Saunders), the Pink Bollworm, attacks cotton flowers and bolls; it is considered one of the most economically damaging insects in the world.

The family Gelechiidae is cosmopolitan and diverse, with 507 genera and 4530 described species. Eighty-six genera and 673 species are recorded in North America; 24 genera and 81 species are known in BC. The largest BC genera are *Chionodes* (34 sp. in BC, 72 sp. in North America) and *Coleotechnites* (9 sp. in BC, 49 sp. in North America).

Chionodes continuella (Zeller) is a Holarctic species that, in Canada, ranges from the BC Interior to Newfoundland; it feeds on Engelmann and White spruce; it has also been reared from *Cladonia* lichens. A western species, *C. retiniella* (Barnes & Busck) mines the apical parts of Ponderosa Pine needles in BC's southern Interior. *Coleotechnites atrupictella* (Dietz) attacks Douglas-fir and Engelmann Spruce in the BC Interior; it ranges east to Newfoundland. The red and cream striped larva binds several needles and eats them within a silken tube. From the BC Interior to Washington the needles of Lodgepole Pine and Grand Fir are mined respectively by *C. canusella* (T.N. Freeman) and *C. granti* (T.N. Freeman). Sustained outbreaks of *Coleotechnites starki* (T.N. Freeman), the Northern Lodgepole Needleminer, can reduce the growth of this conifer in the southern Rockies from BC to Montana.

Dichomeris contains about 75 species in North America but only four are recorded in BC. *Dichomeris marginella* (Fabricius), the Juniper Webworm, is a Eurasian import that first appeared in New York in 1910 and, although mainly a pest in eastern North America, has attacked Common Juniper (*Juniperus communis*) and ornamental junipers in southern BC since 1934. Young caterpillars mine the leaves; mature larvae feed externally on messy masses of silk-webbed leaves. *Anarsia lineatella* Zeller, the Peach Twig Borer, originated in Asia, but has spread to most temperate regions. It has lived in New York state since at least 1860 and is now in the US everywhere peaches are grown. The moth has been a pest in BC since 1908; it damages the young growth and fruit of peaches, apricots and plums. Another orchard problem, *Recurvaria nanella* (Denis & Schiffermüller), the Lesser Bud Moth, arrived from Europe in the eastern US as early as 1776. It showed up in Nova Scotia in 1915 and was recognized in BC some time later. It is predominantly an apple pest but also attacks other fruits produced by plants in the rose family.

The larvae of *Gnorimoschema gallaesolidaginis* (Riley), the Goldenrod Gall Gelechiid, burrow in goldenrod stems and induce spindle-shaped galls. The larva packs the gall with debris before pupating inside. *Metzneria lappella* (Linnaeus) feeds in Common Burdock (*Arctium minus*); *Monochroa fragariae* (Busck), the Strawberry Crown Miner, damages the crowns, buds and leaves of strawberries. *Phthorimaea operculella* (Zeller), the Potato Tuberworm, apparently a native of Australia, is now a worldwide pest, mainly of stored potatoes. It was a minor problem in coastal BC in the 1950s and 1960s but subsequently has not been reported in the province.

Superfamily Zygaenoidea

Family Limacodidae (Slug Caterpillar Moths) (Fig. 57)

Limacodid adults are small to medium-sized, mostly richly coloured in browns and marked with green, silver or other colours. The body is stout; the wings are broadly rounded. The head is densely scaled; the antennae are thread-like, pectinate or toothed and often bipectinate in the basal half in males. The proboscis and maxillary palps are usually reduced; the labial palps are short. There are no ocelli. The fore wing has two complete anal veins; 3A in the fore wing meets 2A near the base. In the hind wing veins Sc and R are separate basally, but are often fused for a short distance near the middle of the discal cell. The fore tibia lack an epiphysis; the tibial spurs are 0-2-2, 0-2-4 or rarely are absent.

Most limacodids are nocturnal and have a fast and erratic flight. They often rest with forelegs raised, or with the abdomen curled upwards above the thorax. Larvae feed on a diversity of trees, shrubs and grasses and some are pests of coconut and oil palms, bananas, tea, coffee, cacao, rice, sugarcane and other crops. The larvae are short and slug-like, smooth or spiny; many bear stinging hairs or spines and contact with them can be painful. Abdominal prolegs are highly reduced and specialized suckers, along with semifluid silk help the insect cling to foliage.

The family Limacodidae contains about 1030 described species around the world but is most diverse in the tropics. There are 21 genera and 49 named species in North America. One species occurs in BC -- *Tortricidia testacea* Packard is a rusty coloured moth that ranges transcontinentally and feeds on a variety of trees, including oaks and birches.

Superfamily Sesiioidea

Family Sesiidae (Clearwing Moths) (Fig. 58)

The Family Sesiidae (= Aegeridae) contains mostly medium-sized moths of striking wasp-like appearance. The body is stout, elongate and frequently marked and banded with white, yellow, orange or red. The scales often are iridescent. The wings are long and narrow with wasp-like proportions and have extensive areas, at least on the hind wing, lacking scales. Sexes often differ in colour pattern and males frequently have larger clear areas on the wings. The fore wing and hind wing are linked with a frenulum and with a unique coupling structure – the hind margin of the fore wing is rolled down and engages the upwardly curled edge of the hind wing. Both margins bear rows of stiff, interlocking scales. The wingspan, in North American species ranges from about 13 to 70 mm. The ocelli are prominent. The antennae are variable, but are often thickened in the middle and frequently bear a tuft of hair at the tip; they are sometimes comb-like

or narrowly feather-like in males. A proboscis is usually present but is frequently reduced. The legs often have thick tufts of hair.

Clearwing moths are diurnal, swift-flying, usually brightly coloured insects that mimic stinging Hymenoptera. Some species visit flowers and feed on nectar but others do not eat. Their elusive habits often make them difficult to find, although extensive studies on female pheromones have led to the successful employment of chemical lures, resulting in greatly improved collections and faunal inventories. The pale, unpatterned larvae bore in roots, trunks and branches of trees or the stems and roots of herbaceous plants. Still others are borers in plant galls induced by beetles and other insects. The pupae have freely moving abdominal segments bearing spines; these enable the pupa to work its way out of the soil or from its tunnel in the host plant where the larval skin often projects after adult emergence. Most sesiids are specific to certain species or groups of plants and some are economic pests. For example, the large worldwide genus *Melittia*, whose conspicuous hair-tufted legs help them mimic pollen-bearing bees, has larvae that damage the stems of plants in the squash family. *Synanthedon* in North America contains two borers that attack commercially grown *Prunus* fruit trees.

The Sesiidae consists of about 1120 named species worldwide; in North America 124 species in 20 genera are recorded. BC has five genera and at least 15 species. The subfamily Tinthiinae, among other characteristics, lacks the scale tuft on the antenna. The sole BC representative is *Pennisetia marginatum* (Harris), the Raspberry Crown Borer, a widespread North American species. It attacks *Rubus* plants, especially raspberries and blackberries; adults sometimes are seen flying around the bushes like yellowjacket wasps.

Some species of the western American genus *Zenodoxus* are recorded close to BC borders and may eventually be discovered in the province.

The large subfamily Sesiinae holds the rest of BC's documented species. *Sesia*, containing the so-called hornet moths, is a predominantly Old World group with only two species in North America. One is a European introduction to the eastern US; the other, *S. tibiale* (Harris), a transcontinental species, is BC's most spectacular clearwing – a beautiful, large yellowjacket mimic up to 40 mm across the wings. The larvae bore in cottonwoods, aspens and willows. *Synanthedon*, with 41 species in North America, has 11 recorded in BC; several more species likely occur. *Synanthedon exitiosa* (Say), the Peachtree Borer, is black with blue iridescence; the male is usually yellow banded and the female bears a single broad orange abdominal band. It is mainly a pest of peaches but it also attacks apricot, sour cherry, plum and almond trees as well as native *Prunus* species such as chokecherry. The larvae bore into the base of the tree trunk. The larvae of the Strawberry Crown Moth, *S. bibionipennis* (Boisduval), hollow out the crowns of strawberry plants from southern BC to Texas and California. The species also develops in many *Rubus*, *Potentilla* and *Rosa* species. *Synanthedon tipuliformis* (Clerck), the Currant Borer, originated in Europe but it is now widespread in temperate regions wherever currants and gooseberries live naturally or have been introduced. It is a small, delicate species with a wingspan of about 17 mm. Several sesiids are notable in BC coniferous forests. *Synanthedon novoensis* (Hy. Edwards), the Douglas-fir Pitch Moth, develops mostly in Engelmann and other spruces from Alaska to California, but it also occurs in pines and Douglas-firs. It is banded with orange, but its close relative, *S. sequoiae* (Hy. Edwards) (Sequoia Pitch Moth) is yellow banded; it has not been recorded in sequoias, but is a pest of pines in the West.

The black and orange *S. canadensis* Duckworth & Eichlin, one of BC's smallest species, is a little-known moth of the Rockies and central BC; it feeds on Lodgepole Pine seeds. Other BC *Synanthedon* clearwings feed in alders, birches, willows, *Ceanothus*, *Eriogonum* and *Polygonum*.

In 2005, the red-belted clearwing moth, *Synanthedon myopaeformis* (Borkhausen), a new alien species to North America, was discovered in an orchard in the Cawston area. This moth is a pest of apple, and could become established in areas where fruit trees are grown, and have a high economic impact.

Paranthrene is a worldwide genus mostly boring in willows, poplars and oaks. Two BC species are recorded -- *P. robiniae* (Hy. Edwards), a western North American moth and *P. tabaniformis* (Rottemburg), a holarctic species. *Albuna pyramidalis* (Walker) tunnels in the roots of *Epilobium* and *Oenothera* species. It is probably the most often collected sesiid in BC; it ranges across the continent.

Superfamily Cossoidea

Family Cossidae (Carpenter Moths, Goat Moths) (Fig. 59)

Members of the Cossidae are small to large heavy bodied moths, with wingspans ranging from about 1 to 24 cm. (usually less than 10 cm in North American species). Usually, the fore wings are long and narrow and the abdomen extends beyond the hind wing. The antennae are usually bipectinate in males, thread-like in females. There is no proboscis.

The fore wing has an accessory cell near the apex of the discal cell, some branches of vein R usually stalked and 1A+2A is present and CuP is present or absent. In the hind wing the frenulum is a single bristle in males, 2 to 30 bristles in females; M is usually forked in the discal cell, CuP is present, sometimes absent basally and there are two anal veins. The larva is stout and pale, with a small head and a large sclerotized shield on top of the prothorax. The pupae are elongate, well sclerotized and often have a spine on the head.

Cossid larvae are woodborers or, in a few cases, tunnel in the soil and feed externally on roots. Many are smelly, a characteristic that has given the family one of its English names -- goat moths. The larvae of some species may take up to four years to mature. Many species can seriously damage trees. The Carpenterworm, *Prionoxystus robiniae* (Peck), a common and widespread Nearctic species, produces extensive galleries that weaken oaks, locusts, maples, elms and other trees. The larvae overwinter in the tunnels, which are about 1.5 cm in diameter and pupate in associated chambers; the cocoons are mixtures of silk and wood chips. The pupa is extruded from the tunnel when the adult emerges. Except for a few Asian species, adults are nocturnal. Females usually lay eggs in bark crevices using an extendible ovipositor but, in some groups, surface egg masses are produced.

The family Cossidae contains about described 670 species arranged in about 113 genera throughout the world. Fifteen genera and 47 species are recorded in North America; BC has only four species in three genera. None are commonly collected but one of the most widespread is the transcontinentally ranging *Prionoxystus robiniae* (noted above), a grey species mottled and lined with dark; the male's hind wing is broadly banded with orange. The female's wingspan reaches 8

cm. Two *Acosus* species feed in aspens, cottonwoods and other poplars; both range transcontinentally. *Acosus populi* (Walker), the Aspen Carpenterworm, has a wingspan of up to 6 cm; its grey wings washed with pale brown basally and beautifully reticulated with fine black markings. *Acosus centerensis* (Lintner), the Poplar Carpenterworm, is smaller, with the fore wing base darker and the hind wing more white; it mainly attacks aspens. In Canada, the genus *Givira*, which often develops in pines, is represented only by *G. cornelia* (Neumoegen & Dyar); the species is restricted to BC in the country.

Superfamily Tortricoidea

Family Tortricidae (Leafroller Moths) (Fig. 60)

Tortricids are small to medium-sized moths; wingspans range from about 7 to 35 mm, rarely to 60 mm. The fore wings are broad and usually square-tipped, giving the adult a characteristic bell- or shield-shape when the wings are folded tent-like at rest. The moths are usually cryptically coloured – tan, brown or grey and striped, spotted or marbled – but many have shining metallic markings. On the head, scales are upwardly directed on the lower half of the frons and there is often a strong tuft of scales protruding between the antennae. Ocelli are almost always present. The antennae are thread-like, often slightly saw-toothed, and often with sensory hairs. The proboscis is well developed and is scaleless near the base. The labial palps are prominent, upturned or drooping; maxillary palps small. An epiphysis is present at the middle of the fore tibia; the tibial spur formula is 0-2-4. The mid tibia typically has modified scales that give the surface a spiny appearance. Females have large flat ovipositor lobes.

Tortricid eggs are strongly flattened and scale-like; they are deposited singly, in small clusters or in large masses and sometimes they are covered, or fenced in, with debris or scales. Larvae use a vast array of plant families. Many species are leafrollers, but larvae of many species have other habits; there are leaf-tiers, feeders in buds, flowers, shoots and seeds and borers in plant parts. Leaf-rolling larvae often pupate in a silk-tied shelter on the food plant; many boring larvae pupate in the ground. Most adults are nocturnal, but there are several brightly coloured day-flying groups. The Tortricidae contains many agricultural and forestry pests. The most notorious are the Spruce Budworm, *Choristoneura fumiferana* (Clemens), which has devastated conifer forests in northeastern North America (in BC it lives east of the Rocky Mountains) and the Codling Moth, *Cydia pomonella* (Linnaeus), a serious pest of apples. Its close relative, *C. deshaisiana* (Lucas) (Mexican Jumping Bean Moth) is a novelty; the seed of a *Sebastiania* plant (Euphorbiaceae) dances as the larva wriggles within.

The family Tortricidae ranges worldwide; there are over 6100 named species in 723 genera. North America records 101 genera and 1210 described species; there are 331 known species in 59 genera in BC, making it the fourth largest family of Lepidoptera in the province. In BC there are two subfamilies, the Tortricinae and the Olethreutinae; the latter has often been given separate family status. The Tribe Cochylini, here placed in the Tortricinae, is also considered a family (Cochylidae) in much of the literature. Its larvae are mainly borers in flower heads, seed capsules, stalks and roots; the genus *Aethes*, with four BC species, is a typical representative. One is the introduced *A. rutilana* (Hübner), the Pale Juniper Webworm, now a transcontinental pest of junipers, especially the native *Juniperus communis*.

Several large genera of tortricids occur in BC; the most diverse (number of species in BC indicated) are *Epinotia* (34), *Acleris* (33), *Phaneta* (33), *Eucosma* (25), *Olethreutes* (20), *Cydia* (16), *Ancylis* (15), *Archips* (14) and *Grapholita* (12). Many species in these and other genera feed on forest, agricultural and ornamental trees and other plants in the region but most are relatively innocuous. Twenty of 48 alien plant-feeding Lepidoptera species introduced to BC by 1980 were tortricids.

Several *Epinotia* species cause economic damage in BC. The Spruce Tip Moth, *E. radicata* (Heinrich) is a boreal species that eats the new growth of spruces and other conifers throughout the province; the Hemlock Needleminer, *E. tsugana* Freeman, occasionally causes serious damage to hemlocks on Vancouver Island. *Acleris gloverana* (Walsingham) (Western Blackheaded Budworm) attacks species of hemlock, fir and spruce, especially on the coast and in the wetter parts of the Interior. The seven species of *Zeiraphera* in BC are minor forest pests; the boreal *Z. canadensis* Mutuura & Freeman (Spruce Bud Moth) is common on spruces in the southern two-thirds of BC; *Z. improbana* (Walker) (Larch Bud Moth) attacks all three BC larch species in the Interior. The Pine Shoot Moth, *Eucosma sonomana* Kearfott, ranges across the southern Interior and bores in the growing shoots of Ponderosa and Lodgepole pines. Also damaging pines, especially ornamental species, the European Pine Shoot Moth (*Rhyacionia buoliana* (Schiffermuller)), was first discovered in the province at Victoria in 1927; it is established on the south coast. *Barbara colfaxiana* (Kearfott) feeds on the seeds of Douglas-fir; this and other cone moths cause economic losses in the forest industry. *Ancylis comptana* (Frölich), the Strawberry Leaf Roller, is widespread in North America, feeding on wild and cultivated strawberries, blackberries and raspberries; the larva folds the leaf over itself, fixing it with silk.

The Spruce Budworm (*Choristoneura fumiferana* (Clemens)), Canada's worst forest defoliator, is a boreal species ranging across Canada east of the Rockies. Its restricted BC range limits its impact on the coniferous forests of the province, but its close relative *C. occidentalis* Freeman (Western Spruce Budworm) is BC's most damaging defoliator of Douglas-fir and other conifers. The genus has eight species in BC; most attack conifers, but the Oblique-banded Leafroller, *C. rosaceana* (Harris), seems to feed on almost anything, from orchard trees such as apple and cherry to poplars, oak, clover, burdock and beans. The related genus *Archips* is full of pests, too – *A. argyrospila* (Walker), the Fruit Tree Leaf Roller, and *A. cerasivorana* (Fitch), the Cherry Tree Tortrix, are two common BC species. Not to be confused with the latter, the Cherry Bark Tortrix, *Enarmonia formosana* (Scopoli) is a recent arrival from Europe. Recorded in BC for the first time in 1989, its larvae burrow under the bark of cherry trees in southern BC; it is particularly common on the coast.

Cydia pomonella (Linnaeus) is the infamous Codling Moth, introduced from Europe to North America and first reported in BC in 1900. The moth larva damages apples by feeding in the core and tunneling out when full grown; it also attacks pears, walnuts and other fruits. Much work on the control of this serious pest, especially by the sterile male technique, has been undertaken in the Okanagan Valley since the 1960s. Since its appearance in BC in 1933, *Cydia nigricana* (Fabricius), the introduced Pea Moth, was responsible for the elimination of the dried pea and pea seed industry in BC. Some other members of the genus are forest pests, feeding on cones and seeds (eg., *C. youngana* (Kearfott) bores in *Picea glauca* cones) or mining in the bark of conifers. A closely related orchard pest, *Grapholita molesta* (Busck), the Oriental Fruit Moth,

an Asian species introduced to eastern North America about 1912, is a serious pest of peaches; it was brought to Summerland, BC in 1956 on Washington fruit imported for canning but was eradicated successfully. Originally from Europe, *Rhopobota naevana* Hübner (Black-headed Fireworm) is a major pest of cultivated cranberries across North America and in BC's Fraser Valley. A form of the species develops in holly berries.

Superfamily Choreutoidea

Family Choreutidae (Metalmark Moths) (Fig. 61)

The species now placed in the Choreutidae were formerly included in the Glyphipterygidae and subsequently given family rank in the Sesiodea. They are now placed in their own superfamily. The Choreutidae consists of small moths with wingspans of 5 to 20 mm; the wings are usually broad, frequently with metallic markings or contrasting patterns. The face is smooth-scaled; the ocelli are large. The proboscis is scaled at the base and the thread-like antennae frequently are strongly scaled dorsally and in the male usually bear long ventral hairs. The labial palps are upcurved; segment 2 often has a ventral scale tuft. The tibiae have a spur formula 0-2-4; there are usually scale tufts near the spurs.

Choreutids are fly during the day or at dusk. They often swarm over the host plants or perch on flowers; many have a characteristically jerky walk. The larvae are mainly leaf webbers or skeletonizers but a few species bore in flower inflorescences. Pupae are encased in a lace-like, often double, cocoon in folded leaves.

About 470 species of the Choreutidae live worldwide. There are about 30 species in eight genera in North America; five of these genera and eight of the species are recorded in BC. *Choreutis pariana* Clerck (Apple and Thorn Skeletonizer) is a European introduction that first appeared in North America in New York in 1917; it was first noticed in BC in 1937. In the West it ranges from BC south to Colorado; in BC it is mainly a problem west of the Coast Mountains. The larvae skeletonize apple leaves and, at least in Eurasia, also attack pear and *Sorbus* trees. *Choreutis diana* (Hübner) also is recorded in BC. Three species of *Tebenna* are recorded in BC – *T. balsamorhizella* (Busck), *T. onustana* (Walker) trans and *T. piperella* (Busck). *Anthophila alpinella* (Busck) is the sole species of the genus in North America. Other species known from the province are *Caloreas multimarginata* (Braun) and *Prochoreutis pernivalis* (Braun).

Superfamily Urodoidea

Family Urodidae (Uroid Moths) (Fig. 62)

Members of the Urodidae are small to medium-sized microlepidoptera with wingspans of about 20 to almost 40 mm. The front margin of the male hind wing has a pencil of hairs; the antennae of males are lamellate. The ocelli are lost and the proboscis is unscaled. The labial palps are upcurved. The tibiae have an epiphysis; the tibial spur formula is 0-2-4. The fore wing has a long pterostigma and vein CuP is distinct only near the margin. On the abdomen, sternum 2 has prominent lateral processes near the front margin.

The few known larvae of the Urodidae feed on broadleaved trees.

This small family consists of only three genera and about 60 described species. Most are Neotropical; one species of *Urodus* is North American. *Wockia* is primarily Asian; *W. asperipunctella* (Bruand) is the sole species of the family in BC.

Superfamily Schreckensteinoidea

Family Schrecksteiniidae (Schrecksteiniid Moths) (Fig. 63)

Schrecksteiniids are small, narrow-winged moths lacking ocelli and scales on the proboscis. Stiff spines on the upper margin of the hind tibiae are characteristic. The male antennae are usually threadlike with minute hairs. The fore wing lacks a pterostigma and vein CuP is vestigial in both wings. The female frenulum is a single bristle. The larvae have unusually slender prolegs; one or both of the dorsal setae on most of the larval segments is strikingly spoon-shaped.

Schrecksteinia feeds on plants in the families Rosaceae, Anacardiaceae and Scrophulariaceae; *S. festaliella* (Hübner), the Blackberry Skeletonizer, feeds on *Rubus*. It has been purposefully introduced into Hawaii to control exotic *Rubus* species. The larvae are exposed feeders but work on the undersides of the leaves. When resting the adult folds the fore wings tightly over the hind wings and the abdomen; the hind legs are conspicuously and obliquely raised.

The Schrecksteiniidae is a small family containing only two genera: *Corsocasis*, with three species, is Oriental; *Schrecksteinia*, with five species, is Neotropical and Holarctic. It has three species in North America; one of these, *Schrecksteinia festaliella* (Hübner), the Blackberry Skeletonizer, is widespread and introduced from Europe. It is the only representative of the family in BC; it feeds on blackberry and raspberry plants.

Superfamily Alucitoidea

Family Alucitidae (Six-plume Moths, Many-plume Moths) (Fig. 64)

Moths in the family Alucitidae have characteristic, deeply divided wing membranes -- the fore wing has six narrow, scale-edged feather-like lobes and the hind wings may be six- or seven-plumed. A few tropical species have the wings only partly or hardly divided. The head is smooth-scaled although dorso-lateral tufts are often prominent. Ocelli are present or absent and the labial palps are upturned. The male antennae are usually threadlike with minute hairs. The proboscis is fully developed and lacks scales.

Adults are nocturnal or crepuscular. At rest they hold the wings partly opened, fan-like, somewhat pressed against the surface they are perched on. Larvae are concealed; they bore in flowers, buds, shoots and fruits or make galls. Host plants include Caprifoliaceae, Rubiaceae and Asteraceae. *Alucita coffeina* Viette is a pest of coffee in Africa; the common European *A. hexadactyla* Linnaeus feeds on honeysuckles.

Over 130 species of the Alucitidae live around the world, but only three *Alucita* species are known in North America. The larvae of all three feed on members of the honeysuckle family

(Caproifoliaceae). The dark-and-light barred adults often hibernate in sheds and basements. Two species, both *Lonicera* feeders, are widespread east of the Rockies but *Alucita montana* Barnes & Lindsey is the only one known in BC. It ranges from Quebec west to BC and south to California. The larvae feed on snowberry (*Symphoricarpos*).

Superfamily Pterophoroidea

Family Pterophoridae (Plume Moths) (Fig. 65)

Plume Moths are slender, usually brown or grey moths with long, narrow wings. The fore wing is normally notched into two to four lobes (two in our fauna), the hind wing into three more deeply cut, feather-like plumes. These deep indentations are a specialization in the family and some species lack them. The wingspan in BC species is about 12 to 30 mm; wings are folded closely and held horizontally outstretched at rest, forming a T-shape. Females have a frenulum of 1 to 2 bristles. The head is smooth-scaled, sometimes with a conical tuft on the frons. The antennae are thread-like; ocelli are absent. The proboscis is well developed but lacks scales; labial palps are well developed but the maxillary palps are absent. The legs are long; the hind tibia is more than twice as long as the femur. The forelegs have a tibial epiphysis and the tibial spurs are prominent; the formula is 0-2-4. There is no tympanum at the base of the abdomen.

Larvae are usually leaf rollers or bore in plant stems, buds and roots. Many are specific to particular plants, mostly herbaceous dicots, but some feed on woody species. *Buckleria paludum* (Zeller) is notable; it feeds only on the sticky leaves of the insectivorous sundew plant *Drosera rotundifolia* Linnaeus in northern European peatlands. In the Pterophorinae, by far the family's largest subfamily, plants in the Asteraceae are the principal hosts; however, species in over 20 plant families are eaten. Externally feeding larvae often are strongly hairy or spiny and some produce sticky defensive secretions. Pterophorids seldom cause significant economic damage, although a few species, such as the Grape Plume Moth, *Geina periscelidactyla* (Fitch) is sometimes a problem in vineyards; it is native to eastern North America and has not appeared in BC. Adults are rather weak fliers and usually are seen around their host plants.

The family Pterophoridae occurs worldwide, with 986 described species placed in 73 genera; there are 25 genera and 150 species recorded in North America. The cosmopolitan Pterophorinae, containing over 85% of the named species in the family, is the only subfamily recorded in BC; there are 14 genera 43 species in the province.

BC's most diverse genera are *Hellinsia* (9 BC sp.), *Oidaematophorus* (9 sp.) and *Paraplatyptilia* (7 sp.). *Hellinsia helianthi* (Walsingham), the Sunflower Plume Moth, is a large species (30 mm wingspan) that develops in wild *Helianthus* sunflowers in the Cordillera. *Oidaematophorus occidentalis* Walsingham, ranging from BC to Arizona, also feeds on wild sunflowers and the host plants of *O. balsamorhizae* McDunnough are the related sunflower-like *Balsamorhiza*, so characteristic of BC's southern grasslands and dry forests.

Platyptilia is a cosmopolitan genus with about 100 described species; there are four recorded in BC. *Platyptilia carduidactylus* (Riley) eats thistles and the related globe artichoke. It is a minor horticultural pest over much of North America. *Emmelina monodactyla* (Linnaeus) ranges across Europe, Asia and North America and develops on wild and cultivated morning

glory (*Convolvulus*), lambs quarters (*Chenopodium*) and other plants. *Geina tenuidactylus* (Fitch), the Berry Plume Moth, eats the buds and leaves of thimbleberry and wild and cultivated blackberries in western North America.

Superfamily Copromorpoidea

Family Copromorphidae (Fig. 66)

The Copromorphidae is a small, weakly defined family whose present make-up may not stand up to future detailed study. Most species have more-or-less rounded wing tips and are coloured for camouflage. The ocelli are present or absent and the antennae are usually thickened, comb-like or feather-like in males. The labial palps are upturned or drooping. The medial vein in the hind wing is three-branched.

The larvae tunnel in fruit, leaf veins, twigs or flower inflorescences or eat between joined leaves. Many species feed on fig plants (Moraceae); other hosts include the Ericaceae and Berberidaceae.

Copromorphids are represented by over 40 species in all regions except the Palaearctic. The family is mainly Asian and Australian. Two genera and five species are known in North America; BC records a single species in both genera -- *Ellabella editha* Busck and *Lotisma trigonana* (Walsingham).

Family Carposinidae (Fig. 67)

Carposinids are small moths with wingspans in North American species ranging from 10 to 20 mm; some tropical species are larger. The family is derived compared to the Copromorphidae, and has reduced venation in the hind wing. Vein M2 is lost and M1 is often absent. Males frequently have raised scale tufts on the fore wings. The antennae bear long setae in males, shorter ones in females. Ocelli are normally lost; if present, they are reduced. Labial palps are usually prominent and arched in males, longer and drooping in females.

Larvae are modified for living inside plants. They bore in leaf and flower buds, growing shoots, fruits, living bark, galls and tree wounds. Over 20 families of plants are affected, including the Ericaceae, Rosaceae, Rutaceae and Grossulariaceae. The Currant Fruitworm, *Carposina fernaldana* Busck, feeds on currants. *Bondia* species often feed in bark and wood, especially in wounds and lesions; *B. comonana* (Kearfott) is a pest of *Prunus*, mainly in eastern North America.

