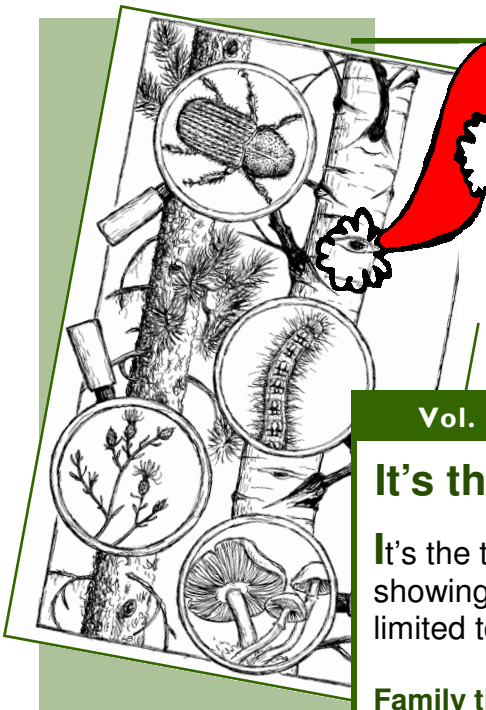


Bugs & Diseases

Vol. 26 No. 3 December 2015

Alberta's eye on forest health

Issue highlights:

Alberta Government

It's the Thought That Counts...

It's the time of year to look forward to spending time with family and showing each other how much we care by giving the perfect gift. This isn't limited to just humans though, insects exhibit this kind of behaviour too!

Family time in ambrosia beetles: The majority of ambrosia beetle species tunnel into the heartwood of weakened trees, where they cultivate fungus as a food source. Like termites, bees, and ants, many ambrosia beetles are eusocial; they live in colonies with many individuals and overlapping generations. Just like human families, every individual in the colony has their job. The brood are responsible for enlarging the gallery and sweeping up the poop (frass). Adults protect the brood and shuffle the frass balls out of the gallery, while everyone helps take care of the fungus garden. And as with many human families, the mother runs things: The matriarch of the ambrosia beetle colony is the sole egg-layer, while the other females care for the offspring. Once the colony is thriving, subordinate females strike out on their own to start their own colonies and become matriarchs in their own right.

Gift-giving in dance flies: Insects are some of the best gift-givers because they give such a wide variety of gifts in many different ways. But here's where it gets a bit racy…these are usually nuptial gifts; gifts that male insects give to females during courtship and mating, often to convince the female that he's Mr. Right. The gift might be "homemade", containing proteins, lipids and minerals wrapped up in saliva or a spermatophore (sperm 'accessory'). These are generally gifted during mating (deposited right along with his proper sperm in her reproductive tract), which are thought to boost the female's fecundity and lifespan. Male dance flies tend to go with the tried and true "store-bought" variety of gift, i.e. insect prey items, sometimes wrapped in a bit of silk. The male presents this to the female (often with a little dance number), and proceeds to mate with her while she's distracted. After all, she is a voracious predator with few qualms about eating her potential mate! However, catching this gift for his lady is an energetically expensive task and some males have begun cheating, by providing inedible silken balloons to the female. Despite being inedible, this gift seems to mesmerize the female and gives the male an opportunity to mate. Sounds a lot like giving cubic zirconia and calling it a diamond…

Anyhoo, enjoy the holidays, be it tending the family fungus garden or giving your loved one beautiful balls of silk. **Merry Christmas!**

Caroline Whitehouse — Edmonton

What's the Buzz...Moths of the Mountains

Sometimes in life when you're looking for one thing, you'll find something completely different. It turns out the same philosophy also applies when you're examining a genetic trial of pine trees! In late September, I was assisting with *Dothistroma* assessments at a site on Whitecourt Mountain, when we noticed something 'pitchy' was going on in these young Lodgepole pine (*Pinus contorta*).

The large glob of pink-cream coloured pitch (shown right) was hard to miss on the pine's bole as it measured approximately 8cm in width. Forest Health Guru Tom Hutchinson was present and he started peeling into the pitch mass, revealing a larva that was part of the Clear Wing moth family Sesiidae.

