Appendix 4 – Insects

There are so many types of insects in Canada, that I almost don't know where to begin. A typical planter will encounter literally hundreds of insects in a day – flying, crawling, creeping, slithering, and jumping. The only ones that I'll cover in detail are the common biters (moquitoes, black flies, no-see-ums, and gnats), the common stingers (yellow jackets, Europeans hornets, and bald-faced hornets), and the commercially problematic species (mountain pine beetle, spruce beetle). Also, a shout out to all the bee species out there, pollinating our food chains and keeping us alive.

With most of these insects, we can't talk about any particular species in detail. That's because there are far too many species which are grouped together in enormous clades (groups of organisms that have evolved from a common ancestor). Within the field of botany (the study of plants), the taxonomic order goes from order to family to genus to species. In zoology, the superfamily is an extra level above the family. Basically, what I'm saying is that there are TONS of varieties of all the insects that I'm going to cover here. Incidentally, the study of insects is called entymology. Don't confuse that with etymology. Word up.

Bees (clade *Anthophila*) – There are almost twenty thousand different known species of bees, in seven distinct biological families. Bees are closely related to wasps and ants. Probably the best known species is the western honey bee. The name of that species leads to the next revelation; not all bees produce honey. The 250 species of bumblebees, which are generally fat and colourful and fuzzy, are included in that group. Bumblebee colonies scale down in size for the winter, so they don't stockpile honey to the extent of being useful producers. That doesn't mean that they aren't useful to humans; bumblebees are excellent pollinators. Not all bees can sting. Male honey bees don't have stingers. In some other bee species, none of the bees have stingers. Another odd fact: Bees are haplodiploid, which means that females develop from fertilized eggs and males develop from unfertilized eggs (thus the males are diploid and have only half the number of parental genes). In fact, the female determines the sex of each offspring individually at the time that the egg is laid, because the female can store the male's sperm and ration it according to the need of the colony. Bees travel from flower to flower in search of both nectar and pollen. The nectar is a sugar-rich liquid found in planters, and bees use that for food energy. Pollen (which contains the "sperm" of the plant) is also eaten by bees for protein, and used as food for bee larvae, but in the process, the bees inadvertently spread some of the pollen to other plants. This is the true value of bees and other pollinators – to ensure that our food systems function normally. Be nice to bees.

European Hornet (*Vespa crabo*) – Despite what you'll read in a few minutes about bald-faced hornets, the Vespa is the only "true" hornet found in North America. Hornets and wasps don't produce honey. The nest of these insects is only used for rearing young, not for storage. Wasps and hornets eat other insects or

fruit juices, and sometimes attack bee hives to try to eat the honey. The European hornet stings in response to being disturbed or physically threatened, but generally ignores humans otherwise. However, they are very defensive of their nests. As the European Hornet eats a lot of pest insects, it should be considered to be beneficial. The only drawback is that they also attack honey bees. Most humans dislike wasps and hornets due to their stings. The sting of a wasp or hornet releases a small amount of venom into the sting site, which is why these stings hurt much more than those of other insects. Every type of wasp or hornet has slightly different venoms, which is why people sometimes have no significant reactions to some stings, and bad reactions to other stings. It's probably that the stings came from different species (or were in parts of the body with different amounts of blood flow). Odd fact: The European Hornet is protected as an endangered species in Germany, where it is illegal to kill them or disturb/destroy nests (which are typically above-ground).

Yellow Jacket (*Vespula* sp) – There are four species of the *Vespula* genus found within Canada. As with other wasps/hornets/bees, only the females are capable of stinging. Yellow jackets are similar to European hornets in many respects, although their colouration patterns are different. Unless some other wasps and hornets, in which some individuals live solitary lives, the yellow jacket is dominantly a communal insect, with colonies often exceeding well over five thousand insects. Males die after mating, but the fertilized queen insects will build up fat reserves and seek shelter to be able to survive through the winter. The sting from a yellow jacket is relatively painful. Yellow jackets frequently build their nests underground.

Bald-Faced Hornet (*Dolichovespula maculate*) – This black and white devil is called a hornet, but it's actually a type of yellowjacket wasp. These wasps only build nests above ground, and can be found all throughout Canada. Bald-faced hornets are omnivorous, and eat a lot of other harmful insects. However, they're not as averse to violence as European hornets, and are especially nasty when their nests are disturbed. Bald-faced hornets are unique in that they don't actually have to sting their prey to transfer venom, but can actually spray it a short distance (this affects small insects, not humans). If you see a bald-faced hornet, be wary.

Mosquitoes (family *Culicidae*) – There are about 3500 species of mosquito found within the *Culicidae* family. Mosquito is Spanish for "little fly" (mosca & ito). Only females bite. They do this to extract blood from the host, to secure the proteins needed for reproduction. Mosquitos bite animals and birds, and will even bite reptiles, amphibians, and fish. Eggs are laid on the surface of standing water. When the larvae hatch, they initially feed on aquatic algae until they develop the ability to fly. Many humans have a reaction to the saliva left behind after a mosquito bite, which is what causes the post-bite itching. Mosquitos carry a number of diseases that are problems for humans, including malaria, West Nile virus, yellow fever, dengue fever, Zika, and others. Mosquitoes kill far more people than any other animal, probably numbering in the millions per year. It's likely that some planters have been infected with West Nile from mosquito bites, although the age range and health characteristics of planters make it likely that affected planters have either been asymptomatic, or have simply assumed that they have a light case of influenza. The average life span of a female mosquito is six to eight weeks, but the male typically only lives for about a week and a half.

