SCIENTIFIC NOTE

Pissodes strobi attack on lodgepole pine in the Kamloops Timber Supply Area

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In July 2022, we observed white pine weevil, *Pissodes strobi* (Peck) attack on lodgepole pine, *Pinus contorta* Dougl. var. *latifolia* Engelmann, in the Jamieson Creek area, northwest of Kamloops. The affected stand was about 20 years old, in the MSdm3 (Montane Spruce dry, mild) biogeoclimatic zone (Lloyd *et al.* 1990). There were small patches of planted and naturally occurring interior spruce, *Picea engelmannii* × *glauca* Parry ex Engelmann, with lodgepole pine comprising the major component of the stand. Most spruce within the stand had sustained one or more *P. strobi* attacks and, as a result, had very poor form, severe defects, and multiple tops, all of which were attacked. *Pissodes strobi* attacks many species of spruce (Furniss and Carolin 1977) in B.C., and although lodgepole pine is listed as a host (Humble *et al.* 1994; Turnquist and Alfaro 1996), records of it attacking lodgepole pine are rare (BCMOF Regional Entomologists, personal communication). Of 631 collections of *P. strobi* in B.C. (Humble *et al.* 1994), only 2.7 per cent were from lodgepole pine, none of which was from the Kamloops Timber Supply Area. In our field observations, *Pissodes strobi* oviposited in the one-year-old terminal of affected lodgepole pine, exactly like its habit on spruce. When oviposition and larval feeding occurs on one-year-old growth, it kills at least two years of terminal growth. There were numerous chip cocoons, diagnostic of many *Pissodes* species, and visible emergence holes showing evidence of successful adult emergence from attacked pine leaders (Fig. 1). Attacks caused severe defects and poor stem form, including multiple tops (Maclauchlan and Brooks 2020), on all affected lodgepole pines (Fig. 1). This damage differs from that of the lodgepole pine terminal weevil, *Pissodes terminalis* (Hopping), which oviposits and feeds solely on the current year's growth (Cameron and Stark 1989; Fig. 2). Final maturation occurs in the pith, so no chip cocoons are created.

To better understand and describe attacks by *P. strobi* on lodgepole pine, we conducted surveys and walk-through assessments in similarly aged stands in the Jamieson Creek and Community Lake areas located in the Kamloops Timber Supply Area. We established ten 3.99-m-radius circular plots in the stand where *P. strobi* attack on lodgepole pine was initially observed (Jamieson Creek). Five plots (attack plot) had a *P. strobi*–attacked lodgepole pine as the centre point, and five plots (control plot) were randomly located within the stand. We specifically

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chose a *P. strobi*–attacked lodgepole pine as the centre point for attack plots to determine if these trees were in closer proximity to spruce (attacked or unattacked) and therefore more likely to be attacked, and to assess tree form and year of attack. Basic information was recorded for each centre tree within each plot, including stem form (Maclauchlan and Brooks 2020). In six additional stands (Community Lake area), we conducted a general walk-through to search for *P. strobi* attack on lodgepole pine and spruce.

Figure 1. *Pissodes strobi* attack on lodgepole pine showing resultant stem form (left, middle) and weevil emergence from chip cocoons (right). Photographs by L. Maclauchlan.