As shown below, the larva was cream coloured with a brown head capsule, 2-3cm in length. After further investigation, it is suspected that this larva is an individual known as *Synanthedon novaroensis*, or the Douglas-Fir Pitch Moth. The larvae in the genus *Synanthedon* are very similar, but the Douglas-Fir Pitch Moth has been known to have a range that includes Whitecourt, Alberta.

So what's the buzz with the Douglas-Fir Pitch Moth? Is it going to cause mortality in this pine stand and be the next epidemic? Luckily no, the damage will probably be limited to what you see in the photo above. The Douglas-Fir Pitch Moth will only be able to kill a small tree after repeated attacks. The adult will lay its eggs in bark crevices in June or July, and the eggs will hatch into larvae within a few weeks. The larva then starts eating into the inner bark and outer sapwood, and creates the pitch mass out of a combination of frass, silk, and the tree's defensive pitch. It takes two years for the Douglas-Fir Pitch Moth to complete its life cycle; the pupal stage takes a month, and then the adult will break out of the pupal case in early summer.

Small, dark, blisters of pitch were also found on a few of the pine trees in the Whitecourt Mountain genetic site on the tree's branch nodes. Peeling back these pitch blisters revealed a different, orange-brown larvae of approximately 15-17mm in length (shown in photo below). This larva was identified as a Pitch Blister Moth, or *Petrova albicapitana*, which is known to be widespread throughout the Province.

The life cycle of the Pitch Blister Moth has many similarities to that of the Douglas-Fir Pitch Moth. The Pitch Blister Moth has a two year life cycle, and the larvae will pupate in their pitch mass. The adult will lay its eggs near the base of a terminal bud, which is where the first pitch-mass will be formed. Months later, the larvae will create a new pitch mass for over-wintering, as well as creating a third and fourth pitch-mass in the spring and June respectively. Pitch masses are up to 20mm in diameter, and are composed of a combination of pitch, frass, and a layer of silk from the larvae. The pitch-blisters they create are smooth and uniform in colour.

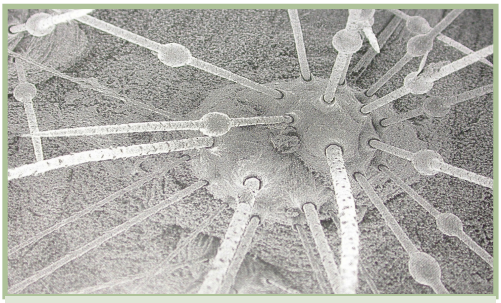
The damage done by the Pitch Blister Moth is usually minimal. The larvae's cambial feeding does not usually girdle stems or twigs, but it may weaken the stems or twigs, making them more prone to breakage. If the feeding of the Pitch Blister Moth does girdle the twig, the foliage of the affected shoot will fade, and the branch may break at the point where the pitch-mass was formed. Furthermore, if the tree is constantly attacked, it may lead to physical deformities.

In the Whitecourt Mountain genetic trial site, the trees did not show any signs of serious damage as a result of the Pitch Blister Moth nor the Douglas-Fir Pitch Moth. Their presence is unlikely to result in serious consequences, but it would be worthwhile to monitor the population levels in future years as these genetic sites are important sources of information for years to come.

Allison Brown—Upper Athabasca Region

Gypsy Moth Detection in NE AB One Year Later—Good News and Bad News

In the December 2014 edition of this newsletter it was reported that Gypsy Moth (*Lymantria dispar*) had been positively identified from a trap close to Ft. McMurray – in Gregoire Lake Provincial Park. Subsequent DNA analysis conducted by the Canadian Food Inspection Agency (CFIA) confirmed that the moth was the European (aka North American) sub-species of this insect. This in, and of itself, was important information as European Gypsy Moth females are not capable of active flight. Their natural mode of dispersal and finding suitable host trees is by "ballooning." The newly hatched larvae.(1st instar) have two types of hairs (or setae) – long thin, 'filiform' ones and others with little air filled chambers called 'aerophores.' These are thought to enhance the ballooning capacity of this insect. For long range dispersal the European Gypsy Moth must rely on human-assisted movement of its egg masses, which the adult female deposits on natural and man-made objects. Females of the Asian sub-species, on the other hand, are capable of active flight and therefore, much more difficult to contain.