The family Carposinidae contains 273 named species in over 20 genera, mostly distributed in Asia and the Australian-Pacific region. Eleven species in three genera are recorded in North America; BC reports only *Bondia crescentella* (Walsingham).

Superfamily Thyridoidea

Family Thyrididae (Window-winged Moths) (Fig. 68)

Thyridid moths are small to rather large, with wingspans of 12 to 72 mm; North American species usually are small and dark. The wings are often patterned in reticulated rows of spots, frequently with translucent patches incorporated. Scales on the head are smoothed and flattened; ocelli are normally absent. The antennae are thread-like, toothed or comb-like. The proboscis is often reduced or absent but, when present, it lacks scales. The wings are usually broad with all branches of the radius vein present and arising from the usually open discal cell. A frenulum is normally absent. The tibial spur formula is 0-2-2, 3 or 4.

The larvae burrow in twigs and stems or feed in rolled or tied leaves. Some cause gall-like swellings in the host plants. Foodplants come from about 30 plant families, including Fabaceae, Rosaceae, Vitaceae and Myrtaceae. Adults rest distinctively with the front of the body strongly raised and wings outstretched or swept back. Many mimic dead leaves but some day-flying Afrotropical species have metallic, warning colours.

The family Thyrididae consists of about 760 described species; most are from tropical and subtropical lowland forests. Eight genera with only 12 species are recorded in North America. The only known BC species, the transcontinentally ranging *Thyris maculata* Harris, comes from a Holarctic genus. The small day-flying adult is brown, gold and white, with a wingspan of about 10 mm; the larvae feed on *Clematis* vines.

Superfamily Pyraloidea

Family Pyralidae (Pyralid Moths, Snout Moths) (Fig. 69)

Pyralids are mostly small to medium-sized moths, with wingspans ranging from about 10 to 55 mm. On the head, the scaling of the frons is usually smooth; the eyes are normally large, globular and lack obvious hairs. The antennae are threadlike or sometimes pectinate or bipectinate. The proboscis is present and scaled at base, or can be reduced or even absent. Labial palps are 3-segmented, angled upward or upturned in front of face; maxillary palps are smaller, often minute or absent. Vein R5 of the fore wing is stalked or fused with R3+4. In the hind wing Sc+R1 is very close to, or joined to, Rs for some distance beyond the discal cell. The fore tibia has an epiphysis; the tibial spurs normally are 0-2-4. Tympanal organs are not on the thorax but are paired on the ventral part of the abdomen base, facing forward towards the thorax. The tympanal case is only narrowly open anteriorly.

About two-thirds of described pyralids are in the subfamily Phycitinae; they are mostly leaf rollers, but many bore in buds, shoots, stems, cones, fruits, galls or under bark. For example, species of a common BC genus, *Dioryctria* often eat the cones, as well as the foliage, of evergreen trees. Many other genera are seed feeders, and some long ago took up habitation with humans, developing in stored food products -- *Plodia interpunctella* (Hübner), the Indian Meal Moth and *Ephestia kuhniella* Zeller, the Mediterranean Flour Moth, are well known examples. Despite their common names, evidence suggests that these two moths are New World species, now found around the world. Some phycitines have been used to control noxious weeds; perhaps the most famous is the Argentinean moth *Cactoblastis cactorum* (Berg). This pyralid was introduced into Australia, South Africa and other regions plagued by rampant prickly pear cactus; this New World weed was successfully controlled by the moth. Other phycitines live as

inquilines in galls and the nests of Hymenoptera. Still others have predatory larvae that hunt down Homoptera; the eastern North American *Laetilia coccidivora* Comstock eats scale insects.

Larvae of some Galleriinae feed on dry plant material; the Rice Moth, *Corcyra cephalonica* Stainton is a widespread pest. A few species such as *Galleria mellonella* (Linnaeus), the Greater Wax Moth, feed on combs of hymenopteran nests and can destroy Honey Bee hives. *Tirathba* species are pests of coconut and other palms. Larvae of the Chrysauginae have a variety of habits including boring in seeds, fruits, stems and roots. Some roll or tie leaves and some inhabit ant nests. The adults of several genera live in sloth fur (eg, *Bradypophila*) and their larvae develop in sloth dung. In the subfamily Pyralinae, *Pyralis farinalis* Linnaeus, the Meal Moth, is a common cosmopolitan stored products pest.

The family Pyralidae, even without the inclusion of the even more diverse Crambidae (which includes subfamilies such as Crambinae, Nymphulinae and the large Pyraustinae) now usually given separate family status, is a large group of cosmopolitan moths. There are about 6200 described species: 1,435 of these in 439 genera are found in North America. Fifty genera and 88 species are recorded in BC. *Dioryctria* has about 30 North American species; 11 of these are recorded in BC, making it the most diverse pyralid genus in the province. *Dioryctria reniculelloides* Mutuura & Munroe, the Spruce Coneworm, is a boreal species while *D. pseudotsugella* Munroe is a cordilleran defoliator and cone feeder of Douglas-fir. *Promylea lunigerella* Ragonot feeds on the foliage of Grand and Amabilis firs along the coast from BC to California.

There are seven species of *Pyla* recorded in BC; the genus is mostly Nearctic in distribution, with one species, *P. fusca* (Haworth), being Holarctic. In Europe, *P. fusca* is a peatland and heath species and feeds on ericaceous plants; in BC it probably develops on *Vaccinium*. *Pyla* has grey nocturnal species and day-flying ones with specialized metallic scales – *P. scintillans* (Grote), a montane species that ranges from BC to California, is one of the latter. *Ephestoides gilvescentella* Ragonot is a common pyralid ranging from BC to California and Texas. It is probably a detritivore feeding around a wide variety of plants; a number of records come from the bases of plants in the aster family as *Senecio* and *Ericameria*.

BC has its share of introduced, cosmopolitan pyralid pests of stored, dried foods -- *Pyralis farinalis*, *Plodia interpunctella*, *Ephestia kuhniella*, *E. elutella* (Hübner) (Tobacco Moth) and *Cadra cautella* (Walker) (Almond Moth) are the most notable. *Vitula serratilineella* Ragonot (Dried Fruit Moth) is a native western species, but apparently has been introduced to Europe from North America. As well as feeding on dried fruit, the larvae eat pollen, honey and larvae in the nests of bees and wasps. Some pyralids attack trees and agricultural crops in the province. *Acrobasis betulella* Hulst, primarily an eastern species, feeds on birch; plums and cherries are the hosts of its relative, *A. tricolorella* Grote. *Zophodia grossulariella* (Hübner) larvae feed on the berries and web the leaves of currants and gooseberries. The species also occurs in Europe, but it was probably introduced there from North America, where it is widespread. *Euzophera semifuneralis* (Walker) larvae burrow under the bark of apple, plum, apricot, mountain ash and other trees. *Hulstia undulatella* (Clemens) is a pest of sugar beets.

Family Crambidae (Grass Moths, Snout Moths) (Figs. 70 & 71)

Crambids are mostly small to large moths, similar to those in the Pyralidae, a family in which they are often placed. Wingspans range from about 10 to 100 mm, but seldom exceed 30 mm in BC species. On the head, the scaling of the frons is usually smooth; the eyes are normally large, globular and lack obvious hairs. The antennae are thread-like, serrate, or sometimes pectinate or bipectinate. The proboscis is usually well developed but sometimes is reduced. The labial palps are 3-segmented, angled upward or upturned in front of face, often very long (thus the name “snout moths”); the maxillary palps are smaller (sometimes reduced or absent), often with a flattened tuft of scales at the tip. Vein R5 of the fore wing is not normally stalked or fused with R3+4. In the hind wing Sc+R1 is very close to, or joined to, Rs for some distance beyond the discal cell. The fore tibia has an epiphysis; the tibial spurs normally are 0-2-4. Tympanal organs are not on the thorax but are paired on the ventral part of the abdomen base, facing forward towards the thorax. Unlike in the Pyralidae, the tympanal case is widely open anteriorly.

Crambids live from polar and alpine tundra to equatorial rainforests and deserts. Species in the subfamily Crambinae are either root and leaf feeders living on the ground and eating grasses or mosses or they are borers in the stems of grasses, sedges and rushes. Both feeding types cause economic losses -- the former, which live mainly in temperate zones, damage lawns, turf and other sod (eg, *Crambus*, *Agriphila*) and the roots of crops such as maize; the latter (eg, *Chilo*, *Diatraea*), mainly in the tropics and subtropics, affect rice, sugar cane and maize. The huge Brazilian crambid *Myelobia smerintha* Hübner bores in bamboo stems. Sod webworm larvae live in silken tubes on the soil, emerging at night to feed.

The subfamily Pyraustinae is by far the largest in the family, with 7400 species worldwide. Many are mainly defoliating pests of pasture and field crops (*Pyrausta*, *Loxostege*, *Achyra*); others are borers in stems and fruits of tomatoes, eggplants, sweetpotato and members of the squash family (eg, *Diaphania*); still others bore in the shoots of coffee, mahogany and other tropical trees. *Ostrinia nubilalis* (Hübner), the European Corn Borer, is one of the most destructive agricultural pests, attacking maize, potatoes, beans and many other crops. Mimicry of bees, wasps and toxic lepidopterans is common, especially in the tropics.

Larvae in the subfamily Scopariinae tunnel in stems of mosses and club mosses (*Eudonia*), eat the roots of vascular plants (*Scoparia*) or web the fronds of ferns (*Phenacodes*). Species of the Evergestinae feed mainly on plants of the mustard family (Brassicaceae) and some (eg, *Evergestis*) are agricultural pests; *Oreanaia* has striking adaptations to high altitudes, such as reduced eyes. Glaphyriinae species are leaf folders (eg, *Hellula* are pests of mustards), are borers in heads of *Typha*, makers of flat cases on lichens, parasites of larvae of Psychidae and inquilines in vespine nests, among other habits. Crambids of the subfamily Nymphulinae are almost all aquatic as immatures. Some feed on vascular plants in standing water and others live in rapid streams under webs on rocks and feed on algae there. Larvae are either air breathers living in air-filled cases or lack functional spiracles and take in dissolved oxygen through tracheal gills.

The family Crambidae is distributed around the world and contains about 11,630 described species. There are 44 genera and 104 species recorded in BC. The most diverse genus in the province is *Crambus*, with 13 species (about 41 in North America). *Crambus pascuella* (Linnaeus), *C. perlella* (Scopoli) and *C. praefectellus* (Zincken) are among the most common. The genus *Udea* contains ten species in BC -- *U. profundalis* (Packard) infests *Crepis* (Asteraceae) species along the Pacific Coast from BC to California.

Eight *Eudonia* species are recorded in BC and all of these are restricted to western North America; some species are known to feed in mosses. *Eudonia commortalis* (Dyar) is a coastal species living from Alaska south to Washington; *E. spenceri* Munroe ranges from BC to Colorado and California. *Evergestis* species are frequently pests of the plant family Brassicaceae; six occur in BC. *Evergestis pallidata* (Hufnagel), the Purple-backed Cabbageworm, damages cabbage, radish, turnip and other crops; it probably was introduced from Europe. All the others are western American species, including *E. obscuralis* Barnes & McDunnough (southern Interior of BC and southern Alberta to New Mexico and California), *E. subterminalis* Barnes & McDunnough (southern BC to California and Colorado) and *E. vincialis* Barnes & McDunnough (isolated mountain populations; known in BC from the Okanagan).

Loxostege, with six BC species, also contains crop pests. *Loxostege sticticalis* (Linnaeus), the Beet Webworm, was probably introduced to eastern North America from Asia; it first appeared in BC in 1938. The moth has become troublesome in the dry Interior where it attacks alfalfa, rape, cereals and assorted vegetables. Larvae sometimes migrate *en masse* from ravaged fields. The native *L. cereralis* (Zeller) the Alfalfa Webworm, is similar; it feeds on alfalfa, carrots and other crops. *L. sierralis* Munroe is a day-flying moth of mountain peatlands and alpine meadows from southern BC to California and Utah.

Chrysoteuchia topiarius (Zeller), the Cranberry Girdler, ranges transcontinentally and feeds on grasses, the bark of cranberry and blueberry plants, and the roots and crowns of conifer seedlings. *Eurrhypara hortulata* (Linnaeus), a European introduction, was first recorded in North America in Nova Scotia in 1907 and in BC 70 years later. It feeds on nettles, mints and currants. *Nomophila nearctica* Munroe (Celery Webworm) is a common pest of celery, various grasses and clover.

Pyrausta is a large genus of 60 North American species; there are seven reported in BC. Some species in the genus are pests of pastures and field crops; many are partial to plants of the mint family. Adults are often diurnal flower visitors. Some of the most attractive BC species are *P. orphisalis* Walker, a small brown moth with yellow markings and *P. signatalis* (Walker) a pink species; both develop on Wild Bergamot (*Monarda*) and similar plants. *Pyrausta unifascialis* (Packard) feeds largely on *Antennaria* in the Asteraceae. The related, day-flying *Anania funebris* (Ström) and *Desmia maculalis* Westwood have black and white dazzle patterns; both species are dark with two large white spots on each wing. Both moths range across southern BC; the former, a Holarctic species, develops on goldenrod. The latter is the Grape Leaf Folder; the larva rolls the leaves of grape vines and Virginia Creeper.

Like species of *Crambus*, those of *Agriphila* (5 sp.), *Catoptria* (4 sp.) and *Pediasia* (3 sp.) are root and sod feeders; *A. plumbifimbriellus* (Dyar), *C. latiradiellus* (Walker) and *P. trisecta* (Walker) are among the BC species. Other widespread BC crambids include *Gesneria centuriella* (Denis & Schiffermüller) an all-dark, Holarctic species common both in coastal and Interior BC; *Herpetogramma pertextalis* (Lederer), which feeds on *Urtica* and *Rumex*; *Saucrobotys futilalis* (Lederer), whose larvae mass in silk webbing on dogbane (*Apocynum*) and *Chalcoela iphitalis* (Walker), which infests *Polistes* wasp nests over much of North America and feeds on the larvae.

Several aquatic crambids are recorded in BC. Like a caddisfly, *Petrophila confusalis* (Walker) lives in fast-flowing streams from BC to California and Nevada; the larvae make silken webs on rocks, under which they feed on diatoms and other algae. They respire through filamentous gills on the abdomen. Adult females crawl under the water surface to lay eggs. *Munroessa icciusalis* (Walker) larvae eat the leaves of aquatic plants such as waterlilies and *Potamogeton* in southern BC, although it is mostly an eastern species. The larvae make cases of plant material. Those of *Synclita occidentalis* Lange feed on the undersides of the floating leaves of the same kind of plants and *Ostrinia penitalis* (Grote), whose caterpillar bores in the buds, fruits and stems of waterlilies, is apparently an introduction to BC from the southern US. The closely related but terrestrial *Ostrinia nubialis* (Hübner), a serious agricultural pest over much of North America, evidently has not yet been reported from BC.

Superfamily Hesperioidea

Family HesperIIDae (Skippers) (Fig. 72)

Skippers get their English name from their characteristic, rapid and darting flight. They are small to medium-sized butterflies, the largest BC specimens having wingspans less than 5 cm. Most have dull brown, grey or orange colours, and with their stout muscular bodies and short wings, resemble moths. The head is broad; the clubbed antennae arise far apart and the club is usually narrowed and hooked at the tip. All three pairs of legs are used for walking and the fore wing has 12 veins unbranched from the discal cell or the wing base to the wing margin. The larvae are usually smooth and unornamented; the head is large and separated from the rest of the body by a narrow, neck-like prothorax.

Hesperiid larvae live in silk-lined nests on the food plants, which they construct by cutting and folding leaves or by using several leaves bound together. Some species build a cover of leaf bits or debris and carry this around while they feed. A few bore in plant tissue. Food plants include a wide range of angiosperms, but the diverse and widespread subfamily Hesperinae (and some others) feeds exclusively on monocots such as grasses, lilies, orchids and palms. A few species, especially in the tropics, may be economically important – some eat the leaves of rice, sugarcane, palms and bananas.

When considered the sole family in the superfamily Hesperioidea, the HesperIIDae contains about 3500 species in over 500 genera. There are 293 species described in 92 genera in North America; BC has 29 species in 14 genera. The BC species are placed in two subfamilies. The Pyrginae (Spread-wing Skippers) hold their wings out flat. Most BC species are mottled black, grey or brown and some are checkered with white. The larvae feed on dicotyledonous plants. Perhaps the most distinctive species, *Epargyreus clarus* (Cramer) (Silver-spotted Skipper) has a large silvery spot on the underside of the hind wing. This large skipper is uncommon in the southern Kootenays, where the larvae feed on *Glycyrrhiza lepidota* (Wild Licorice) and *Robinia pseudoacacia* (Black Locust); the population once known from the south coast is apparently gone. The five *Erynnis* species in BC are darkly mottled and are known as duskywings. The most widespread are *E. persius* (Scudder) (Persius Duskywing) and *E. icelus* (Scudder & Burgess) (Dreamy Duskywing). The food plants of the former are lupines and other legumes; the larvae of the latter feed on willows and poplars. The largest species (wingspan about 4 cm) is *E. propertius* (Propertius Duskywing) -- its larvae eat Garry Oak leaves and, because this plant and

its habitat is threatened in BC, the skipper is blue-listed. The three BC species of *Pyrgus* are black spotted with white; the widespread southern *P. ruralis* (Boisduval) (Two-banded Checkered Skipper), the alpine *P. centaureae* (Rambur) (Grizzled Skipper) and the uncommon *P. communis* (Grote) (Checkered Skipper) of southern Interior valleys. Two other genera in the subfamily contain only one species each in BC: *Pholisora catullus* (Fabricius) (Common Sootywing) and *Thorybes pylades* (Scudder) (Northern Cloudywing).

The Subfamily Hesperinae, called the Grass Skippers because many feed on grasses in the larval stage, are sometimes termed “branded skippers” -- the males are marked with a dark patch of scent scales on the fore wing. At rest they hold the fore wings almost vertically and the hind wings horizontally. *Hesperia* contains five species in BC; *H. comma* (Linnaeus) (Common Branded Skipper), the most widespread species in the province, is Holarctic in distribution. The six BC species of *Polites* are Interior inhabitants and include *P. sabuleti* (Boisduval) (Sandhill Skipper), which is restricted to the Okanagan Valley, although the larvae are found in lawns and other human-made habitats. In BC *P. draco* (W.H. Edwards) (Draco Skipper) lives only in the extreme Northwest; *P. themistocles* (Latreille) (Tawny-edged Skipper) is widespread from Prince George south to the US border. *Ochlodes sylvanoides* (Boisduval) (Woodland Skipper) is the most abundant skipper in southern BC after midsummer. *Euphyes vestris* (Boisduval), the Dun Skipper, is a rare, chocolate brown species whose larva feeds on sedges; it occurs on the south coast and up the Fraser River to Lillooet. *Thymelicus lineola* (Ochsenheimer), the European Skipper, an introduced species first found in BC in 1960, lives in scattered localities in the province, especially in the southern Interior. It is associated with hayfields and roadsides. Other genera of BC grass skippers are *Carterocephalus*, *Oarisma*, *Atalopedes* and *Amblyscirtes*; each is represented in the province by a single species.

Superfamily Papilionoidea (Butterflies)

Family Papilionidae (Swallowtails and Apollos) (Figs. 73 & 74)

Butterflies in the Family Papilionidae have hairless eyes, short antennae and three fully developed pairs of legs. The fore wing has 11 or 12 veins; veins 1A and 2A are separate. BC species range from about 40 to about 105 mm in wingspan and include some of the province’s largest butterflies. All BC species are yellow or white with black markings and all our members of the subfamily Papilioninae (swallowtails) have tails on the hind wings while those in the subfamily Parnassiinae (apollos) do not (these characteristics do not hold for the world fauna of the family). Parts of the wings of apollos, especially the outer borders, lack scales; this condition is usually more striking in females than males. The larvae usually lack spines and have a Y-shaped, eversible gland (osmaterium) on the top of the thorax that, in most species, produces defensive chemicals to deter predators. Young swallowtail larvae look like bird droppings. The pupae in the Papilioninae have a silk girdle that helps hold them to the plant on which they have pupated; BC Parnassiinae pupate on the ground in a loose silk cocoon.

BC swallowtail food plants are varied – a few examples include umbellifers (*Papilio zelicaon*, *P. indra*), chokecherry (*P. multicaudatus*), willows, poplars, alder and birch (*P. canadensis*, *P. rutulus*), *Ceanothus* (*P. eurymedon*) and *Artemisia* (*P. bairdii*, *P. machaon*). *Parnassius* species eat species of stonecrop (*Sedum*), bleeding hearts (*Dicentra*) and their relatives, *Corydalis*. Some papilionids outside BC feed on poisonous plants and sequester the

chemicals for protection against predators. This has resulted in brilliant warning colours and elaborate mimicry by non-poisonous butterfly species.

Swallowtails are strong fliers and males of some species often search out mates by hilltopping, a mating strategy where individuals fly uphill until they meet in concentrations at the height of land. Apollo females usually are found with a sphragis, a hard structure placed in the abdomen by the male during mating; this helps prevent further matings by other males. Most apolloes are mountain butterflies and tend to be darker the colder the climate; this helps them absorb the heat of the sun. Males, especially, can be strongly hairy, perhaps an adaptation for reducing heat loss during long, mate-searching flights.

The Family Papilionidae contains about 600 species in 26 genera worldwide. Most swallowtails are tropical, and are especially diverse in the Old World; they include the huge birdwing butterflies of the genera *Ornithoptera* and *Troides*. Most apolloes live in Eurasian temperate regions. About 34 papilionid species, placed in five genera, occur in North America; BC has 11 species in two genera – the swallowtails in *Papilio* (7 species) and the apolloes in *Parnassius* (4 species). The three swallowtails in the subgenus *Papilio*, the so-called Old World group, have a large black triangular patch at the base of the fore wing (in *P. indra* the wing is largely black) and round red eyespots at the base of the tail. *Papilio machaon* Linnaeus (Old World Swallowtail) ranges from Britain and North Africa east across Eurasia to the boreal forests of Quebec; among the four rather distinctive subspecies in BC, *P. m. aliaska* Scudder is restricted to the North and *P. m. bairdii* (W.H. Edwards) (Baird's Swallowtail) is a grassland species of the Interior. Some authors consider Baird's Swallowtail a distinct species. *Papilio zelicaon* Lucas, the Anise Swallowtail, also ranges widely in western North America; the larvae often feed on parsley, carrots and fennel in vegetable gardens. The rarest BC species, *P. indra* Reakirt (Indra Swallowtail) is known only in the subalpine areas of Manning Provincial Park in the Cascade Mountains.

The tiger swallowtails (subgenus *Pterourus*) have longitudinal dark stripes on the wings. *Papilio canadensis* Rothschild & Gordon (Canadian Tiger Swallowtail) is the most widespread, occurring across the continent, mainly in boreal habitats; in BC it hybridizes widely with the more southern *P. rutulus* Lucas (Western Tiger Swallowtail), its Cordilleran counterpart. Also a western species, *P. eurymedon* (Pale Swallowtail) is like a white version of *P. rutulus*; it is common across southern BC. *Papilio multicaudatus* W. Kirby (Two-tailed Swallowtail), lives in the southern grasslands and adjacent riparian habitats of the Interior; with the Monarch it vies for the title of BC's largest butterfly.

Two BC apolloes, *P. eversmanni* Ménétriés (Eversmann's Apollo) and *P. phoebus* (Fabricius) (Phoebus Apollo) are known only from the northern reaches of the province; both are Beringian species, with most of their range in northern Asia. Much more common are *P. smintheus* Doubleday (Rocky Mountain Apollo) and *P. clodius* Ménétriés (Clodius Apollo). The former is widespread in alpine and subalpine areas and in higher Interior grasslands; the latter is the only species likely to be seen at low elevations along the coast.

Family Pieridae (Whites, Marbles and Sulphurs) (Figs. 75 & 76)

Pierids are mostly medium-sized butterflies, generally white, yellow, orange or greenish, marked in black and frequently other colours. Males and females are often strikingly different in appearance. For example, in sulphurs, males usually have a solid black wing border, while that of females often has pale markings, is reduced or is even absent. Different generations of a species in a single year may show different markings. There are three functional pairs of legs and the two claws on the end of each leg are divided in two. The larvae are cylindrical, striped and covered in fine, short hair.

Most BC whites feed on cruciferous plants (Family Brassicaceae) while most sulphurs feed on legumes (Family Fabaceae). A couple of species are economically important. The introduced European *Pieris rapae* (Linnaeus) (Cabbage White) now occurs all over the world where cabbage, broccoli, mustards and other crucifers are cultivated. *Colias eurytheme* Boisduval (Orange Sulphur) can be a pest of alfalfa, at least in warm climates where populations are large. The larvae of sulphurs overwinter; whites spend the winter in the pupal stage.

The family Pieridae contains about 1000 named species in 75 genera; 70 species and 16 genera are recorded in North America. British Columbia has 28 species in 6 genera. In BC the family can be divided into two subfamilies, the Pierinae (whites, 15 sp.) and the Coliadinae (sulphurs, 13 sp.). *Neophasia menapia* (C. & R. Felder) (Pine White) is commonly seen in southern BC, especially at the height of its flight season in August; it is an exception in the cruciferous feeding whites – the larvae feed on pines, firs and other conifers. In BC *Pontia* and *Pieris* both contain four species. *Pontia occidentalis* (Reakirt), the Western White, is the most common and widespread of the former genus, especially in the southern Interior, where it ranges from valley floors to alpine ridges. *Pieris angelika* Eitschberger (Arctic White) is a Beringian species restricted to the far northwestern corner of North America whereas *P. oleracea* Harris (Mustard White) ranges from the BC Interior to Newfoundland. Populations of the latter species have suffered where it has come into competition with the introduced *P. rapae* Linnaeus (Cabbage White). *Euchloe ausonides* (Lucas) (Large Marble) is common in the Interior; a population once found on southeastern Vancouver Island is now gone. *Euchloe creusa* (Doubleday) (Northern Marble) inhabits the Rockies and the far North; *E. lotta* Beutenmüller (Desert Marble) lives in dry grasslands in southern Interior valleys and ranges in the West to Mexico. The two BC species of *Anthocharis* are white (males) or yellow (almost all females) and have orange tips on the fore wings. *Anthocharis sara* Lucas (Sara's Orangetip) is coastal and *A. stella* (W.H. Edwards) (Stella's Orangetip) lives in the Interior; the larvae of both feed on *Arabis*.

British Columbia is the centre of diversity in North America for the sulphur genus *Colias* -- 13 species live in the province, although almost all are restricted to the Interior. *Colias occidentalis* Scudder (Western Sulphur), which lives on Vancouver Island and in the Cascade Mountains, is the main species on the coast. The most common and widespread species in BC (and all North America) is *C. philodice* Godart (Clouded Sulphur); the larvae feed on clovers, vetches and alfalfa. *Colias eurytheme* Boisduval (Orange Sulphur), another transcontinental species, migrates north each summer into BC's southern valleys; the species does not overwinter in the province. Several other sulphurs are also transcontinental but are more northerly in distribution. For example, *C. interior* Scudder (Pink-edged Sulphur) is common in northern forests where its food plants in the genus *Vaccinium* thrive; *C. nastes* Boisduval (Arctic Sulphur)

and *C. hecla* Lefèbvre (Hecla Sulphur) are tundra dwellers, ranging across the arctic and descending southwards into BC. The largest *Colias* in the province, *C. gigantea* Strecker (Giant Sulphur) is widespread in the West, but in BC is restricted to swamps and fens in the Cariboo and northern regions. The larva is unusual in that it feeds on willows.

Family Lycaenidae (Gossamer Wings) (Fig. 77)

Lycaenid butterflies are usually small, with a wingspan of about 20 to 50 mm. They are often brightly coloured, frequently in iridescent blues, greens and coppery tones; many have small, hair-like tails on the hind wings. The narrow head bears indented eyes. The forelegs of male adults are reduced in length (the tarsal segments are fused) and lack claws, but those of females have a normal structure and are fully functional. The larvae are oval, flattened and grub-like; many have glands that produce sweet liquids.

Many lycaenid larvae are symbiotic with ants, which protect them from predators in exchange for the honeydew from their abdominal glands. Most species have four larval stages, one less than other butterflies. They feed on many groups of dicotyledonous plants, often eating only the buds, flowers and seeds. Some are carnivorous; for example, the eastern North American *Fenisecta tarquinius* (Fabricius) eats woolly aphids. Some adult coppers, and especially hairstreaks, have remarkable false head patterns on the hind wings, including tails that mimic antennae; they also have special behaviours that promote this protective deception.

