Original Contribution

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The Hungarian Spruce Scale, *Physokermes inopinatus* Danzig & Kozár (Hemiptera: Coccoidea: Coccidae) in Sweden

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Abstract: The presence of the Hungarian Spruce Scale, *Physokermes inopinatus* Danzig & Kozár has been confirmed for the first time in a southern province of Sweden in 2010. It developed large populations and infested several mid- and late rotation stands of even-aged Norway spruce (*Picea abies*). Large amounts of honeydew resulted in much sooty mold and defoliation. Several areas were severely damaged. The damage was already detected in satellite data in 2009, the year before the damage were actually noted in the field. During the autumn of 2010 and in the spring of 2011, the infestation came to an end (apparently due to a population collapse).

Keywords: *Physokermes inopinatus*, *Picea abies*, Sweden

Introduction

In the most southern province of Sweden, a severe infestation of stands of even-aged Norway spruce (*Picea abies*) by a scale insect was observed in the summer 2010. The species was finally identified as *Physokermes inopinatus* in September 2010. During spring and summer the species produced large amounts of honeydew covering the above-ground parts of the trees.

This led to growth of sooty mold which partly caused defoliation of the attacked trees. Several areas, in all approximately 1000 hectares, were severely damaged (Fig. 1). The most severely damaged stands were clear-cut to salvage the timber. During autumn 2010 and spring 2011, no further signs of infestation could be observed (apparently the population of *P. inopinatus* collapsed) (Gertsson, Isacsson 2012). Whether *P. inopinatus* was recently introduced to Sweden or had been present for some time is not clear. The species was probably introduced to our region as a consequence of international trade.

Scale insects infesting spruce (*Picea* spp.) trees have been reported for Sweden previously. The scale-insect genus *Physokermes* is represented in Sweden by two further species: *P. hemicryphus* (Dalman) and *P. piceae* (Schrank). *P. hemicryphys* is common on *Picea glauca* var. *conica*, an ornamental tree occurring frequently in gardens and churchyards. Up to now this species has never been reported as a serious pest. The distribution of *P. piceae* in Sweden is poorly known (Gertsson, Isacsson 2012). *P. piceae* was observed in a southern province (Småland) between April and May 2011 on Norway spruce (*Picea*

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Fig. 1. Severe defoliation of *Picea abies* by *Physokermes inopinatus*, Sweden, Scania, Häckeberga, September 2010. Photo: C.-A. Gertsson

Fig. 2. Adult females *P. inopinatus* on Norway spruce (*Picea abies*), Scania, Häckebrega, October 2010. Photo: G. Isacsson

Fig. 3. Norway spruce twig, summer 2012. Note the variation in needle length from 2010 (red arrow) and the recovery during the two succeeding years. Scania, Sjöbo, August 2012. Photo: G. Isacsson

abies) where an area of 10-15 hectares was attacked. The infested trees were clear-cut to save the timber. No new attacks were detected in the year of 2012 (Gertsson, Isacsson 2012). Both species have a very short adult and mating period and the most frequently collected insects are females in post-reproductive stage. The similarity in occurrence resulted in a taxonomic confusion between the two species (Kosztarab, Kozár 1988; Kosztarab 1996).

Morphology and Biology

Adult post-reproductive females are kidney-shaped, strongly sclerotized, with a diameter of 5-8 mm, but only 3 mm in crowded conditions (as in Sweden during 2010) (Kosztarab, Kozár 1988). The females are situated along the twigs between the needles (compared with *P. hemicryphus* and *P. piceae*, which normally settle in the branching of the twigs) (Gertsson, Isacsson 2012) (Fig. 2). Males develop on the upper surface of the needles whereas females are found at the base of the needles. The ratio of females to males is 1:19 (Danzig, Kozár 1973). *P. inopinatus* completes one generation per year and overwinters as 2nd instar nymph (Kosztarab, Kozár 1988).

Geographical Distribution and Host Plants

P. inopinatus appears to be restricted to Europe (Ben-Dov *et al.* 2012), where it has been recorded from Hungary (Danzig, Kozár 1973), Greece (Stathas, Kozár 2010), Austria, Ukraine (Ben-Dov *et al.* 2012), Romania (Fetykó *et al*. 2010) and Sweden (Gertsson, Isacsson 2012). It feeds on trees of thr genus *Picea* and *Abies* (Ben-Dov *et al.* 2012). In Sweden it infested *Picea abies* and *P. sitchensis* (Gertsson, Isacsson 2012).

Symptoms

The species produced a large amount of honeydew which covered the above-ground parts of the trees. On this cover sooty mold, a collective of fungi building superficial, colonies grew. These colonies occur as incrustations, giving branches and needles a grey-black color. This caused a reduction in photosynthesis and a physiological weakening which partly culminated in defoliation of the trees. The weakening of trees was due not only to the honeydew and sooty mold but also due to a direct weakening by the removal of tree sap, and this led to changes in growth of needles. For infested trees, needles from 2009 were of ”normal” length, while needles from 2010 had half or less than normal length, whilst needles formed in 2011 were intermediate, indicating recovery in 2011 from the attack (Mc Carthy, Skovsgaard 2011) (Fig. 3). A number of predators (*Anthribus nebulosus*, Col.) and parasitoids (emergence holes) were observed already in the summer and autumn of 2010 (Gertsson, Isacsson 2012).

Previous Observations

A study from 2011 (Mc Carthy, Skovsgaard 2011) showed evidence that the mass attack by *P. inopinatus* had been triggered by a sequence of droughts. It is believed that the drought in June 2008 helped the insect to establish itself. The population expanded unnoticed in the relatively dry year of 2009. Large populations combined with droughts in June 2010 lead to a severe mass infestation. The study also showed a positive correlation between the degree of infestation and terrain slope, with those on the slopes appearing to be more severely infested than trees at lower altitude on essentially flat terrain. In addition, stem discs from infested and un-infested trees were analyzed and this showed a significant reduction in stem diameter growth (up to 90 %) in 2010.

In a second study, Olsson *et al.* (2012) viewed satellite images and were able to detect damage, and found that some of the areas heavily infested in 2010 were already colonized by *P. inopinatus* in 2009.

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