Aerophores. Image source: CFIA

Knowing the sub-species is important, however, it is only one of several important criteria determining the appropriate response to a new pest being detected. Once a pest species of significant concern (such as European Gypsy Moth) is detected it is important to determine whether or not it has established a naturally reproducing population, and whether or not it has spread beyond the initial point of detection. To accomplish this, the CFIA initiated a two year delimitation survey in and around the park. The number of traps set was greatly increased (from one to 31), as was the area covered by the survey. The **good news** from the initial year of this delimitation survey is that even with the far greater survey intensity, no more gypsy moths were captured in the vicinity of Gregoire Lake. The CFIA will continue its increased surveillance in 2016. If those results also prove to be negative, then it would be reasonable to assume that the insect was unable to sustain itself beyond the initial detection – at least for that particular area.

Now the **bad news**. As mentioned in the Dec. 2014 article, Forest Health and Adaptation staff have been assisting the CFIA's Gypsy Moth monitoring program by setting out and collecting traps throughout the province's Green Area. During the 2015 survey season, a second European Gypsy Moth was identified from another one of these monitoring sites, about 60 km south of Ft. McMurray. This site is approximately 40 km south west of Gregoire Lake, so probably not connected to the first detection. The CFIA will now have to conduct a delimitation survey around the new detection point, starting in 2016.

The prospect of Gypsy Moth becoming established in Northern Alberta is disconcerting. This is not only because this is one of the most damaging forest insects in eastern North America, but also because the possible regulatory response could have huge implications. The CFIA has extraordinary powers to establish regulated (quarantine) areas under Canada's Plant Protection Act for pests like Gypsy Moth. The movement of things out of a regulated area to other parts of Canada and the USA can be subject to inspection and certification. "Things" are very broadly defined and could include a diverse array of items from vehicles and machinery, to logs, or even garden gnomes. Indeed, this could make for a very difficult situation affecting industrial, recreational, or any other activities.

Egg masses. Image source: CFIA

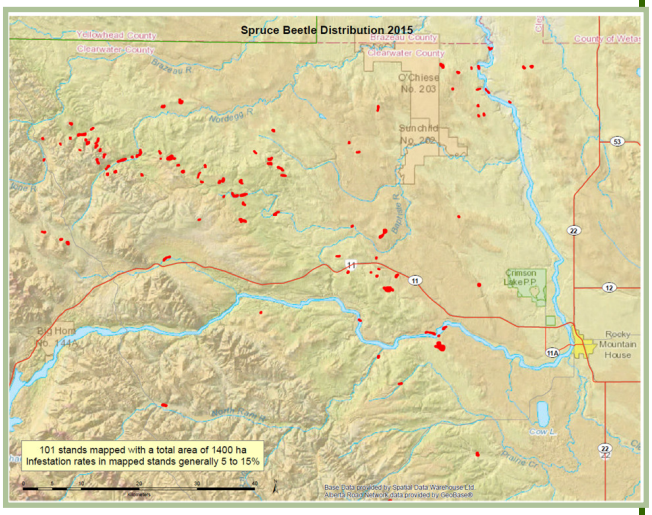
Forest Health and Adaptation will continue to work with the CFIA, to help monitor for Gypsy Moth throughout the Green Area of the province, and assist with delimitation surveys in whatever capacity necessary. It is important to work together to ensure invasive forest pests, such as Gypsy Moth, do not become established in Alberta. The two Gypsy Moth detections so far may well prove to be isolated events...one can only hope that will be the case. So, fingers crossed (and perhaps toes crossed too), that we will be spared the prospect of having to deal further with Trouvelot's accidental introduction. Stay tuned, hopefully we have found the last Gypsy Moth in Northeastern Alberta.

European (left) and Asian (right) female gypsy moths. Photo: Natural Resources Canada, Canadian Forest Service.

Tom Hutchison— Edmonton

Spruce Beetle Update in the Rocky Mountain House Area

This summer in the Rocky Mountain House area we mapped 1400 hectares with spruce beetle (*Dendroctonus rufipennis*) infestations. Currently 950 hectares have low infestation rates less than 15% with the remaining 450 hectares have around 25%. Approximately 80% of these infestations are in creek bottoms, mainly in the Baptiste, Nordegg and Wawa.