The family contains about 4700 named species in about 570 genera worldwide. There are about 150 North American species placed in 45 genera; BC records 43 species in nine genera. The subfamily Lycaeninae (coppers) contains nine species in BC, all in the genus *Lycaena*; the larvae feed on plants in the family Polygonaceae, such as *Rumex*, *Polygonum* or *Eriogonum* or on *Potentilla* (Rosaceae) and *Vaccinium* (Ericaceae). The most widespread species, found over the entire province, is the western *Lycaena mariposa* (Reakirt) (Reakirt's Copper); the larvae feed on *Vaccinium*. Another mainly western copper, *Lycaena helloides* (Boisduval) (Purplish Copper) is common across southern BC, especially in disturbed habitats. *Lycaena heteronea* Boisduval (Blue Copper) is the only BC copper in which the upper surface of the wings of males is blue; it's a species of western grasslands and dry subalpine meadows where the foodplant, *Eriogonum*, grows.

The subfamily Theclinae (hairstreaks) is largely tropical, but is well represented in BC. A common species in the southern valleys is *Strymon melinus* Hübner (Grey Hairstreak), a transcontinental species whose larvae feed on all sorts of plants and can be a pest of garden beans. The genus *Satyrium* has seven BC species, including *S. behrii* (W.H. Edwards), a threatened species associated with the shrinking Antelope-brush steppe of the South Okanagan. This tawny species ranges south to New Mexico. Another rare species with about the same BC range is *S. fuliginosum* (W.H. Edwards) (Sooty Hairstreak); caterpillars feed on lupines. *Satyrium liparops* (LeConte) (Striped Hairstreak), on the other hand, is a Great Plains species restricted in BC to the Peace River Canyon in the Northeast. All other BC hairstreaks can be placed in the genus *Callophrys*, although some authors break the group into smaller units. Two of these have green underwings, *C. affinis* (W.H. Edwards) (Immaculate Green Hairstreak) and *C. sheridanii* (W.H. Edwards) (Sheridan's Hairstreak), both restricted to dry Interior valleys. The

foodplant of *C. johnsoni* (Skinner) (Johnson's Hairstreak) is a mistletoe on Western Hemlock; the butterfly, found in BC only on the south coast, is considered endangered.

About 14 species of blues (subfamily Polyommatainae) occur in BC. Many feed on legumes, but foodplant of the holarctic *Vacciniina optilete* (Knoch), found in BC only in the far North, is *Vaccinium*, common in the peatlands and wet tundra where the butterfly lives. Another holarctic blue, *Agriades glandon* (de Prunner) feeds on plants of several families but most often on *Saxifraga*. The Greenish Blue, *Plebejus saepiolus* (Boisduval); Silvery Blue, *Glaucopsyche lygdamus* (Doubleday) and Northern Blue, *Lycaeides idas* (Linnaeus) are all common transcontinental species. *Euphilotes battoides* (Behr) (Square-spotted Blue) is Cordilleran, ranging from the BC southern Interior to Mexico.

Family Riodinidae (Metalmarks) (Figs. 78)

The metalmarks are closely related to the gossamer-wings and are often included as a subfamily in the Lycaenidae. They are small to medium-sized; North American species seldom have wingspans over 50 mm and most are coloured in browns, orange and black, sometimes checkered in white. Some species have metallic, coloured marks on the wings; these give the family its English name. The diverse tropical fauna shows a spectacular array of colours and forms, including tailed species. The antennae are long, usually half the length of the fore wing. The forelegs of the male are less than half the length of the other legs (tarsal segments have been lost) and are not used for walking. The coxa on the foreleg is extended as a terminal spine. The hind wing has a precostal vein that is absent in lycaenids. The larvae are intermediate in shape between the broad, flattened caterpillars of the Lycaenidae and the cylindrical forms of other Lepidoptera and, unlike those of the Lycaenidae, riodinid larvae cannot retract the head. Metalmark larvae often have some of their hairs clustered on bumps or tubercles.

Riodinid butterflies often rest with their wings spread flat or cocked at a 45° angle; many species, especially neotropical ones, typically land on the undersides of leaves. A number of North American species have rather specific habitat requirements and live in such places as sand dunes or wetlands where they can be uncommon and threatened by environmental change. Many species have mutualistic relationships with ants.

About 1250 described species of metalmarks, placed in 140 genera, occur worldwide, but about 90% of these live in the new Worlds tropics. There are 26 species in seven genera in North America. The sole Canadian species, *Apodemia mormo* (C. & R. Felder), the Mormon Metalmark, ranges from extreme southern BC and Saskatchewan south to northern Mexico. In BC it lives only in the South Okanagan and Similkameen valleys; because of its restricted distribution and rarity, it is considered endangered. Adults fly mostly from mid-August to late September. Larvae eat the leaves of *Eriogonum niveum* (Snow Buckwheat).

Family Nymphalidae (Brush-footed Butterflies) (Figs. 79-83)

Most North American brush-footed butterflies are medium-sized (40 to 70 mm wingspan) and many are orange or brown with dark markings -- but size and colour vary greatly. Both sexes have their forelegs reduced in length and covered in long brush-like hairs, thus the English name of the group. These legs are useless for walking or perching but are used as sense organs. The

face is broad, the eyes are not indented adjacent to the antennae and the latter usually have prominent clubs. Caterpillars commonly have branched spines; the hind end of the larvae of the Satyrinae is forked. The pupae are often strongly angled, bear thorn-like projections and lack a silk girdle.

Many nymphalids are strong fliers and some species are migratory and are among the most cosmopolitan of insects (*Vanessa*, *Danaus*). Others, such as members of the subfamily Melitaeinae fly only short distances and live in small, local colonies, often living together in silk webs, overwintering as young larvae. In BC members of the subfamily Nymphalinae either spend the winter as adults or migrate from the south in the spring.

The Nymphalidae is perhaps the largest family of butterflies with about 6000 species in 350 genera in all areas supporting butterflies. North America has about 170 species in 43 genera, BC 72 species in 17 genera. The family as now defined is composed of several subfamilies, some of which have long been treated as separate families (e.g., Danaidae, Satyridae, Heliconiidae). The subfamily Nymphalinae (anglewings and relatives) has six BC genera: *Polygonia* (5 sp.), *Roddia* (1 sp., namely *Roddia vaualbum* Denis & Schiffermüller), *Nymphalis* (2 sp.), *Aglais* (1 sp.) and *Vanessa* (4 sp.). Food plants of *Polygonia* species in BC range from currants and nettles to birch, alder and willows. These butterflies are more or less transcontinental except for the uncommon Cordilleran *P. oreas* (W.H. Edwards) (*Oreas Comma*), which ranges from southern BC to California. *Roddia l-album* (Esper) (*Compton Tortoiseshell*), *Nymphalis antiopa* (Linnaeus) (*Mourning Cloak*), *Vanessa atalanta* (Linnaeus) (*Red Admiral*) and *V. cardui* (Linnaeus) (*Painted Lady*) range around the northern hemisphere. All four BC *Vanessa* species are migratory and lack permanent, year-round populations in the province.

The fritillaries of the subfamily Argynninae are typically orange with black markings on the upper surface. The BC species are divided into three genera – *Euptoieta* (1 sp.), *Speyeria* (8 sp.) and *Boloria* (13 sp.). *Euptoieta claudia* (Cramer) (*Variiegated Fritillary*) is a southern species that rarely appears in the East Kootenays as a non-breeding migrant. *Speyeria* is a nearctic genus whose larvae feed on violets; variation is rampant and species can be difficult to identify. Several species are transcontinental, such as the large *S. cybele* (Fabricius) (*Great Spangled Fritillary*); others (e.g. *S. hesperus* (W.H. Edwards), the *Northwestern Fritillary*) are widely western, while still others (e.g. *S. hydaspe* (Boisduval), the *Hydaspe Fritillary*) are restricted to the Rocky Mountains and westward. *Boloria* (*Lesser Fritillaries*) is often split into two genera, *Boloria* and *Clossiana*. *Boloria napaea* (Hoffmansegg) (*Mountain Fritillary*), a circumpolar species, would be the sole BC species in the former group; it lives in moist meadows in northern BC. The larvae of the three BC temperate species, such as *B. epithore* (W.H. Edwards) (*Western Meadow Fritillary*), feed on violets; the northern, holarctic ones (e.g. *B. frigga* (Thunberg) (*Frigga Fritillary*) eat such plants as willows, blueberries and saxifrages.

The subfamily Melitaeinae (*Checkerspots*) in BC consists of three genera: *Phyciodes* (5 sp.), *Chlosyne* (= *Charidryas*) (3 sp.) and *Euphydryas* (4 sp.). Larvae eat a variety of plants, such as *Aster*, *Penstemon* and *Lonicera*. *Euphydryas editha* (Boisduval) (*Edith's Checkerspot*) ranges from BC south to northern Mexico; it has populations at sea level on the south coast and in the subalpine and alpine in the southern Interior. The coastal form, *E. e. taylori* (W.H. Edwards) is considered endangered in BC. The subfamily Limenitidinae (*Admirals*) contains a single genus in BC – *Limenitis*, with three species recorded. The common western *Limenitis lorquini* (Boisduval) (*Lorquin's Admiral*) is a familiar species of southern lowlands in BC; its boreal

relative, *L. arthemis* (Drury) (White Admiral) is widespread over much of the province. The Viceroy, *L. archippus* (Cramer), is extirpated from BC. Before 1930 it occurred in the southern Interior where its food plants were willows and apples; intensive spraying of cultivated apples with insecticides probably eliminated the small populations.

The subfamily Satyrinae (Satyrs) contains four genera in the province -- *Coenonympha* (2 sp.), *Cercyonis* (3 sp.), *Erebia* (8 sp.) and *Oeneis* (10 sp.). All BC species feed on grasses and sedges. The status of *Coenonympha* species is an example of that taxonomic argument so common in BC biology – are the Nearctic populations distinct enough from the closely related Eurasian ones (which sometimes, as in this case, extend into Alaska, Yukon and northern BC) to be considered separate? Here *C. tullia* (Müller) (Common Ringlet) is considered the same species from Britain east to Newfoundland. *Cercyonis pegala* (Fabricius) (Common Woodnymph) is common across North America; *C. oetus* (Boisduval) (Small Woodnymph) and *C. sthenele* (Boisduval) (Great Basin Woodnymph) are widespread in dry regions of the West. *Erebia* and *Oeneis* species are typically butterflies of the high mountains and the North; none of the former occur west of the Coast range and only two of the latter do so (*O. melissa* (Fabricius) (Melissa Arctic) and *O. nevadensis* (C. & R. Felder) (Great Arctic).

The subfamily Danainae (Milkweed Butterflies) contains one uncommon species in BC, the famous Monarch, *Danaus plexippus* (Linnaeus). Larvae feed on showy milkweed (*Asclepias speciosa*) in the dry valleys of the southern Interior; the butterflies sequester cardiac glycoside poisons from the foodplant and use them to discourage predation. Adults migrate in late summer to winter on the California coast. Some wandering individuals show up now and again on the BC coast where they sometimes find garden-grown milkweeds on which to lay eggs.

Superfamily Drepanoidea

Family Drepanidae (Hook-tips and Thyatirid Moths) (Figs. 84)

Members of the family Drepanidae are small to rather large, but mostly medium-sized moths. The wingspans of BC species range from about 3.5 to 4.5 cm. In the subfamily Drepaninae, the fore wing tips are often sickle-shaped, thus the name “hook-tips”. In the fore wing vein Rs has 3 or 4 branches; Rs4 is stalked at least with Rs3. In the hind wing, Sc +R lies very close to, or is fused to, Rs beyond the discal cell. A frenulum may be present or absent. The antennae are often lamellate or bipectinate. The proboscis is absent or weakly developed and the ocelli are often absent or very small. The sclerites that connect tergum 1 with sternum 2 are modified into abdominal tympanal organs; the tympana are internal. The structure of these organs is unique in the Lepidoptera. Larvae of the Drepaninae lack anal prolegs.

Most drepanid larvae feed on the foliage of trees or shrubs. Some are gregarious when young. During the day, larvae are exposed or are concealed in rolled leaves or leaves tied together. The larvae of many drepanids have the abdomen tapering to a point; many rest with the head and tail raised. Cocoons are usually spun between leaves; sometimes they are almost lacking or are formed in the soil. Adult postures vary -- most Thyatirinae hold the wings roof-like while most Drepaninae hold them outspread.

The family Drepanidae contains about 650 described species assigned to 120 genera. The subfamily Thyatirinae has usually been considered a separate family. Nine genera and 21 species

are known in North America; BC has seven genera with 11 species. Four of the five North American species of the subfamily Drepaninae live in BC. The species are broad-winged, small-bodied and resemble geometrids while species in the subfamily Thyatirinae are narrow-winged, heavy-bodied and noctuid-like.

The only two *Drepana* species in North America occur in southern BC – *D. arcuata* Walker (Arched Hook-tip) and *D. bilineata* (Packard) (Two-lined Hook-tip); they both range transcontinentally. The larvae feed on alders and birches. The other two BC species in the subfamily also occur across the continent. *Oreta rosea* (Walker) (Rose Hook-tip) is variable in colour but usually is washed in pink, yellow and brown; its caterpillars feed on Highbush Cranberry and other species of *Viburnum*. *Eudeilinia herminiata* (Guenée) is mostly white and lacks the hook-tipped wings; it feeds on *Cornus*.

In BC the subfamily Thyatirinae consists of four genera and seven species. *Habrosyne* is a predominantly temperate Old World genus, with only two North American species. The lovely *Habrosyne scripta* (Gosse) is transcontinental; in BC the golden-orange larvae feed on shrubby species of *Rubus*, such as thimbleberry, salmonberry and blackberry. The three BC species of *Ceranemota* are strictly western; the larvae feed on rosaceous trees and shrubs such as *Prunus emarginata* and *Amelanchier*. *Ceranemota albertae* Clarke is an Interior species and ranges east to Saskatchewan. The other two species are restricted to BC in Canada -- *C. improvisa* (H. Edwards) is coastal and *C. fasciata* (Barnes & McDunnough) lives both east and west of the Coast Range. *Pseudothyatira cymatophoroides* (Guenée) is common in wet forests on the coast and in the Interior; the foodplants of the orange-brown larvae range from *Populus* and *Alnus* to *Rubus* and *Prunus*. Across southern BC, *Euthyatira* species feed mainly on *Cornus*. The adult of *E. pudens* (Guenée) has pink-white patches on the fore wing which, when the moth is resting, gives it the appearance of a bird dropping. The species is distributed across the continent; *E. semicircularis* (Grote) is restricted to BC in Canada.

Superfamily Geometroidea

Family Uraniidae (Uraniid Moths) (Fig. 85)

The Uraniidae includes small to large, usually slender bodied moths. Some tropical species are brilliantly iridescent and tailed like papilionid butterflies, but most are cryptically coloured. In the fore wing veins M1 and R5 are fused and stalked at the base and are well separated from R4. The hind wing is often angled, notched or tailed at M3. The frenulum is often lacking, but it occurs in most North American forms. The antennae are thread-like, saw-toothed or comb-like; the ocelli are small or absent. In males, the abdominal tympanal organs occur laterally where terga 2 and 3 meet; in females they are on the front part of sternum 2.

Larvae of Epipleminae, including the North American species, are social when young, making webs that they abandon as they mature. They eat a wide variety of plant families, from Caprifoliaceae and Verbenaceae to Rosaceae and Rubiaceae. The larvae of Uraniinae, which contains some species whose adults are colourful day-flying forms, eat species of Euphorbiaceae. Pupation usually occurs in leaf litter. Adults hold their wings outspread or rolled, often with the fore wings and hind wings widely separated. They never hold them in a roof-like position.

The family Uraniidae consists of about 700 described species in 90 genera. Most species are tropical and fewer than a dozen are known in North America. The latter are placed in the almost cosmopolitan subfamily Epipleminae, which is often given family rank. The sole BC species, *Callizzia amorata* Packard, is transcontinental and ranges widely in the province. The adult is pale and mottled with a fine, complex pattern of brown, including a distinctive dark spot in the middle of the outer margin of the fore wing. The wingspan is only about 1.5 to 2 cm; the outer edge of the hind wing is concave. Larvae feed on plants of the honeysuckle family.

Family Geometridae (Geometer Moths, Loopers) (Fig. 86)

Geometer moths are small to large (about 10 to 50 mm wingspan in BC, but to over 100 mm elsewhere), typically slender bodied with broad, delicate wings. In our fauna, colours are usually subdued, with browns, greys, whites and rusts predominating; some are green, yellow, or black and white. Frequently delicate lines or bands cross both wings from front to back. In some species the females are short-winged or wingless; wing loss is more common in the Geometridae than in any other lepidopteran family. The head is densely scaled and the antennae are thread-like, serrate or bipectinate. Ocelli are normally absent. The proboscis is usually present (sometimes reduced or absent) and lacks basal scaling. The fore tibia bears an epiphysis; the typical tibial spur count is 0-2-4. In the hind wing, vein SC is often bent strongly near the base and may lie close to, or fuse with, Rs for part of its length. Vein M2 usually arises midway between M1 and M3, or nearer M1, or may be absent. A pair of structurally unique tympanal organs occur at the base of the abdomen; these open ventrolaterally. Most larvae have lost the front three of the usual five pairs of prolegs, but some species have retained more than two (with some reduced).

Adult geometrids are mostly nocturnal and many are attracted to lights; when resting they typically hold the cryptically coloured wings outspread, but some fold the wings tightly over the abdomen. Some species are diurnal and some of these are brightly coloured. The loss of prolegs results in the looping habit of the moving larva; the name “Geometridae” is derived from this “earth measuring” motion. Other names -- measuringworms, inchworms, spanworms, loopers -- refer to this distinctive movement. Characteristically, many caterpillars are beautifully camouflaged and, when disturbed, may stand erect on the prolegs, strikingly resembling a little twig. The larvae usually are externally feeding defoliators, although some attack fruits, dead leaves and stored products; a few are carnivorous. Many are serious pests, especially of fruit-bearing shrubs and trees and ornamental and forest trees. Food preferences of some genera are wide-ranging. For example, although the larvae of most species in the large cosmopolitan genus *Eupethecia* conceal themselves in buds and flowers or bore in cones, in Hawaii they ambush and devour small insects and spiders. As larvae *Scopula* species feed mostly on herbaceous plants, but adults of some species in Southeast Asia imbibe blood from wounds in mammals, or sip sweat and even tears.

The family Geometridae is huge, containing 21,000 species globally; in the Lepidoptera it is second in size only to the Noctuidae. In North America there are 255 genera containing about 1390 described species. British Columbia has 113 genera and 336 species; the most diverse genera in the province are *Eupethecia* (47 sp.), *Macaria* (23 sp.), *Hydriomenia* (20 sp.), *Xanthorhoe* (18 sp.), *Digrammia* (14 sp.), *Dysstroma* (10 sp.) and *Scopula* (10 sp.).

Biston betularia (Linnaeus) (Peppered Moth), found around the north temperate zone, is one of the most famous geometer moths –an icon of evolution in action. In Britain the white form, common in pollution-free areas, was largely replaced by a dark (melanic) form in regions affected by industrial pollution. Evidently the pale moths (formerly camouflaged against pale lichens on tree bark) were more easily found by predators on the dirty tree trunks in polluted areas than were the dark forms. In BC the same industrial melanism, as it is called, may occur. The dark form is present in the Vancouver region and is absent, or at least occurs at much lower frequencies, in parts of the Interior with cleaner air. *Archiearis infans* (Möschler), the sole North American representative of the genus, is an unusually colourful BC geometer with an “underwing” pattern. The fore wings are red-brown to black with white patches and the hind wings are orange with dark markings. They fly on warm spring days. The green larvae eat alder and birch and are also unusual – they have all five pairs of prolegs. The fore wings of *Dysstroma* adults are generally beautifully banded with brown, white, grey and black; the hind wings are white or grey. *Dysstroma sobria* Swett is a south coastal species that feeds on salal and rhododendrons; *D. truncata* (Hufnagel) eats Western Larch in the Interior; *D. citrata* (Linnaeus) feeds on *Rubus*, *Vaccinium* and other plants across the province.

Many species of the Geometridae are forest defoliators; almost 60 species feed on conifer trees in BC although only about eight are economically important. Perhaps the most damage is done by *Lambdina fiscellaria* (Guenée), whose larvae eat a wide range of evergreen and deciduous trees. The eastern subspecies, *L. f. fiscellaria* (Guenée), the Hemlock Looper, is known in BC only east of the Rockies and although major outbreaks have occurred in eastern Canada, none have been reported in BC. The Western Hemlock Looper, *L. fiscellaria lugubrosa* (Hulst), is a different story; ranging from central BC south to California, it has frequently been a destructive force in the province’s forests. The larvae especially attack Western Hemlock, Douglas-fir and Western Redcedar. A third subspecies, *L. fiscellaria somniaria* (Hulst), the Western Oak Looper, mainly devours Garry Oak on the south coast but also may feed on any Douglas-firs nearby.

Melanolophia imitata (Walker) (Greenstriped Forest Looper) has a similar distribution to the Western Hemlock Looper and attacks the same species of trees; the green and white striped larva is well camouflaged among conifer needles. *Nematocampa resistaria* (Herrich-Schäffer), the Filament Bearer, bears two pairs of weird, long, curled projections on the back of the mid-abdominal segments. This looper ranges transcontinentally feeding on many tree and shrub species; in BC the principal host plants of forestry importance are Douglas-fir and Western Hemlock. *Macaria sexmaculata* (Packard), the Larch Looper, damages Western Larch and Tamarack in BC and across the boreal forest, respectively. *Macaria* is diverse in BC; a number of species attack conifers, and those that do often have green and white striped larvae.

Some BC species have delicate green adults. *Chlorochlamys triangularis* Prout develops on rabbitbrush in the dry Interior grasslands, *Campaea perlata* (Guenée) on alders, saskatoon and hazel in wetter areas. The latter has brown larvae oddly fringed along the under surface; they also have two pairs of mid-ventral prolegs. *Chlorosea banksaria* Sperry eat Ocean Spray and *Nemoria darwiniata* (Dyar) feeds on Garry Oak, Snowberry and other plants; the larvae of both have characteristic, prominent flanges on the sides of abdominal segments two to five. Several small black and white, day-flying geometers catch the eye throughout much of BC -- *Mesoleuca*

gratulata (Walker) feeds on hazelnut, *M. ruficillata* (Guenée) on birch; larvae of *Rheumaptera hastata* (Linnaeus) and *R. subhastata* (Nolcken) eat alder leaves.

For British Columbia gardeners, at least on the coast, the Winter Moth, *Opheroptera brumata* (Linnaeus) is a most familiar geometrid. The males fly in November and December, mating with the wingless females, which crawl up the trunks and stems of the host plants to lay eggs. Oaks, apples and roses are particularly hard hit by the green larvae; plants can be attacked by larvae hatching on them or by those drifting in by air, carried on long silk strands. The Winter Moth is an invader from Europe, first appearing in North America in Nova Scotia in about 1930. It was well established in BC by the time it was first identified in 1976; earlier, evidently, it escaped detection because it had been mistaken for the native Bruce's Spanworm. Severe infestations were brought under control by imported tachinid flies and parasitic wasps but, ever since, it has been a notable pest in the region. The native *Operophtera bruceata* (Hulst) (Bruce Spanworm) and *O. danbyi* (Hulst) are also generalist feeders with similar life histories; the former is widespread in the West, the latter is restricted to the Pacific Coast. Another species that frequently appears on mild winter nights is *Triphosa haesitata* (Guenée), the Brown Tissue, which flies from July into the next spring; the caterpillar feeds on *Prunus* and *Cascara* across southern BC.

Superfamily Lasiocampoidea

Family Lasiocampidae (Tent Caterpillar Moths, Lappet Moths) (Fig. 87)

Lasiocampids are medium-sized to very large, stout-bodied, hairy moths. BC species are at the lower end of the size range, with wingspans ranging from about 25 to 35 mm and are predominantly brown, yellow or grey. The fore wing has vein R distinctly close to Sc towards the wingtip and vein CuA2 arises in the basal half of the discal cell. There is no frenulum to link front and hind wings in flight; instead, the front of the hind wing base is expanded and humeral veins are present. The mouthparts are non-functional, the eyes are often haired and the antennae are somewhat feathery, especially in males. Tent caterpillar larvae (*Malacosoma*) are hairy and often colourful, with stripes and spots of white, blue, orange and other colours. Lappet moth larvae (*Tolyte*, *Phyllodesma*) are softly hairy have a small lobe or lappet on either side of each segment.

Larvae of the Lasiocampidae feed mostly on deciduous trees and shrubs. Lappet moths seldom reach pest status but the tent caterpillars often cause severe defoliation during cyclical outbreaks. They live in colonies in spring and most kinds, including a common BC species, *Malacosoma californicum* (Packard) (Western Tent Caterpillar), construct silken tents in branch forks and tips for shelter. They also deposit trails of silk as they move from the tents to feeding sites on the foliage. The widespread *M. disstria* Hübner (Forest Tent caterpillar) does not construct nests, but lives in large, sometimes immense, aggregations linked by silk trails. Mature larvae wander and, when shelter is found, pupate in cocoons made of silk and hair. The adults produce eggs banded around twigs and covered with hardened foam; the moths overwinter as unhatched larvae. Adults rest in a distinctive posture: the fore wings are held tent-like and often much of the anterior part of the hind wing is uncovered in front of the fore wing.

The family Lasiocampidae is practically cosmopolitan but is best represented in the tropics; it includes about 1500 species placed in roughly 150 genera. In North America, approximately 35 species are recorded in 11 genera; there are five species in three genera in BC. *Malacosoma disstria* ranges all across North America; in BC it is particularly abundant in the central and northern regions of the province where it attacks willow, alder, birch and especially aspen. The larvae are blue and black with orange lateral stripes and white keyhole-shaped spots dorsally. Adults are yellow-orange with a darker band on the fore wing. The Northern Tent Caterpillar, *M. californicum pluviale* (Dyar), a subspecies of the Western Tent Caterpillar, is distributed from Quebec to BC. It is abundant across southern areas of the province and in some parts of the north, where it feeds on a variety of deciduous plants, including willow, alder and many kinds of fruit trees. The variably coloured larva, in BC usually has white dorsal patches bordered in black and orange; the adult is rusty with two pale lines crossing the fore wing.

Phyllodesma americana (Harris) is rich red-brown to pale tawny; the hind angle of the fore wing is strongly notched. This lappet moth is common across much of North America; the silvery grey caterpillar feeds on willows, alders, oaks and other deciduous trees and shrubs from Vancouver Island to the Peace River region. Another common lasiocampid, *Tolyte dayi* (Blackmore) (Day's Lappet Moth), a grey species with white tufted thorax and legs especially prominent in the female, feeds on trees such as Douglas-fir, Ponderosa Pine and Lodgepole Pine from southern BC to California. *Tolyte laricis* (Fitch) (Larch Lappet Moth) develops on many conifer species across the continent's northern forests; it is recorded in the Interior.

Superfamily Bombycoidea

Family Saturniidae (Giant Silkworm Moths) (Figs. 88-90)

Members of the Saturniidae are medium-sized to very large moths, with wingspans of about 30 to 280 mm. The largest specimens are in the genus *Attacus* from Southeast Asia. BC species have wingspans ranging from about 60 mm (small *Hemileuca* specimens) to 140 mm (large *Antheraea* examples). The body is heavy and covered in hair-like scales. The ground colour of the wings is highly variable, but mostly is some shade of brown; many species have concentric-ringed eyespots (thus the family name). The fore wing ante- and postmedian lines and the submarginal band on the hind wing are perhaps the most characteristic features of the colour pattern. There is no frenulum. The hind wing has one anal vein; veins Sc and Rs in the hind wing fork at the wing base and are not connected by a crossvein; veins Rs and M1 are not stalked beyond the discal cell. The antennae are normally somewhat plumose, especially in males; each segment has four branches except in *Hemileuca*, where there are two. The mouthparts are reduced and non-functional. Larvae often have tubercles or spines on the body; the pupae usually are enclosed in a silken cocoon, often incorporating leaves.

Adults are usually nocturnal, although some Saturniinae and many Hemileucinae fly in the daytime; BC species of *Hemileuca* are diurnal. Adults typically do not feed. The larvae are frequently polyphagous; some species eat dozens of plant genera. Most are solitary, but Hemileucinae larvae are gregarious, feeding in tight clusters; they also bear tubercles with poisonous spines, although the stings are usually not serious. Temperate species usually overwinter as a pupa, although some do so in the egg. The pupal cocoon may be aerial, attached to a twig or leaf of the hostplant, or spun in the leaf litter, or less frequently in the soil;

subterranean pupae may lie in a silk cell or may directly burrow in the earth, as is often the case in *Hemileuca*. This genus has successfully adapted to the dry grasslands and deserts of the American West.

The main commercial production of silk comes from *Bombyx mori* (Linnaeus) in the family Bombycidae, which has been domesticated for about 4000 years. However, saturniid moths in genera such as *Samia* and, especially *Antheraea*, produce commercial amounts of silk, mainly in China and India. In Asian silk-producing countries, dried larvae and pupae of the moths are used as food and larvae are eaten in Africa. The larvae and pupae of *Coloradia pandora* Blake (Hemileucinae), are gathered in large numbers eaten by native peoples in California and adjacent states. Saturniids are seldom serious pests, but *Hemileuca oliviae* Cockerell can cause significant economic damage to the grasses of rangelands. Species of *Coloradia*, which feed on pines, have periodically devastated large areas of pine forest in the western US.

