

EUONYMUS SCALE *UNASPIS EUONYMI* (HEMIPTERA: DIASPIDIDAE); AN INTRODUCED PEST OF SPINDLE (*EUONYMUS*) IN BRITAIN

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ABSTRACT

The euonymus scale *Unaspis euonymi* (Comstock) is a pest of spindle (*Euonymus* spp.) which can cause plant death. A native of South East Asia, it became established in Britain in the late 1950s but did not become widespread in England until the 1990s and 2000s. The distribution, identification, life cycle, natural enemies and host range of this pest are outlined, and its status and control in Britain discussed.

INTRODUCTION

The euonymus scale, *Unaspis euonymi* (Comstock) (Diaspididae) is native to temperate Eastern Asia (Pellizzari & Germain, 2010) and was first recorded in Britain in 1936 (Anon., 1939; Dennis, 1969). During the last two decades it has dramatically expanded its geographical range and become more abundant in Britain. It feeds by sucking the sap from the stems and foliage of its host plants, usually *Euonymus* spp., and is one of the most damaging scale insects found in Britain. The purpose of this communication is to highlight the increase in frequency and distribution of *U. euonymi* in Britain, and to review its biology and control.

IDENTIFICATION

Unaspis euonymi was originally described in the genus *Chionaspis* by Comstock (1881) from specimens collected from Norfolk, Virginia, USA, on *Euonymus latifolia*; it has been re-described and illustrated by Balachowsky (1954), Ferris (1937), Kosztarab & Kozár (1988), and Miller & Davidson (2005). It is a sexually dimorphic species; the adult female scale covers are oyster-shell shaped, dark brown and slightly convex reaching 2.2mm in length whilst the exuviae are terminal and brownish yellow. Male tests (protective covers for the immature stages) are 1.0mm long, white, felted elongate oval with three longitudinal ridges; the exuviae are terminal and brownish yellow like the females (Plate 12, Figs. 1–4). Adult males have a single pair of wings and resemble small flies. Male tests predominate on the leaves and female scales on stems and branches.

Unaspis euonymi is the only *Unaspis* species currently established in Britain and the only diaspidid scale likely to be encountered on *Euonymus*: *U. citri* (Comstock) is a quarantine listed pest for the European Union (EPPO/CABI, 1997) and is occasionally intercepted on *Citrus* plants and fruit, and *U. yanonensis* (Kuwana) has become established in parts of France and Italy, and is also found on citrus (Smith *et al.*, 1992; The Food and Environment Research Agency (FERA) data).

LIFECYCLE

Several studies investigating the lifecycle of *U. euonymi* show that there are usually two generations a year, although three can occur (Dennis, 1969; Kosztarab & Kozár, 1988; Savopoulou-Soultani, 1996; Özyurt & Ülgentürk, 2007). The scale reproduces sexually and overwinters as mated females, although nymphs can also be present throughout the winter. In May each female produces 30–70 eggs which hatch after one or two days. These eggs hatch into nymphs which become adults from mid-June to July. Eggs of the second generation are present from late June and the new generation of adults from September. The lifecycle varies between years depending on climatic conditions.

DISTRIBUTION

Unaspis euonymi is native to temperate Eastern Asia (Pellizzari & Germain, 2010) but is now found in nearly all warm temperate regions where euonymus is grown (Davidson & Miller, 1990). In Britain *U. euonymi* was first reported in 1936 from Shropshire (VC40) on *Euonymus* plants imported from Spain (Anon, 1939; Dennis, 1969). It was not reported again until 1952 when 'very severe damage' was reported on several shrubs in a Southampton garden (South Hampshire VC11) (MAF, 1952). The Royal Horticultural Society first received a report on euonymus in 1955 from New Milton, Hampshire (RHS data). The lack of reported cases in Britain between 1936 and 1952 suggests that *U. euonymi* did not become established in Britain during that time. In 1960 an infestation caused the decline and death of *Euonymus japonicus* hedges in Swanage (Dorset, VC9) (Dennis, 1969). Dennis assumed that the scale had been imported with the plants from somewhere in Europe and that infestations in Britain were a result of importation. However, a further five records from the southern counties during the 1960s, in South Hampshire (VC11), Dorset (VC9) and East Sussex (VC14) (RHS and FERA data), indicate that the scale had become established along the south coast of England. Diaspidids are highly cryptic and it usually takes several years before the scale populations reach damaging levels and are noticed (Malumphy, 2011). It is therefore likely that *U. euonymi* became established along the south coast in the 1950s. In the 1970s the scale was reported seven times, including the first records for Cambridgeshire (VC20) and the Isle of Wight (VC10) (RHS and FERA data). During the 1980s the scale was reported on 13 occasions, mostly from counties where it had previously been reported, and for the first time from East Kent (VC15) in 1989. During the 1990s *U. euonymi* became a more frequent pest, being reported to FERA and the RHS on 41 occasions, adding Surrey (VC17), Middlesex (VC21), Berkshire (VC22), West Kent (VC16) and Edinburgh (VC83) to the list of areas with reported cases. Between 2000 and the end of 2012, 154 reports of the scale were received. It is now widespread in England, with the exception of the south west, and has been recorded as far north as South East Yorkshire (VC61). There are scattered reports from Wales (Fig. 1) and only one from Scotland, Kirknewton, Edinburgh in 1996, although it is not known if the pest has established in Scotland. The upward trend in the number of enquiries is clearly represented in a summary of the proportion of enquiries received by the RHS advisory service (Fig. 2).