After chasing this beetle around for the past two years trying to accurately map and predict population expansion it appears that the spruce beetle in this area has a two year life cycle which can make mapping quite difficult.

Second spring after attack showing reddish appearance with new beetle brood overwintering as adults.

The first year the tree is attacked the spruce beetle brood overwinter as larvae and the tree stays green until the following spring in late April and early June when most of the needles fall off leaving only the fine branch stubs giving the tree an overall reddish appearance. The brood then develop into adults over the summer and in the fall many of the brood move down to the lower bole and duff to overwinter.

Along with this quick needle drop and subtle fade confounding our mapping efforts we have also found that there is an inordinate amount of strip attack over multiple years which can make categorizing infested trees by year of attack virtually impossible.

While 1400 hectares may not seem like an alarming amount of beetle there are significant populations building to the west of us in British Columbia. About 300,000 hectares were mapped in central BC last summer which was a 15% increase over the year before.

There is also a large population building to the south of us in Colorado of 200,000 hectares. The outbreak in Colorado is thought to be the result of drought and warmer than usual winter. The population to the north of us in the Yukon and Alaska appears to be on the decline after reaching 350,000 hectares in the Yukon and around 1.5 million hectares in south central Alaska.

Secon

Pam Melnick - Red Deer/North Saskatchewan Region

Mountain Pine Beetle Update

Aerial surveying for red trees killed by mountain pine beetle was completed on September 15th. Within the leading edge of the infestation there were on average 5.6 red trees per surveyed site this year, down from the 6.8 red trees per site last year. The drop in red tree number is likely due to relatively low beetle productivity over the past two years, the sustained and aggressive control program, and the harvesting of infested stands by industry partners.

The largest drops in the number of red trees were in areas south of Grande Prairie and east towards Whitecourt. Numbers in the Hinton area are similar to last year (with some range expansion). Red tree numbers are up in the eastern edge around Slave Lake.

This coming year the Province expects to control about 109,000 trees in over roughly 12,000 high priority sites. This is a slight decline compared to the 129,000 trees controlled over 16,200 sites last year.

Ground surveying began in some areas in mid-November, and will be followed by control work that will continue until the end of March.

In total, there are 7 contracted companies working on 11 survey and control projects:

Upper Peace Region has 6 projects between 3 companies

81,597 estimated control trees
6,745 estimated sites

Upper Athabasca Region (Central District) has 3 projects between 3 companies

16,866 estimated control trees
2,754 estimated sites

Upper Athabasca Region (North District) has 1project and 1 company

7465 estimated control trees
1342 estimated sites

Upper Athabasca Region (South District) has 1 project and 1 company

2,719 estimated control trees
985 estimated sites

Mike Undershultz & Devon Belanger—Edmonton

2015 Biocontrol Summary

This past summer was the third season of Forest Health & Adaptation's biocontrol program. For the un-initiated, biological control/biocontrol is the use of insect and pathogen pests from an introduced, invasive plant's country of origin and used for control.

This season an additional release was made of the stem-mining weevil *Mogulone crucifer* on hound's-tongue in the Porcupine Hills and one of the seed-feeding weevil *Omphalapion hookeri* on scentless chamomile west of Whitecourt. All previous releases of these agents have established and are working hard.

A 2014 mass rearing attempt of the common toadflax stem-mining weevil *Mecinus janthinus* was less than spectacular, yielding only three insects. It's likely the problem was plant stem diameters too small to be attractive for egg-laying or support larval development. Another attempt was made this year using much larger plants with hopes of a greater magnitude of weevil emergence in the early summer of 2016. Two releases of this insect purchased from McClay Ecoscience were made this summer; one just north of Athabasca and the other down in the Castle area south of the Crowsnest Pass. While this agent has been available for many years, establishment has been difficult in Alberta and populations that have established took many years build their numbers.