The family Saturniidae is cosmopolitan, and is absent from only the most northerly and southerly regions. It is best represented in the tropics, especially in the New World. There are about 1480 species in 165 genera and approximately 76 species in 18 genera are recorded for North America; BC has three genera and six species. The largest and probably the most familiar BC species is *Antheraea polyphemus* (Cramer), the Polyphemus Moth, one of BC largest insects. The species ranges across North America and south into Mexico – the most widespread of the saturniids in North America. *Hyalophora euryalis* (Boisduval) (Ceanothus Silkmoth) is also widespread across southern BC. Its large green caterpillar is adorned with red dorsal tubercles and two rows of lateral blue tubercles – all tubercles bear black spines. They eat Douglas-fir, birch, alder, willow, ceanothus and other plants. Populations in the BC Interior and Rocky Mountains are usually treated as hybrids with *H. columbia gloveri* (Strecker) (= *H. gloveri* (Strecker)), although a few specimens from the Peace River region east of the Rockies apparently are true *H. columbia gloveri*.

The subfamily Hemileucinae is restricted to the New World. The three BC representatives are striking, day-flying species. *Hemileuca eglanterina* (Boisduval) (Common Sheep Moth) is a pink and yellow, black marked species about 70 mm across the wings. It ranges from Vancouver Island across the southern Interior and south into California and Arizona where the larval foodplants range from *Prunus* and *Rosa* to *Ribes* and *Symphoricarpos*. *Hemileuca nuttalli* (Strecker) and *H. hera* (Harris) are moths of the dry Interior grasslands; the former feeds on *Purshia tridentata* and *Symphoricarpos albus*, the latter on *Artemisia tridentata*.

Family Sphingidae (Sphinx Moths, Hawk Moths) (Figs. 91 & 92)

Members of the Sphingidae are medium-sized to large, heavy bodied moths with long narrow fore wings and relatively small hind wings; in BC species, wingspans range from about 40 to 140 mm. In the fore wing vein M2 arises a little nearer M3 than M1. Veins Sc and Rs in the hind wing are parallel to end of discal cell and beyond (or may nearly meet); near the midpoint of the discal cell they are connected by an oblique crossvein. Some species have much of wings devoid of scales and resemble bumblebees (*Hemaris*). A frenulum is present but is often rudimentary in the Smerinthinae. The antennae are threadlike or often thickened and somewhat spindle-shaped towards the tip. Sometimes they are comb-like. The eyes lack hairs and ocelli are

absent. The proboscis is usually long (sometimes much longer than the body, especially in the Sphinginae) but sometimes is short or vestigial, as in some Smerithinae. Most larvae lack obvious hairs and usually have a spine or button-like process near the end of the body, thus giving them the name hornworms. The sides of larval abdominal segments 1 to 7 in species of subfamilies Sphinginae and Smerithinae bear an oblique stripe. Most species pupate in the soil or in leaf litter; the sheath of the developing proboscis sometimes resembles the handle of a cup or jug.

Sphinx moths fly strongly with rapidly beating wings; many feed on flower nectar much as do hummingbirds, probing tubular blooms with the proboscis. They are probably important pollinators of some BC plants. Some suck oozing tree sap or fluids from rotten fruit. Most fly and feed at dusk or at night, but a few of the most familiar, such as species of *Hemaris* and *Proserpina*, fly during the day. Species in these genera probably mimic bumblebees. Larvae of some species damage commercial crops; for example, *Manduca quinquemaculata* feeds on tomato plants and *M. sexta* on those of tobacco. Larvae often rear up when disturbed and, in this position, have reminded some imaginative people of the Sphinx of Egypt.

About 1200 species of Sphingidae are placed in 200 genera worldwide. North America has approximately 125 species in 42 genera; BC records 21 species in 10 genera. The subfamily Sphinginae includes three genera in BC. The well-known *Manduca quinquemaculata* (Haworth), from a predominantly Neotropical genus, is usually called the Five-spotted Hawk Moth because of the five yellow pairs of marks on the abdomen. The larvae feed on tomato and other plants in the Solanaceae and give the species its other English name, Tomato Hornworm. It is probably introduced to BC, where it mainly occurs east of the Coast Range. *Agrius cingulatus* (Fabricius), the Pink-spotted Hawk Moth, is predominantly a moth of the American subtropics and tropics, but wanders widely northward; there is a record from Robson in the West Kootenays. The genus *Sphinx* contains five species in BC; they are mostly grey, grey-brown and white. The most common is *S. vashti* Strecker (Snowberry Sphinx), a species widespread throughout western North America. It ranges across southern BC; the larvae feed on Common Snowberry (*Symphoricarpos albus*).

The subfamily Smerinthinae in BC consists of five transcontinental species whose adults are grey or brown with pink hind wings (yellow in *Paeonias myops*) that usually bear eyespots. The most often seen is the widespread *Smerinthus cerisyi* Wm. Kirby (One-eyed Sphinx); *S. jamaicensis* (Drury) (Twin-spotted Sphinx) is more often found in the Interior than on the coast. Both feed mainly on willows and poplars, as does the largest BC sphinx moth, *Pachysphinx modesta* (Harris) (Big Poplar Sphinx). *Paonias excaecata* (J.E. Smith) (Blinded Sphinx) and *P. myops* (J.E. Smith) (Small-eyed Sphinx) feed on a wide range of trees and shrubs, including cherries and plums.

The day-flying species in BC belong to the holarctic genera *Hemaris* and *Proserpinus* in the subfamily Macroglossinae. *Hyles* species are also sometimes diurnal. The foodplants of the clearwings (*Hemaris*) are mainly honeysuckles and their relatives, including *Symphoricarpos* species. *Hemaris thysbe* (Fabricius), the Common Clearwing and *H. diffinis* (Boisduval), the Snowberry Clearwing, range across the continent; *H. senta* (Strecker), closely related to the latter, is a western montane species known in BC only from Kaslo. *Proserpinus* species feed mostly on plants in the Onagraceae such as fireweed and evening primrose. *Proserpinus clarkiae*

(Boisduval), Clark's Day Sphinx, is a western moth; *P. flavofasciata* (Walker), the Yellow-banded Day Sphinx, is transcontinental. *Hyles gallii* (Rottenburg) (Bedstraw Sphinx), like *H. lineata* (Fabricius) (White-lined Sphinx) ranges across the continent, but is much more widespread in northern regions than its relative, which is restricted to southern BC. The former species lives all over BC and occurs north in the Yukon to treeline. *Darapsa choerilus* (Cramer), the Azalea Sphinx, is primarily an eastern species that may range to the Peace River region of BC; the only BC record, from Ucluelet, is probably mislabelled. *Deilephila elpenor* (Linnaeus), the Elephant Hawk Moth, is a beautiful pink and yellow-green Palaearctic species recently introduced to the Pitt Meadows region of the Lower Mainland; it feeds mainly on *Epilobium*.

Superfamily Noctuoidea

Family Notodontidae (Prominents) (Figs. 93 & 94)

Notodontid moths are mostly robust and medium-sized (wingspans about 25 mm to 60 mm in BC species), brown, grey, olive or yellow and spotted or streaked with darker or lighter tones. Many are strongly hairy and often bear backward projecting tufts on the hind margins of the fore wing that protrude when wings are folded. These, along with the large tubercles and processes on the backs of many larvae, give the family its scientific name, which means ("back tooth"). The English name, "prominents" also refers to these projections. The antennae are usually thread-like or bipectinate in females and bipectinate in males. The proboscis is usually well developed but can be reduced or absent. The thorax often bears dorsal crests of scales and the metathoracic tympanal organs usually have the tympanum facing downward. The tibial spurs have serrated edges. In most prominents veins Sc+R1 and Rs in the hind wing are close together and parallel along the front of the discal cell; RS and M1 are fused and then separate a short distance past the discal cell. The larvae have prominent, sometimes bizarre humps and tubercles; the colours can be striking, with mottled or striped patterns. A forked, eversible defensive organ is sometimes present under the prothorax; it produces formic acid and ketones. Some genera also have the posterior prolegs modified into long chemosecretory defensive organs.

Most notodontids feed on the foliage of trees and shrubs. Many adults and larvae are cryptic in form, pattern and posture -- twig, bark, lichen and dead leaf imitations are found throughout the family. For example, some *Schizura* larvae, with their angled dorsal margins and scalloped green and brown patterns, look much like the damaged edge of a leaf. On the other hand, some larvae produce defensive secretions when disturbed. Still others flaunt warning colours of red or yellow, sometimes raising the front and rear of the body or extruding long tails. Some larvae are gregarious when young but become solitary as they mature. Prominents are mostly nocturnal as adults, but the subfamily Dioptinae, mainly living in the New World tropics, contains colourful, day-flying, butterfly-like moths that have developed complex systems of mimicry. Not surprisingly, the larvae feed on herbaceous plants containing toxins.

More than 2800 notodontid species are described in all world regions except the Pacific islands and New Zealand. The Neotropical fauna is especially diverse. The Old World subfamily Thaumetopoeinae is given family status by some authors as is the mostly neotropical Dioptinae. North America has 43 genera containing 138 named species; BC has 22 species in 10 genera. Several common BC genera are Holarctic and have species that develop primarily on poplars and willows -- *Clostera* (4 sp.), *Gluphisia* (2 sp.), *Odontosia* (1 sp.) and *Pheosia* (2 sp.). *Clostera*

albosigma Fitch, the Sigmoid Prominent, has a white s-shaped mark on the fore wing. The larvae of *Gluphisia septentrionis* Walker (Common Gluphisia) are green with red dorsal patches bordered in yellow. *Phaeosia rimosa* Packard (Black-rimmed Prominent) caterpillars are sometimes called false hornworms because they have a horn-like projection on their rear much like sphinx moth larvae do. The four species of *Furcula* in BC -- *F. cinerea* (Walker), *F. modesta* (Hudson), *F. scolopendrina* (Boisduval) and *F. occidentalis* (Lintner) -- all range transcontinentally. They feed on willows and poplars. Their larvae extrude long tails when alarmed and the adults are patterned in white, grey and black.

Nadata gibbosa (J.E. Smith) (White-dotted Prominent) is a common yellow-brown moth with two white dots on each fore wing. It lives across southern BC and develops on willow, oak, alder and maple. It is distributed across North America, as are *N. pacifica* Behr and *N. simplaria* Graef. *Oligocentria* species have similar food habits; *O. pallida* (Strecker) and *O. semirufescens* (Walker) are common pale grey and rusty moths found across southern BC; the former is restricted to BC in Canada, the latter is transcontinental. The three BC *Schizura* species are also pale grey and rusty; they are widespread across the continent and all can be occasional pests in fruit orchards. *Schizura concinna* (J.E. Smith) (Red-humped Caterpillar) sometimes attacks apple and cherry trees in the Interior; the larva is yellow with black and white stripes, a red head and a red hump on the first abdominal segment. The Unicorn Caterpillar, *S. unicornis* (J.E. Smith) is one of the few notodontids that eats any conifer in BC. It feeds on Western Larch as well as birch, alder, willow, oak, poplar, and other trees. The spectacular horn just behind the green thorax gives it its name. *Shizura ipomoeae* Doubleday (Morning Glory Prominent) has a similar larva and also ranges across southern BC. *Datana ministra* (Drury) (Yellow-necked Caterpillar) larvae are black with yellow stripes, long white hairs and a yellow or orange prothorax. When young, they mass together on the host plants, which are often commercial apples, plums and other orchard species as well as a wide range of other trees.

Family Noctuidae (Owlet, Tiger, Tussock Moths and Relatives) (Figs. 95-100)

The classification of the Noctuoidea has undergone recent radical change and former familiar families such as Nolidae, Arctiidae and Lymantriidae are placed as subfamilies with the traditional Noctuidae to form a new, larger and more unified family Noctuidae. This taxon is equivalent to the group known as the quadrifid Noctuoidea and its designation as a family resolves all sorts of thorny problems that once plagued Lepidoptera taxonomists. The family is mainly defined as a group in which vein M2 in the fore wing lies in the lower part of the discal cell so that the cubital vein appears to have four branches.

The Noctuidae in the former, more restricted sense (called owlet moths here) vary in size and coloration but, at least in North America, most are heavy bodied moths with wingspans ranging from 20 to 80 mm (up to at least 150 mm in some tropical species); the fore wings are usually finely mottled or figured in browns and greys and the hind wings are pale and more unicolourous. Many species defy this pattern, however. For example, many forester moths such as species of *Alypia* are normally black with white or yellow spots and most underwings (*Catocala*) have the hind wings brightly banded black and red, yellow or white. Ocelli are almost always present and the antennae are usually thread-like, but can be sawtoothed or comb-like. The proboscis is normally well developed. An epiphysis is present; the tibial spur formula is 0-2-4 and the tibiae and tarsi sometimes bear spines. The myriad of subfamilies group into a quadrifine

series where vein M2 in the hind wing is prominent, close to M3 and joined to it by a strong crossvein (Cu appears to be 4-branched) and a trifine series in which M2 is absent or weak and distant from M3 (Cu apparently 3-branched). In the hind wing, vein Sc is basally fused with R1 for a short distance. The tympanal organs are on the metathorax; the tympanum is oblique and the tympanal hood lies behind the spiracle.

Adults of this diverse group are largely nocturnal and strongly attracted to light; their eyes brightly reflect the light as they flutter or rest nearby. “Noctua” in Latin means “owl”; thus the family common name “owlet moths”. The family has attracted other common names – millers, underwings, daggers, cutworms, armyworms. Some genera are dayflying – the forester moths in the genus *Alypia* are familiar examples. The normally strong proboscis enables adults to feed extensively on plant nectar, sap and fermenting fruit. Some tropical species pierce thick-skinned fruits to feed on juices and the Southeast Asian *Calyptra eustrigata* Hampson and some close relatives suck blood from mammals.

Most owlet moth larvae are naked or clothed in fine, sparse hairs; a few, such as some *Acronicta* and *Panthea*, are more densely hairy like their relatives, the tiger and tussock moths. Quadrifine larvae tend to be long and slender; many of these are loopers, with the first two pairs of prolegs lost. Trifine larvae are usually stouter and many of these are cutworms, resting in the soil during the day and emerging at night, feeding on the bases of young plants or climbing higher and eating shrub and tree foliage. Many are stem and root borers. Others feed openly on leaves and stems, or chewing fruits, buds and flower heads. Some become gregarious and migratory at high densities; these armyworms are among the most destructive moth pests. A few noctuids have been used in biological control; for example, *Calophasia lunula* (Hufnagel) was introduced to North America to combat the invasive weed *Linaria vulgaris* P. Mill. (Common Toadflax).

The family Noctuidae as defined in Kristensen (i.e. without nolids, arctiids, lymantriids and pantheids) consists of more than 35,000 described species in at least 4200 genera, and was the most diverse family in the Lepidoptera including the Nolidae and Erebiidae. About 590 genera and 3290 species are recognized in North America. With the derived Nolidae, Arctiidae, and Lymantriidae included, the more inclusively defined Noctuidae is, of course, even larger – about 50,000 species in well over 5000 genera worldwide. Only a few of the subfamilies are treated below. The Arctiinae, Lymantriinae, and Nolinae, and having been familiar families until recently, are given more comprehensive subfamily accounts. Currently the BC fauna consists of 253 genera and 804 described species.

Subfamily Noctuinae

The subfamily Noctuinae contains species whose larvae feed widely on herbaceous angiosperms. Older larvae are active at night, cutting plant parts and feeding on them in their shelters in the soil. Many of these “cutworms” are agricultural pests, especially in the genus *Agrotis* (8 BC sp.) and *Euxoa* (91 BC sp.). *Agrotis ipsilon* (Hufnagel) (Black Cutworm) ranges over much of the world and attacks vegetable and field crops; *Euxoa auxiliaris* (Grote) (Army Cutworm) damages alfalfa, wheat and other crops.

Noctua comes Hübner and *N. pronuba* (Linnaeus), the sole members of the genus in North America, are introductions from Europe. Both are common in gardens on the BC south coast where the larvae feed on grasses and other low plants; the adults of both species have bright orange-yellow hind wings bordered in black. *Noctua pronuba* spread across North America from its original introduction in Nova Scotia in 1979 and was first identified in BC in Delta in 2002. *Noctua comes* first appeared in North America in Vancouver in 1982 now also known from Vancouver Island and the southern Interior south to Oregon. *Peridroma saucia* (Hübner) (Variegated Cutworm) is cosmopolitan and causes damage almost everywhere crops are grown. It has a taste for garden produce; the first serious outbreak in BC was in 1900. *Abagrotis* has 23 BC species -- *A. glenni* Buckett and *A. mirabilis* (Grote) feed on *Juniperus scopulorum* Sargent and the larvae of these and other species often are patterned like the scaly twigs of conifers. *Abagrotis duanca* (J.B. Smith) is common in dry pinelands and sagebrush steppe where the larvae eat the foliage of Big Sagebrush.

Subfamily Hadeninae

The subfamily Hadeninae contains, among other species, the agriculturally destructive armyworms, especially those in the genus *Spodoptera*, which has two species in BC. *Spodoptera exigua* (Hübner) (Beet Armyworm) and *S. praefica* (Grote) (Western Yellow-striped Armyworm). Larvae feed on grasses and innumerable crops. *Orthosia* (9 BC sp.) has two BC species distinctive owing to their red fore wings – *O. mys* (Dyar) develops on Manzanita and *O. transparens* (Grote) on Arbutus and rhododendrons. In *Lithophane* (16 BC sp.), *L. atara* (J. B. Smith) and *L. ponderosa* Troubridge & Lafontaine feed on Ponderosa Pine from BC to California and Colorado. The larva of the former is green with white-bordered red stripes; the latter lacks the red coloration. The Corn Earworm, *Helicoverpa zea* (Boddie) is widespread in the Americas; it is a major pest of corn, tomatoes, cotton and other plants, eating fruits and flowers as is typical of members of the subfamily Heliothinae. Northern populations, including Canadian ones, are temporary, the result of adult dispersal from the south.

Many larvae in the subfamily Plusiinae are loopers; they are frequently associated with disturbed habitats and many species feed on a wide range of herbaceous plants. Some are strongly migratory as adults. These characteristics have made some species important pests. *Trichoplusia ni* (Hübner) (Cabbage Looper) is an important pest of cabbage and many other vegetable crops throughout much of North America. *Autographa* contains 13 species in BC; *A. californica* (Speyer) (Alfalfa Looper) is a common pest of dozens of crops as well as feeding on native plants in woodland habitats. A number of the 16 *Syngrapha* species in the province are defoliators of conifers; these usually have green and white striped larvae. *Syngrapha rectangula* (Wm. Kirby), a boreal and montane species, feeds on hemlock and spruce; the adult is a striking black and white moth.

Alypia langtoni Couper and *A. ridingsii* Grote are noticeable day-flying moths in the subfamily Agaristinae (Foresters). In BC their larvae, white with orange and black markings, eat fireweed (*Epilobium*) foliage. Moths in the genus *Feralia* (subfamily Psaphidinae) are mostly North American defoliators of conifer trees; the larvae are typically green striped with white and sporting a red lateral line. Adults are lichen mimics, with green fore wings marked with black and white. *Feralia comstocki* (Grote) is transcontinental; in BC it lives east of the Coast Range where it feeds on Douglas-fir, hemlock, spruce and firs. On the coast, *F. deceptiva* McDunnough

ranges from BC south to California. Twenty species of *Acronicta* (Acronictinae) are recorded in the province. The adults are usually greyish, but the caterpillars are frequently distinctively and colourfully haired. The larva of *A. cyanescens* Guenée is spectacular – its green body is obscured by a dense mop of long white hairs; it feeds on *Ceanothus velutinus*. *Acronicta grisea* Walker and *A. impleta* Walker feed on alders.

Ascalapha odora (Linnaeus), subfamily Erebinae, is a rare visitor to BC from the American tropics and subtropics. Called the Black Witch, this is one of the largest of the owl moths (up to 150 mm wingspan); it develops on leguminous trees. BC records one of these wanderers, on average, every 5 to 10 years, usually in August. In BC the subfamily Catocalinae is represented by ten species of the large genus *Catocala* which, in North America, contains about 110 species). The adults are among the largest BC noctuids (wingspans to 80 mm) and, when startled, open the cryptic fore wings to flash the brightly patterned hind wings. Several species with red and black hind wings develop on Garry Oak on the south coast – *C. aholibah* Strecker is the most common and often flies late in the day. The transcontinental *Catocala relictata* Walker has whitish fore wings and black hind wings crossed by a white band; the larvae feed on willows and Trembling Aspen. Common Red-winged species, *C. briseis* W. H. Edwards and *C. californica* W. H. Edwards also feed on willows.

Subfamily Arctiinae (Tiger Moths)

The noctuid subfamily Arctiinae gets its English name, “tiger moths”, from the colourful, striped and spotted adults of many species. The often densely hairy caterpillars provide the scientific name, which comes from the Greek *arktos*, or “bear”. The word also, of course, means “north” -- home of the “Great Bear” constellation, which points to the North Star. Until recently, the group was given family rank; some species are among our most recognizable moths.

Adults are small to medium-sized moths (about 12 to 80 mm in the North American fauna), often heavy-bodied and coloured in spots and bands of black, brown, white, pink, red, yellow and orange. Many are mostly white. The antennae are normally narrowly featherlike or haired in males, threadlike in females. Ocelli are present, often very small and hard to see, or absent. The proboscis is small or absent. The tarsal spur formula is 0-2-4 or 0-2-2. Vein Cu in the hind wing appears 4-branched and Sc and R are fused to about middle of discal cell; ctenuchids lack Sc+R1 in the hind wing. In females dorsal eversible pheromone glands are associated with the anal papillae and both sexes of most groups have sound-producing tymbal organs on the metathorax. Most larvae are densely tufted with hairs and bristles (some are the familiar “woolly bears”); they pupate in cocoons made of felted larval hairs and little silk.

Larvae are mostly gregarious in their early stages and usually become solitary as they mature. Many overwinter as larvae and are familiar sights in autumn when they wander in search of shelter. Many species of Arctiinae feed on grasses and other low plants; others are tree and shrub feeders. Some eat fungi and detritus such as fallen flowers and leaves. Lichens are the main food of the footman moths (Lithosiini), which are usually smaller and less flamboyantly coloured than many of the more striking Arctiini. Tiger moth larvae frequently eat plants containing alkaloid poisons. Larvae and adults may sequester these chemicals for defence against predators; many species exude distasteful liquids from prothoracic glands. The bright colours of many adults and larvae warn potential predators of the presence of these chemicals. Some males use the poisons to construct the pheromones used in mate attraction and, in some cases, they

transfer these chemicals to the females during mating in order that the females and their eggs are also protected. Warnings are not restricted to coloration or form. Many nocturnal species produce clicking sounds with their tymbal organs when they detect bats nearby, warning the bats of the moths' distastefulness. These sounds also may subvert the bats' echolocation system and confuse the bats as to the location of the moths. Sounds from the tymbal organs are probably also used in mate attraction. Tymbal organs are reduced or absent in dayflying species such those in *Ctenucha*, *Cisseps* and their relatives; however, mimicry of Hymenoptera is frequent these "wasp moths", which are especially diverse in the Neotropics.

There are few economically important Arctiinae, but three should be mentioned here. The Fall Webworm (*Hyphantria cunea* (Drury)) damages shade and fruit trees in North America and also in Europe, where it was accidentally introduced. It eats over 600 species of plants, more than any other plant-eating insect. *Lophocampa argentata* (Packard) (Silver-spotted Tiger Moth) attacks Douglas-firs and other conifers, sometimes resulting in aesthetic damage to ornamental trees. *Tyria jacobaeae* Linnaeus (Cinnabar Moth) has been introduced to various parts of North America to control Tansy Ragwort (*Senecio jacobaeae* Linnaeus), a plant poisonous to livestock; both the adult and larva are brightly coloured -- the adult is red and grey, the larva is banded yellow and black. In BC this day-flying moth is established on the south coast.

The Arctiinae is distributed worldwide and contains about 11,000 named species, 6000 of which are neotropical. There are 88 genera and 267 species described in North America; BC has 48 species in 27 genera. The footman moths or lichen moths (Tribe Lithosiini) are represented by five genera and six species. *Eilema bicolor* (Grote) feeds on lichens growing on conifers all over BC; *Hypoprepia miniata* (Wm. Kirby), striped in red and grey, is mainly found in the wetter parts of the southern Interior.

The bulk of BC's Arctiinae are found in the tribe Arctiini. There are few genera in BC with more than one or two species, but the largest is *Grammia*, with ten species. These are pretty moths, with the forewing dark brown or black with pink-white reticulation and the hind wing pink-red with black spots and blotches. In BC *Grammia* is mainly a genus of the Interior; the most common and widespread species are *G. ornata* (Packard) and *G. parthenice* (Wm. Kirby). *Spilosoma* contains five species in BC – the most common are *S. pteridis* Hy. Edwards, *S. vagans* (Boisduval) and *S. virginica* (Fabricius). The latter, the Yellow Woolly Bear, is common over much of North America; the larva is densely yellow or orange-haired and feeds on a wide variety of woody and herbaceous plants. The adult is white with a few fine black spots and yellow on the abdomen. *Lophocampa argentata* (Packard) and *L. maculata* Harris (Spotted Tussock Moth) are familiar arctiines in BC. The former, a species restricted to western North America, feeds on conifers, mainly on the coast; the latter, ranging transcontinentally and common throughout southern BC, eats deciduous tree foliage. *Hyphantria cunea* (Drury), the Fall Webworm, makes silken tents on a great variety of trees and shrubs across the southern half of BC in the late summer and fall. Unlike those of tent caterpillars (Lasiocampidae), which leave their tents to feed, webworm larvae remain inside the tents, which surround the leaves they are eating.

Pyrharctia isabella (J.E. Smith), the Banded Woolly Bear, and *Estigmene acrea* (Drury), the Saltmarsh Caterpillar, are widespread BC species common across the continent. The former is the familiar black caterpillar with the rusty band in the middle; both feed on a variety

of plants, including crops and garden ornamentals. Two of the largest and most colourful species found over much of the province are the holarctic *Arctia caja* (Linnaeus) (Garden Tiger Moth) and the boreal *Platarctia parthenos* (Harris) (St. Lawrence Tiger Moth). Both have wingspans of about 50 to 65 mm. In the Garden Tiger the brown forewing is crossed with yellow-white reticulations, the orange hind wing orange has black spots. The rust and black larva eats many herbaceous and shrubby plants. The latter, widespread in the Interior, eats willows, alder and birch. The adult forewing is brown with yellow spots; the hind wing is orange banded with black.

The genera *Cisseps* and *Ctenucha* and their relatives until recently were placed in their own family, the Ctenuchidae, often called wasp moths. The larvae of these two genera feed mainly on grasses and sedges; the adults fly during the day. *Cisseps fulvicollis* (Hübner) (Yellow-collared Scape Moth) is widespread in BC; the adult is grey with white in the centre of the hind wing; the prothorax is orange-yellow. *Cisseps packardii* (Grote) is also recorded in the province. *Ctenucha virginica* (Esper) (Virginia Ctenucha) is striking with its black wings, metallic blue body and orange head.

Subfamily Lymantriinae (Tussock Moths)

The Lymantriinae (=Liparinae) are mostly medium-sized to large moths, with a wingspan of 15 to at least 115 mm; colours generally range from white to brown. The adult male resting posture is characteristic – the wings are held in a broad triangle and pressed to the substrate while the densely hairy forelegs are extended in front of the head. In the hind wing M1 is often stalked with Rs beyond the discal cell; the base of M2 is normally closer to M3 than to M1. There is a trend towards flightlessness in females; for example, *Orgyia* females are large bodied but wingless. There are no ocelli and males have plumose antennae, each branch bearing one to three apical, bristle-like spinules. Some genera have tufts of spoon-shaped scales on the top of the mesoscutellum and the basal abdominal segments; some females have large hair tufts at the tip of the abdomen. The larvae have long, abundant hair, frequently with clumped needlelike spines; two anterior and two or three posterior pencils of long plumose hairs may be present, as well as short, dense tufts on the top of at least the first four abdominal segments. Some of the hairs may be irritating. All larvae have a single eversible, usually yellow to red gland on top of abdominal segment 6 or, in all native North American species, on segments 6 and 7.

Many species feed on trees, are often polyphagous and a large number (about a third of North American species) are considered pests. However, many of the family also are specialist feeders on flowers, fruits and herbs; some African and Asian species eat algae and fungi. Species with larvae bearing irritating hairs incorporate these hairs into the cocoon and emerging females then use them to cover the egg mass. In some species newly hatched larvae feed in aggregations, their protected bodies covered in the toxic scales that were deposited on the egg clusters by their mothers. Wingless females obviously cannot fly, but many fully winged species, such as *Lymantria dispar*, can only flutter weakly along the ground. Most species are nocturnal, but males of some species, such as *L. dispar* and *Orgyia pseudotsugata*, fly during the day or evening.

