The first records in Norway of *Pityogenes saalasi* Eggers, 1914 (Coleoptera, Curculionidae, Scolytinae) and notes on the biology

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The first records in Norway of *Pityogenes saalasi* Eggers, 1914 are presented from Lierne, in Nord-Trøndelag County. Observations on the biology and the distribution are presented and discussed. Host trees are slow-growing and old Norway spruce (*Picea abies* (L.) H. Karst.). The records were made in trunks less than 8 cm in diameter on dead threes with rather smooth bark. In addition, branches as small as one cm is utilized. *P. saalasi* has a clear northern distribution in Fennoscandia. The record of *P. saalasi* increases the number of documented bark beetles (Curculionidae, Scolytinae) in Norway to 72 species.

Key words: *Pityogenes saalasi*, Norway, Coleoptera, Scolytinae, new records, faunistic.

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Introduction

Pityogenes saalasi Eggers, 1914 was first found by Uunio Saalas in Kittilä: Alakylä in Finland 9 August 1913 (Saalas 1923). Kittilä is the type locality since Eggers (1914) described the species based on these specimens. *P. saalasi* was erroneously mentioned as recorded from Norway in the last Palaearctic catalogue (Löbl & Smetana 2011), probably based on Wood & Bright (1992). Later it was deleted from the Norwegian list of bark beetles (Kvamme & Lindelöw 2014). The present paper gives information on the first records from Norway. In addition, we present a review of the biology based on experiences mainly from Fennoscandia. Including *P. saalasi,* the number of known bark beetle species in Norway is 72.

The records

During a field excursion to Lierne municipality in Nord-Trøndelag County (Figure 1), *P. saalasi* was recorded from three localities, all within the EIS grid number 103.

On 7 August, 2015, the localities at the southern side of a boggy area in Lierne municipality (Raudbergfloan (UTM 33 E448850 N7147070)) were investigated. This is close to the nature reserve Nordre Skograudberget and is the first locality where *P. saalasi* was recorded in Norway. The bog had scattered *Pinus sylvestris* L. (Scots pine) and *Picea abies* (L.) H. Karst. (Norway spruce) and the surrounding forests were dominated by Norway spruce, mixed with Scots pine and birch (*Betula* spp.). Altitude of the area is approximately 400 m a.s.l.. Like on many inland boggy areas the trees are growing rather

FIGURE 1. The map shows the three localities in NTI: Nord-Trøndelag, Lierne Municipality (EIS 103) where *Pityogenes saalasi* Eggers, 1914, was sampled.

FIGURE 2. Distribution of records of *Pityogenes saalasi* Eggers, 1914, in Fennoscandia. The red star indicates the records in Norway and the blue star indicates the type locality at Kittilä. Black triangels are based on Lekander *et al.* (1977), red triangels are based on data from ArtDatabanken in Sweden, red dots are based on data from Ilpo Mannerkoski.

slowly. Often it takes several years before such trees are completely dead, and bark beetles thus may utilize the trees more than one year. Bark beetles were sampled from newly dead spruce and pine trees. Both standing and lying trees were inspected and bark was peeled off on trunks and branches. In addition to one dead specimen a live female of *P. saalasi* was found. The following bark beetle species were recorded from standing dead Norway spruce in the area: *Polygraphus subopacus* C.G. Thomsen, 1871, *Cryphalus saltuarius* Weise, 1891, *Dryocoetes autographus* (Ratzeburg, 1837), *Ips typographus* (Linnaeus, 1758), *Orthotomicus suturalis* (Gyllenhal, 1827), *Pityogenes chalcographus* (Linnaeus, 1760) and *Trypodendron lineatum* (Olivier, 1795). *Hylurgops glabratus* (Zetterstedt, 1828) and *D. hectographus* Reitter, 1913 were sampled from a fallen Norway spruce. In Scots pine *Tomicus piniperda* (Linnaeus, 1758), *Orthotomicus laricis* (Fabricius, 1792), *Pityogenes quadridens* (Hartig, 1834) and *P. bidentatus* (Herbst, 1784) were sampled.

