Box psyllids

the most important insect pests of box plants in southern England and South Wales - their biology, occurrence, and associated predators.

Summary

Psylla buxi and Spanioneura fonscolumbii are the major pests of box plants in southern England and South Wales. *P. buxi* is a widespread species found in all box plantations surveyed, whereas S. *fonscolumbii* appears to be more patchily distributed. **P.** buxi nymphs are usually confined inside the cupped leaves of the plant whereas in *S. fonscolumbii* nymphs are exposed on the shoots. Both species produce unsightly white secretions on plants. Adults of both species usually appear from April to July. Only a few species of predators are associated with box psyllids and their numbers are always low. The main insect predators observed are anthocorid bugs, ladybird beetles, earwigs, and green lacewings. A tendency for psyllids to preferentially infest variegated as opposed to non-variegated plants was noted.

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1 Biology

Psyllids or jumping plant lice are the major insect pests of box plants in southern England and South Wales. The two species of psyllids which cause most damage to box plants are *Psylla* buxi and Spanioneura *fonscolumbii* (Homoptera: Psyllidae) (McEwen et *al.,* 1997). P. buxi is a widespread species found in all four box plantations surveyed, whereas S. fonscolumbii was confined **to** two plantations. The adults of both species are small, about 3 mm long, and superficially resemble miniature cicadas. The two species are easily distinguishable by the presence of three black dots on the top cells of the wing in *S.* fonscolumbii when observed under the dissecting light microscope. In the case of *P. buxi* no such marking is found and it is also relatively larger and darker green in colour than *S.* fonscolumbii.

Differentiation between the two species at the larval stages is extremely difficult as both species emerge at more or less the same time of the year and look alike. However, *P. buxi* larvae are initially confined to the inside of cupped leaves whereas S. *fonscolumbii* nymphs are exposed and distributed on the surface of the shoots, so differentiation is possible in this way. In addition, under the dissecting microscope, *P. buxi* larvae appear to be darker with a v-shaped circumanal pore which surrounds the anus as compared to lighter colour and t-shaped circumanal pore in *S. fonscolumbii.*

2 Damage done to box plants

Both the psyllid species damage box plants by sucking the sap of the terminal shoots and at the same time produce unsightly white waxy secretions on the plant. It is the feeding by P. *buxi* nymphs which causes the characteristic cupping of the terminal leaves. *P. buxi* nymphs stay within the cupped leaves and undergo moulting to subsequent nymphal stages. Usually the 5th nymphal stage will leave this shelter and develop into an adult outside the cup. In the case of *S. foncolumbil,* although no leaf cupping is produced, the shoot becomes dehydrated. The white secretions produced are principally used to protect the psyllids from dehydration and also appear to attract ants, which feed on the honeydew produced by feeding psyllids. The ants protect the psyllids from predators. The white secretions produced by *S. fonscolumbii* are more obvious than those of P. *buxi* as most of the secretions are directly on the shoot. Both the cupping of the shoots and the white secretions cause substantial cosmetic damage to the plants. Under extreme cases the whole plant is covered with the white secretion which can coat the ground beneath the plants.

3 Field incidence

Both psyllid species lay their tiny orange spindle-shaped eggs under the leaf bud scale, somewhere between late summer and autumn. The eggs enter diapause to survive the winter and emerge into the first nymphal stage during February or March. Adults usually emerge around the month of April to July. We also believe that a few psyllids overwinter as adults (see below). In southern England and South Wales adults of both species are found in abundance in June and July. Monitoring of adult field populations using sticky yellow traps was carried out monthly in southern England from 1997 to 1999 based on the methodology of Horton *et al.* (1995). The use of sticky yellow traps to monitor the psyllid population was made following a six month trial which showed that yellow traps accounted for 46.8 % of all psyllids caught as compared to 15.2% red, 14.3% blue, 0.7% green and 10.1% white. This pattern was true for both species as reported by McEwen and Baker (1997).

Figure 1 shows that the peak of the adult psyllid

population appeared between May and July in all 3 years studied. The worst outbreak occurred in 1997 where up to 500 *S. fonscolumbii* were caught per month from a total of 4 square feet of yellow sticky trap. Although P *buxi* sometimes dominated in the sticky trap catches in this experiment, it is interesting to note that *S. fonscolumbii* almost always outnumbered P. *buxi* in direct plant beating studies (Fig. 2). In this method, at each sampling, 6 plants were randomly selected from the box plantation. Each plant was beaten 3 times by hand over a sticky tray and the insects collected were taken to the laboratory for identification.

The discrepancies between these two methods of sampling may relate to differences in flight behaviour between the species, seemingly implying a greater tendency for *P. buxi* to disperse. From field observation the direct plant beating method is a more accurate determinant of real psyllid numbers and is an important tool which can be used to monitor psyllid build up prior to any control measures.

