Factsheet 01/12

Field Vegetables

# Pea bruchid – an assessment of risk to UK pea production

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Pea bruchid is not currently a pest in the UK but as part of continued efforts to ensure the supply of high quality peas in the UK, an assessment has been undertaken to predict the likelihood of pea bruchid (*Bruchus pisorum* Linnaeus) becoming a pest in peas for vining, fresh market or dry harvest and the impact that this would have on the crop. In addition consideration has been given to management techniques to prevent the movement of the pest into the UK and management and control used in countries where the pest is currently present. The assessment is based on evidence from other countries and, as such, a degree of extrapolation from available information has been necessary to predict the behaviour of the insect under the conditions experienced in the UK. Factors such as its biology, likelihood of establishment and spread and the risk of economic damage have been taken into account.

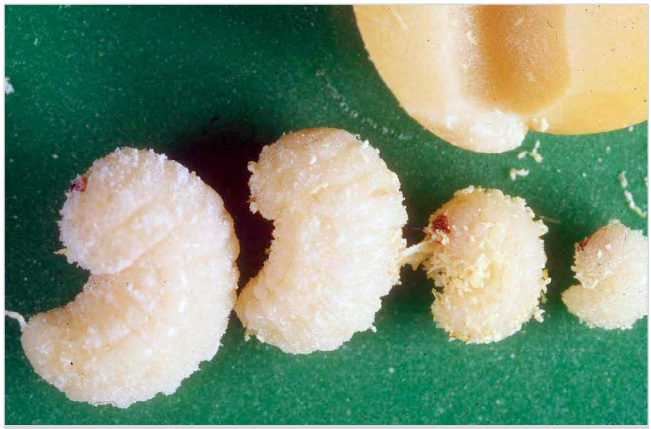
## Introduction

Pea bruchid, also called pea weevil, is widespread in Europe, North Africa, Asia, North America, Central and South America and South-western Australia. It is a pest that only affects peas (*Pisum sativum*) and belongs to the family Bruchidae, order Coleoptera. Although the insect has been recorded in the UK, it is possible that these recordings are inaccurate and that the bean seed beetle (*Bruchus rufimanus*) has been mis-identified as pea bruchid (*B. pisorum*). There have to date been no reports of crop damage caused by the pea bruchid in the UK.

## Description and life-cycle

Adults are 4 to 5mm long, grey or brownish-black, covered with reddish-grey hairs on the upper surfaces of the body (Figure 1). The wing cases are short and do not completely cover the abdomen, the exposed part of which is white. The larvae are cream coloured with a brown head and 4 to 5mm long at final instar (Figure 2).

1. The adult pea bruchid



2. Pea bruchid larvae are cream coloured with a brown head

The adults over-winter in pea seed during storage (Figure 3) and also in the surrounding environment, under tree bark, leaf litter, mosses and lichens and fences (Interactive Ecological Atlas of Russia and neighbouring countries). In the southern regions of Russia the insects over-winter in the surrounding environment. In the northern regions the species over-winters during the pupal phase inside the seed. US sources indicate that the adults over-winter in alfalfa, peas or other perennial legumes, in peas in storage or in the field, or in protected areas in trash along field margins and wooded areas. Similar protected areas are indicated in Australian literature.

**3. Adult pea bruchids over-winder in pea seed during storage**

Adults migrate from over-wintering sites in spring when temperatures reach 18°C. In the northern hemisphere this can be anytime between April and June and in Australia the end of August to beginning of September. The adults may fly up to five kilometres in search of pea flowers as female reproductive development is dependent on the beetles feeding on pea flower pollen. However, for survival, they may feed on pollen of a range of flowering plant species in the absence of flowering peas. Colonisation of crops can take place before flowering but the maximum invasion usually occurs once flowering has begun.

On average in most countries, the time taken between invasion of the pea crop and eggs being laid is about two weeks. Eggs are cigar shaped, yellow to orange and 1.5mm long by 0.6mm wide. They are laid on the surface of developing pods and hatch between seven and 28 days later depending on the region (Figure 4). The larvae bore directly from the egg through the pod wall and into the seed without exposure. For this reason control of pea bruchid adults must be carried out prior to egg-laying.

**4. Eggs are laid on developing pods**

Larval development takes between four and six weeks. When nearly fully grown the larvae chew circular holes, about 3mm in diameter, partly through the seed coat, leaving a translucent skin over the hole before pupation. Depending on the temperature, emergence of adults can take up to three weeks (Figure 5). Adults may leave the pea immediately or stay inside the pea during the winter and emerge the following spring. There is one life-cycle per year and insects require peas to be harvested dry to reach adult maturity.

**5. Adults emerge three after pupation**

The adults survive well during cold conditions, with insects inside seeds surviving at temperatures as low as -20°C, and those in the natural environment surviving at -18°C where snow is abundant. Where there is no snow, insects die at temperatures below -9°C. Survival of adults is significantly lower during mild winters.