On 8 August 2015, *P. saalasi* (Figure 2) was recorded from two other localities. The first locality was on the southeastern slope of the mountain Tissvassklumpen (UTM 33 E432000 N7138050), approximately 550 m a.s.l.. The other locality was on the eastern side of Tjølløvtjørna (Figure 3) (UTM E430025 N7142750), about 520 m a.s.l.. Both localities have the same characters with forest along the bog edges, dominated by Norway spruce, with Scots pine and birch trees mixed in. On the more wet spots, the spruce is growing slowly and the trees are in general small. The area looks like a typical high altitude spruce forest. Other bark beetle species sampled from the same standing trees were *Phloeotribus spinulosus* (Rey, 1883), *Pityophthorus micrographus* ssp. *micrographus* (Linnaeus, 1758), *Dryocoetes autographus* (Ratzeburg, 1837) and *Trypodendron lineatum* (Olivier, 1795). *P. poligraphus* (Linnaeus, 1758) and *P. subopacus* were both found on the same tree, but the last species was more abundant. In the same area *Polygraphus punctifrons* C.G. Thomson, 1886 and *Hylurgops glabratus* (Zetterstedt, 1828), were also found in more shaded and fallen trees.

FIGURE 3. Male (left) and female of *Pityogenes saalasi* Eggers, 1914. Photo: Vítězslav Maňák.

Discussion

P. saalasi was expected to occur in Norway. Eggers (1914) described the species from North Finland (ca. 68° N). Statistical biogeographical analysis of the bark beetles in Northern Europe (Heliövaara *et al*. 1991) predicted a high probability that *P. saalasi* should occur in Norway along the Swedish border. In Sweden, this species has a northern distribution (Lekander *et al.* 1977), and is found in the counties Torne Lappmark, Lule Lappmark, Pite Lappmark, Lycksele Lappmark, Norrbotten, Västerbotten, south to Jämtland. This indicates a clear northern distribution (cf. NCG 2015). The records are mostly distributed in the western part, close to the mountain areas, which is characterized by slow growing spruce stands at higher elevations. Most records are made in branches and small trunks on standing dead trees, sometimes occurring together with *P. chalcographus*. The total distribution of *P. saalasi* includes Sweden, Finland, Poland, Russia (North European Territory, West Siberia and East Siberia), Mongolia and China (Xinjiang, Quinghai, Gansu, Liaoning) (Löbl & Smetana 2011). The record of *P. saalasi* from Poland represents an extremely southern locality. According to Miloš Knížek (pers. com.), no specimens that confirm the identity of the species in Poland have been found. We thus leave the question open. In the Republic of Altay *P. saalasi* has been characterised as a pest species (Shatilov 1985).

According to Pfeffer (1995), *P. saalasi* uses only *Picea obovata* Ledeb. as host tree, while Lekander *et al*. (1977) mentioned *P. abies* as host tree. *P. abies* and *P. obovata* have been considered as one species by some authors and as separate species by others. Separation of the two tree species is difficult on a morphological basis alone. New results based on DNA studies support the conclusion that *P. abies* and *P. obovata* are different species (Popov 2003, Tollefsrud *et al.* 2015). *P. abies* distributed in northern Fennoscandia has genetic elements from *P. obovata* and is a hybrid (Tollefsrud *et al.* 2015). The distribution of *P. saalasi* overlaps the distribution areas of both

FIGURE 4. Frons of female *Pityogenes saalasi* Eggers, 1914 has a very characteristic round excavation, surrounded by hairs. Photo: Karsten Sund.

FIGURE 5. The male of *Pityogenes saalasi* Eggers, 1914, is easily identified by the distance between the second and third tooth, which is longer than from the first to the second tooth on elytra. Combined with the punctures on elytra these characters are species specific. Males head has no excavation on frons. Photo: Karsten Sund.

P. abies and *P. obovata* (Hultén & Fries 1986a, 1986b, Tollefsrud *et al*. 2015). Thus, it is clear that both tree species are used as host trees. In addition, Wood and Bright (1992) also mention *Picea asperata, P. balouriana* and *P. schrenkiana* as host tree species. Shatilov (1985) wrote that *P. saalasi* has been sampled from *Picea* sp. and Siberian pine (latin species names not mentioned) in the Republic of Altay, and that the species can be harmful during outbreaks.

The natural distribution of Norway spruce (*Picea abies*) in Norway is limited westwards to Voss and some scattered small populations even further west (Tollefsrud & Kvaalen 2015). The main distribution area of *P. abies* is from Lyngdal in the south through eastern Norway north to Saltfjellet. In addition, Norway spruce has a natural distribution in Pasvik, Finnmark County (Hultén & Fries 1986a, 1986b, Tollefsrud *et al*. 2015). Based on the known distribution in Fennoscandia we consider the potential distribution to follow higher altitude spruce forests in eastern Norway, up to the northern distribution limit of *P. abies* in Nordland County. Our experience indicates that *P. saalasi* is locally common in Lierne. *P. saalasi* is probably overlooked in Sweden (Ehnström & Axelsson 2002). Also in Norway *P. saalasi* has

FIGURE 6. Bengt Ehnström in front of the Norway spruce, colonised mainly by *Pityogenes saalasi* Eggers, 1914, in branches and the upper parts of the stem. Note that the tree still has some brownish needles. The largest of the Tølløvtjørna lakes is seen in the background.

been overlooked, but it is easily distinguished from *Pityogens chalcographus* (Linnaeus, 1760) (Figures 3, 4, 5).