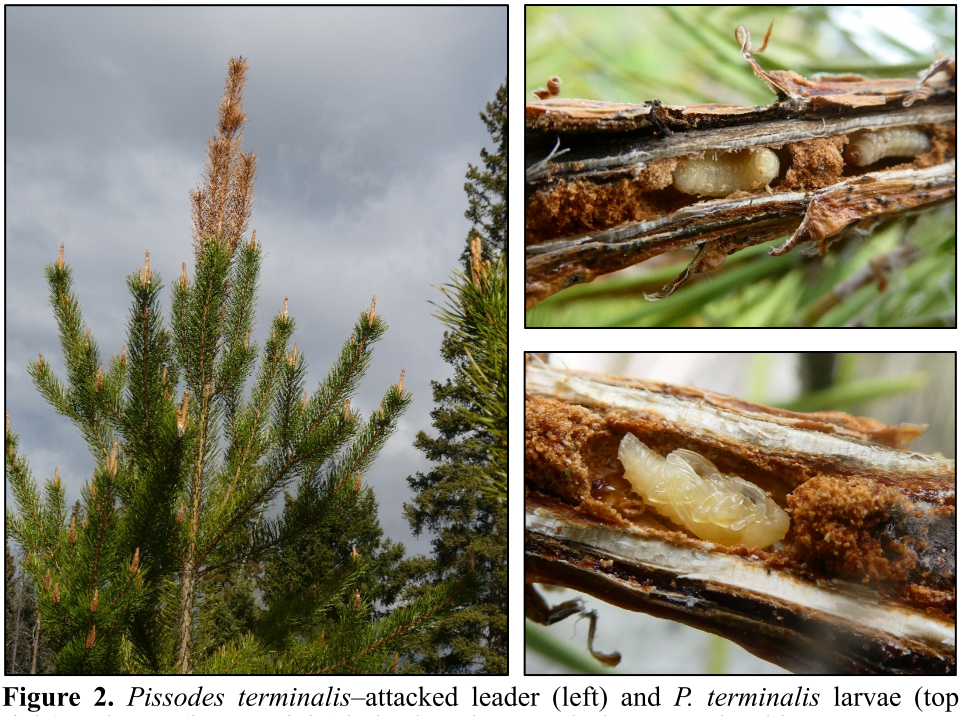


Figure 2. *Pissodes terminalis*–attacked leader (left) and *P. terminalis* larvae (top right) and pupa (bottom right) in leader. Photographs by L. Maclauchlan.

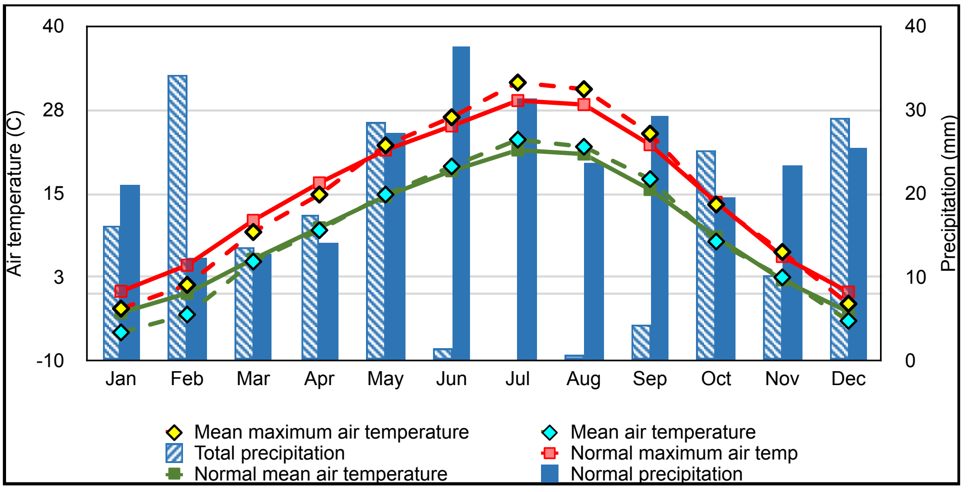
At Jamieson Creek, the ratio of spruce to pine was higher in attack plots, yet there was no significant difference (*t*-test; $P > 0.05$) in density or percent spruce or percent spruce attacked by *P. strobi* in either the attack plots or the control plots. *Pissodes terminalis* was also present in the stand. Of the total lodgepole pine assessed (all plots combined), only 1.5% of trees had both *P. strobi* and *P. terminalis* attack. The average height of *P. strobi* attack on lodgepole pine was 1.6 m, thus affecting the most economically valuable portion of the tree bole.

At Jamieson Creek, the incidence of *P. strobi* attack on spruce was not significantly different between the attack and control plots, with an average of 37% in the attack plots and 46% in the control plots. However, because we selected an attacked lodgepole pine as the centre tree for the attack plots, 21% of lodgepole pine had *P. strobi* attack in the attack plots, whereas fewer than 3% of lodgepole pine were attacked in the control plots. The majority of spruce in these stands had multiple attacks per tree, thus forming multiple tops. The year of attack is determined by counting the number of major branch whorls from the point of attack to terminal leader, taking into consideration that *P. strobi* oviposits in one-year-old growth. Most *P. strobi* attack on lodgepole pine occurred in about 2017–2018, resulting in major stem deformities (Fig. 1). A few older attacks and new 2021 attacks by *P. strobi* on pine were also noted.