## Sources of infestation

In different countries, the main sources of pea bruchid infestation are from pea seed shattered in the field, from volunteer peas, from pea haulm, from protected natural over-wintering sites and from seed in storage. Movement of pea bruchids into the UK would be most likely to occur in imported seed (Figure 6).

**6. Pea bruchids are most likely to arrive in the UK from imported seed**

## Damage

In peas harvested fresh for the freezing and fresh-picked markets, larvae are present in the seed and there is a degree of seed-coat blemishing as the larvae penetrate the seed coat on entry. The main damage in combinable crops is a circular hole in the seed leading to rejection of produce for premium human consumption and seed markets.

Heavily infested combinable crops may suffer up to 10% yield loss as up to 25% seed weight can be lost through larval feeding. Seeds may also be more fragile at harvest causing further yield loss as they shatter. Germination capacity of pea seed is likely to be affected as the seed is small and the radicle and plumule likely to be damaged. There may also be increased susceptibility to fungal pathogens caused by the hole in the seed.

## Risk

Several factors are considered when assessing the risk of pea bruchid becoming a pest in the UK. The pest can be identified precisely to species and the area under consideration can be defined as any area within the UK that has suitable conditions for the survival of the adult. This should include any area with temperatures of, or exceeding, 18°C during the period of egg laying (May to June). Experience in the UK with the related species, bean seed beetle (*B. rufimanus*), shows that the spread of the insect, which requires the same conditions as pea bruchid has extended as far north as Yorkshire. Hot spots are found in the east and south east. The geographical extent of pea crops in the UK is similar to that of field beans, although the area is smaller at about 35,000ha of vining and fresh market peas and 20,000ha of combining peas. It could be assumed that, where suitable conditions exist for the survival of bean seed beetle, it would be possible for pea bruchid to survive.

Where infested seed is sown, there is evidence to suggest that live insects may colonise crops from the seed source, and populations would build from this point. However, a small trial carried out in field beans in the UK failed to support the evidence that bruchids in beans can colonise crops from a live seed infestation, and this should be investigated further. It is possible that imported seed would be the initial source of colonisation by pea bruchid although up to now, the incidence of live insects in imported pea seed has been low.

Climatic conditions in parts of the UK are comparable to other areas of the world where the pest is known to be a serious problem. It is also significant that vining peas are grown in the same areas as combining peas. In order to complete the life cycle, the insect requires that the crop reaches full maturity. They will reach only the larval stage in vining peas or fresh market peas, therefore only dry harvested peas will allow insect maturity and survival into the following year.

The potential economic impact of the pest becoming a problem in the UK could be serious. UK production of vining peas is around 135,000 tonnes per annum with a value of £40.5 million. About 110,000 (value £33 million) tonnes are produced in the area south of Beverley in Yorkshire, which experiences conditions likely to be suitable for pea bruchid. Tolerance to the presence of bruchid larvae in vining peas would be zero and the impact of infestations would be great, with the risk of load rejection at the factory being high if larvae were present.

Production of combining peas is around 130,000 tonnes per annum worth around £33.75 million. With a potential yield loss of 10% due to weight loss damage by the larvae, this would translate to potential losses of up to £3.4 million per year. In addition, peas for human consumption would be unsuitable for use if bruchid damage was greater than 3%, with ensuing loss of premiums paid for high quality crop products.

### Conclusion

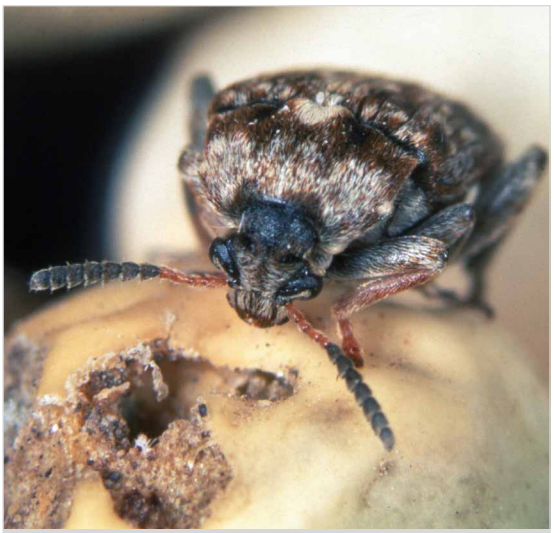
Pea bruchid can be considered to present a risk to the UK in terms of its requirements for survival. If it were to become established in the UK, it is likely that economic impact would be serious, although it is difficult to estimate the length of time needed for populations of the pest to build to sufficient numbers to create a significant problem. A fuller pest risk analysis should be carried out if pea bruchid is detected either in seed lots or in crops.