The subfamily Lymantriinae consists of over 2500 described species in about 360 genera, mostly living in the Old World tropics. Only about 200 species are native to the New World; one of them, *Gynaephora groenlandica* (Wocke), which lives on north coast of Ellesmere Island and Greenland, occurs about as far north as any land animal. Thirty-three species in seven genera are

recorded in North America; three of these genera are introduced from Europe. There are seven species in four genera in BC. *Dasychira* is a Nearctic genus inhabiting temperate forests; there are three BC species. *Dasychira griseifacta* (Dyar), the Pine Tussock Moth and *D. plagiata* (Walker), the Northern Pine Tussock Moth, feed on various conifers; the former is a cordilleran species, the latter is boreal. The Variable Tussock Moth, *D. vagans* (Barnes & McDunnough), ranges transcontinentally; the larvae eat willows, poplars and other deciduous trees and shrubs.

Orgyia has females with wings reduced to small pads but, despite this, is the most widely distributed lymantriid genus on earth. *Orgyia antiqua* (Linnaeus) (Rusty Tussock Moth) is a widespread Holarctic moth common over much of North America where it feeds on at least 50 tree species. In BC it mainly attacks Engelmann and White spruce, Lodgepole Pine, Black Cottonwood and various willows. *Orgyia pseudotsugata* (McDunnough), the Douglas-fir Tussock Moth, is a cordilleran species ranging from BC to California and New Mexico. In BC it is largely a problem in the dry southern Interior where periodically it severely damages conifer forests, especially those of Douglas-fir.

Leucoma salicis (Linnaeus) (Satin Moth), a native of Eurasia, appeared in both New England and BC in 1920. Subsequently, these two populations have expanded considerably; in BC the species ranges throughout the southern half of the province. The adult is satiny white with black marks on the legs. In BC major hosts include poplars of all sorts, especially Trembling Aspen and Black Cottonwood. The notorious Gypsy Moth, *Lymantria dispar* (Linnaeus) was introduced from Europe to the US east coast in the late 1860s; since the 1980s it has been repeatedly accidentally introduced to BC. However, eradication programs have, so far, prevented its establishment. The European Gypsy Moth feeds on dozens of different kinds of trees, although it has a special fondness for oaks. It has most often been introduced to the province as dormant egg masses on vehicles and trailers from eastern Canada and the United States. This has allowed the species spread westward despite the fact the fat white females cannot fly. The species is highly variable, however, and female moths from eastern Asia do fly and like eating conifers as well as deciduous trees. These Asiatic Gypsy Moths have been intercepted on ships and containers at BC seaports.

Subfamily Nolidae (Nolid Moths)

Noline moths are difficult to define simply. Many North American species have tufts of raised scales on the upper surface of the forewings and the ocelli are usually absent. Basal abdominal tymbal organs are frequent in the family. In the family as a whole, most of the defining characters of the larva and adult are too technical for inclusion here, but the most striking and characteristic feature is the boat-shaped cocoon bearing a vertical slit at the front for the exit of the emerging adult. The double walls of the cocoon are also unusual.

In Africa, Asia and Australia the spiny bollworms of the genus *Earias* are major pests of cotton. The communal larvae of *Nola sorghiella* Riley, the Sorghum Webworm, sometimes damage sorghum crops in the US.

The subfamily Nolinae in the present classification it contains about 1400 species in 308 genera worldwide. It is primarily a group of the Old World tropics. Five BC species are placed in three genera. *Meganola miniscula* (Zeller) ranges across the continent; the caterpillars eat lichens on Garry oak on the south coast. *Nola minna* Butler is restricted to southern BC in Canada.

Larvae feed on *Ceanothus* species; the caterpillars are grey, green-brown and pink-white with tufts of pale hairs arising from rounded tubercles. Adults are pale grey marked with dark brown on the forewing; the most characteristic mark is an elongate one at the front edge of the wingbase. The wingspan is about 20 mm. The three BC species of *Nycteola* feed on willows and poplars. The adults have the forewings strongly mottled in black, grey, white and often pale green; the hind wings are pale, darkening at the margins. *Nycteola cinereana* Neumoegen & Dyar and *N. frigidana* (Walker) are transcontinental species; *N. columbiana* (H. Edwards) is recorded only in BC in Canada.

ORDER STREPSIPTERA (Twisted-wing Parasites) (Fig. 101 & 102)

Description

Strepsiptera: from the Greek *strepsis*, = twisting, and *ptera* = wings.

Strepsiptera is a small order (about 450 described species) of rarely encountered parasitic insects which undergo hypermetamorphosis. In one family both males and females leave the host to pupate and are free-living as adults. In all other families, including the family found in British Columbia, both sexes pupate within the host but only the males leave the host. The free-flying males are very short-lived, in BC species living only 6-8 hours. The females are neotenic and remain in the host with only the anterior part of the cephalothorax extruded between the abdominal segments of the host. The body of the female nearly completely fills the abdomen of the host causing suppression of the sexual development of the host but also leading to a longer life for the host. The young are produced live and have eyes and legs and are active in searching for appropriate hosts. Once the larva enters the host, it moults into a legless worm-like parasite which feeds in the body cavity of the host and undergoes several moults before pupating within the final larval skin.

Although any given strepsipteran species will accept only one or a few host species, as an order they attack members of eight other orders of insects: Thysanura, Blattodea, Mantodea, Orthoptera, Homoptera, Hemiptera, Diptera and Hymenoptera. The members of one family of Strepsiptera, males and females parasitize members of different orders, males in ants and females in Orthoptera and Mantodea.

Adult males have six legs and three body segments as is usual in insects. They have protruding eyes and antennae with often well developed lateral processes. The fore wings are small haltere-like structures while the hind wings are large very characteristic batwing-like structures with only longitudinal veins. Females usually lack eyes, antennae and legs and have very indistinct body segments.

There are eight extant families globally with five found in North America, three known from Canada but only one reported from British Columbia.

Description of Families of STREPSIPTERA

Family Stylopidae (Fig. 101)

This is the largest and most widespread family in Strepsiptera with its member species being parasites of wasps and several families of solitary bees. Adult males are characterized by four-segmented tarsi with no claws, antenna with 4- or 6 segments and mandibles knife-shaped and crossed distally. The final instar females have a flattened but not shortened cephalothorax with 2-5 genital pores and brood canals with slit-shaped openings.

Two genera of Stylopidae are known from British Columbia: *Stylops* Kirby and *Xenos* Rossius. The genus *Stylops*, are parasites of *Andrena* sp., and characterized by adult males with 6-segmented antennae (namely, *Stylops advarians* Pierce (host presumably *Andrena advarians*

Vier.), *S. leechi* Bohart (host: *A. advarians* Vier., and *S. shannoni* Pierce (host: *A. hippotes* Robertson). The single species of *Xenos*, namely, *Xenos peckii* Kirby (host: *Polistes fuscatus* (Fabricius)), is a parasite of *Polistes* sp., and is characterized by adult males with 4-segmented antennae.

Table 1. Figure details.**Figure details: Lepidoptera and associated Orders**

Fig. No.	Order	Illustration	Photo	Image Credits	Family	Species
1	Megaloptera		X	Darren Copely	Corydalidae	<i>Dysmichohermes disjunctus</i> (Walker)
2	Megaloptera		X	Steve Marshall	Sialidae	<i>Sialis</i> sp., adult
3	Raphidioptera	X		G. Scudder	Inocelliidae	<i>Nega inflata</i> (Hagen), head and pronotum
4	Raphidioptera		X	R.A. Cannings & M.B. Cooke	Raphidiidae	<i>Agulla</i> sp.
5	Neuroptera		X	Steve Marshall	Berothidae	<i>Lomanyia</i> sp. [Higher resolution image to follow]
6	Neuroptera		X	M.B. Cooke & R.A. Cannings	Chrysopidae	<i>Chrysopa nigricornis</i> Burmeister
7	Neuroptera		X	Steve Marshall	Chrysopidae	<i>Chrysoptera carnea</i> complex
8	Neuroptera		X	Darren Copely	Chrysopidae	<i>Nothochrysa californica</i> Banks
9	Neuroptera	X		L. Lucas (redrawn after Publication 2)	Coniopterygidae	<i>Conwentzia hageni</i> (Banks), adult
10	Neuroptera		X	Steve Marshall	Hemerobiid	<i>Hemerobius humulinus</i> L.
11	Neuroptera	X		J. Klimaszewski	Hemerobiid	<i>Hemerobius humulinus</i> L.
12	Neuroptera		X	Steve Marshall	Mantispidae	<i>Climaciella brunnea</i> (Say)
13	Neuroptera		X	Jeff Hollenbeck	Mantispidae	<i>Leptomantispa pulchella</i> (Banks)
14	Neuroptera		X	Steve Marshall	Myrmeleontidae	<i>Brachynemurus abdominalis</i> (Say)
15	Neuroptera	X		L. Lucas (redrawn after Publication 3)	Polystoechotidae	<i>Polystoechotes punctatus</i> (Fabricius)
16	Neuroptera		X	Steve Marshall	Sisyridae	<i>Sisyra</i> sp. [Higher resolution image to follow]
17	Mecoptera		X	Baldo Villegas	Boreidae	<i>Boreus californicus</i> Packard, female
18	Mecoptera	X		L. Lucas (redrawn from G. Scudder unpubl. illus.)	Boreidae	<i>Boreus californicus</i> Packard, female
19	Siphonaptera	X		L. Lucas (redrawn after Publication 1)	Ceratophyllidae	<i>Dasypsyllus perpinnatus</i> (Baker), head and thorax, male
20	Siphonaptera	X		L. Lucas (redrawn after Publication 1)	Ctenophthalmidae	<i>Catallagia charlottensis</i> (Baker), head and thorax, male
21	Siphonaptera		X	T.D. Galloway	Ctenophthalmidae	<i>Corypsylla ornatus</i> Fox
22	Siphonaptera		X	T.D. Galloway	Ctenophthalmidae	<i>Epitedia wenmanni</i> (Rothschild)
23	Siphonaptera	X		L. Lucas (redrawn after Publication 1)	Hystrichopsyllidae	<i>Hystrichopsylla occidentalis</i> Holland, head and thorax, male
24	Siphonaptera	X		L. Lucas (redrawn after Publication 1)	Hystrichopsyllidae	<i>Atyphloceras maltidenatus</i> Fox, head and thorax, male
25	Siphonaptera	X		L. Lucas (redrawn after Publication 1)	Ischnopsyllidae	<i>Nycteridopsylla vancouverensis</i> Wagner, head and thorax, male

26	Siphonaptera	X	L. Lucas (redrawn after Publication 1)	Leptopsyllidae	<i>Amphipsylla pollionis</i> (Rothschild), head and thorax, male
27	Siphonaptera	X	L. Lucas (redrawn after Publication 1)	Pulicidae	<i>Ctenocephalides felix</i> (Bouché), head and thorax, male
28	Siphonaptera	X	L. Lucas (redrawn after Publication 1)	Pulicidae	<i>Pulex irritans</i> Linnaeus, head and thorax, male
29	Siphonaptera		X UBC Zoology teaching material	Pulicidae	<i>Pulex irritans</i> Linnaeus
30	Siphonaptera	X	L. Lucas (redrawn after Publication 1)	Vermipsyllidae	<i>Chaetopsylla tuberculaticeps</i> (Bezzi), head and thorax, male
31	Lepidoptera		X Veronica Bura	Micropterididae	<i>Epimatyria auricrinella</i> Walsingham [Eastern sp.]
32	Lepidoptera		X Veronica Bura	Hepialidae	<i>Gazoryctra roseicaput</i> (Neumoegen & Dyar)
33	Lepidoptera		X Veronica Bura	Nepticulidae	<i>Stigmella</i> sp.
34	Lepidoptera		X Veronica Bura	Heliozelidae	<i>Coptodisca arbutiella</i> Busck
35	Lepidoptera		X Veronica Bura	Adelidae	<i>Adela septentrionella</i> Walsingham
36	Lepidoptera		X Veronica Bura	Prodoxidae	<i>Lampronia oregonella</i> (Walsingham)
37	Lepidoptera		X Veronica Bura	Tischeriidae	<i>Tischeria solidaginifoliella</i> Clemens
38	Lepidoptera		X Veronica Bura	Tineidae	<i>Morophagoides burkerella</i> (Busck)
39	Lepidoptera		X Stephen Marshall	Psychidae	<i>Dahlica triquetrella</i> (Hübner)
40	Lepidoptera		X Veronica Bura	Bucculatricidae	<i>Bucculatrix aineiella</i> Murtfeldt
41	Lepidoptera		X Veronica Bura	Gracillariidae	<i>Cameraria gaultheriella</i> (Walsingham)
42	Lepidoptera		X Veronica Bura	Yponomeutidae	<i>Eucalantica polita</i> (Walsingham)
43	Lepidoptera		X Veronica Bura	Ypsolophidae	<i>Ypsolopha canariella</i> (Walsingham)
44	Lepidoptera		X Veronica Bura	Plutellidae	<i>Plutella armoraciae</i> Busch
45	Lepidoptera		X Veronica Bura	Glyphipterididae	<i>Glyphipterix bifasciata</i> (Walsingham)
46	Lepidoptera		X Veronica Bura	Bedelliidae	<i>Bedellia somnulentella</i> (Zeller)
47	Lepidoptera		X Veronica Bura	Lyonetiidae	<i>Lyonetia prunifoliella</i> (Hübner)
48	Lepidoptera		X Veronica Bura	Lyonetiidae	<i>Paraleucoptera albella</i> (Chambers)
49	Lepidoptera		X Veronica Bura	Elachistidae	<i>Perittia eremonoma</i> (Braun)
50	Lepidoptera		X Veronica Bura	Scythrididae	<i>Scythris noricella</i> (Zeller)
51	Lepidoptera		X Veronica Bura	Chimabachidae	<i>Dastroma salicella</i> (Hübner) [Eastern sp.]
52	Lepidoptera		X Veronica Bura	Oecophoridae	<i>Brymblia quadrimaculella</i> (Chambers)
53	Lepidoptera		X Veronica Bura	Batrachedridae	<i>Batrachedra praeangusta</i> (Haworth)
54	Lepidoptera		X Veronica Bura	Coleophoridae	<i>Coleophora pruniella</i> Clemens
55	Lepidoptera		X Veronica Bura	Cosmopterigidae	<i>Sorhagenia nimbosea</i> (Braun)
56	Lepidoptera		X Veronica Bura	Gelechiidae	<i>Caryocolum pullatella</i> (Tengström)
57	Lepidoptera		X Veronica Bura	Limacodidae	<i>Tortricidia testacea</i> Packard
58	Lepidoptera		X Veronica Bura	Sesiidae	<i>Synanthedon myopaeformis</i> (Borkhausen)
59	Lepidoptera		X Veronica Bura	Cossidae	<i>Acosus populi</i> (Walker)
60	Lepidoptera		X Veronica Bura	Tortricidae	<i>Pelochrista santillana</i> (Clemens)

61	Lepidoptera	X	Veronica Bura	Choreutidae	<i>Prochoreutis pernivalis</i> (Braun)
62	Lepidoptera	X	Veronica Bura	Urodidae	<i>Wockia asperipunctella</i> (Bruand)
63	Lepidoptera	X	Veronica Bura	Schreckensteiniidae	<i>Schreckensteinia festaliella</i> (Hübner)
64	Lepidoptera	X	Veronica Bura	Alucitidae	<i>Alucita montana</i> Linnaeus
65	Lepidoptera	X	Veronica Bura	Pterophoridae	<i>Platyptilia carduidactylus</i> (Riley)
66	Lepidoptera	X	Veronica Bura	Copromorphidae	<i>Lotisma trigonana</i> (Walsingham)
67	Lepidoptera	X	Veronica Bura	Carposinidae	<i>Bondia crescentella</i> (Walsingham)
68	Lepidoptera	X	Veronica Bura	Thyrididae	<i>Thyris maculata</i> Harris
69	Lepidoptera	X	Veronica Bura	Pyralidae	<i>Pyla serrata</i> Neunzig
70	Lepidoptera	X	Veronica Bura	Crambidae	<i>Neodactria murellus</i> (Dyar)
71	Lepidoptera	X	Veronica Bura	Crambidae	<i>Sitochroa chortalis</i> (Grote)
72	Lepidoptera	X	Veronica Bura	Hesperiidae	<i>Hesperia colorado</i> (Scudder)
73	Lepidoptera	X	Veronica Bura	Papilionidae	<i>Papilio machaon</i> Linnaeus
74	Lepidoptera	X	Veronica Bura	Papilionidae	<i>Parnassius smintheus</i> Doubleday
75	Lepidoptera	X	Veronica Bura	Pieridae	<i>Colias occidentalis</i> Scudder
76	Lepidoptera	X	Veronica Bura	Pieridae	<i>Neophasia menapia</i> (Felder & Felder)
77	Lepidoptera	X	Veronica Bura	Lycaenidae	<i>Plebejus saepiolus</i> (Boisduval)
78	Lepidoptera	X	Veronica Bura	Riodinidae	<i>Apodemia mormo</i> (Felder & Felder)
79	Lepidoptera	X	Veronica Bura	Nymphalidae	<i>Erebia vidleri</i> Elwes
80	Lepidoptera	X	Veronica Bura	Nymphalidae	<i>Roddia vaualbum</i> (Denis & Schiffermüller)
81	Lepidoptera	X	Rob Cannings	Nymphalidae	<i>Danaus plexippus</i> L., adult
82	Lepidoptera	X	Rob Cannings	Nymphalidae	<i>Danaus plexippus</i> L., larva
83	Lepidoptera	X	Rob Cannings	Nymphalidae	<i>Danaus plexippus</i> L., pupa
84	Lepidoptera	X	Veronica Bura	Drepanidae	<i>Drepana arcuata</i> Walker
85	Lepidoptera	X	Veronica Bura	Uraniidae	<i>Callizzia amorata</i> Packard
86	Lepidoptera	X	Veronica Bura	Geometridae	<i>Iridopsis larvaria</i> (Guenée)
87	Lepidoptera	X	Veronica Bura	Lasiocampidae	<i>Malacosoma disstria</i> Hübner
88	Lepidoptera	X	Veronica Bura	Saturniidae	<i>Hemileuca eglanterina</i> (Boisduval)
89	Lepidoptera	X	Veronica Bura	Saturniidae	<i>Hyalophora euryalus</i> (Boisduval)
90	Lepidoptera	X	Rob Cannings	Saturniidae	<i>Hemileuca hera</i> Harris, larva
91	Lepidoptera	X	Veronica Bura	Sphingidae	<i>Hemaris thysbe</i> (Fabricius)
92	Lepidoptera	X	Veronica Bura	Sphingidae	<i>Sphinx vashti</i> Strecker
93	Lepidoptera	X	Veronica Bura	Notodontidae	<i>Pheosia portlandia</i> Hy. Edwards
94	Lepidoptera	X	Rob Cannings	Notodontidae	<i>Nadata gibbosa</i> (J.E. Smith)
95	Lepidoptera	X	Veronica Bura	Noctuidae: Arctiinae	<i>Orthosia hibisci</i> (Guenée)
96	Lepidoptera	X	Rob Cannings	Noctuidae: Arctiinae	<i>Cynia tenera</i> Hübner
97	Lepidoptera	X	Veronica Bura	Noctuidae: Arctiinae	<i>Platarctia parthenos</i> (Harris)
98	Lepidoptera	X	Veronica Bura	Noctuidae: Arctiinae	<i>Drasteria divergens</i> (Behr)
99	Lepidoptera	X	Veronica Bura	Noctuidae: Lymantriinae	<i>Orgyia pseudotsugata</i> (McDunnough)
100	Lepidoptera	X	Veronica Bura	Noctuidae: Nolinae	<i>Nycteola columbiana</i> (Hy. Edwards)

101	Strepsiptera	X	R.E. Ross	Stylopidae	<i>Stylop pacifica</i> Bohart [not a BC sp.]
102	Strepsiptera	X	Stephen Marshall	Stylopidae	<i>Xenos peckii</i> Kirby (<i>Polistes</i> wasp parasitized by <i>X. peckii</i>) [Higher resolution image to follow]

Publications referenced

- 1 Holland, G.P. 1985. The fleas of Canada, Alaska and Greenland (Siphonaptera). Memoirs of the Entomological Society of Canada No. 130, Ottawa.
- 2 Essig, E.O. 1929. Insects of Western North America. The MacMillan Company, N.Y.
- 3 Essig, E.O. 1942. College Entomology. The MacMillan Company, N.Y.

Appendix 1. Checklist of MEGALOPTERA in B.C.

Order MEGALOPTERA

Family CORYDALIDAE

Genus *Chauliodes* Latreille

- * *C. pectinicornis* Linnaeus

Genus *Dysmicohermes* Munroe

D. disjunctus (Walker)

Genus *Protochauliodes* Weele

- * *P. spenceri* Munroe

Family SIALIDAE

Genus *Sialis* Latreille

S. californica Banks

- * *S. hamata* Ross

S. joppe Ross

S. rotunda Banks

- * *S. velata* Ross

Appendix 2. Checklist of RAPHIDOPTERA in B.C.

Order RAPHIDOPTERA

Family INOCELLIDAE

Genus *Negha* Navas

N. inflata (Hagen)

Family RAPHIDIIDAE

Genus *Agulla* Navas

A. adnixa (Hagen)

A. arizonica (Banks)

A. assimilis (Albarda)

A. bicolor (Albarda)

A. crotchi (Banks)

A. herbsti (Esben-Petersen)

A. unicolor Carpenter

Appendix 3. Checklist of NEUROPTERA in B.C.

Order NEUROPTERA

Family BEROETHIDAE

Genus *Lomamyia* Banks*L. occidentalis* (Banks)

Family CHRYSOPIDAE

Genus *Chrysopa* Leach*C. chi* Fitch*C. coloradensis* Banks*C. excepta* Banks*C. nigricornis* Burmeister*C. occulata* Say*C. pleuralis* Banks*C. quadripunctata* BurmeisterGenus *Chrysoperla* Steinmann*C. carnea* (Stephens)Genus *Eremochrysa* Banks*E. canadensis* (Banks)*E. fraterna* (Banks)* *E. punctinervis* (McLachlan)Genus *Mallada* Navas* *M. perfectus* (Banks)Genus *Meleoma* Fitch*M. dolicharthra* (Navas)*M. emuncta* (Fitch)* *M. schwarzi* (Banks)*M. signoretti* FitchGenus *Nineta* Navas* *N. gravida* (Banks)Genus *Nothochrysa* McLachlan* *N. californica* Banks

Family CONIOPTERYGIDAE

Genus *Coniopteryx* Curtis*C. canadensis* Meinander*C. tineiformis* Curtis

Genus *Conwentzia* Enderlein*C. californica* Meinander*C. pineticola* Enderlein*C. psociformis* (Curtis)Genus *Helicocoris* Enderlein*H. californica* Meinander* *H. similis* MeinanderGenus *Semidalis* Enderlein*Semidalis angusta* (Banks)A *Semidalis pseudouncinata* Meinander*Semidalis* sp.

Family HEMEROBIIDAE

Genus *Hemerobius* Linnaeus*H. bistrigatus* Currie*H. conjunctus* Fitch*H. costalis* Carpenter*H. discretus* Navás*H. dorsatus* Banks*H. humulinus* Linnaeus*H. kokaneeanus* Currie*H. nigrans* Carpenter*H. ovalis* Carpenter*H. pacificus* Banks*H. pinidumus* Fitch*H. simulans* Walker*H. stigma* StephensGenus *Megalomus* Rambur*M. angulatus* Carpenter* *M. fidelis* (Banks)Genus *Micromus* Rambur*M. angulatus* (Stephens)*M. borealis* Klimaszewski & Kevan*M. montanus* Hagen* *M. posticus* (Walker)* *M. subanticus* (Walker)*M. variegatus* (Fabricius)*M. variolus* HagenGenus *Symphorobius* Banks*S. angustus* (Banks)* *S. californicus* Banks

- * *S. killingtoni* Carpenter
- S. perparvus* (McLachlan)

Genus *Westmalius* Krüger

- W. brunnea* (Banks)
- W. coloradensis* (Banks)
- W. furcata* (Banks)
- W. involutus* (Carpenter)
- W. longifrons* (Walker)
- W. nervosus* (Fabricius)
- * *W. pretisoa* (Banks)

Family MANTISPIDAE

Genus *Climaciella* Ederlein

- * *C. brunnea* (Say)

Genus *Leptomantispa* Illiger

- * *L. pulchella* (Banks)

Family MYRMELEONTIDAE

Genus *Brachynemurus* Hagen

- B. abdominalis* (Say)
- B. brunneus* Currie
- B. ferox* (Walker)
- B. peregrinus* (Hagan)

Genus *Dendroleon* Brauer

- D. speciosum* Banks

Genus *Myrmeleon* Linnaeus

- M. exitialis* Walker

Family POLYSTOECHOTIDAE

Genus *Polystoechotes* Burmeister

- P. punctata* (Fabricius)

Family SISYRIDAE

Genus *Sisyra* Burmeister

- S. fuscatus* (Fabricius)
- S. vicarius* (Walker)

Appendix 4. Checklist of MECOPTERA in BC

Order MECOPTERA

Family BOREIDAE

Genus *Boreus* Latreille

B. californicus Packard

B. elegans Carpenter

B. insulanus Blades

B. nix Carpenter

B. pilosus Carpenter

B. reductus Carpenter

References

Blades, D.C.A. 2002. A new species of *Boreus* (Mecoptera: Boreidae) from Vancouver Island, British Columbia. J. Entomol. Soc. B.C. 99:133-139.

Penny, N.D. 1977. A systematic study of the Boreidae (Mecoptera). Univ. Kansas Sci. Bull. 51(5):141-217.

Appendix 5. Checklist of SIPHONAPTERA in BC

(NB: Arranged alphabetically)

Order SIPHONAPTERA

Family CERATOPHYLLIDAE

Genus *Aetheca* Smith*A. thambus* (Jordan)*A. wagneri* (Baker)Genus *Amalaraeus* Ioff*A. dissimilis* (Jordan)Genus *Amaradix* Smith*A. euphorbae* (Rothschild)Genus *Amphalius* Jordan*A. necopinus* (Jordan)Genus *Ceratophyllus* Curtis*C. adustus* Jordan*C. celsus* Jordan*C. ciliatus* Baker*C. diffinis* Jordan*C. garei* Rothschild*C. idius* Jordan & Rothschild*C. niger* Fox*C. petrochelidoni* Wagner*C. rauschi* Holland*C. riparius* Jordan & Rothschild*C. vision* BakerGenus *Dasypsyllus* Baker*D. perpinnatus* (Baker)*D. stejneri* (Jordan)Genus *Eumolpianus* Smit*E. eumolpi* (Rothschild)Genus *Foxella* Wagner*F. ignotus* (Baker)Genus *Malaraeus* Jordan*M. telchinum* (Rothschild)

Genus *Megabothris* Jordan*M. abantis* (Rothschild)*M. lucifer* (Rothschild)*M. megacolpus* (Jordan)*M. quirini* (Rothschild)Genus *Mioctenopsylla* Rothschild*M. traubi* Holland & JellisonGenus *Nosopsyllus* Jordan*N. fasciatus* (Bosc)Genus *Opisodasys* Jordan*O. keeni* (Baker)*O. pseudarctomys* (Baker)*O. vesperalis* (Jordan)Genus *Orchopeas* Jordan*O. agilis* (Rothschild)*O. caedens* (Jordan)*O. leucopus* (Baker)*O. nepos* (Rothschild)Genus *Orophyslla* Wagner & Ioff*O. arctomys* (Baker)*O. idahoensis* (Baker)*O. tuberculatus* (Baker)Genus *Spicata* Fox*S. comis* (Jordan)Genus *Tarsopsylla* Wagner*T. coloradensis* (Baker)Genus *Thrassis* Jordan*T. acamantis* (Rothschild)*T. petiolatus* (Baker)*T. spenceri* Wagner

Family CTENOPHTHALMIDAE

Genus *Callistopsyllus* Jordan & Rothschild*C. terinus* (Rothschild)Genus *Catallagia* Rothschild*C. chamberlini* Hubbard*C. charlottensis* (Baker)

C. dacenkoi Ioff
C. decipiens Rothschild
C. jellisoni Holland
C. mathesoni Jameson
C. sculleni Hubbard

Genus *Corrodopsylla* Wagner

C. curvata (Rothschild)

Genus *Corypsylla* Fox

C. jordani Hubbard
C. kohlsi Hubbard
C. ornatus Fox

Genus *Delotelis* Jordan

D. hollandi Smit
D. telegoni (Rothschild)

Genus *Epitedia* Jordan

E. scapani (Wagner)
E. stewarti Hubbard
E. wenmanni (Rothschild)

Genus *Megarhroglossus* Jordan & Rothschild

M. divisus (Baker)
M. procus Jordan & Rothschild
M. sicamus Jordan & Rothschild
M. spenceri Wagner

Genus *Meringis* Jordan

M. shannoni (Jordan)

Genus *Nearctopsylla* Rothschild

N. brooksi (Rothschild)
N. hyrtaci (Rothschild)
N. jordani Hubbard

Genus *Neopsylla* Wagner

N. inopina Rothschild

Genus *Phalacropsylla* Rothschild

P. allos Wagner

Genus *Rhadinopsylla* Jordan & Rothschild

R. arborea Smit
R. difficilis Smit

R. goodi (Hubbard)
R. linta Smit
R. media Smit
R. sectilis Jordan & Rothschild

Genus *Trichopsylloides* Ewing
T. oregonensis Ewing

Family HYSTRICHOPSYLLIDAE

Genus *Atyphlocera* Jordan & Rothschild
A. multidentatus (Fox)

Genus *Hystrichopsylla* Taschenberg
H. dippiei Rothschild
H. occidentalis Holland
H. schefferi Chapin
H. spinata Holland

Family ISCHNOPSYLLIDAE

Genus *Myodopsylla* Jordan & Rothschild
M. gentilis Jordan & Rothschild
M. insignis (Rothschild)
M. palposus (Rothschild)

Genus *Nycteridopsylla* Oudemans
N. vancouverensis Wagner

Family LEPTOPSYLLIDAE

Genus *Amphipsylla* Wagner
A. pollionis (Rothschild)

Genus *Ctenophyllus* Wagner
C. armatus Wagner

Genus *Dolichopsyllus* Baker
D. stylosus (Baker)

Genus *Leptopsylla* Jordan & Rothschild
L. segnis (Schönherr)

Genus *Peromyscopsylla* Fox
P. hamifer (Rothschild)
P. hesperomys pacifica Holland
P. ravalliensis (Dunn)
P. selenis (Rothschild)

Family PULICIDAE

Genus *Ctenocephalides* Stiles & Collins

C. canis (Curtis)

C. felis (Bouche)

Genus *Euhophsyllus* Ewing

E. lynx (Baker)

Genus *Pulex* Linnaeus

P. irritans Linnaeus

Genus *Xenopsylla* Glinkiewicz

X. cheopis Rothschild

Family VERMIPSYLLIDAE

Genus *Chaetopsylla* Kohaut

C. setosus Rothschild

C. tuberculaticeps (Bezzi)

Reference

Holland, G.P. 1985. The Fleas of Canada, Alaska and Greenland (Siphonaptera). Mem. Entomol. Soc. Can. 130:631 pp.