P. saalasi was found on the higher parts of the trees, in the area with rather smooth and thin bark and with branch and stem diameters ranging from approximately 1-8 cm. This is in agreement with the description of the biology as written by Saalas (1923). However, Saalas mention that the trees infested with P. saalasi was between 7- 30 cm.

The tree with *P. saalasi* at Tjølløvtjørna (Figure 6), had very little growth of lichens. According to Ehnström & Axelsson (2002) and Artdatabanken (2008) the host trees in Sweden are often colonised by lichens. Although common, we consider lichens of the host trees to be of little or no importance compared to properties of the bark.

One factor, which is emphasized by several authors, is that *P. saalasi* attacks slow-growing

FIGURE 7. Galleries of *Pityogenes saalasi* Eggers, 1914 in Norway spruce at the time of recording. Only egg niches and very short larval mines are developed at the time. Photo: Dan Aamlid, NIBIO.

trees (i.e. Saalas 1923, Ehnström & Axlsson 2002). This is also in agreement with the data from Vietas, Stora Sjöfallet National Park in

FIGURE 8. Larval gallery of *Pityogenes saalasi* Eggers, 1914 after five weeks in laboratory. Photo: Dan Aamlid, NIBIO.

Swedish Lappland from 1967. The locality was at the uppermost timberline for conifers, close to the subalpine birch zone with very slow growing spruces (Ehnström unpublished data). This is an important observation in understanding why the species has a northern distribution. Up north, at higher altitudes and on poor productivity soils and bogs, the trees grow slowly and are of small dimensions. The attacked host tree found at Tjølløvtjørna is a good example. The height of the tree was about 6 m and the maximum diameter at Diameter at breast height (DBH, ca. 1.3 m above ground) measured 9.5 cm (Figure 9). The number of annual growth rings at DBH was 156. Adding 36 years, which is the average a tree needs to reach breast-height on poor productivity soil class in North-Trøndelag County (Landskogstakseringen 1947), the age of the tree is then found to be 192 years. Hågvar & Tveite (2011) also describe age estimation of small, suppressed trees. This clearly shows how slowly the host tree was growing.

In early August, the galleries in the trunks consisted mainly of tunnels made by the females and egg niches. Very few larval tunnels were visible (Figure 7) and very few larvae could be seen. The conclusion is that the development of the new generation cannot be fulfilled this year and that larvae and probably imagines hibernate in the host trees. The hibernation in standing trees tells that the beetles are exposed to low temperature during the winter season. The combination together with the distribution of the species indicates strong cold hardiness. On the other hand, the species can respond to higher temperature. After 5 weeks in laboratory (ca. 20°C) the larval activities increased and many larvae could be seen (Figure 8).

Trees colonized by *P. saalasi* often have a high diversity of other bark beetle species with northern and inland distribution in Fennoscandia. In Lierne the lower parts of the stems, where the bark is thicker *P. subopacus* was a dominant species. In thinner branches *C. saltuarius*, *P. spinulosus*, *P. micrographus* were collected. At Vietas, Stora Sjöfallet National Park, a rich fauna of bark beetles was sampled in the thin stems and bigger branches of five Norway spruces trees examined. Species found in these trees were *Xylechinus pilosus* (Ratzeburg, 1837), *P. spinulosus*, *P. subopacus*, *P. chalcographus*, *C. saltuarius*, *Pityophthorus traegardhi* Spessivtseff, 1921 and *P. micrographus*. In addition, the rare and probably overlooked species *Carphoborus teplouchovi* Spessivtseff, 1916, was found here (Ehnström unpublished data).

P. saalasi has no Norwegian name so far. In Sweden, the name used is *Saalas barkborre* (Ehnström & Axelsson 2002). We propose the name *Saalas granbarkbille* as the Norwegian name. This is also in agreement with the history since Eggers dedicated the species to professor Uunio Saalas.

FIGURE 9. A cross section of the stem from Tølløvtjørna, where *Pityogenes saalasi* Eggers, 1914 was found. It shows that the tree was very slow growing with very small tree ring widths. The maximum diameter of the cross section is 9.5 cm. The stem section is from about DBH and the bark beetle holes are made by *Polygraphus subopacus* C.G. Thomson, 1871. Photo: Dan Aamlid, NIBIO

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