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First record of the scale insect *Kermes vermilio* (Planchon, 1864) (Hemiptera, Coccoidea) in Switzerland

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In 2014, the kermesid scale *Kermes vermilio* (Planchon, 1864) was found on infested holm oaks (*Quercus ilex*) on the shores of Lake Zurich. This is the first record of Kermesidae from Switzerland. The scales were presumably introduced together with their host trees. In this paper we describe and summarize the literature on their biology and economic significance.

Keywords: Kermesidae, holm oak, new records, canton of Zurich, Switzerland

INTRODUCTION

The «berry kermes» scale *Kermes vermilio* (Planchon, 1864) (Hemiptera, Kermesidae) is one of only 10 European species belonging to this family. Its distribution in the Mediterranean region is summarized in Pellizzari *et al.* (2012). The original



Fig. 1. Holm oak (*Quercus ilex*) heavily infested by *K. vermilio* in a front garden beside Lake Zurich.

distribution area of *K. vermilio* ranges from North Africa, the Iberian Peninsula, France, Italy, Greece to Turkey, including most Mediterranean islands. *Kermes ilicis* (L.), a close relative, is also present in Austria, Hungary, Poland and Moldova, but not in Turkey. The two species can only be reliably distinguished on the basis of their larvae (Pellizzari *et al.* 2012).

In this paper, the first finding of *K. vermilio* in Switzerland is described and the biology and economic significance of this potential pest are summarized and discussed.

FIRST RECORD IN SWITZERLAND

In July 2014, we received samples of holm oak (*Quercus ilex*) infested by an unknown scale insect for diagnosis. The tree affected was located in the front garden of a private property in Rüschlikon (ZH) on the western shore of Lake Zurich. Our evaluation of the samples revealed that the infestation was caused by a scale of the genus *Kermes*. A visual inspection in the garden in early September showed that out of the eight cylindrically pruned holm oaks about 5 meters in height, one tree was heavily infested and two partially. All three had brown, desiccated leaves (Fig. 1). The shoots were covered with the «brood chambers» of the dead females, most of which had been abandoned by the first-instar larvae (Fig. 2). Nevertheless, enough brood chambers still containing the crawlers necessary for correct identification could be collected. Some of these crawlers were sent to the scale expert, Prof. Giuseppina Pellizzari (University of Padua, Italy), for identification. She identified the samples without any doubt as *K. vermilio*.

According to the trees' owner, the holm oaks originated from the Pistoia region in Tuscany, Italy. They were planted in Rüschlikon in 1999 when they were approximately 25 years old, and an additional tree was added in 2007 that had the same origin. First symptoms became visible in 2014. A further inspection in August 2015 revealed that the oak trees had recovered after repeated insecticide application and, after the dead branches had been pruned, looked fairly healthy.

According to all the information available this appears to be the first record not only of this species but also of the family Kermesidae from Switzerland. Inquiries at the natural history museums of Geneva and Lugano revealed no specimens of Kermesidae in their collections. There are no corresponding data in the data base of the Centre Suisse de Cartographie de la Faune (CSCF) either. An infested twig with brood chambers is deposited in the sample collection of the Swiss Forest Protection group at the Swiss Federal Institute WSL.

BIOLOGY

Like all Kermesidae, *K. vermilio* lives on evergreen oak species, mainly on holm oak. The globular reproductive females are about 5 mm in size and dark red to brown in color, with a fine covering of white wax powder (Fig. 2). The morphology of the individual instars and their biology have been described in detail by Balachowsky (1950), Marotta *et al.* (1999) and Pellizzari *et al.* (2012). After mating with a winged male, which, like all coccid males, has only one pair of wings, the female produces more than 1000 eggs in the brood chamber underneath her body. The crawlers then hatch in the brood chamber of the dead female (Fig. 3), where they remain



Fig. 2. Post-reproductive females (brood chambers) of *K. vermilio* on a dead twig of holm oak.

for some time before they disperse distally along the young shoots. They attach themselves to the shoot and produce a scale from secretions and excrements. After three molts, the female scales reach the legless, pre-reproductive adult stage, which is somewhat smaller than the later reproductive stage.

The phenology of the univoltine generation was investigated by Marotta *et al.* (1999). The crawlers hatch in July at protected sites on the shoot and resume sap-sucking next spring with the bud burst of the plants. In early April the crawlers molt for the first time, followed by the second molt soon after in mid May. By the end of May the population is mainly comprised of adults. The subsequent oviposition of the females lasts about three weeks, with the first crawlers hatching in mid June. Following hibernation, most larvae stay attached to the same place on the shoot during their further development until adult oviposition. These phenological specifications are valid for the climatic conditions of southern Italy. In Central Europe the phenology may be delayed by at least half a month, according to some information available for some instars (Balachowsky 1950). The scale's known natural enemies are mainly parasitic wasps of the family Encyrtidae (Hymenoptera) (Marotta *et al.* 1999).

ECONOMIC SIGNIFICANCE AND SPREAD

Heavy infestation leads to conspicuous discoloration and desiccation of the shoots and leaves. The withdrawal of assimilates weakens the plant and individual branches may die back (Malumphy 2008). At the end of the 20th century, the hitherto largely unnoticed *Kermes* scale became detrimental on a large scale on ornamental holm oaks planted in residential areas in central and southern Italy (Marotta *et al.* 1999;



Fig. 3. Dissected brood chamber of a dead *K. vermilio* female filled with crawlers. Their red color was commercially utilized for the crimson dye in ancient times.

Pellizzari *et al.* 2012). Recently, this species has been introduced into England as well (Malumphy 2008).

The gravid females produce the red crimson dye which is also present in the first two larval instars (Fig. 3). The term kermes is often used as a synonym for this dye. In the Middle Ages this dye was of great economic importance and was even used as a means of payment (Encyclopedia Britannica 2015). The crimson dye can also be obtained from some other scale insects and even a few plants.

Like *K. vermilio*, the holm oak originates from the Mediterranean area. The tree depends on a warm climate and is thus not very winter-hardy. It is still planted as ornamental tree in Central Europe at sites with mild conditions. The *Kermes* scales reported here most likely arrived in Switzerland together with their host trees from Italy and were probably kept in check for several years when winter temperatures were harsh enough to prevent them developing visual symptoms. *Kermes vermilio* was introduced into England in a similar way in 2002 (Malumphy 2008). Further introductions of this species in Central Europe and successful establishment are probable in view of the ongoing climate warming. *Kermes vermilio* poses hardly any risk for native, deciduous oak species since it thrives almost exclusively on evergreen oaks like *Q. coccifera* L. and *Q. suber* L.

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ZUSAMMENFASSUNG

Die Schildlaus *Kermes vermilio* (Planchon, 1864) wurde als erstmaliger Vertreter der Familie Kermesidae in der Schweiz an Steineichen (*Quercus ilex*) entdeckt. Die am linken Zürichseeufer gepflanzten Zierbäume zeigten dürre Blätter und abgestorbene Äste. Die Biologie dieser Schildlaus und ihre Bedeutung als Schadorganismus und Lieferantin des Farbstoffs Karmin werden zusammengefasst.

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