Note: Nomenclature updated by G.G.E. Scudder 14 March 2007, according to Lewis, R.E. 1996. Siphonaptera pp. 1123-1143 (in) Nomina Insecta Nearctica Volume 3: Diptera, Lepidoptera, Siphonaptera. Entomological Information Services, Rockville, MD.

Appendix 6. Checklist of LEPIDOPTERA in BC

Classification based on Handbuch der Zoologie with some changes based on revisions.

Order LEPIDOPTERA

Superfamily MICROPTERIGOIDEA

Family MICROPTERIGIDAE (1 genus, 1 species)

Epimatryria sp.n. near *pardella* (Wals.)

Superfamily HEPIALOIDEA

Family HEPIALIDAE (3 genera, 6 species)

Gazoryctra mathewi (Hy. Edwards)

G. roseicaput (Neumoegen & Dyar)

Phymatopus behrensii (Stretch)

P. californicus (Boisduval)

Sthenopis argenteomaculatus (Harris)

S. purpurascens (Packard)

Superfamily NEPTICULOIDEA

Family NEPTICULIDAE (1 genus, 6 species)

Stigmella alba Wilkinson & Scoble

S. corylifoliella (Clemens)

S. latifasciella (Chambers)

S. pomivorella (Packard)

S. populetorum (Frey & Boll)

S. stigmaciella Wilkinson & Scoble

Family HELIOZELIDAE (1 genus, 1 species)

Coptodisca arbutiella Busck

Family ADELIDAE (3 genera, 6 species)

Adela purpurea Walker

A. septentrionella Walsingham

A. trigrapha Zeller

Cauchas cockerelli (Busck)

C. simpliciella (Walsingham)

Elasmion bellela (Walker)

Family PRODOXIDAE (2 genera, 12 species)

Greya enchrysa Davis & Pellmyr

G. obscuromaculata (Braun)

G. piperella (Busck)

G. politella (Walsingham)

G. punctiferella (Walsingham)

G. subalba Braun

G. variata (Braun)

Lampronia aenescens (Walsingham)
L. capitella (Clerck)
L. corticella (Linnaeus)
L. oregonella (Walsingham)
L. sublustris Braun

Superfamily TISCHERIOIDEA

Family TISCHERIIDAE (1 genus, 1 species)

Tischeria splendida Braun

Superfamily TINEOIDEA

Family TINEIDAE (7 genera, 8 species)

Monopis crocicapitella (Clemens)
M. spilotella Tengström
Morophagoides burkerella (Busck)
Nemapogon granella (Linnaeus)
Scardia antomella Grote
Tinea pellionella (Linnaeus)
Tineola bisselliella Hummel
Trichophaga tapetzella (Linnaeus)

Family PSYCHIDAE (3 genus, 4 species)

Apterona helicoidella (Vallot)
Dahlica lichenella (L.)
D. triquetrella (Hübner)
Hyaloscotes pithopoera (Dyar)

Superfamily GRACILLARIOIDEA

Family BUCCULATRICIDAE (1 genus, 11 species)

Bucculatrix ainslella Murtfeldt
B. angustisquamella Braun
B. arnicella Braun
B. canadensisella Chambers
B. divisa Braun
B. eurotiella Walsingham
B. pomifoliella Clemens
B. saluatoria Braun
B. seorsa Braun
B. tridenticola Braun
B. zophopasta Braun

Family GRACILLARIIDAE (9 genera, 26 species)

Callisto denticulella (Thunberg)
Caloptilia alnicolella (Chambers)
C. alnivorella (Chambers)
C. invariabilis (Braun)

C. melanocarpae (Braun)
C. pulchella (Chambers)
C. rhoifoliella (Chambers)
C. sanguinella (Beutenmüller)
C. serotinella (Ely)
C. strictella (Walker)
C. syringella (Fabricius)
Cameraria gaultheriella (Walsingham)
Marmara arbutiella Busck
Micrurapteryx salicifoliella (Chambers)
Parectopa albicostella Braun
Parornix alta (Braun)
Phyllocnistis populiella Chambers
Phyllonorycter apparella (Herrich-Schäffer)
P. arbutusella (Braun)
P. blancardella (Fabricius)
P. elmaella Doganlar & Mutuura
P. incanella (Walsingham)
P. martiella (Braun)
P. mespilella (Hübner)
P. salicifoliella (Chambers)
P. scudderella (Frey & Boll)

Superfamily YPONOMEUTOIDEA

Family YPONOMEUTIDAE (7 genera, 20 species)

Argyresthia columbia T.N. Freeman
A. conjugella Zeller
A. cupressella Walsingham
A. freyella Walsingham
A. goedartella (Linnaeus)
A. laricella Kearfott
A. monochromella Busck
A. oreasella Clemens
A. pseudotsuga T.N. Freeman
A. pygmaeella (Hübner)
A. tsuga T.N. Freeman
Eucalantica polita (Walsingham)
Eucratia castella Walsingham
E. securella Walsingham
Ocnerostoma piniariella Zeller
Swammerdamia caesiella (Hübner)
Yponomeuta malinellus Zeller
Y. padella (Linnaeus)
Zelleria haimbachi Busck
Z. hepariella Stainton

Family Ypsolophidae (1 genus, 10 species)

- Ypsolopha canariella* (Walsingham)
- Y. cervella* (Walsingham)
- Y. dentella* (Fabricius)
- Y. dentiferella* (Walsingham)
- Y. dorsimaculella* (Kearfott)
- Y. falciferella* (Walsingham)
- Y. rubrella* (Dyar)
- Y. senex* (Walsingham)
- Y. ustella* (Clerck)
- Y. walsinghmiella* (Busck)

Family PLUTELLIDAE (2 genera, 6 species)

- Plutella armoraciae* Busck
- P. porrectella* (Linnaeus)
- P. vanella* Walsingham
- P. xylostella* (Linnaeus)
- Rhigognostis interrupta* (Walsingham)
- R. poulella* (Busck)

Family GLYPHIPTERIGIDAE (2 genera, 3 species)

- Diploschizia impigritella* (Clemens)
- Glyphipterix bifasciata* (Walsingham)
- G. sistes* Heppner

Family BEDELLIIDAE (1 genus, 1 species)

- Bedellia somnulentella* (Zeller)

Family LYONETIIDAE (3 genera, 4 species)

- Leucoptera laburnella* (Stainton)
- Lyonetia prunifoliella* (Hüber)
- L. saliciella* Busck
- Paraleucoptera albella* (Chambers)

Superfamily GELECHIOIDEA

Family OECOPHORIDAE (10 genera, 10 species)

- Brymblia quadrimaculella* (Chambers)
- Carcina quercana* (Fabricius)
- Decantha boreasella* (Chambers)
- Denisia haydenella* (Chambers)
- Eido trimaculella* (Fitch)
- Endrosis sarcitrella* (Linnaeus)
- Hofmannophila pseudospretella* (Stainton)
- Oecophora bractella* (Linnaeus)
- Pleurota albastrigulella* (Kearfott)
- Polix coloradella* (Walsingham)

Family BATRACHEDRIDAE (1 genus, 1 species)

Batrachedra praeangusta (Haworth)

Family COLEOPHORIDAE (3 genera, 27 species)

Coleophora acutipennella Walsingham

C. bidentella McDunnough

C. cratipennella Clemens

C. cretaticostella Clemens

C. deauratella Lienig & Zeller

C. glaucicolella Wood

C. intermediella McDunnough

C. irroratella Walsingham

C. kearfottella Barnes & Busck

C. laricella (Hübner)

C. mayrella (Hübner)

C. multipulvella Chambers

C. pruniella Clemens

C. rosaefoliella Clemens

C. sacramenta Heinrich

C. serratella (Linnaeus)

C. spinella (Schrank)

C. trifolii (Curtis)

C. vancouverensis McDunnough

C. wyethiae Walsingham

Holcocera immaculella McDunnough

Mompha albapalpella (Chambers)

M. circumscriptella (Zeller)

M. conturbetella (Hübner)

M. eloisella (Clemens)

M. idaei (Zeller)

M. unifasciella (Chambers)

Family ELACHISTIDAE (10 genera, 42 species)

Agonopterix alstroemeriana (Clerck)

A. antennariella Clarke

A. argillacea (Walsingham)

A. canadensis (Busck)

A. clarkei Keifer

A. flavicomella (Engel)

A. fusciterminella Clarke

A. gelidella (Busck)

A. nervosa (Haworth)

A. rosaciliella (Busck)

Chrysoclista cambiella (Busck)

C. linneela (Clerck)

Depressaria angustati Clarke
D. artemisiae Nickerl
D. artemisiella McDunnough
D. daucella (Denis & Schiffermüller)
D. pastinacella (Duponchel)
Depressariodes canella (Busck)
D. ciniflonella (Lienig & Zeller)
D. fulva (Walsingham)
D. nivalis (Braun)
D. sordidella (J.F.G. Clarke)
D. umbraticostella (Walsingham)
Elachista amrodella Kaila
E. apina Kaila
E. aurocristata Braun
E. epimicta Braun
E. hololeuca Braun
E. lamina Braun
E. morwenella Kaila
E. subalbidella Schlöger
Ethmia albistrigella (Walsingham)
E. coquilletella Busck
E. marmorea (Walsingham)
E. monticola (Walsingham)
Nites betulella (Busck)
Perittia cygnodiella (Busck)
P. eremonoma (Braun)
Pyramidobela quinquecristata (Braun)
Semioscopis inornata Walsingham
S. mcdunnoughi Clarke
S. merricella Dyar

Family COSMopterigidae (3 genera, 3 species)

Cosmopterix fernaldella Walsingham
Sorhagenia nimbosa (Braun)
Walshia miscecolorella (Chambers)

Family Gelechiidae (25 genera, 81 species)

Anacampsis fragariella Busck
A. innocuella (Zeller)
A. niveopulvella (Chambers)
Anarsia lineatella Zeller
Aristotelia devexella Braun
A. fungivorella (Clemens)
A. nigrobasiella Clarke
Aroga paraplutella (Busck)
Battaristis concinusella (Chambers)

Caryocolum pullatella (Tengström)
Chionodes abella (Busck)
C. abitus Hodges
C. acerella Sattler
C. agriodes (Meyrick)
C. braunella (Keifer)
C. ceanothiella (Busck)
C. chlorocephala (Meyrick)
C. continuella (Zeller)
C. dolo Hodges
C. grandis Clarke
C. histon Hodges
C. lugubrella (Fabricius)
C. mediofuscella (Clemens)
C. metoecus Hodges
C. nigrobarbatus (Braun)
C. obscurusella (Chambers)
C. occidentella (Chambers)
C. occlusa (Braun)
C. permactus (Braun)
C. petalumensis Clarke
C. pinax Hodges
C. praecia Hodges
C. praeclarella (Herrich-Schäffer)
C. praetor Hodges
C. pseudofondella (Barnes & Busck)
C. psiloptera (Barnes & Busck)
C. restio Hodges
C. retiniella (Barnes & Busck)
C. sabiniana Powell
C. salicella Sattler
C. sattleri Hodges
C. terminimaculella (Kearfott)
C. trichostola (Meyrick)
C. viduella (Fabricius)
Chrysoesthia lingulacella (Clemens)
Coleotechnites atrupictella (Dietz)
C. canusella (T.N. Freeman)
C. granti (T.N. Freeman)
C. huntella (Keifer)
C. nigritus (Hodges)
C. occidentis (T.N. Freeman)
C. pinella (Busck)
C. quercivorella (Chambers)
C. starki (T.N. Freeman)
Dichomeris gnoma Hodges

D. levisella (Fyles)
D. marginella (Fabricius)
D. offula Hodges
Euscrobipalpa atriplicella (von Röslerstamm)
Exoteleia pinifoliella (Chambers)
Filatima albicostella Clarke
F. aulaea (Clarke)
F. dimissae (Keifer)
Gnorimoschema gallaesolidaginis (Riley)
Helcystogramma badia (Braun)
H. casca (Braun)
H. melanocarpa (Meyrick)
Lita princeps (Busck)
L. recens Hodges
L. sexpunctella (Fabricius)
Metzneria lappella (Linnaeus)
Monochroa fragariae (Busck)
M. placidella (Zeller)
Phthorimaea operculella (Zeller)
Recurvaria nanella (Denis & Schiffermüller)
Scrobipalpa macromaculata (Braun)
Scrobipalpula radiatella (Busck)
Scrobipalpus lutescella (Clarke)
Teleiodes proximella (Hübner)
Telphusa longifasciella (Clemens)
T. sedulitella (Busck)

Family SCYTHRIDIDAE (2 genera, 5 species)

Asymmetrura impositella (Zeller)
Scythris immaculatella Chambers
S. inspersella (Hübner)
S. noricella (Zeller)
S. trivinctella (Zeller)

Family CHIMABACHIDAE (1 genus, 1 species)

Cheimophila salicella (Hübner)

Superfamily COSSOIDEA

Family COSSIDAE (3 genera, 4 species)

Acossus centerensis (Lintner)
A. populi (Walker)
Givira cornelia (Neumoegen & Dyar)
Prionoxystus robiniae (Peck)

Superfamily TORTRICOIDEA

Family TORTRICIDAE (59 genera, 330 species)

Acleris aenigmata Powell
A. bowmanana (McDunnough)
A. braunana (McDunnough)
A. britannia Kearfott
A. caliginosana (Walker)
A. celiana (Robinson)
A. comariana (Zeller)
A. cornana (McDunnough)
A. emargana (Fabricius)
A. forbesana (McDunnough)
A. forskaleana (Linnaeus)
A. fragariana Kearfott
A. fuscana (Barnes & Busck)
A. gloveranus (Walsingham)
A. hastiana (Linnaeus)
A. holmiana (Linnaeus)
A. hudsoniana (Walker)
A. implexana (Walker)
A. lipsiana (Denis & Schiffermüller)
A. logiana (Clerck)
A. maccana (Treitschke)
A. maximana (Barnes & Busck)
A. nigrolinea (Robinson)
A. nivisellana (Walsingham)
A. okanagana (McDunnough)
A. paracinderella Powell
A. ptychogrammos (Zeller)
A. robinsoniana (W.T.M Forbes)
A. schalleriana (Linnaeus)
A. semiannula (Robinson)
A. senescens (Zeller)
A. variana (C.H. Fernald)
A. variegana (Denis & Schiffermüller)
Aethes deutschiana (Zetterstedt)
A. promptana (Robinson)
A. rutilana (Hübner)
A. smeathmanniana (Fabricius)
Amorbia cuneanum (Walsingham)
A. humerosana Clemens
Ancylis apicana (Walker)
A. columbiana (McDunnough)
A. comptana (Frölich)
A. diminutana (Haworth)
A. discigerana (Walker)
A. laciniana (Zeller)
A. mediofasciana (Clemens)

A. metamelana (Walker)
A. mira Heinrich
A. nubeculana (Clemens)
A. pacificana (Walsingham)
A. simuloides (McDunnough)
A. subaequana (Zeller)
A. tenebrica (Heinrich)
A. unguicella (Linnaeus)
Aphelia alleniana (C.H. Fernald)
A. koebelei Obraztsov
Apotomis apateticana (McDunnough)
A. capreana (Hübner)
A. infida (Heinrich)
A. removana (Kearfott)
A. spinulana (McDunnough)
A. tertiaria (McDunnough)
Apotomops wellingtoniana (Kearfott)
Archepandemis coniferana Mutuura
Archips alberta (McDunnough)
A. argyrospila (Walker)
A. cerasivorana (Fitch)
A. eleagnana (McDunnough)
A. fervidana (Clemens)
A. mortuana Kearfott
A. negundana (Dyar)
A. oporana (Linnaeus)
A. packardiana (C.H. Fernald)
A. podana (Scopoli)
A. purpurana (Clemens)
A. rosana (Linnaeus)
A. strianus (C.H. Fernald)
A. tsuganus (Powell)
Argyrotaenia citrana (C.H. Fernald)
A. dorsalana (Dyar)
A. franciscana (Walsingham)
A. gogana (Kearfott)
A. occultana T.N. Freeman
A. pinatubana (Kearfott)
A. provana (Kearfott)
A. tabulana Free
A. velutinana (Walker)
Bactra furfurana (Haworth)
B. verutana Zeller
Barbara colfaxiana (Kearfott)
B. mappana T.N. Freeman
Choristoneura biennis T.N. Freeman

C. conflictana (Walker)
C. lambertiana (Busck)
C. occidentalis T.N. Freeman
C. orae T.N. Freeman
C. pinus T.N. Freeman
C. rosaceana (Harris)
C. zapulata (Robinson)
Clepsis clemensiana (C.H. Fernald)
C. consimilana (Hübner)
C. fucana (Walsingham)
C. moeschleriana (Wocke)
C. peritana (Clemens)
C. persicana (Fitch)
C. spectrana (Treitschke)
Cnephasia longana (Haworth)
Croesia albicomana (Clemens)
C. curvalana (Kearfott)
Cydia americana (Walsingham)
C. bracteata (C.H. Fernald)
C. confusana (McDunnough)
C. latiferreana (Walsingham)
C. lautiuscula (Heinrich)
C. miscitata (Heinrich)
C. nigricana (Fabricius)
C. obnisa (Heinrich)
C. piperana Kearfott
C. pomonella (Linnaeus)
C. populana (Busck)
C. prosperana (Kearfott)
C. pseudotsugae (Evans)
C. rana (W.T.M Forbes)
C. rusticella (Clerck)
C. strobilella (Linnaeus)
Decodes fragariana (Busck)
D. macdunnoughi Powell
Dichrorampha radicolana Walsingham
D. sedatana (Busck)
D. simulana (Clemens)
D. vancouverana McDunnough
Ditula angustiorana (Haworth)
Eana argentana (Clerck)
E. georgiella (Hulst)
E. osseana (Scopoli)
Enarmonia formosana (Scopoli)
Endothenia hebesana (Walker)
E. nubilana (Clemens)

Epiblema brightonana (Kearfott)
E. periculosana Heinrich
E. resumptana (Walker)
Epinotia albangulana (Walsingham)
E. arctostaphylana (Kearfott)
E. biangulana (Walsingham)
E. castaneana (Walsingham)
E. crenana (Hübner)
E. criddleana (Kearfott)
E. cruciana (Linnaeus)
E. digitana Heinrich
E. emarginana (Walsingham)
E. hopkinsana (Kearfott)
E. indecorana (Zetterstedt)
E. johnsonana (Kearfott)
E. kasloana McDunnough
E. lindana (C.H. Fernald)
E. lomonana (Kearfott)
E. medioplagata (Walsingham)
E. meritana Heinrich
E. miscana (Kearfott)
E. nanana (Treitschke)
E. nigralbana (Walsingham)
E. nisella (Clerck)
E. plumbolineana Kearfott
E. pulsatillana (Dyar)
E. rectiplicana (Walsingham)
E. sagittana McDunnough
E. salicicolana Kuznetsov
E. silvertoniensis Heinrich
E. solandriana (Linnaeus)
E. solicitana (Walker)
E. subviridis Heinrich
E. terracoctana (Walsingham)
E. trigonella (Linnaeus)
E. trossulana (Walsingham)
E. tsugana T.N. Freeman
Episimus argutana (Clemens)
Eucosma agricolana (Walsingham)
E. biplagata (Walsingham)
E. bobana Kearfott
E. canariana Kearfott
E. caniceps (Walsingham)
E. conspiciendana Heinrich
E. crambitana (Walsingham)
E. derelecta Heinrich

E. dodana Kearfott
E. dorsisignatana (Clemens)
E. excusabilis Heinrich
E. hohana Kearfott
E. junciticiliana (Walsingham)
E. lathamii W.T.M Forbes
E. lolana Kearfott
E. louisiana McDunnough
E. mediotriata (Walsingham)
E. morrisoni (Walsingham)
E. optimana Dyar
E. ridingsana (Robinson)
E. serpentana (Walsingham)
E. smithiana (Walsingham)
E. sonomana Kearfott
E. subflavana (Walsingham)
E. watertonana McDunnough
Eulia ministrana (Linnaeus)
Grapholita caeruleana Walsingham
G. conversana Walsingham
G. edwardsiana (Kearfott)
G. imitativa Heinrich
G. lana (Kearfott)
G. libertina Heinrich
G. lunatana Walsingham
G. molesta (Busck)
G. packardi Zeller
Griselda radicans Heinrich
Gypsonoma adjuncta Heinrich
G. fasciolana (Clemens)
Hedya nubiferana (Haworth)
H. ochroleucana (Frölich)
Henricus brevipalpatus McDunnough
H. fuscodorsanus (Kearfott)
Hystriophora asphodelana (Kearfott)
H. paradisiae Heinrich
H. stygiana (Dyar)
Lozotaenia rindgei Obraztsov
Notocelia culminana (Walsingham)
N. cynosbatella (Linnaeus)
N. illotana (Walsingham)
N. purpurissatana (Heinrich)
Olethreutes albiciliana (C.H. Fernald)
O. appendiceum (Zeller)
O. astrologana (Zeller)
O. bipartitana (Clemens)

O. buckellana (McDunnough)
O. carolana (McDunnough)
O. coruscana (Clemens)
O. costimaculana (C.H. Fernald)
O. deprecatoria Heinrich
O. galaxana Kearfott
O. glaciana (Möschler)
O. metallicana (Hübner)
O. minaki (McDunnough)
O. olivaceana (C.H. Fernald)
O. polluxana (McDunnough)
O. punctanum (Walsingham)
O. quadrifidus (Zeller)
O. schulziana (Fabricius)
O. trinitana (McDunnough)
O. turfosana (Herrich-Schäffer)
Orthotaenia undulana (Denis & Schiffermüller)
Pandemis canadana Kearfott
P. cerasana (Hübner)
P. heparana (Denis & Schiffermüller)
P. lamprosana (Robinson)
P. limitata (Robinson)
P. pyrusana Kearfott
Paralobesia piceana (Freeman)
Pelochrista argenteana (Walsingham)
P. occipitana (Zeller)
P. rorana (Kearfott)
P. santillana (Clemens)
Petrova albicapitana (Busck)
P. metallica (Busck)
Phaneta alatana (McDunnough)
P. altana (McDunnough)
P. columbiana (Walsingham)
P. complicana (McDunnough)
P. corculana (Zeller)
P. crassana (McDunnough)
P. dorsiatomana (Kearfott)
P. elongana (Walsingham)
P. fasciculatana (McDunnough)
P. fertoriana (Heinrich)
P. implicata (Heinrich)
P. indagatricana (Heinrich)
P. indeterminana (McDunnough)
P. influana (Heinrich)
P. lapidana (Walsingham)
P. modernana (McDunnough)

P. montanana (Walsingham)
P. nepotinana (Heinrich)
P. octopunctana (Walsingham)
P. oregonensis (Heinrich)
P. pallidarcis (Heinrich)
P. parmatana (Clemens)
P. perangustana (Walsingham)
P. refusana (Walker)
P. salmicolorana (Heinrich)
P. setonana (McDunnough)
P. striatana (Clemens)
P. tarandana (Möschler)
P. transversa (Walsingham)
P. umbrastriana (Kearfott)
P. verna Miller
P. vernalana (McDunnough)
P. youngi (McDunnough)
Phtheochroa aureoalbida (Walsingham)
P. cartwrightana (Kearfott)
P. fulviplicana (Walsingham)
P. riscana (Kearfott)
P. villana (Busck)
P. vulneratana (Zetterstedt)
P. waracana (Kearfott)
Platphalonidia felix (Walsingham)
P. lavana (Busck)
Platynota idaeusalis (Walker)
P. stultana Walsingham
Proteoteras arizonae Kearfott
Pseudexentera oregonana (Walsingham)
Pseudosciaphila duplex (Walsingham)
Retinia picicolana (Dyar)
Rhopobota naevana (Hübner)
Rhyacionia buoliana (Denis & Schiffermüller)
R. busckana Heinrich
R. pasadenana (Kearfott)
R. subcervinana (Walsingham)
Sparganothis senecionana (Walsingham)
S. striata (Walsingham)
S. tunicana (Walsingham)
S. vocaridorsana Kearfott
S. xanthoides (Walker)
Spilonota ocellana (Denis & Schiffermüller)
Syndemis afflictana (Walker)
Taniva albolineana (Kearfott)
Thaumatographa youngiella (Busck)

Xenotemna pallorana (Robinson)
Zeiraphera canadensis Mutuura & T.N. Freeman
Z. fortunana (Kearfott)
Z. hesperiana Mutuura & T.N. Freeman
Z. improbana (Walker)
Z. pacifica T.N. Freeman
Z. unfortunana Powell
Z. vancouverana McDunnough

Superfamily SESIOIDEA

Family SESIIDAE (5 genera, 15 species)

Albuna pyramidalis (Walker)
Paranthrene robiniae (Hy. Edwards)
Pennisetia marginatum (Harris)
Sesia tibiale (Harris)
Synanthedon albicornis (Hy. Edwards)
S. bibionipennis (Boisduval)
S. canadensis Duckworth & Eichlin
S. culiciformis (Linnaeus)
S. exitiosa (Say)
S. mellinipennis (Boisduval)
S. myopaeformis (Borkhausen)
S. novaroensis (Hy. Edwards)
S. polygona (Hy. Edwards)
S. sequoiae (Hy. Edwards)
S. tipuliformis (Clerck)

Superfamily CHOREUTOIDEA

Family CHOREUTIDAE (5 genera, 8 species)

Anthophila alpinella (Busck)
Caloreas multimarginata (Braun)
Choreutis diana (Hübner)
C. pariana (Clerck)
Prochoreutis pernivalis (Braun)
Tebenna balsamorrhizella (Busck)
T. onustana (Walker)
T. piperella (Busck)

Superfamily URODOIDEA

Family Urodidae (1 genus, 1 species)

Wockia asperipunctella (Bruand)

Superfamily SCHRECKENSTEINIOIDEA

Family Schreckensteiniidae (1 genus, 1 species)

Schreckensteinia festaliella (Hübner)

Superfamily ZYGAENOIDEA

Family LIMACODIDAE (1 genus, 1 species)

Tortricidia testacea Packard

Superfamily COPROMORPHOIDEA

Family COPROMORPHIDAE (2 genera, 2 species)

Ellabella editha Busck*Lotisma trigonana* (Walsingham)

Family CARPOSINIDAE (1 genus, 1 species)

Bondia crescentella (Walsingham)

Superfamily ALUCITOIDEA

Family ALUCITIDAE (1 genus, 1 species)

Alucita montana Linnaeus

Superfamily PTEROPHOROIDEA

Family PTEROPHORIDAE (14 genera, 43 species)

