



Grower Summary

FV 453

Peas: Survey of UK pea crops
for the presence of viral
pathogens

Final 2017

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Project title: Pea viruses: Investigating the current knowledge on distribution and control of pea viruses

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GROWER SUMMARY

Headline

The current state of virus health of the UK pea crop is unknown. Investigations into pea affecting viruses have been carried out in other countries but this has been sporadic. Emerging viruses have been identified in northern Europe, but at present these viruses are not known to occur in the UK.

Background

This work was undertaken as a response to the perceived lack of knowledge regarding the virus health of UK pea crops and potential management actions which could be taken to mitigate viral threats to those crops.

Summary

Pea (*Pisum sativum*) is an important legume crop which is grown worldwide for consumption by humans and animals. Pea plants also form a key part of cereal rotations partly to act as a break crop to help manage disease, but also to improve soil fertility as a consequence of nitrogen fixing (Congdon et al., 2017b; Coutts et al., 2008). Using peas, or other legumes, in rotation can greatly reduce the need for application of pesticides and synthetic nitrogen fertilizer (Cernay et al., 2015). The European Union is looking to increase the production of legume crops in order to reduce negative impacts on the environment from use of fertiliser and also to reduce imports of soybean from America (Cernay et al., 2015). However, changing the crops grown in an area can lead to changes in pathogen pressure, which in turn make predicting diseases more difficult.

The range of viruses infecting peas

There are a broad range of viruses which are known to infect pea. The web-source 'Plant Virus Online' (Brunt et al., 1996) lists 124 viruses which have the ability to infect peas, however, only 43 of these viruses were reported occurring from natural infections with the remainder having pea listed as an experimental host. However, there is a lack of recent survey reports covering either the United Kingdom (UK) or the European Union (EU) which means the current health status of pea crops is unknown. Seven viruses were reported to occur in peas in the UK, with early confirmed reports dating back to 1964. Two of these viruses are known to be seed-borne and regular diagnostic testing is carried out to help ensure high seed health. One of these viruses, *Pea seed-borne mosaic virus* (PSbMV) has been the subject of a recent in-depth studies in Australia (Congdon et al., 2017a; Congdon et al., 2017b; Congdon et al., 2016a; Congdon et al., 2016b, 2017c) which have resulted in a greater understanding of the

epidemiology and control of PSbMV outbreaks in pea crops in the Mediterranean-type climate of south-west Australia. These studies have highlighted that wind-mediated plant-to-plant contact may exacerbate outbreaks of this virus, a factor not previously considered for this virus in the UK. Additionally, a predictive model was devised from these studies which may be applicable to UK PSbMV outbreaks, however, this would need to be investigated in UK climatic and agronomic conditions.

Diagnostics and control strategies

There were limited reports on the use of molecular diagnostics in investigations of pea viruses. The majority of work has used ELISA based testing, however, these methods will not be sensitive or specific enough should future investigative work seek to monitor aphid transmission factors. Additionally, given the current status of pea viruses in the UK is unknown, should novel or unusual symptoms present as part of any future symptomatic survey, technology is now available to determine the identity of diseases of unknown aetiology.

There were also limited reports on effective control measures. Where these do occur specifically for peas they are focussed on either chemical control or cultural approaches (e.g. seed fractionation to reduce PSbMV inoculum). In many cases the control measures listed have been applied for pea affecting viruses in other crops, or have been applied more generally to reduce aphid transmitted viruses (e.g. the use of mineral oils). These approaches may hold some value for reducing the virus risk to UK pea crops but further investigation would be required into their efficacy and practical application. Part of such an evaluation would need to include a study to ascertain the viruses to prioritise for control as this is not currently known.

Emerging threats?

Several viruses have been reported from European pea crops which have not yet been detected in the UK. Of greatest significance are the newly emerging genus of nanoviruses, primarily *Pea necrotic yellow dwarf virus* (PNYDV). This virus was initially reported from a single province of Germany in 2009, and by 2017 has been found in all pea growing regions of Germany as well as being detected in Austria and The Netherlands from a range of leguminous crops (Gaafar et al., 2016; Gaafar et al., 2017; Grigoras et al., 2010; Steinmüller et al., 2016). This aphid-transmitted virus, and more broadly this emerging group of viruses poses a potential risk to peas should it establish in the UK as they have been recorded causing significant damage to pea crops where they occur.

Conclusions

The primary conclusion of this study is that investigations should be carried out to ascertain the current state of the UK pea crop with respect to virus infections. To ensure outputs are of use to growers any future work should be considered under a programme which addresses the fundamental principles of plant virus management:

- **Plant clean seed:** As part of any future research programme input seed stocks should be surveyed to ensure the assumed high virus health status of input seeds is reflected in the seed being planted. This work should focus on the known seed borne viruses *Pea seed-borne mosaic virus* (PSbMV) and *Pea early-browning virus* (PEBV).
- **Grow in absence of virus reservoirs:** With limited information available on the presence and incidence of pea viruses it should be a priority to baseline current virus populations affecting pea crops. Such work should focus on those viruses known to occur in UK crops such as *Bean yellow mosaic virus* (BYMV), *Bean leaf-roll virus* (BLRV), *Pea enation mosaic virus* (PEMV), *Pea early browning virus* (PEBV), *Pea seed borne mosaic virus* (PSbMV), *Broad bean true mosaic virus* (BBTMV) and *Pea streak virus* (PeSV), but should also include testing to ensure that emerging viruses from Europe, such as the nanoviruses, are not establishing in the UK.
- **Grow in absence of vectors:** Any future survey programme should include an aphid monitoring programme and diagnostics should be developed to allow for aphids to be tested for the presence of viruses supporting epidemiological study.
- **Isolate from similar crops:** If surveillance is carried out into the viruses present in crops, this should be initially carried out on a regional basis and near neighbour crops could be compared for relative virus presence and incidence.
- **Use resistant (or tolerant?) varieties:** Field survey should include a review of resistance status of any cultivars surveyed and this information can be used to assess the relative virus health of crops.

Ultimately a decision support system for the industry would be required to allow the prediction of virus outbreaks and assess the risk of virus in individual crops. Assessing the applicability of existing models may facilitate the development of such a system but at present the knowledge gaps regarding the UK pea crop pathosystem may be too great for such models to be of immediate use.

Financial Benefits

Given the high degree of uncertainty around what viruses are present, their incidence and impact and the complication of potential multiple infections in a crop it is difficult to give any indication of potential financial benefits at this point. Work in Australia estimated yield losses from PSbMV at between 13%-25%, but this was influenced by the inoculum level in input seed and whether prevailing conditions were conducive to aphid transmission of the virus.

Action Points

There are no action points for growers arising from this review.