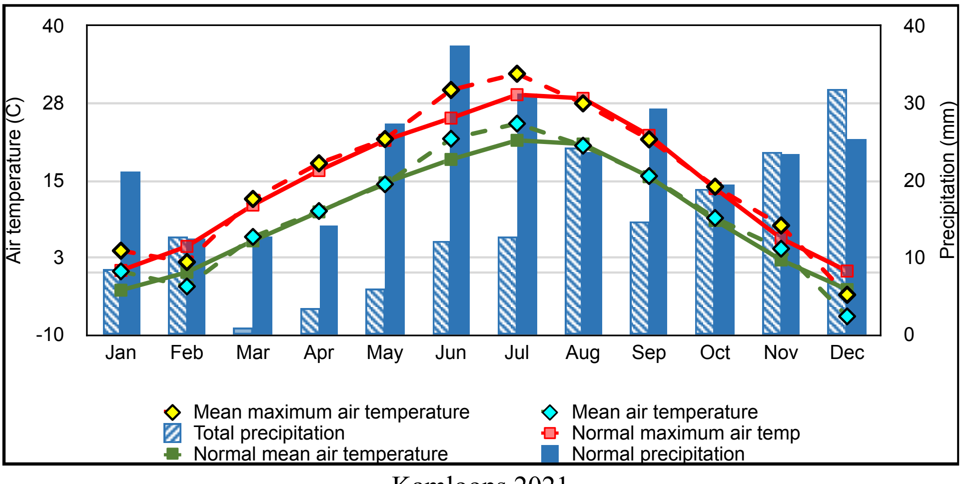
In 2017, many young regenerating stands in the southern interior of B.C. were severely impacted by drought. Then, in 2021, an unprecedented heat dome and drought affected forests throughout the province. Figure 3 shows the extreme climatic conditions recorded in Kamloops in 2017 and 2021, where notably in 2017, there was almost no precipitation and very high temperatures from June through September, a critical developmental time for *P. strobi*. These climatic events negatively affect both young and old forests of all species and can exacerbate the incidence and severity of many damage agents.

Six additional walkthrough assessments were conducted in July 2022 in the Community Lake area (northeast of Kamloops) with three stands in the IDFdk2 (Interior Douglas-fir dry, cool) and three stands in the MSdm3; however, no plots were established. *Pissodes strobi* attack on lodgepole pine was evident in four of the randomly selected stands. Once again, 2017–2018 were the most predominant years for attack on pine. Two of the affected stands were in the IDFdk2, and two in the MSdm3. There were also high levels of *P. terminalis* attack in all stands, particularly in 2021.

These survey results suggest that *P. strobi* attack on lodgepole pine may be something to monitor in the future as we experience longer and warmer growing seasons. The attacks occurred during or after particularly warm and dry growing seasons (Fig. 3). *Pissodes strobi* attack levels on its primary host were high in these stands, even though spruce was a minor component of the stands, and given the longer developmental time available, brood can easily develop from egg to adult in one season (McMullen 1976). Thus, *P. strobi* populations may be able to increase more rapidly on spruce hosts and possibly spill over onto lodgepole pine. Because these stands are predominantly lodgepole pine, with low levels of interior spruce, emerging *P. strobi* may resort to attacking lodgepole pine more frequently. Although we observed successful development and emergence of *P. strobi* from lodgepole pine, no studies have been conducted on the relative reproductive success of this insect in lodgepole pine. More surveys should be conducted to determine the extent and frequency of this phenomenon.



Kamloops 2017



Kamloops 2021

Figure 3. Kamloops climate data from 2017 and 2021 showing monthly total and normal precipitation; mean maximum and normal maximum air temperature, and; mean and normal mean air temperature. (Supplied by Vanessa Foord, Research Climatologist, BC Ministry of Forests, Regional Operations Division - North Area, Prince George, B.C.)

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