Adaina cinerascens (Walsingham)*A. montanus* (Walsingham)*Amblyptilia pica* (Walsingham)*Capperia evansi* (McDunnough)*Dejongia lobidactylus* (Fitch)*Emmelina monodactyla* (Linnaeus)*Geina tenuidactylus* (Fitch)*Gillmeria albertae* (Barnes & Lindsey)*G. pallidactyla* (Haworth)*Hellinsia corvus* (Barnes & Lindsey)*H. costatus* (Barnes & Lindsey)*H. gratiosus* (Fish)*H. helianthi* (Walsingham)*H. homodactylus* (Walker)*H. inconditus* (Walsingham)*H. kellicottii* (Fish)*H. lacteodactylus* (Chambers)*H. pectodactylus* (Staudinger)*Oidaematophorus balsamorrhizae* McDunnough*O. brucei* (C.H. Fernald)*O. castor* Barnes & Lindsey*O. cineraceus* Fish*O. eupatorii* (C.H. Fernald)*O. grisescens* Walsingham*O. mathewianus* (Zeller)*O. occidentalis* Walsingham*O. phaceliae* McDunnough*Oxyptilus delawaricus* Zeller

Paraplatyptilia albiciliatus (Walsingham)
P. albidorsellus (Walsingham)
P. albidus (Walsingham)
P. edwardsii (Fish)
P. fragilis (Walsingham)
P. nana (McDunnough)
P. shastae (Walsingham)
Platyptilia ardua McDunnough
P. carduidactylus (Riley)
P. percnodactyla (Walsingham)
P. tesseradactyla (Linnaeus)
Stenoptilia coloradensis C.H. Fernald
S. columbia McDunnough
S. exclamationis (Walsingham)
Trichoptilus pygmaeus Walsingham

Superfamily THYRIDOIDEA

Family THYRIDIDAE (1 genus, 1 species)

Thyris maculata Harris

Superfamily PYRALOIDEA

Family PYRALIDAE (50 genera, 88 species)

Acallis gripalis (Hulst)
Achroia grisella (Fabricius)
Acrobasis betulella Hulst
A. tricolorella Grote
Aglossa cacamica (Dyar)
A. caprealis (Hübner)
Ambesa laetella Grote
A. walsinghami (Ragonot)
Apomyelois bistriatella (Hulst)
Arta statalis Grote
Bandera binotella (Zeller)
B. virginella Dyar
Cacotherapia leucocope (Dyar)
Cadra cautella (Walker)
Coenochroa californiella Ragonot
Cuniberta subtinctella (Ragonot)
Dasypyga alternosquamella Ragonot
Dioryctria abietivorella (Grote)
D. auranticella (Grote)
D. cambiicola (Dyar)
D. contortella Mutuura, Munroe & Ross
D. monticolella Mutuura, Munroe & Ross
D. okanaganella Mutuura, Munroe & Ross
D. pentictonella Mutuura, Munroe & Ross

D. pseudotsugella Munroe
D. reniculelloides Mutuura & Munroe
D. rossi Munroe
D. tumicolella Mutuura, Munroe & Ross
Ephestia elutella (Hübner)
E. kuehniella (Zeller)
Ephestiodes erythrella Ragonot
E. gilvescentella Ragonot
Etiella zinckenella (Treitschke)
Eulogia ochrifrontella (Zeller)
Eurythmia spaldingella Dyar
Euzophera semifuneralis (Walker)
E. vinnulella Neunzig
Herculia thymetusalis (Walker)
Homoeosoma albescentella Ragonot
H. electella (Hulst)
Honora mellinella Grote
H. subsciurella Ragonot
Hulstia undulatella (Clemens)
Interjectio columbiella (McDunnough)
I. denticulella (Ragonot)
Melitara dentata (Grote)
Meroptera abditiva Heinrich
M. pravella (Grote)
Myelopsis alatella (Hulst)
M. minutularia (Hulst)
M. subtetricella (Ragonot)
Nephopterix basilaris Zeller
N. fernaldi (Ragonot)
N. termitalis (Hulst)
Ocala dryadella Hulst
Oreana unicolorella (Hulst)
Ortholepis pasadamia (Dyar)
Phobus funerellus (Dyar)
P. incertus Heinrich
Phycitodes mucidellus (Ragonot)
Pima albiplagiata (Packard)
P. albocostialis (Hulst)
P. fosterella Hulst
P. vividella (McDunnough)
Plodia interpunctella (Hübner)
Pococera aplastella (Hulst)
Promylea lunigerella Ragonot
Pseudasopia cohortalis (Grote)
Pyla aeneella Hulst
P. criddlella Dyar

P. fasciolalis (Hulst)
P. fusca (Haworth)
P. hypochalciella (Ragonot)
P. scintillans (Grote)
P. serrata Neunzig
Pyralis farinalis Linnaeus
Ragonotia dotalis (Hulst)
Sarata edwardsialis (Hulst)
S. nigrifasciella Ragonot
S. pullatella (Ragonot)
Staudingeria albipenella (Hulst)
Telethusia ovalis (Packard)
Toripalpus trabalis (Grote)
Trachycera suavella (Zincken)
Tulsa umbripennis (Hulst)
Vitula serratilineella Ragonot
V. setonella (McDunnough)
Zophodia grossulariella (Hübner)

Family Crambidae (44 genera, 103 species)

Agriphila attenuatus (Grote)
A. plumbifimbriellus (Dyar)
A. ruricolellus (Zeller)
A. straminella (Denis & Schiffermüller)
A. vulgivagellus (Clemens)
Anania funebris (Ström)
Anatralata versicolor (Warren)
Catoptria latiradiellus (Walker)
C. maculalis (Zetterstedt)
C. oregonicus (Grote)
C. trichostomus (Christoph)
Chalcoela iphitalis (Walker)
Choristostigma disputalis (Barnes & McDunnough)
C. plumbosignalis (C.H. Fernald)
Chrysoteuchia topiarius (Zeller)
Cosipara tricoloralis (Dyar)
Crambus ainliellus Klots
C. alienellus (Zincken)
C. bidens Zeller
C. cockleellus Kearfott
C. cypridalis Hulst
C. hamella (Thunberg)
C. leachellus (Zincken)
C. pascuella (Linnaeus)
C. perlella (Scopoli)
C. praefectellus (Zincken)

C. tutillus McDunnough
C. unistriatellus Packard
C. whitmerellus Klots
Desmia maculalis Westwood
Dicymolomia metalliferalis (Packard)
Eoparargyractis floridalis Lange
Euchromius californicalis (Packard)
Eudonia albertalis (Dyar)
E. commortalis (Dyar)
E. echo (Dyar)
E. expallidalis (Dyar)
E. rectilinea (Zeller)
E. spaldingalis (Barnes & McDunnough)
E. spenceri Munroe
E. torniplagalalis (Dyar)
Eurrhyncha hortulata (Linnaeus)
Evergestis funalis (Grote)
E. obscuralis Barnes & McDunnough
E. pallidata (Hufnagel)
E. simulatilis (Grote)
E. subterminalis Barnes & McDunnough
E. vinctalis Barnes & McDunnough
Fumibotys fumalis (Guenée)
Gesneria centuriella (Denis & Schiffermüller)
Herpetogramma pertextalis (Lederer)
Loxostege anartalis (Grote)
L. cereralis (Zeller)
L. commixtalis (Walker)
L. sierralis Munroe
L. sticticalis (Linnaeus)
L. thalophilalis (Hulst)
Mecyna mustelinalis (Packard)
Microtheoris ophionalis (Walker)
Mimoschinia rufofascialis (Stephens)
Munroessa icciusalis (Walker)
Mutuuraia mysippusalis (Walker)
Neodactria luteolellus (Clemens)
N. murellus (Dyar)
Nomophila nearctica Munroe
Occidentalia comptulatalis (Hulst)
Orenaia trivialis Barnes & McDunnough
Ostrinia penitalis (Grote)
Pediasia dorsipunctellus (Kearfott)
P. trisecta (Walker)
P. truncatellus (Zetterstedt)
Perispasta caeculalis Zeller

Petrophila confusalis (Walker)
Phlyctaenia coronata (Hufnagel)
Prorasea praeia (Dyar)
Pyrausta fodinalis (Lederer)
P. nicalis (Grote)
P. orphisalis Walker
P. perrubralis (Packard)
P. signatalis (Walker)
P. socialis (Grote)
P. unifascialis (Packard)
Saucrobotys fumoferalis (Hulst)
S. futilalis (Lederer)
Scoparia basalis Walker
S. biplagiata Walker
S. palloralis Dyar
Sitochroa chortalis (Grote)
Stegia salutalis (Hulst)
Synclita occidentalis Lange
Tehama bonifatella (Hulst)
Thaumatopsis pexellus (Zeller)
T. repandus (Grote)
Udea abstrusa Munroe
U. derasa Munroe
U. inquinatalis (Zeller)
U. itysalis (Walker)
U. livida Munroe
U. profundalis (Packard)
U. radiosalis (Möschler)
U. saxifragae (McDunnough)
U. turmalis (Grote)
U. washingtonalis (Grote)

Superfamily GEOMETROIDEA

Family GEOMETRIDAE (113 genera, 336 species)

Acasis viridata (Packard)
Aethalura intertexta (Walker)
Anavitrinella addendaria (Grossbeck)
A. pampinaria (Guenée)
Anticlea multiferata (Walker)
A. vasiliata Guenée
Aplocera plagiata (Linnaeus)
Apodrepanulatrix litaria (Hulst)
Archiearis infans (Möschler)
Besma quercivoraria (Guenée)
Biston betularia (Linnaeus)
Cabera borealis (Hulst)

C. erythemaria Guenée
C. exanthemata (Scopoli)
C. variolaria Guenée
Campaea perlata (Guenée)
Caripeta aequaliaria Grote
C. angustiorata Walker
C. divisata Walker
Carsia sororiata (Hübner)
Ceratodalia gueneata Packard
Chlorochlamys triangularis Prout
Chlorosea banksaria Sperry
C. nevadaria Packard
Cladara atroliturata (Walker)
C. limitaria (Walker)
Colostygia turbata Hübner
Coryphista meadii (Packard)
Costaconvexa centrostrigaria (Wollaston)
Cyclophora dataria (Hulst)
C. pendulinaria (Guenée)
Dasyfidonia avuncularia (Guenée)
Digrammia californiaria (Packard)
D. curvata (Grote)
D. decorata (Grossbeck)
D. delectata (Hulst)
D. denticulata (Grote)
D. irrorata (Packard)
D. muscariata (Guenée)
D. neptaria (Guenée)
D. nubiculata (Packard)
D. respersata (Hulst)
D. rippertaria (Duponchel)
D. setonana (McDunnough)
D. subminiata (Packard)
D. triviata (Barnes & McDunnough)
Drepanulatrix carnearia (Hulst)
D. falcataria (Packard)
D. foeminaria (Guenée)
D. quadraria (Grote)
D. secundaria Barnes & McDunnough
D. unicalcararia (Guenée)
Dysstroma brunneata (Packard)
D. citrata (Linnaeus)
D. colvillei Blackmore
D. formosa (Hulst)
D. hersiliata (Guenée)
D. mancipata (Guenée)

D. ochrofuscaria Ferguson
D. sobria Swett
D. truncata (Hufnagel)
D. walkerata (Pearsall)
Ecliptopera silaceata (Denis & Schiffermüller)
Ectropis crepuscularia (Denis & Schiffermüller)
Enchoria lacteata (Packard)
Ennomos alniaria (Linnaeus)
E. magnaria Guenée
Entephria kidluidata (Munroe)
E. lagganata Taylor
E. multivagata (Hulst)
E. takuata Taylor
Enypia griseata Grossbeck
E. packardata Taylor
E. venata (Grote)
Epirrhoe alternata (Müller)
E. plebeculata (Guenée)
E. sperryi Herbulot
Epirrita autumnata (Borkhausen)
E. pulchraria (Taylor)
Erannis vancouverensis Hulst
Eubaphe mendica (Walker)
E. unicolor (Robinson)
Eudrepanulatrix rectifascia (Hulst)
Eufidonia convergaria (Walker)
E. discospilata (Walker)
Eulithis destinata (Möschler)
E. flavibrunneata (McDunnough)
E. propulsata (Walker)
E. testata (Linnaeus)
E. xylinea (Hulst)
Eumacaria latiferrugata (Walker)
Euphyia intermediata (Guenée)
Eupithecia absinthiata (Clerck)
E. agnesata Taylor
E. albicapitata Packard
E. annulata (Hulst)
E. anticaria Walker
E. assimilata Doubleday
E. behrensata Packard
E. borealis (Hulst)
E. bryanti Taylor
E. casloata (Dyar)
E. columbiata (Dyar)
E. cretaceata (Packard)

E. gelidata Möschler
E. gilvipennata Cassino & Swett
E. graefii (Hulst)
E. harrisonata MacKay
E. interruptofasciata Packard
E. intricata (Zetterstedt)
E. lachrymosa (Hulst)
E. lafontaineata Bolte
E. lariciata (Freyer)
E. longipalpata Packard
E. maestosa (Hulst)
E. misturata (Hulst)
E. multistrigata (Hulst)
E. mutata Pearsall
E. nevadata Packard
E. nimbicolor (Hulst)
E. niphadophilata (Dyar)
E. niveifascia (Hulst)
E. olivacea Taylor
E. ornata (Hulst)
E. palpata Packard
E. perfusca (Hulst)
E. placidata Taylor
E. pseudotsugata MacKay
E. pygmaeata (Hübner)
E. ravocostaliata Packard
E. regina Taylor
E. rotundopuncta Packard
E. satyrata (Hübner)
E. sharronata Bolte
E. spermaphaga (Dyar)
E. subfuscata (Haworth)
E. tenuata Hulst
E. tripunctaria Herrich-Schäffer
E. unicolor (Hulst)
Eurhinosea flavaria Packard
Eustroma atrifasciata (Hulst)
E. fasciata Barnes & McDunnough
E. semiatrata (Hulst)
Euchlaena johnsonaria (Fitch)
E. madusaria (Walker)
E. marginaria (Minot)
E. tigrinaria (Guenée)
Gabriola dyari Taylor
Glena nigricaria (Barnes & McDunnough)
Gnophos macguffini Smiles

Hemithea aestivaria (Hübner)
Hesperumia latipennis (Hulst)
H. sulphuraria Packard
Horisme incana Swett
H. intestinata (Guenée)
Hydrelia albifera (Walker)
H. brunneifasciata (Packard)
Hydriomena albifasciata (Packard)
H. albimontanata McDunnough
H. californiata (Packard)
H. crokeri Swett
H. divisaria (Walker)
H. edenata Swett
H. exculpata Barnes & McDunnough
H. expurgata Barnes & McDunnough
H. furcata (Thunberg)
H. irata Swett
H. macdunnoughi Swett
H. manzanita Taylor
H. marinata Barnes & McDunnough
H. nevadae Barnes & McDunnough
H. nubilofasciata (Packard)
H. perfracta Swett
H. quinquefasciata (Packard)
H. renunciata (Walker)
H. ruberata (Freyer)
H. speciosata (Packard)
Hypagyrtis piniata (Packard)
H. unipunctata (Haworth)
Idaea demissaria (Hübner)
I. dimidiata (Hufnagel)
I. rotundopennata (Packard)
Iridopsis clivinaria (Guenée)
I. larvaria (Guenée)
Ixala desperaria (Hulst)
Lambdina fiscellaria (Guenée)
Leptostales rubromarginaria (Packard)
Leucobrephephos brephoides (Walker)
Lobocleta quaesitata (Hulst)
Lobophora canavestita (Pearsall)
L. magnoliatoidata (Dyar)
L. montanata Packard
L. nivigerata Walker
L. simsata Swett
Lomographa semiclarata (Walker)
Lycia rachelae (Hulst)

L. ursaria (Walker)
Macaria adonis Barnes & McDunnough
M. anataria (Swett)
M. andersoni (Swett)
M. atrimaculata Barnes & McDunnough
M. bicolorata (Fabricius)
M. bitactata (Walker)
M. brunneata (Thunberg)
M. colata (Grote)
M. decorata (Hulst)
M. exauspicata Walker
M. loricaria (Eversmann)
M. lorquinaria (Guenée)
M. marmorata (Ferguson)
M. occiduaria (Packard)
M. perplexata (Pearsall)
M. plumosata (Barnes & McDunnough)
M. quadrilinearia (Packard)
M. sexmaculata Packard
M. signaria (Hübner)
M. sulphurea (Packard)
M. truncataria (Walker)
M. ulsterata (Pearsall)
M. unipunctaria (W.S. Wright)
Melanolophia imitata (Walker)
Meris suffusaria McDunnough
Mesoleuca gratulata (Walker)
M. ruficillata (Guenée)
Mesothea incertata (Walker)
Metanema determinata Walker
M. inatomaria Guenée
Metarranthis duaria (Guenée)
Nematocampa resistaria (Herrich-Schäffer)
Nealcis californiaria (Packard)
Neoterpes trianguliferata (Packard)
Nemoria darwiniata (Dyar)
N. glaucomarginaria (Barnes & McDunnough)
N. unitaria (Packard)
Nepytia freemani Munroe
N. phantasmata (Strecker)
N. umbrosaria (Packard)
Operophtera bruceata (Hulst)
O. brumata (Linnaeus)
O. danbyi (Hulst)
Orthofidonia exornata (Walker)
Pasiphila rectangulata (Linnaeus)

Perizoma basaliata (Walker)
P. costiguttata (Hulst)
P. curvilinea (Hulst)
P. custodiata (Guenée)
P. grandis (Hulst)
Pero behrensaria (Packard)
P. honestaria (Walker)
P. mizon Rindge
P. morrisonaria (Hy. Edwards)
P. occidentalis (Hulst)
Phaeoura mexicanaria (Grote)
Phigalia plumogeraria (Hulst)
P. punctomacularia (Hulst)
Plagodis phlogosaria (Guenée)
P. pulveraria (Linnaeus)
Plataea trilinearia (Packard)
Plemyria georgii Hulst
Probole alienaria Herrich-Schäffer
P. amicaria (Herrich-Schäffer)
Prochoerodes amplicineraria (Pearsall)
P. forficaria (Guenée)
Prorella leucata (Hulst)
P. mellisa (Grossbeck)
Protitame matilda (Dyar)
P. virginalis (Hulst)
Protoarmia porcelaria (Guenée)
Psychophora phocata (Möschler)
Rheumaptera hastata (Linnaeus)
R. subhastata (Nolcken)
R. undulata (Linnaeus)
Sabulodes edwardsata (Hulst)
Scopula ancellata (Hulst)
S. frigidaria (Möschler)
S. fuscata (Hulst)
S. junctaria (Walker)
S. luteolata (Hulst)
S. quadrilineata (Packard)
S. sentinaria (Geyer)
S. septentrioncola McDunnough
S. siccata McDunnough
S. sideraria (Guenée)
Selenia alciphearia Walker
S. kentaria (Grote & Robinson)
Sericosema juturnaria (Guenée)
S. wilsonensis Cassino & Swett
Sicya macularia (Harris)

Spargania luctuata (Denis & Schiffermüller)
S. magnoliata Guenée
Spodolepis substriataria Hulst
Stamnoctenis morrisata (Hulst)
S. pearsalli (Swett)
Stamnodes blackmorei Swett
S. marmorata (Packard)
S. topazata (Strecker)
Stenoporpia excelsaria (Strecker)
S. pulmonaria (Grote)
S. separataria (Grote)
Synaxis cervinaria (Packard)
S. formosa (Hulst)
S. jubararia (Hulst)
S. pallulata (Hulst)
Synchlora aerata (Fabricius)
S. bistriaria (Packard)
Tetracis cachexiata Guenée
Thallopaga hyperborea (Hulst)
Thera otisi (Dyar)
T. taylorata (Hulst)
Trichodezia albovittata (Guenée)
Triphosa haesitata (Guenée)
Venusia cambrica Curtis
V. duodecemlineata (Packard)
V. obsoleta (Swett)
V. pearsalli (Dyar)
Xanthorhoe abrasaria (Herrich-Schäffer)
X. alticolata Barnes & McDunnough
X. baffinensis McDunnough
X. borealis Hulst
X. clarkeata Ferguson
X. decoloraria (Esper)
X. defensaria (Guenée)
X. dodata Swett & Cassino
X. ferrugata (Clerck)
X. fossaria Taylor
X. iduata (Guenée)
X. incursata (Hübner)
X. labradorensis (Packard)
X. lacustrata (Guenée)
X. macdunnoughi Swett
X. packardata McDunnough
X. pontiaria Taylor
X. ramaria Swett & Cassino
Xanthotype sospeta (Drury)

Zenophleps alpinata Cassino
Z. lignicolorata (Packard)

Superfamily DREPANOIDEA

Family DREPANIDAE (7 genera, 11 species)

Ceranemota albertae Clarke
C. fasciata (Barnes & McDunnough)
C. improvisa (Hy. Edwards)
Drepana arcuata Walker
D. bilineata (Packard)
Eudeilinia herminiata (Guenée)
Euthyatira pudens (Guenée)
E. semicircularis (Grote)
Habrosyne scripta (Gosse)
Oreta rosea (Walker)
Pseudothyatira cymatophoroides (Guenée)

Superfamily URANIOIDEA

Family URANIIDAE (1 genus, 1 species)

Callizzia amorata Packard

Superfamily HESPERIOIDEA

Family HESPERIIDAE (14 genera, 29 species)

Amblyscirtes vialis (W. H. Edwards)
Atalopedes campestris (Boisduval)
Carterocephalus palaemon (Pallas)
Epargyreus clarus (Cramer)
Erynnis afranius (Lintner)
E. icelus (Scudder & Burgess)
E. pacuvius (Lintner)
E. persius (Scudder)
E. propertius (Scudder & Burgess)
Euphyes vestris (Boisduval)
Hesperia assiniboia (Lyman)
H. colorado (Scudder)
H. comma (Linnaeus)
H. juba (Scudder)
H. nevada (Scudder)
Oarisma garita (Reakirt)
Ochlodes sylvanoides (Boisduval)
Pholisora catullus (Fabricius)
Polites draco (W. H. Edwards)
P. mystic (W. H. Edwards)
P. peckius (Wm. Kirby)
P. sabuleti (Boisduval)
P. sonora (Scudder)

P. themistocles (Latreille)
Pyrgus centaureae (Rambur)
P. communis (Grote)
P. ruralis (Boisduval)
Thorybes pylades (Scudder)
Thymelicus lineola (Ochsenheimer)

Superfamily PAPILIONOIDEA

Family PAPILIONIDAE (2 genera, 11 species)

Papilio canadensis Rothschild & Jordan
P. eurymedon (Lucas)
P. indra Reakirt
P. machaon Linnaeus
P. multicaudatus Kirby
P. rutulus Lucas
P. zelicaon Lucas
Parnassius clodius Ménétriés
P. eversmanni Ménétriés
P. phoebus (Fabricius)
P. smintheus Doubleday

Family PIERIDAE (6 genera, 28 species)

Anthocharis sara Lucas
A. stella W. H. Edwards
Colias alexandra W. H. Edwards
C. canadensis Ferris
C. chippewa W. H. Edwards
C. christina W. H. Edwards
C. eurytheme Boisduval
C. gigantea Strecker
C. hecla Lefebvre
C. interior Scudder
C. meadii W. H. Edwards
C. nastes Boisduval
C. occidentalis Scudder
C. pelidne Boisduval & Le Conte
C. philodice Godart
Euchloe ausonides (Lucas)
E. creusa (Doubleday)
E. hyantis (W. H. Edwards)
E. naina Kozhantschikov
Neophasia menapia (Felder & Felder)
Pieris angelika Eitschberger
P. marginalis Scudder
P. oleracea Harris
P. rapae (Linnaeus)

Pontia beckerii (W. H. Edwards)
P. occidentalis (Reakirt)
P. protodice (Boisduval & Le Conte)
P. sisymbrii (Boisduval)

Family RIODINIDAE (1 genus, 1 species)

Apodemia mormo (Felder & Felder)

Family NYMPHALIDAE (17 genera, 72 species)

Aglais milberti (Godart)
Boloria alaskensis (Holland)
B. alberta (W. H. Edwards)
B. astarte (Doubleday & Hewitson)
B. bellona (Fabricius)
B. chariclea (Schneider)
B. epithore (W. H. Edwards)
B. eunomia (Esper)
B. freija (Thunberg)
B. frigga (Thunberg)
B. improba (Butler)
B. natazhati (Gibson)
B. polaris (Boisduval)
B. selene (Denis & Schiffermüller)
Cercyonis oetus (Boisduval)
C. pegala (Fabricius)
C. sthenele (Boisduval)
Chlosyne hoffmanni (Behr)
C. palla (Boisduval)
C. whitneyi (Behr)
Coenonympha tullia (Müller)
Danaus plexippus (Linnaeus)
Erebia discoidalis (Wm. Kirby)
E. epipsodea Butler
E. magdalena Strecker
E. mancinus Doubleday & Hewitson
E. pawloskii Ménétriés
E. rossii (Curtis)
E. vidleri Elwes
Euphydryas anicia (Doubleday)
E. chalcedona (Doubleday)
E. editha (Boisduval)
E. gillettii (Barnes)
Euptoieta claudia (Cramer)
Limenitis archippus (Cramer)
L. arthemis (Drury)
L. lorquini (Boisduval)

Nymphalis antiopa (Linnaeus)
N. californica (Boisduval)
Oeneis alberta Elwes
O. bore (Schneider)
O. chryxus (Doubleday & Hewitson)
O. jutta (Hübner)
O. macounii (W. H. Edwards)
O. melissa (Fabricius)
O. nevadensis (Felder & Felder)
O. polixenes (Fabricius)
O. rosovi Kurentzov
O. uhleri (Reakirt)
Phyciodes batesii (Reakirt)
P. cocyta (Cramer)
P. mylitta (W. H. Edwards)
P. pallida (W. H. Edwards)
P. pulchella (Boisduval)
Polygonia faunus (W. H. Edwards)
P. gracilis (Grote & Robinson)
P. oreas (W. H. Edwards)
P. progne (Cramer)
P. satyrus (W. H. Edwards)
Roddia vaualbum (Denis & Schiffermüller)
Speyeria aphrodite (Fabricius)
S. atlantis (W. H. Edwards)
S. callippe (Boisduval)
S. cybele (Fabricius)
S. hesperis (W. H. Edwards)
S. hydasphe (Boisduval)
S. mormonia (Boisduval)
S. zereine (Boisduval)
Vanessa annabella (Field)
V. atalanta (Linnaeus)
V. cardui (Linnaeus)
V. virginiensis (Drury)

Family LYCAENIDAE (9 genera, 43 species)

Callophrys affinis (W. H. Edwards)
C. augustinus (Westwood)
C. eryphon (Boisduval)
C. gryneus (Hübner)
C. johnsoni (Skinner)
C. mossii (Hy. Edwards)
C. nelsoni (Boisduval)
C. niphon (Hübner)
C. polia (Cook & Watson)

C. sheridanii (Carpenter)
C. spinetorum (Hewitson)
Celastrina echo (W. H. Edwards)
C. lucia (Wm. Kirby)
Cupido amyntula (Boisduval)
C. comyntas (Godart)
Euphilotes battoides (Behr)
Glaucopsyche lygdamus (Doubleday)
G. piasus (Boisduval)
Lycaena cupreus (W. H. Edwards)
L. dione (Scudder)
L. dorcas (Wm. Kirby)
L. helloides (Boisduval)
L. heteronea Boisduval
L. hyllus (Cramer)
L. mariposa (Reakirt)
L. nivalis (Boisduval)
L. phlaeas (Linnaeus)
Plebejus anna (W. H. Edwards)
P. glandon (de Prunner)
P. icarioides (Boisduval)
P. idas (Linnaeus)
P. lupini (Boisduval)
P. melissa (W. H. Edwards)
P. optilete (Knoch)
P. saepiolus (Boisduval)
Satyrium behrii (W. H. Edwards)
S. californica (W. H. Edwards)
S. fuliginosa (W. H. Edwards)
S. liparops (Le Conte)
S. saepia (Boisduval)
S. sylvinus (Boisduval)
S. titus (Fabricius)
Strymon melinus Hübner

Superfamily BOMBYCOIDEA

Family LASIOCAMPIDAE (3 genera, 5 species)

Malacosoma californica (Packard)
M. disstria Hübner
Phyllodesma americana (Harris)
Tolype dayi Blackmore
T. laricis (Fitch)

Family SATURNIIDAE (3 genera, 6 species)

Antheraea polyphemus (Cramer)
Hemileuca eglanterina (Boisduval)

H. hera (Harris)
H. nuttalli (Strecker)
Hyalophora euryalus (Boisduval)
H. columbia (Smith)

Superfamily SPHINGOIDEA

Family SPHINGIDAE (11 genera, 21 species)

Agrius cingulata (Fabricius)
Darapsa choerilus (Cramer)
Deilephila elpenor (Linnaeus)
Hemaris diffinis (Boisduval)
H. senta (Strecker)
H. thysbe (Fabricius)
Hyles gallii (Rottemburg)
H. lineata (Fabricius)
Manduca quinquemaculata (Haworth)
Pachysphinx modesta (Harris)
Paonias excaecata (J.E. Smith)
P. myops (J.E. Smith)
Proserpinus clarkiae (Boisduval)
P. flavofasciata (Walker)
Smerinthus cerisyi Wm. Kirby
S. jamaicensis (Drury)
Sphinx chersis (Hübner)
S. drupiferarum J.E. Smith
S. perelegans Hy. Edwards
S. poecila Stephens
S. vashti Strecker