HOST RANGE, DAMAGE AND CONTROL

Unaspis euonymi exhibits a strong preference for *Euonymus* although it has been recorded on 18 genera in 13 plant families (*Buxus*, *Camellia*, *Celastrus*, *Daphne*,

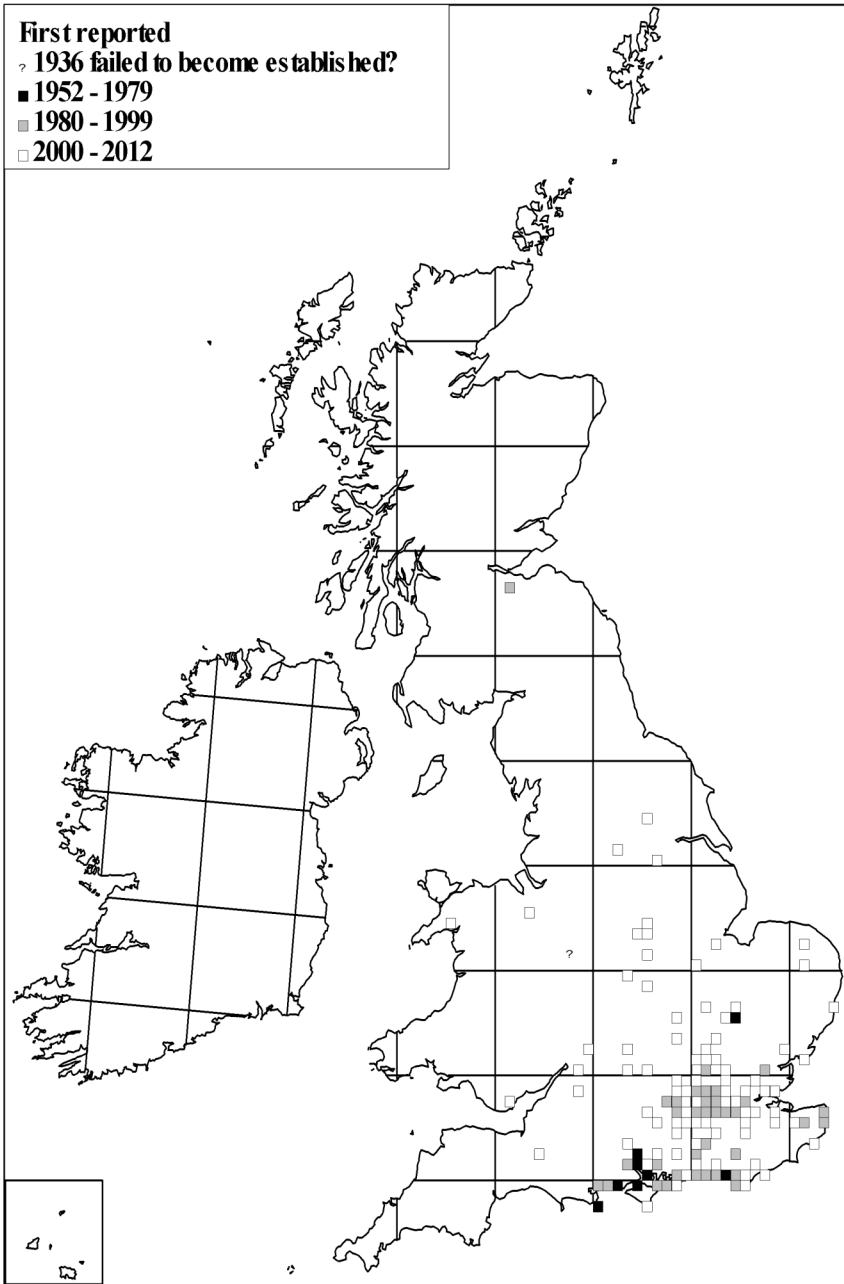


Fig. 1. Distribution of the Euonymus scale, *Unaspis euonymi* (Comstock) in Britain, 1936 to December 2012. RHS and FERA data. Produced using Dmap©.