Two new common toadflax agents were received this year, one from Agriculture and Agri-Food Canada (AAFC) and one from the B.C. Ministry of Forests, Lands and Natural Resource Operations. The stem-galling weevil *Rhinusa pilosa* from AAFC was approved for field releases in 2014 and now habitat limits are being investigated. This batch of insects went to a toadflax patch near the *Mecinus* release just north of Athabasca. About 162 galls containing the root-galling weevil *Rhinusa linariae* were received from B.C. in early August and put into winter storage. This agent has established in B.C. and has significantly reduced the toadflax where it has been released. Some potted toadflax plants were coddled through the summer to develop their root mass, are being overwintered, and will go into the tent in the spring with the weevils.

Further collections of tall buttercup (*Ranunculus acris)* plant material was collected from around the Green Area this summer and again shipped to New Zealand. Molecular analysis of the plant material will help to further identify whether both Alberta and NZ are dealing with the same species.

On October 23rd the North American Invasive Species Management Association hosted a one-day biocontrol consortium seminar. This was a rare opportunity to listen to and chat with biocontrol research scientists from CABI in Switzerland. Updates on the agent search and screening progress for eighteen different invasive plant species was covered. Thirteen of these plant species are present in Alberta. It should be noted that these consortiums fund the entire process, from search to importation, of

Marian Jones—Red Deer/North Saskatchewan Region

Eastern larch beetle: Biology and Life History

This is the first of two articles on the eastern larch beetle that will appear in this newsletter. This issue gives a brief introduction of the biology and life history of the eastern larch beetle. The April 2016 issue will focus on the eastern larch beetle as an agent of forest disturbance, the beetle activity currently occurring in Alberta, and will outline some of the future plans the forest health team has for examining eastern larch beetle activity in Alberta.

The eastern larch beetle, *Dendroctonus simplex* LeConte, (Fig. 1A & B) is a bark beetle native to North America [3]. The range of the beetle is sympatric with its principal host, the eastern larch (tamarack), l, and extends throughout the boreal forest of North America [9]. The eastern larch beetle is one of the few species of North American bark beetle – and the only member of the *Dendroctonus* genus – that attacks and colonizes tamarack [14]. However, laboratory studies have shown that eastern larch beetles can reproduce very successfully in logs of western larch, *L. occidentalis* [2]. Beetle reproduction is also possible – but limited – in logs of Rocky Mountain Douglas-fir, *Pseudotsuga menziesii* var. *glauca* [1].

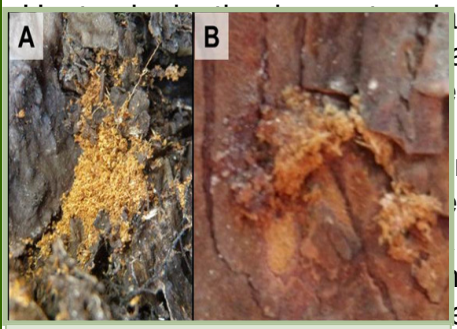


Figure 2. Photo: Fraser McKee

rch beetles is facilitated via
attract conspecific beetles to a
mio-chemical communication helps the beetles to attract mates

ree being attacked. The eastern larch beetle colonizes the
r
responsible for conducting
e roots and the foliage. Beetles access the phloem by chewing
entering the phloem, the beetles mate and begin to excavate
nich to deposit eggs [14]. As the number of beetles colonizing a
s of the parent beetles soon begin to intersect and become a confused network [5]. Early Indications that a tamarack is being colonized by eastern larch beetles is the presence of bright orange frass on bark scales and in bark crevices (Fig. 2A), as well as orange, resin-soaked “frass plugs” found under bark scales and that cover the egg gallery entrance are [6,9] (Fig. 2B).