Superfamily NOCTUOIDEA

Family NOTODONTIDAE (10 genera, 22 species)

Clostera albosigma Fitch
C. apicalis (Walker)
C. brucei (Hy. Edwards)
C. strigosa (Grote)
Datana ministra (Drury)
Furcula cinerea (Walker)
F. modesta (Hudson)
F. occidentalis (Lintner)
F. scolopendrina (Boisduval)
Gluphisia septentrionis Walker
G. severa Hy. Edwards
Nadata gibbosa (J.E. Smith)
Notodonta pacifica Behr
N. simplaria Graef
Odontosia elegans (Strecker)

Oligo pallida (Strecker)
O. centria semirufescens (Walker)
Pheosia portlandia Hy. Edwards
P. rimosa Packard
Schizura concinna (J.E. Smith)
S. ipomoeae Doubleday
S. unicornis (J.E. Smith)

Family NOCTUIDAE (234 genera, 804 species)

Abagrotis apposita (Grote)
A. baueri McDunnough
A. brunneipennis (Grote)
A. cupida (Grote)
A. dickeli Lafontaine
A. dodi McDunnough
A. duanca (J.B. Smith)
A. erratica (J.B. Smith)
A. forbesi (Benjamin)
A. glenni Buckett
A. hermina Lafontaine
A. mirabilis (Grote)
A. nanalis (Grote)
A. nefascia (J.B. Smith)
A. orbis (Grote)
A. placida (Grote)
A. pulchrata (Blackmore)
A. reedi Buckett
A. scopeops (Dyar)
A. trigona (J.B. Smith)
A. turbulenta McDunnough
A. variata (Grote)
A. vittifrons (Grote)
Abrostola urentis Guenée
Acerra normalis Grote
Acopa perpallida Grote
Actebia balanitis (Grote)
A. fennica (Tauscher)
Admetovis oxymorus Grote
A. similaris Barnes
Acontia areli Strecker
A. major J.B. Smith
Acronicta cyanescens Guenée
A. dactylina Grote
A. fragilis (Guenée)
A. funeralis Grote & Robinson
A. furcifera Guenée

A. grisea Walker
A. hasta Guenée
A. impleta Walker
A. impressa Walker
A. innotata Guenée
A. lanceolaria (Grote)
A. lepusculina Guenée
A. mansueta J. B. Smith
A. marmorata J. B. Smith
A. oblinita (J.E. Smith)
A. perdita Grote
A. quadrata Grote
A. radcliffei (Harvey)
A. strigulata J. B. Smith
A. vulpina Guenée
Adelphagrotis indeterminata (Walker)
A. stellaris (Grote)
Adita chionanthi (J.E. Smith)
Agnorisma bugrai (Kocak)
Agrochola bicolorago (Guenée)
A. decipiens (Grote)
A. pulchella (J. B. Smith)
A. purpurea (Grote)
A. verberata (J. B. Smith)
Agrotis antica Crabo & Lafontaine
A. gravis Grote
A. ipsilon (Hufnagel)
A. obliqua (J. B. Smith)
A. ruta (Eversmann)
A. vancouverensis Grote
A. venerabilis Walker
A. vetusta (Walker)
Alastria chico Lafontaine & Troubridge
Alypia langtoni Couper
A. ridingsii Grote
Amphipoea americana (Speyer)
A. pacifica (Speyer)
Amphipyra glabella (Morrison)
A. pyramidoides Guenée
A. tragopoginis (Clerck)
Anagrapha falcifera (Wm. Kirby)
Anaplectoides prasina (Denis & Schiffermüller)
A. pressus (Grote)
Anarta columbica (McDunnough)
A. crotchii (Grote)
A. decepta (Grote)

"A." *edwardsii* (J. B. Smith)
A. farnhami (Grote)
A. hamata (McDunnough)
A. montanica (McDunnough)
A. mutata (Dod)
A. nigrolunata Packard
A. oregonica (Grote)
A. trifolii (Hufnagel)
Androloma maccullochii (Wm. Kirby)
Andropolia aedon (Grote)
A. contacta (Walker)
A. diversilineata (Grote)
A. epichysis (Grote)
Anhimella contrahens (Walker)
A. pacifica McDunnough
A. perbrunnea (Grote)
Anicla exuberans (J. B. Smith)
A. tepperi (J. B. Smith)
Annaphila danistica Grote
A. decia Grote
A. diva Grote
Anathix aggressa (J. B. Smith)
A. puta (Grote & Robinson)
Apamea acera (J. B. Smith)
A. alia (Guenée)
A. amputatrix (Fitch)
A. antennata (J. B. Smith)
A. atriclava (Barnes & McDunnough)
A. centralis (J. B. Smith)
A. cinefacta (Grote)
A. cogitata (J. B. Smith)
A. commoda (Walker)
A. contradicta (J. B. Smith)
A. cuculliformis (Grote)
A. devastator (Brace)
A. impulsiva (Guenée)
A. inficita (Walker)
A. inordinata (Morrison)
A. lignicolora (Guenée)
A. longula (Grote)
A. lutosa (Andrews)
A. maxima (Dyar)
A. niveivenosa (Grote)
A. occidens (Grote)
A. plutonia (Grote)
A. remissa (Hübner)

A. scoparia Mikkola, Mustelin & Lafontaine
A. sora (J. B. Smith)
A. sordens (Hufnagel)
A. spaldingi (J. B. Smith)
A. vultuosa (Grote)
A. zeta (Treitschke)
Apharetra californiae McDunnough
A. dentata (Grote)
Aplectoides condita (Guenée)
Archanara oblonga (Grote)
A. subflava (Grote)
Arctia caja (Linnaeus)
A. opulenta (Hy. Edwards)
Ascalapha odorata (Linnaeus)
Aseptis adnixa (Grote)
A. binotata (Walker)
A. characta (Grote)
A. fumosa (Grote)
Autographa ampla (Walker)
A. bimaculata (Stephens)
A. buraetica (Staudinger)
A. californica (Speyer)
A. corusca (Strecker)
A. flagellum (Walker)
A. mappa (Grote & Robinson)
A. metallica (Grote)
A. pseudogamma (Grote)
A. rubidus Ottolengui
A. sansoni Dod
A. speciosa Ottolengui
A. v-alba Ottolengui
Behrensia conchiformis Grote
Bellura gargantua (Dyar)
B. obliqua (Walker)
Benjaminiola colorada (J. B. Smith)
Bleptina caradrinalis Guenée
Brachylomia algens (Grote)
B. cascadia Troubridge & Lafontaine
B. discinigra (Walker)
B. populi (Strecker)
B. thula (Strecker)
Bruceia pulverina Neumoegen
Bulia deducta (Morrison)
Caenurgina annexa (Hy. Edwards)
C. caerulea (Grote)
C. crassiuscula (Haworth)

C. erectea (Cramer)
Calophasia lunula (Hufnagel)
Caradrina camina (J. B. Smith)
C. meralis Morrison
C. montana Bremer
C. morpheus (Hufnagel)
C. multifera Walker
Catabena lineolata Walker
Catocala aholibah Strecker
C. allusa Hulst
C. briseis W. H. Edwards
C. californica W. H. Edwards
C. faustina Strecker
C. junctura Walker
C. relictata Walker
C. semirelictata Grote
C. ultronia (Hübner)
C. unijuga Walker
Celaena reniformis (Grote)
Cerastis enigmatica Lafontaine & Crabo
C. salicarum (Walker)
Charadra deridens (Guenée)
Chersotis juncta (Grote)
Chortodes basistriga (McDunnough)
C. defecta (Grote)
C. inquinata (Guenée)
Chrysodeixis eriosoma (Doubleday)
Chytolita morbidalis (Guenée)
C. petrealis Grote
Chytonix palliatricula (Guenée)
"C." *divesta* (Grote)
Cisseps fulvicollis (Hübner)
Cissusa indiscreta (Hy. Edwards)
Clemensia albata Packard
Coenophila opacifrons (Grote)
Condica discistriga (J. B. Smith)
Conochares arizonae (Hy. Edwards)
Copablepharon absidum (Harvey)
C. fuscum Troubridge & Crabo
C. hopfingeri Franclemont
C. spiritum Crabo & Fauske
Coranarta luteola (Grote & Robinson)
C. macrostigma (Lafontaine & Mikkola)
Cosmia elisae Lafontaine & Troubridge
C. praeacuta (J. B. Smith)
Crambidia casta (Packard)

C. impura Barnes & McDunnough
Cryphia cuerva (Barnes)
C. olivacea (J. B. Smith)
Cryptocala acadiensis (Bethune)
Ctenucha virginica (Esper)
Cucullia antipoda Strecker
C. dorsalis Lintner
C. eulepis (Grote)
C. florea Guenée
C. intermedia Speyer
C. mcdunnoughi (Henne)
C. montanae Grote
C. omissa Dod
C. postera Guenée
C. pulla (Grote)
C. similaris J. B. Smith
C. speyeri Lintner
C. strigata (J. B. Smith)
Cyenia oregonensis (Stretch)
C. tenera Hübner
Dargida procinctus (Grote)
Dasychira grisefacta (Dyar)
D. plagiata (Walker)
D. vagans (Barnes & McDunnough)
Deltote bellicula (Hübner)
Diachrysia aereoides (Grote)
Diarsia calgary (J. B. Smith)
D. dislocata (J. B. Smith)
D. esurialis (Grote)
D. rosaria (Grote)
D. rubifera (Grote)
Dichagyris variabilis (Grote)
Drasteria adumbrata (Behr)
D. divergens (Behr)
D. hastingsii (Hy. Edwards)
D. howlandii (Grote)
D. hudsonica (Grote & Robinson)
D. ochracea (Behr)
D. petricola (Walker)
D. sabulosa (Hy. Edwards)
D. socia (Behr)
Dryotype opina (Grote)
Egira cognata (J. B. Smith)
E. crucialis (Harvey)
E. curialis (Grote)
E. dolosa (Grote)

E. hiemalis (Grote)
E. perlubens (Grote)
E. rubrica (Harvey)
E. simplex (Walker)
E. variabilis (J. B. Smith)
Eilema bicolor (Grote)
Elaphria alapallida Pogue & Sullivan
Enargia decolor (Walker)
E. infumata (Grote)
Eosphoropteryx thyatyroides (Guenée)
Epidemas melanographa Hampson
Epiglaea apiata (Grote)
Eremobina claudens (Walker)
Estigmene acrea (Drury)
Euchalcia borealis Lafontaine & Poole
Eucirroedia pampina (Guenée)
Euclidia arditia Franclemont
E. cuspidea (Hübner)
Eueretagrotis perattentus (Grote)
Euplexia benesimilis McDunnough
Eupsilia devia (Grote)
E. fringata (Barnes & McDunnough)
E. tristigmata (Grote)
Eurois astricta Morrison
E. nigra (J. B. Smith)
E. occulta (Linnaeus)
Eutricopis nexilis Morrison
Euxoa aberrans McDunnough
E. adumbrata (Eversmann)
E. aequalis (Harvey)
E. agema (Strecker)
E. albipennis (Grote)
E. altens McDunnough
E. atomaris (J. B. Smith)
E. atristrigata (J. B. Smith)
E. auripennis Lafontaine
E. auxiliaris (Grote)
E. bicollaris (Grote)
E. biformata J. B. Smith
E. bochus (Morrison)
E. brevipennis (J. B. Smith)
E. brunneigera (Grote)
E. campestris (Grote)
E. castanea Lafontaine
E. catenula (Grote)
E. choris (Harvey)

E. cicatricosa (Grote & Robinson)
E. cinereopallidus (J. B. Smith)
E. comosa (Morrison)
E. costata (Grote)
E. dargo (Strecker)
E. declarata (Walker)
E. difformis (J. B. Smith)
E. divergens (Walker)
E. edictalis (J. B. Smith)
E. excogita (J. B. Smith)
E. extranea (J. B. Smith)
E. flavicollis (J. B. Smith)
E. furtivus (J. B. Smith)
E. hollemani (Grote)
E. idahoensis (Grote)
E. infausta (Walker)
E. infracta (Morrison)
E. intermontana Lafontaine
E. intrita (Morrison)
E. laetificans (J. B. Smith)
E. lewisi (Grote)
E. lillooet McDunnough
E. macleani McDunnough
E. macrodentata Hardwick
E. maimes (J. B. Smith)
E. messoria (Harris)
E. mimallonis (Grote)
E. mitis (J. B. Smith)
E. munis (Grote)
E. murdocki (J. B. Smith)
E. nevada (J. B. Smith)
E. nomas (Erschov)
E. nostra (J. B. Smith)
E. obeliscoides (Guenée)
E. oblongistigma (J. B. Smith)
E. occidentalis Lafontaine & Byers
E. ochrogaster (Guenée)
E. olivalis (Grote)
E. olivia (Morrison)
E. pallidimacula Lafontaine
E. pallipennis (J. B. Smith)
E. perexcellens (Grote)
E. perolivalis (J. B. Smith)
E. perpolita (Morrison)
E. pestula J. B. Smith
E. plagigera (Morrison)

E. pleuritica (Grote)
E. pluralis (Grote)
E. punctigera (Walker)
E. quadridentata (Grote & Robinson)
E. quebecensis (J. B. Smith)
E. ridingsiana (Grote)
E. rockburnei Hardwick
E. rufula (J. B. Smith)
E. satiens (J. B. Smith)
E. satis (Harvey)
E. scotogrammoides McDunnough
E. septentrionalis (Walker)
E. servitus (J. B. Smith)
E. setonia McDunnough
E. shasta Lafontaine
E. silens (Grote)
E. simona McDunnough
E. simulata McDunnough
E. subandera Lafontaine
E. terrenus (J. B. Smith)
E. tessellata (Harris)
E. tristicula (Morrison)
E. vallus (J. B. Smith)
E. vetusta (Walker)
E. westermanni (Staudinger)
E. wilsoni (Grote)
Faronta diffusa (Walker)
F. terrapictalis Buckett
Feltia herilis (Grote)
F. jaculifera (Guenée)
F. mollis (Walker)
F. nigrita (Graeser)
Feralia comstocki (Grote)
F. deceptiva McDunnough
F. jocosa (Guenée)
Fishia discors (Grote)
F. yosemitae (Grote)
Galgula partita Guenée
Gnophaela vermiculata (Grote)
Grammia celia (Saunders)
G. complicata (Walker)
G. doris (Boisduval)
G. elongata (Stretch)
G. nevadensis (Grote & Robinson)
G. ornata (Packard)
G. parthenice (Wm. Kirby)

G. quenseli (Paykull)
G. virgo (Linnaeus)
G. williamsii (Dodge)
Graphiphora augur (Fabricius)
Hada sutrina (Grote)
Hadena caelestis Troubridge & Crabo
H. capsularis (Guenée)
H. ectrapela (J. B. Smith)
H. variolata (J. B. Smith)
Hadenella pergentilis Grote
Helicoverpa zea (Boddie)
Heliocheilus paradoxus Grote
Heliothis ononis (Fabricius)
H. oregonica (Hy. Edwards)
H. phloxiphaga Grote & Robinson
Hillia iris (Zetterstedt)
H. maida (Dyar)
Holoarctia sordida (McDunnough)
Holomelina ferruginosa (Walker)
H. fragilis (Strecker)
Homoglaea californica (J. B. Smith)
H. carbonaria (Harvey)
H. dives J. B. Smith
H. hircina Morrison
Homohadena fifia Dyar
H. infixa (Walker)
H. stabilis J. B. Smith
Homorthodes carneola McDunnough
H. communis (Dyar)
H. discreta (Barnes & McDunnough)
H. fractura (J. B. Smith)
H. furfurata (Grote)
H. hanhami (Barnes & McDunnough)
Hydraecia columbia (Barnes & Benjamin)
H. pallescens J. B. Smith
H. perobliqua Hampson
Hypena abalienalis Walker
H. atomaria (J. B. Smith)
H. bijugalis Walker
H. californica Behr
H. decorata J. B. Smith
H. edictalis Walker
H. humuli Harris
H. modestoides Poole
H. palparia (Walker)
Hypercompe permaculata (Packard)

Hyphantria cunea (Drury)
Hypocoena rufostrigata (Packard)
Hypoprepia miniata (Wm. Kirby)
Hyppa brunneicrista J. B. Smith
H. contrasta McDunnough
H. indistincta J. B. Smith
Idia aemula Hübner
I. americalis (Guenée)
I. lubricalis (Geyer)
I. occidentalis (J. B. Smith)
Ipimorpha nanaimo Barnes
I. pleonectusa Grote
I. viridipallida Barnes & McDunnough
Lacanobia atlantica (Grote)
L. nevadae (Grote)
L. radix (Walker)
L. subjuncta (Grote & Robinson)
Lacinipolia anguina (Grote)
L. arietis (Grote)
L. comis (Grote)
L. cuneata (Grote)
L. davena (J. B. Smith)
L. lorea (Guenée)
L. lustralis (Grote)
L. meditata (Grote)
L. olivacea (Morrison)
L. patalis (Grote)
L. pensilis (Grote)
L. rectilinea (J. B. Smith)
L. renigera (Stephens)
L. stenotis (Hampson)
L. stricta (Walker)
L. strigicollis (Wallengren)
L. vicina (Grote)
L. wyatti (Barnes & Benjamin)
Lasionycta conjugata (J. B. Smith)
L. discolor (J. B. Smith)
L. impingens (Walker)
L. lagganata (Barnes & Benjamin)
L. leucocycla (Staudinger)
L. luteola (J. B. Smith)
L. macleani (McDunnough)
L. marloffi (Dyar)
L. mutilata (J. B. Smith)
L. perplexa (J. B. Smith)
L. poca (Barnes & Benjamin)

L. quadrilunata (Grote)
L. secedens (Walker)
L. subfuscata (Grote)
L. taigata Lafontaine
L. uniformis (J. B. Smith)
Lateroligia ophiogramma (Esper)
Leptarctia californiae (Walker)
Leucania anteoclara J. B. Smith
L. commoides Guenée
L. farcta (Grote)
L. insueta Guenée
L. multilinea Walker
L. oregona J. B. Smith
Leucoma salicis (Linnaeus)
"Lithacodia" *albidula* (Guenée)
Litholomia napaea (Morrison)
Lithomoia germana (Morrison)
Lithophane amanda (J. B. Smith)
L. atara (J. B. Smith)
L. baileyi Grote
L. contenta Grote
L. dilatocula (J. B. Smith)
L. fagina Morrison
L. georgii Grote
L. innominata (J. B. Smith)
L. itata (J. B. Smith)
L. patefacta (Walker)
L. pertorrida (McDunnough)
L. petulca Grote
L. pexata Grote
L. ponderosa Troubridge & Lafontaine
L. thaxteri Grote
L. vivida (Dyar)
Lophocampa argentata (Packard)
L. maculata Harris
L. roseata (Walker)
Lycophotia phyllophora (Grote)
Lygephila victoria (Grote)
Lymantria dispar (Linnaeus)
Macronoctua onusta Grote
Mamestra configurata Walker
Marathyssa inficita (Walker)
Megalographa biloba (Stephens)
Meganola miniscula (Zeller)
Melanchra adjuncta (Guenée)
M. assimilis (Morrison)

M. picta (Harris)
M. pulverulenta (J. B. Smith)
Melipotis jucunda (Hübner)
Merolonche lupini (Grote)
Mesogona olivata (Harvey)
M. subcuprea Crabo & Hammond
Mniotype ducta (Grote)
M. tenera (J. B. Smith)
Mycterophora longipalpata Hulst
Mythimna oxygala (Grote)
M. unipuncta (Haworth)
M. yukonensis (Hampson)
Neoarctia beanii (Neumoegen)
N. brucei (Hy. Edwards)
Neoligia albirena Troubridge & Lafontaine
N. invenusta Troubridge & Lafontaine
N. lancea Troubridge & Lafontaine
N. lillooet Troubridge & Lafontaine
N. subjuncta (J. B. Smith)
N. tonsa (Grote)
Nephelodes minians Guenée
Noctua comes Hübner
N. pronuba (Linnaeus)
Nola minna Butler
Nycteola cinereana Neumoegen & Dyar
N. frigidana (Walker)
N. columbiana (H. Edwards)
Ochropleura implecta Lafontaine
Ogdoconta cinereola (Guenée)
Oligia illocata (Walker)
O. indirecta (Grote)
O. mactata (Guenée)
O. modica (Guenée)
O. obtusa (J. B. Smith)
O. rampartensis Barnes & Benjamin
O. tusa (Grote)
O. violacea (Grote)
Oncocnemis albifasciata Hampson
O. augustus Harvey
O. barnesii J. B. Smith
O. chalybdis Troubridge & Crabo
O. cibalis Grote
O. columbia McDunnough
O. coprocolor Troubridge & Crabo
O. dunbari (Harvey)
O. extremis J. B. Smith

O. figurata (Harvey)
O. glennyi Grote
O. greyi Troubridge & Crabo
O. laticollis J. B. Smith
O. levis Grote
O. major Grote
O. mus Troubridge & Crabo
O. occata (Grote)
O. pallidior Barnes
O. parvanigra Blackmore
O. phairi McDunnough
O. poliochroa Hampson
O. pudorata J. B. Smith
O. riparia Morrison
O. sandaraca Buckett & Bauer
O. semicollaris J. B. Smith
O. umbrifascia J. B. Smith
O. youngi McDunnough
Orthodes goodelli (Grote)
O. obscura (J. B. Smith)
Orgyia antiqua (Linnaeus)
O. pseudotsugata (McDunnough)
Orthosia ferrigera (J. B. Smith)
O. hibisci (Guenée)
O. mys (Dyar)
O. pacifica (Harvey)
O. praeses (Grote)
O. pulchella (Harvey)
O. revicta (Morrison)
O. segregata (J. B. Smith)
O. transparens (Grote)
Palthis angulalis (Hübner)
Panthea acronyctoides (Walker)
P. gigantea (French)
P. pallescens McDunnough
P. virginarius (Grote)
Papaipema insulidens (Bird)
P. pertincta Dyar
Papestra biren (Goeze)
P. brenda (Barnes & McDunnough)
P. cristifera (Walker)
P. invalida (J. B. Smith)
P. quadrata (J. B. Smith)
Parabagrotis cupidissima (Grote)
P. exsertistigma (Morrison)
P. formalis (Grote)

P. insularis (Grote)
P. sulinaris Lafontaine
Paradiarsia littoralis (Packard)
Pararctia yarrowii (Stretch)
Parasemia plantaginis (Linnaeus)
Parastichtis suspecta (Hübner)
Peridroma saucia (Hübner)
Phalaenostola metonalis (Walker)
Phlogophora periculosa Guenée
Phobolosia anfracta (Hy. Edwards)
Phragmatobia assimilans Walker
P. fuliginosa (Linnaeus)
Platarctia parthenos (Harris)
Platypolia anceps (Stephens)
P. contadina (J. B. Smith)
P. loda (Strecker)
Platyrepia virginalis (Boisduval)
Pleromelloida bonuscula (J. B. Smith)
P. cinerea (J. B. Smith)
P. conserta (Grote)
Plusia nichollae (Hampson)
P. putnami Grote
P. venusta Walker
Polia delecta Barnes & McDunnough
P. detracta (Walker)
P. discalis (Grote)
P. imbrifera (Guenée)
P. nimbosa (Guenée)
P. nugatis (J. B. Smith)
P. piniae Buckett & Bauer
P. propodea McCabe
P. purpurissata (Grote)
P. richardsoni (Curtis)
P. rogenhoferi (Möschler)
Polychrysia esmeralda (Oberthür)
Prognorisma substrigata (J. B. Smith)
Pronoctua craboi Lafontaine
P. peabodyae (Dyar)
P. typica J. B. Smith
Properigea albimacula (Barnes & McDunnough)
P. niveirena (Harvey)
Protolampra rufipectus (Morrison)
Protoperigea anotha (Dyar)
P. posticata (Harvey)
Protorthodes curtica (J. B. Smith)
P. oviduca (Guenée)

P. rufula (Grote)
Proxenus mendosa McDunnough
P. mindara Barnes & McDunnough
P. miranda (Grote)
Pseudanarta crocea (Hy. Edwards)
P. flava (Grote)
Pseudeva palligera (Grote)
Pseudobryomima muscosa (Hampson)
Pseudohermonassa flavotincta (J. B. Smith)
P. tenuicula (Morrison)
Pseudorthodes irrorata (J. B. Smith)
Pyrrharctia isabella (J.E. Smith)
Pyrrhia exprimens (Walker)
Raphia coloradensis Putnam-Cramer
R. frater Grote
Resapamea passer (Guenée)
R. venosa (J. B. Smith)
Rhyacia clemens (J. B. Smith)
Rivula propinqualis Guenée
Schinia acutilinea (Grote)
S. cumatilis (Grote)
S. honesta (Grote)
S. intermontana Hardwick
S. nuchalis (Grote)
S. suetus (Grote)
S. villosa (Grote)
S. walsinghami (Hy. Edwards)
Scoliopteryx libatrix (Linnaeus)
Setagrotis pallidicollis (Grote)
Sideridis fuscolutea (J. B. Smith)
S. maryx (Guenée)
S. rosea (Harvey)
S. uscripta (J. B. Smith)
Simyra insularis (Herrich-Schäffer)
Spaelotis bicava Lafontaine
S. clandestina (Harris)
Spargaloma sexpunctata Grote
Spilosoma congrua Walker
S. danbyi (Neumoegen & Dyar)
S. pteridis Hy. Edwards
S. vagans (Boisduval)
S. virginica (Fabricius)
Spiramater grandis (Guenée)
S. lutra (Guenée)
Spodoptera exigua (Hübner)
S. praefica (Grote)

Stretchia muricina (Grote)
S. plusiaeformis Hy. Edwards
Sutyna profundus (J. B. Smith)
Sympistis funebris (Hübner)
S. lapponica (Thunberg)
S. wilsoni Barnes & Benjamin
S. zetterstedtii (Staudinger)
Syngrapha abstrusa Eichlin & Cunningham
S. alias (Ottolengui)
S. alticola (Walker)
S. angulidens (J. B. Smith)
S. borea (Aurivillius)
S. celsa (Hy. Edwards)
S. diasema (Boisduval)
S. epigaea (Grote)
S. ignea (Grote)
S. interrogationis (Linnaeus)
S. microgamma (Hübner)
S. octoscripta (Grote)
S. orophila (Hampson)
S. parilis (Hübner)
S. rectangula (Wm. Kirby)
S. viridisigma (Grote)
Tarachidia semiflava (Guenée)
T. tortricina (Zeller)
Tesagrotis atrifrons (Grote)
T. corrodera (J. B. Smith)
T. piscipellis (Grote)
Tetanolita palligera (J. B. Smith)
Therasea augustipennis (Grote)
Tholera americana (J. B. Smith)
Trichocerapoda oblita (Grote)
Trichoplusia ni (Hübner)
Trichordestra dodii (J. B. Smith)
T. lilacina (Harvey)
T. liquida (Grote)
T. tacoma (Strecker)
Tyria jacobaeae (Linnaeus)
Ufeus plicatus Grote
U. sagittarius Grote
U. satyricus Grote
Xanthia tatago Lafontaine & Mikkola
Xestia atrata (Morrison)
X. bryanti (Benjamin)
X. c-nigrum (Linnaeus)
X. fabulosa (Ferguson)

X. finatimis Lafontaine
X. homogena (McDunnough)
X. imperita (Hübner)
X. infimatis (Grote)
X. lupa Lafontaine & Mikkola
X. maculata (J. B. Smith)
X. mixta (Walker)
X. mustelina (J. B. Smith)
X. oblata (Morrison)
X. okakensis (Packard)
X. perquiritata (Morrison)
X. plebeia (J. B. Smith)
X. praevia Lafontaine
X. smithii (Snellen)
X. speciosa (Hübner)
X. ursae (McDunnough)
X. verniloides Lafontaine
X. xanthographa (Denis & Schiffermüller)
Xylena brucei (J. B. Smith)
X. cineritia (Grote)
X. curvimacula (Morrison)
X. nupera (Lintner)
X. thoracica (Putnam-Cramer)
Xylotype arcadia Barnes & Benjamin
Zale duplicata (Bethune)
Z. lunata (Drury)
Z. minerea (Guenée)
Zanclognatha bryanti Barnes
Z. lotalba (J. B. Smith)
Zosteropoda hirtipes Grote
Zothea tranquilla Grote

Appendix 7. Checklist of STREPSIPTERA in B.C.

Order STREPSIPTERA

Family STYLOPIDAE

Genus *Stylops* Kirby

S. advarians Pierce

S. leechi Bohart

S. shannoni Pierce

Genus *Xenos* Rossius

X. peckii Kirby

References

Kenner, R.D. 2002. *Stylops shannoni* (Stylopidae, Strepsiptera): A new species for Canada, with comments on *Xenos peckii*. J. Entomol. Soc. B.C. 99:99-102.

Leech, H.B. 1966. A British Columbia record for *Xenos peckii*. J. Entomol. Soc. B.C. 63:40.

Peck, S.B. 1991. Order Strepsiptera twisted-winged parasites. Research Branch, Agriculture Canada Publication 1861/E:366-367.