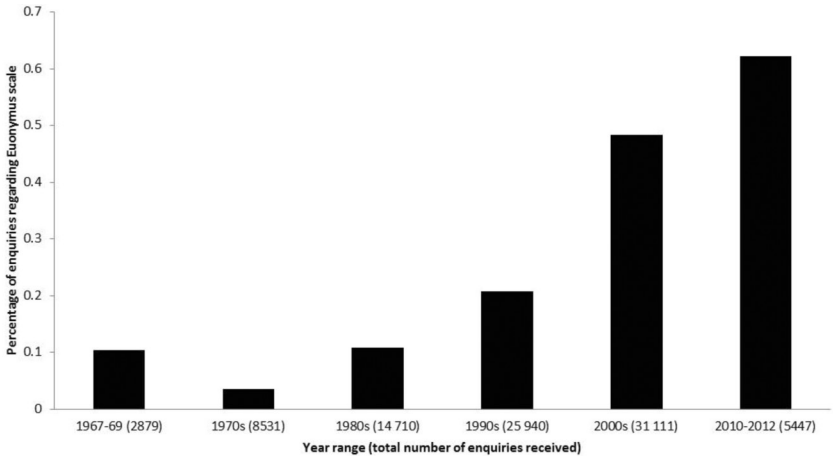


Fig. 2. *Euonymus* scale (*Unaspis euonymi*) enquiries as a percentage of total pest enquiries received by the RHS Advisory Service (1967 to 2012; reliable total number of enquiries data is only available from 1967).

Eugenia, *Euonymus*, *Hibiscus*, *Ilex*, *Jasminum*, *Ligustrum*, *Lonicera*, *Olea*, *Pachistima*, *Pachysandra*, *Perychmenum*, *Prunus* and *Syringa*) (Kosztarab & Kozár, 1988). In Britain it has rarely been found on plants other than *Euonymus* with only one of the 274 records of *U. euonymi* reported on an alternative plant, *Lonicera japonica* (Table 1). The most frequent host plant reported in Britain is Japanese spindle *Euonymus japonicus* (Thunberg) and its cultivars although this may be because this is the most commonly planted *Euonymus* in ornamental situations. It is likely that most *Euonymus* species can be attacked, although susceptibility of different species and cultivars varies; in designed field and container studies in Virginia, USA, significantly lower levels of euonymus scale were observed on *Euonymus kiautschovicus* 'Manhattan', *E. japonicus*, and *E. fortunei* and *E. alatus* compared to *E. japonicus* 'Albomarginatus' and *E. japonicus* 'Microphyllus' (Jefferson & Schultz, 1995).

Heavy infestations of *U. euonymi* can encrust all aerial parts of the plant, obscuring the stem and lower leaf surfaces (Fig. 3; Plate 12, Figs. 1 & 2). The males and females infest different parts of the plant, with males primarily on the leaves and females mostly on the stems and branches (Özyurt & Ülgentürk, 2007). Leaves can become chlorotic, due to chloroplast destruction, especially in the palisade parenchyma cells (Cockfield, Potter & Houtz, 1987). Leaves often drop prematurely, leaving plants sparsely foliated and with the remaining foliage concentrated at the tips of branches. This leads to lack of vigour, dieback and in severe infestations plant death (Cockfield & Potter, 1986; Van Drieshe *et al.*, 1998; Özyurt & Ülgentürk, 2007; Malumphy & Badmin, 2012).

Infested plants can be sprayed with approved insecticides in May and July, when the more vulnerable crawler nymphs are present, although this will not always eradicate the pest or save host plants (Davidson & Miller, 1990). Another option is to grow species or cultivars of *Euonymus* that are less susceptible to *U. euonymi*. This has been found to be the only reasonable approach in parts of the USA (Davidson & Miller, 1990).