Legislation in the UK states that certified seed of peas shall not be contaminated with pea bruchid. However, vining pea seed is covered by the Vegetable Seed Regulations which does not have these restrictions. This may help to constrain the build up of populations from combining pea seed sources, but not from vining pea seed imports. Seed imported from Member States of the EU is not subject to regulations requiring freedom from bruchids, although it is likely that seed lots containing obvious signs of the presence of live insects would be rejected by the purchaser.

# Managing pea bruchid

### Imported seed

All seed that is imported into the UK should be free of pea bruchid. Where live insects are present, the seed lot should be treated with a fumigant or be rejected or destroyed (Figure 7). The use of bruchid-free or fumigated seed is critical in controlling the spread of the pest.



7. **Where live insects are present, in the seed lot should be treated with a fumigant or rejected**

### Control and monitoring

Control measures include winter ploughing to bury infested seed lost through pod shatter before or during harvest, and insecticide treatments during flowering and at first pod. Early harvesting before the larvae have pupated may remove the pest from the field before adults emerge. Immediate fumigation following harvest will prevent further seed damage and emergence of adults. Cleaning up seed spillages in fields following harvest can prevent survival of the insect in surrounding field margins.

Monitoring using sweep nets to detect numbers of adults in the spring will give a threshold for spray applications. In Australia the crop edge is swept every week and numbers counted for every 10 sweeps. 5 to 10 sites are swept and sprays applied where an average of one or more adults is collected per 10 sweeps.

Insecticide treatments are routinely applied in traditional pea growing areas in some countries as it is assumed that pea bruchids are present. Border sprays to 40 metres are effective in most situations as the adults tend to be at their highest populations on the edges of pea fields. Sprays are applied after adults have emerged from winter hibernation but before the first eggs are laid. If infestations are heavy it becomes necessary to spray whole fields.

Pyrethroid insecticides have given up to 75% control of pea bruchids and are generally applied before first eggs are laid. A two spray program is sometimes necessary as chemical persistence is only about 7 days for most products. Many different products are used in other countries to control adult pea bruchids and it is likely that products currently used in the UK for the control of bean seed beetle (*B. rufimanus*) would give control of pea bruchid (*B. pisorum*). There are restrictions on the use of insecticides during flowering in beans as they are pollinated by beneficial insects and therefore the risk of damage to these is high. Restrictions on the use of insecticides in peas are not as great as peas are self-pollinating, although there are strict harvest intervals, particularly in vining peas.

# A comparison of pea bruchid and bean seed beetle

There are many similarities between pea bruchid and bean seed beetle. And this is a cause of concern when considering the risk of the pest becoming a problem in peas in the UK. The bean seed beetle is now endemic in the UK and is distributed as far north as Beverley in Yorkshire, with the highest levels of infestation in the south and south-east. Bean seed beetle has been present in the UK for many years and was first noticed at damaging levels in crops in 1975 to 1976 following hot, dry seasons. By 1988 the UK area of field beans reached a peak at 154,000 hectares, and again in 1993. There was an increase in spring bean area after 1987, compared to winter beans, and the increased flowering period associated with having both winter and spring varieties of field beans led to a major impact of increasing populations of the insect. In broad beans the life-cycle is not complete at harvest and therefore the insects do not survive to re-infest beans the following year. It is the presence of field beans that allows the insects to complete their life-cycle. The same principal applies to peas and although vining peas would be severely impacted

8. **It is critical to apply insecticides before the adults start laying eggs**

by the presence of pea bruchid, the larvae would not survive to adulthood without the presence of combinable pea crops.

The life cycle and conditions of survival are the same. The main similarities are the temperature threshold required for emergence from over-wintering sites, the requirement to feed on host plant pollen for female reproductive development, conditions for and manner of oviposition, egg-hatching and the length of time from eggs being laid to adult emergence. As with the bean bruchid, the adults are strongly attracted to the host plant by volatile chemicals in the plant.

Critically, the temperature threshold for start of egg laying for pea bruchid (18°C) is two degrees lower then that required for the bean seed beetle. The main period of crop infestation and oviposition in the northern hemisphere for pea bruchid is June when many crops of peas are flowering and setting pods.

Pea bruchid is also able to feed on pollen from other flowering species to survive in the absence of host plant pollen. It lays eggs on the pod surface, which hatch directly through the base of the egg, through the pod wall and into the underlying seed, making it impossible to target the larvae using insecticide applications. Thus it is critical to target adults just prior to start of eggs being laid.

As with bean seed beetle, the pea bruchid over-winters in the seed or in field margins, hedgerows and surrounding natural features. No further damage is caused by adults during storage. Because the insects colonise the edges of the fields, it is thought that control of pea bruchid can be achieved by a well timed border spray, reducing the economic and environmental impact of insecticide applications. However, there are some areas of the world where infestations affect the whole crop and in this case whole field applications are necessary.

## Further information

**HDC factsheet 25/11**

Control of bruchid beetle on broad beans. This factsheet provides information on bruchid beetle (bean seed beetle) control in the UK.

## Figure references

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## Notes

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