Black Flies (family *Simuliidae*) – There are about 2200 known species of black flies. Typically, female black flies try to feed on the blood of mammals, although males typically feed on nectars. These insects are very annoying to people who live in rural settings, especially in wetter regions such as northern Ontario, where they drive some planters to the point of literal mental breakdowns. Many regional governments have eradication programs. Black flies are a big problem for cattle in some parts of Canada, as their incessant biting leads to weight loss and occasionally even kills cattle. Black flies lay their eggs in running water, rather than polluted water. There's a song called "Black Fly" that was written by Wade Hemsworth. A video for this song can be found in the media links for this appendix.

No-See-Ums (family *Ceratopogonidae*) – There are about five thousand species of this family of flies, and they are also known commonly as biting midges. Like black flies, they frequently feed on nectar, but the females seek out the blood of vertebrates to get protein for their eggs. No-see-ums are much smaller than mosquitos, with an adult fly being about as long as the graphic tip of a pencil is wide (only a couple millimeters long). That means that a typical mosquito is about five to ten times larger by comparison. No-see-ums are small enough to pass through typical window screening, but on a positive note, they are repelled by DEET.

Mountain Pine Beetle (*Dendroctonus ponderosae*) – The MPB is a specific species of bark beetle which is native to the forests in Western North America. It is probably most well-known for the devastation that it has caused to forests in BC over the past decade and a half, although its range has traditionally extended down to Mexico, and it's been a known insect in BC for more than a century. To date, the beetle has destroyed about thirty percent of BC's total forested area, although the rate of destruction has slowed significantly in the past few years (probably because the beetles are running out of food). The MPB usually lives in a wide variety of pine species (ponderosa, whitebark, Scotch, and Jack), but the problem in BC has been with the large numbers of lodgepole pine that have been destroyed. The infestation cycle begins when the beetles lay eggs under the bark. They introduce a "blue stain" fungus into the sapwood that prevents the tree from responding to the attack. Dime-sized extrusions of resin, called pitch-tubes, start to appear all over the trunk of the tree. Within a few weeks, the tree is dead, although it takes about a year before the needles turn red, and another year or two after that for the needles to completely drop. These beetles are quite small, only about half a centimeter long at maturity. Historically, the beetles were controlled by deep-freezing in winter. Temperatures need to drop to approximately -40^{o}C for a period of 7-10 days to kill the beetles. It is believed that global warming over the past few decades is the reason that these low temperature freezes haven't been achieved, thus allowing the beetles to survive much longer than a typical infestation bloom. At this point, the beetles are now fairly well established in northern and central Alberta, and are slowly working their way eastward, and have caused similar destruction all over the US west coast and parts of the Midwest. For more insights into the MPB, read a book called Empire Of The Beetle, which I found to be quite fascinating. The author is Andrew Nikiforuk. There should be a link at www.replant.ca/books

Spruce Beetle (*Dendroctonus rufipennis*) – The spruce beetle is found throughout most of Canada, although populations seem to be greatest in BC, Ontario, Quebec, and the Maritimes. I guess that's maybe because that's where most of the spruce trees are. Spruce beetles attack Englemann, white, Sitka, and Colorado blue spruce species, with white and Englemann being their preferred hosts. They are typically more

attracted to blowdown or dead logs than they are to live trees, and if they're going to attack a live tree, it's usually a mature tree rather than a juvenile. They are slightly larger than the mountain pine beetle, but only by a couple of millimeters. Despite their small size, they do a lot of damage, and have recently become more noteworthy in BC even as the pine beetle is starting to decline.

Sawyer Beetle (*Monochamus scutellatus*) – This insect is also commonly called the white-spotted sawyer, or spruce sawyer. The sawyer beetle has a small white spot at the base of the wings (upper back). These beetles typically live for about one to four years. They feed on both pine and spruce trees, and use dead or dying trees or logs as the host for the eggs that they lay. Although they prefer dead trees, sawyer beetles and similar wood-boring insects cause significant losses to the logging industry, and are considered to be economic pests. These beetles are quite large (their bodies are often two inches long), and their antenna are even longer. These beetles have a rudimentary ability to fly. They're also one of the largest insects that you'll encounter while planting.

Pitch Blister Moths (*Petrova metallica*) – The common name for this pest, long form, is the metallic pitch blister moth. This moth is found all over western Canada. Planters probably won't notice it, but it's significant because it causes some long-term damage to commercial conifer stands. The injury to the host results from larval feeding. The larvae feed on new branch shoots and sometimes on the leaders. This leads to dead terminals, crooked leaders, and height reduction in the host. The pitch blister moth attacks juvenile trees more frequently than mature trees, especially those that are five meters in height or less. Single-species stands (such as replanted cut blocks) can exhibit especially high populations of this pest. Some other insects and birds may help curtail growth of the pitch blister moths, but there are no widely recommended management approaches.

There are about 5.5 million other species of insects throughout the world, of which about 55,000 can be found in Canada. If you don't like bugs, you'd better learn to get used to them.

For more photo and video resources associated with this appendix, visit:
www.replant.ca/training/insects