Table 1. Reported hosts of *Euonymus* scale (*Unaspis euonymi*) in Britain (RHS & FERA data)

Host	Number of reports (%)
<i>Euonymus</i> unspecified	173 (63)
<i>Euonymus fortunei</i>	5 (2)
<i>Euonymus japonicus</i>	93 (34)
<i>Euonymus europaeus</i>	2 (0.7)
<i>Euonymus hamiltonianus</i>	1 (0.4)
<i>Lonicera japonica</i>	1 (0.4)

Fig. 3 *Euonymus* stems (*Euonymus* sp.) encrusted with *Euonymus* scale (*Unaspis euonymi*). FERA ©

NATURAL ENEMIES

Seventeen species of hymenopterous parasitoids, six predatory beetles and five species of predatory mite have been found in association with *U. euonymi* (Ben-Dov, Miller & Gibson, 2013). Lacewing (*Chrysoperla* sp.) larvae were found to feed on the prepupa and pupal stages of euonymus scale in Turkey but had no impact on infestations (Özyurt & Ülgentürk, 2007). In Britain, the kidney spot ladybird, *Chilocorus renipustulatus* (Scriba) (Coleoptera: Coccinellidae) is often found feeding on *U. euonymi* (Kirby, 2008), and a predatory mite (*Anystis* sp., Anyslidae) has been reported in association with *U. euonymi* (Dennis, 1969).

DISCUSSION

Euonymus scale, *U. euonymi* has been established in Britain since the 1950s. It has spread from the south coast to become widespread in England and has become a frequently reported problem on *E. japonicus*. Heavy infestations of this pest can kill its host plants and it is likely that it will spread to most of Britain. Currently, control

of the scale insect is limited to the use of insecticides or the growing of resistant cultivars. However, the interactions of the scale with its natural enemies are poorly known and may be worthy of further investigation.

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SHORT COMMUNICATION

Drag-Vac – another use of a domestic vacuum cleaner as a suction sampler. – I have previously reported the use of a Vax LiFE handheld vacuum cleaner as a suction sampler in the study of Hemiptera-Heteroptera (Ryan, 2012). This device comes as an ‘unplugged Multipack’ with an upright vacuum cleaner that runs off the same lithium ion battery. Upon buying a second handheld device, I became the owner of another upright vacuum cleaner, and it dawned upon me that I was likely to accumulate an impressive collection of these appliances, as the handhelds inevitably wore out and needed replacement; and so long as Vax insisted on selling the two items together and not separately. Under these circumstances, I felt obliged to make use of the upright vacuum cleaners somehow. My wife was unwilling to give up her Henry, which I believe is another make of vacuum cleaner, so that left field work as the only employment option.

I reasoned that by removing the head of the appliance, which is easy to do, and covering the bare end with the same garden netting used for the handheld, I could drag the device behind me as I walked, whereby it might sample the invertebrate fauna at the roots of vegetation, and do so more conveniently than could be achieved by hand searching or by using my handheld sampler. A trial run of this bizarre contraption was conducted at a secluded spot, out of view from members of the public, and was very successful. Collecting was almost effortless, the headless upright being sufficiently light to be trailed behind me without fatigue for as long as the batteries lasted (an hour for the two batteries I have), but sufficiently heavy and smoothly contoured to cut a wake through the vegetation and keep the bare end close to the ground. The electrical tape used to secure the netting proved resilient to the inevitable abrasion, and the only disadvantage encountered in use was the need to stop occasionally to clear debris from the netting and to check the fill of the collecting chamber. The collecting chamber is easily detached from the appliance, and emptied by putting a plastic bag over the end and pressing the release button. Any large, easily identifiable insects (e.g. shieldbugs) can then be liberated, and the bag sealed and placed in a sandwich box, for later examination of the remaining contents at home under the microscope.

During the late summer of 2012, ‘drag-vac’ (as the application of this towed suction sampler became referred to in my field notebook) was employed on a number of occasions on dry sites in the Chiltern Hills, North Wessex Downs and Cotswolds. The appliance collected a variety of bugs that I had seldom taken sweeping at these sites: the stiltbugs *Berytinus montivagus* (Meyer-Dür), *Berytinus signoreti* (Fieber), *Berytinus minor* (Herrich-Schäffer), *Berytinus clavipes* (F.) and *Gampsocoris punctipes* (Germar) (Berytidae); the shieldbugs *Podops inuncta* (F.) (Pentatomidae), *Thyreocoris scarabaeoides* (L.) (Thyreocoridae) and *Canthophorus impressus* (Horváth) (Cydnidae); the lacebugs *Catoplatus fabricii* (Stål), *Agramma laetum* (Fallén), *Acalypta parvula* (Fallén) and *Kalama tricornis* (Schrank) (Tingidae); the



PLATE 12. Figs. 1 & 2: *Euonymus* stem (*Euonymus* sp.) encrusted with female *Euonymus* scale, *Unaspis euonymi*. FERA ©. Fig. 3: *Euonymus* stem (*Euonymus* sp.) encrusted with male and female *Euonymus* scale, *Unaspis euonymi*. FERA ©. Fig. 4: *Euonymus* leaf (*Euonymus* sp.) encrusted with *Euonymus* scale, *Unaspis euonymi*. FERA ©.