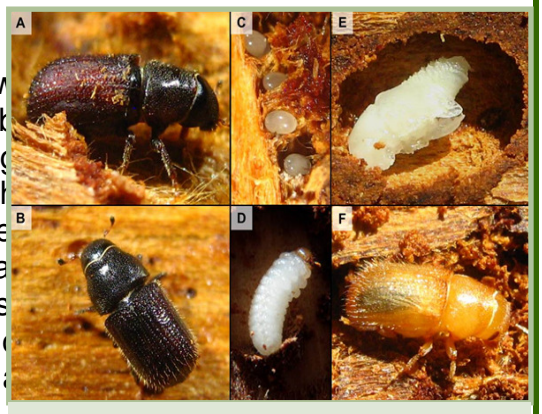


Figure 1. Photo: Fraser McKee

Fully mature eastern larch beetles are 3.5 – 5.0 mm long, w
covers (elytra) are iridescent maroon, while the rest of the b
B). Eggs are white, oval, and approximately 0.9 mm in leng
into the margins of the egg gallery (Fig. 1C). Larvae are wh
ange head capsule (Fig. 1D). Larvae are 1 – 5 mm long de
(Fig. 1E) average 5 mm in length and have visible appenda
darken with maturation. Young adult beetles recently eclos
‘callow’ or ‘teneral’ adults. Teneral adults are initially white
darkening to chestnut brown, and finally achieve the black
maroon colours of a mature beetle [3,9,14].

The timing of the life-cycle of eastern larch beetles is variable depending on geographic location, climate, and annual weather conditions. In general, mature beetles emerge in the early spring (mid April – mid May) from trees attacked the previous year and in which the

beetles completed development and over-wintered. Following emergence, the parent beetles disperse via flight to locate and colonize a new host tree in which to reproduce. A single eastern larch beetle female can establish up to three offspring broods per year. Parent beetles may re-emerge from colonized host trees, re-disperse, and establish a second brood in an additional host tree. A third brood may be established following a second re-emergence period by parent beetles [3,4,5,6,10,13]. Offspring broods established by the same female are termed 'sister' or 'sibling' broods.

Eggs of the first sibling brood are generally laid within 14 days of parent beetle emergence on the spring. Eggs generally begin to hatch within 7 – 14 days. Larvae are found feeding in the phloem in various stages of development throughout the summer and fall (June – October) depending on when the eggs of a particular brood were laid and environmental conditions. Pupae are present throughout the summer and fall (June – October). Young adult beetles ranging in colour from tan to fully black and maroon are found under the bark from July until the onset of winter, with darker individuals being more prevalent as the year progresses. Many young adult beetles will exit the pupal chamber, chew through the bark, drop to the base of the host tree, and re-enter the bark to overwinter in specially constructed hibernal galleries. Other young adults will overwinter in the pupal chamber [4,5,6,13]. Young adult beetles that await winter either in the hibernal galleries or pupal chambers are considered to enter quiescent state [6]. It has been suggested that young eastern larch beetles enter diapause prior to winter [4,5]. However, it appears possible for beetle to avert or delay diapause [6,7] potentially in response to environmental conditions. However, more research regarding this aspect of the beetle's biology is required. The percentage of young beetles that re-position themselves prior to winter varies from 15 – 85% and appears to vary with brood maturity and annual weather patterns [6,9]. The re-positioning of young beetles to the base of the host tree helps ensure the beetles are beneath the snow line during the winter. This behaviour may an adaptive trait to reduce over-wintering mortality due to extreme winter temperatures since temperatures beneath the snow can be up to 20°C warmer than ambient air temperatures [12,13]. Nevertheless, eastern larch beetles are extremely cold hardy. Adult beetles and larvae can survive temperatures as low as -42 and -49°C, respectively [11].

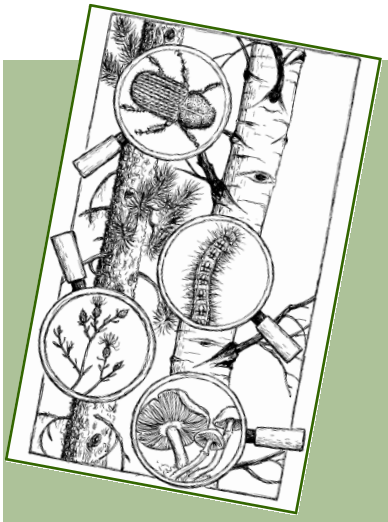
Eastern larch beetles were suspected of possessing an obligate uni-voltine lifecycle capable of only a single reproductive generation per year (i.e., the spring-emergent parent beetles). An obligate over-wintering period was suggested as a requirement for young beetles to

become reproductively mature [5]. However, recent laboratory data indicates that young beetles do not require overwintering period to become reproductively viable [7]. Moreover, recent field data suggest that eastern larch beetles can exhibit more than a single reproductive generation per year under natural field conditions. In such cases, the young adults from the first sibling brood emerge from natal host trees during the summer, attack new hosts, and successfully reproduce to establish the second generation of offspring for the year[6]. The reason for this shift in beetle voltinism is not definitively known. However, the shift may be related to climate warming and increased summer temperatures in areas along the southern margins of the beetle's range where mutli-voltinism of eastern larch beetles is reported. This new information on the reproductive biology of eastern larch beetles has important implications when considering the potential of this insect to become an important agent of forest disturbance under climate change scenarios.