Using the plant beating method we can also detect, at an early stage, the presence of psyllid larvae based on the white secretions which fall on the beating tray, particularly from *S. fonscolumbii.* Interestingly we also detected a few overwintering adult psyllids. Overwintering S. fonscolumbii adults usually appeared with a banded abdomen especially in the females. In the case of overwintering *P.* buxi adults no such banding was observed, but they did appear to be relatively bigger than usual and more brownish in colour.

4 Insect predators associated with box psyllids

Direct plant beating and sticky traps were used to sample predators. From this it appears that only a few species of insect predators are associated with box plants. These predators usually appear during spring having undergone diapause to overwinter. Most of the predators emerge from diapause just as psyllid nymphs become active. The major insect predators collected in order of importance based on their abundance are anthocorid hugs *(Anthocoris* nemorum), ladybird beetles *(Propylea 14 punctata,* and *Adalia bipunctata),* the European earwig *(Forficula auricularia)* and the green lacewing *(Chrysoperla cornea).*

From our work earwigs, anthocorids and ladybirds are the most commonly occurring insect predators in order of importance associated with box in southern England (Fig. 3), whereas the order of importance in South Wales is anthocorid bugs, followed by earwigs and then lacewings (Fig. 4). The late nymphal instars of the anthocorid bugs were usually observed inside the cupped shoots of box plants together with, and attacking, the developing P buxi nymphs. Using artificial refugia placed on the box plants it is possible to catch up to 30 earwigs per refugia on a single mature plant although smaller numbers were recorded using the plant beating and sticky trap sampling methods. In the summer months earwigs were sometimes found on the shoots where the psyllids were most active. Generally speaking ladybird numbers were very low and less than 13 were collected from any specific area per year. The so-called common green lacewing was the least common predator found in southern England, and was also infrequent in South Wales. Only on a few occasions were larvae of lacewings collected through plant beatings. However, a relatively high population of adults was observed hibernating in the roof of a building adjacent to one of the experimental areas in southern England. Generally speaking the population numbers of all these predators was low and almost insignificant compared to the psyllid population. Manipulations of these natural predators such as inundative release or construction of artificial refugia, could be an important part of the biological control of psyllids.

5 Do psyllids prefer non-variegated to variegated box varieties?

It is generally believed that psyllids prefer non-variegated box to variegated box varieties (Nguyen, 1968). This belief is based on the anecdotal observation that no serious infestation is observed on the variegated varieties even during major psyllid outbreaks. However, this might be due to the fact that white secretions do not show up so well on variegated plants. We decided to see if this observation was really true. A surveillance study was carried out on both variegated and non-variegated varieties using the plant beating method between February 1998 and November 1999. Six plants from each box variety were sampled every month and the number of psyllids caught was recorded. From this study it was found that 84.1% of all psyllids caught were from variegated as compared to 15.9% on non-variegated variety and this difference was statistically significant ($P < 0.01$). Both psyllid species were preferentially attracted to variegated plants where 84.8% and 78.0% of *S. fonscolumbii* and *P. buxi* respectively were recorded. These results indicate that the anecdotal evidence that psyllids preferably attack non-variegated box is incorrect and the reverse seems to be true.

Current work

Presently work is being conducted to determine quantitatively the extent of natural predation in the box plantations using polyclonal antiserum studies. This technique will provide a definite answer to the question as to what is eating what in the field.

This will allow us to make rational decisions on the manipulation of natural enemy populations, to maximise psyllid predation. Work on the evaluation of artificial refugia for green lacewings, ladybirds and earwigs is also in progress in the hope that this will lead to a build up of predators over a period of years. Besides insect pests, mite infestations in box plantations are also being closely monitored.

References

Horton, D R; Butts, E C; Lewis, T M & Coop, L B (1995) Sticky trap catch of winterform and summerform pear psylla (Homoptera, Psyllidae) over non-orchard habitats. Pan Pacific Entomologist 7(3), 176-189.

McEwen, P K; Baker, M; Muhammad, H & Symondson, W 0 C (1997) Psyllids (Psylloidea: Homoptera) attacking Box (Buxus sempervirens) in South England. Antenna 21(4) 200-201

McEwen, P K & Baker, M (1997) Pest control in boxwood. Topiaries, Autumn Vol 5

Nguyen, T H (1968) Role de la temperature dans revolution et relimination de la diapause larvaire de *Psylla* buxi (Horn., Psyllidae). Ann. *Soc. Ent.* Fr. *(N.S.)* 4, 69-74.

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Fig.3 Predators collected in southern England using plant beating *method 1998-1999*