Fraser McKee—Lower Athabasca Region

References

1. Dodds, K. J., D. W. Gilmore, and S. J. Seybold. 2010. Assessing the threat posed by indigenous exotics: a case study of two North American bark beetle species. Annals of the Entomological Society of America **103**:39-49.
2. Furniss, M. M. 1976. Controlled breeding, comparative anatomy and bionomics of *Dendroctonus simplex* LeConte and *Dendroctonus pseudotsugae* Hopkins (Coleoptera: Scolytidae). Department of Entomology Anniversary Publication # 15, University of Idaho, Department of Entomology, Moscow, ID, U.S.A.
3. Hopkins, A. D. 1909. The eastern larch beetle. The Douglas fir beetle. Bulletin #83, Part #1, USDA - Bureau of Entomology, Washington, D.C., U.S.A.
4. Langor, D. W. and A. G. Raske. 1987a. Emergence, host attack, and overwintering behavior of the eastern larch beetle, *Dendroctonus simplex* LeConte (Coleoptera: Scolytidae), in Newfoundland. The Canadian Entomologist **119**:975-983.
5. Langor, D. W. and A. G. Raske. 1987b. Reproduction and development of the eastern larch beetle, *Dendroctonus simplex* LeConte (Coleoptera: Scolytidae), in Newfoundland. The Canadian Entomologist **119**:985-992.
6. McKee, F. R. 2015. Biology and population dynamics of the eastern larch beetle, *Dendroctonus simplex* LeConte, and its interactions with eastern larch (tamarack), *Larix laricina*. University of Minnesota, St. Paul.
7. McKee, F. R. and B. H. Aukema. 2015. Successful reproduction by the eastern larch beetle (Coleoptera: Curculionidae) in the absence of an overwintering period. The Canadian Entomologist **147**:602-610.
8. Prendergast, B. F. 1991. The chemical ecology of the eastern larch beetle, *Dendroctonus simplex* LeConte, and the spruce beetle, *D. rufipennis* (Kirby). M.Sc. thesis. State University of New York, Syracuse, NY, USA.
9. Seybold, S. J., M. A. Albers, and S. A. Katovich. 2002. Eastern larch beetle. Forest Insect & Disease Leaflet #175, United States Department of Agriculture - Forest Service, Northern Research Station, St. Paul, MN, U.S.A.
10. Simpson, L. J. 1929. The biology of Canadian bark beetles. The seasonal history of *Dendroctonus simplex* Lec. The Canadian Entomologist 61:274-279.
11. Venette, R. C. and A. J. Walter. 2008. Connecting overwintering success of eastern larch beetle to health of tamarack. Pages 167-169 in K. M. Potter and B. L. Conkling, editors. Forest health monitoring: 2008 national technical report. General Technical Report SRS-158. United States Department of Agriculture - Forest Service, Southern Research Station, Ashville, NC,



Oh tiny weevils
We know it is a lot to ask
Of ones so small, to try at all
Such a herculean task

Still, we want
Expect, and need
You to do, what we ask of you
And control a nasty weed

So off you go
Please do your stuff
We'll set you free, and hope to see
All the plants that you will snuff

Tom Hutchison—Edmonton

Bugs bugs bugs…
Why do people think
They're all tiny pests
Or taking us to the brink

Of eco-enviro-chaos
Some bugs are pretty cool
Biodiversity, dude –
Remember that from school?

Most known life forms
Are insects or arthropods
"an inordinate fondness for beetles"
Was how Haldane described god

They pollinate, they masticate
They circulate nutrients
They also can affect
forest disturbance

Insects are a lot more
Than just "bugs" or "pests"
As long as they're outside, that is
Otherwise get rid of that mess!

Jodie Krakowski—ATISC