

Agapanthus Gall Midge

– update 20.10.2015 (Hayley Jones, Andrew Salisbury, Ian Waghorn & Gerard Clover)
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Background

The agapanthus gall midge is an undescribed pest affecting *Agapanthus* that belongs to the Cecidomyiidae family of flies. The tiny gall midge lays eggs which develop into maggots inside the individual flower buds or inside the closed scapes. The midge can cause the bud to be deformed and discoloured and often fail to open. The severity of this can range from a couple of buds failing, to collapse of the entire flower head. Infestation can be confirmed by opening the buds or flower heads and looking for the presence of small maggots 1-3mm in length which are a creamy yellow colour (Figure 1).



Figure 1.
Agapanthus
gall midge
symptoms
and larvae

This problem was first noticed in a private garden in 2014 and reported to the Royal Horticultural Society (RHS) through the RHS Gardening Advice service. Inspection at RHS Garden Wisley showed it was present in the living collections and subsequent reports indicate that it has been present in the UK for at least two years and it is widely established in other parts of southern England.

The species of midge causing this problem is undescribed (new to science). Consequently, very little is known about the biology and lifecycle of this insect and what control options may be successful. Therefore the Plant Health team at Wisley has launched a project to study it, working with Defra and international experts.

Distribution

In order to determine how widespread the midge has become in the UK we have been requesting samples and photographs of infested agapanthus plants from home gardeners. This call was disseminated via a press release which was taken up by the gardening press, along with social media publicity and pieces in *The Garden*. A segment on BBC Gardeners' World on non-native pests further raised the profile of the agapanthus gall midge.

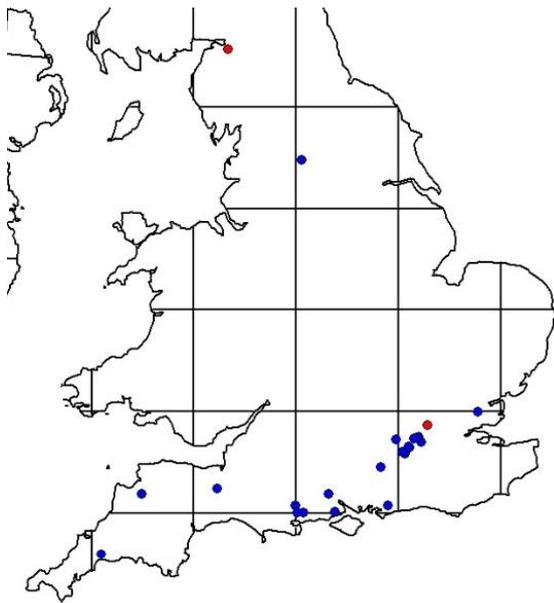


Figure 2. *Agapanthus* gall midge distribution 2014-2015, confirmed records in blue, unconfirmed in red.

The call to the public in 2015 has yielded six confirmed and two probable locations of midge infestation in the UK. Defra's Animal and Plant Health Agency (APHA) undertook an intensive survey of commercial premises, and of the >170 surveyed 8 cases were confirmed. Two records were also received from Guernsey and further information indicates the midge is well established there. There are currently no cases we are aware of from mainland Europe.

Figure 2 shows the location of all records, demonstrating that the midge's distribution seems widespread, mostly restricted to the South of England but with isolated cases in the north. The West Yorkshire case has been confirmed by a sample with larvae present, the owner of the *Agapanthus* had purchased a plant in Guernsey in spring 2014.

Biology and lifecycle

Observations made on plants in RHS Garden Wisley and on plants contained in the RHS's Field Research Facility have yielded some information about the midge's biology and lifecycle. Adults were obtained and photographed and can be seen in Figure 3. The adults have a body length of up to 3 mm, and live adults rest with legs bent.



Figure 3. *Agapanthus* gall midge adult (dead) and larvae with scale bar

Infestation has been observed at very early stages of flowering, when the flower head sheath has not yet opened (Figure 4). When infested at this stage the larvae develop between the stems of the developing buds inside the sheath, rather than inside buds. Heavy infestation at this stage can cause the flower head to abort completely.



Figure 4. Agapanthus infested with gall midge before the flower head has emerged from its sheath.



Initial rearing experiments, combined with observation of plants in the *Agapanthus* trial at Wisley indicate that the midge is likely to have multiple generations per year. Larvae placed into rearing pots on 24.07.2015 started emerging as adults on 07.08.2015, indicating a pupation time of around two weeks (Figure 5). A long period of activity and breeding was found with adults continuing to emerge from these tubes throughout August and early September. A small number of adults also emerged from larvae placed into a rearing tube on 21.08.2015. Additionally active larvae were found in plants in the garden as late as 30.09.2015.



Figure 5. Rearing tubes; larvae are placed onto a substrate in the opaque tubes wherein they can pupate. Emerging adults fly upwards towards the light.

A graph outlining levels of infestation on the *Agapanthus* trial at Wisley can be seen in Figure 6. This shows that while the peak number of new flower heads (~1800) occurred in late July the number of infested flower heads stayed reasonably constant between 50 and 200. Consequently the proportion of flower heads affected is highest in the early and late season. Similarly the severity of infestation was highest in the early and late season. This may indicate that the availability of suitable flowers for oviposition was not a constraining factor at Wisley, but other factors were, which could include population size, environmental conditions or natural enemies.

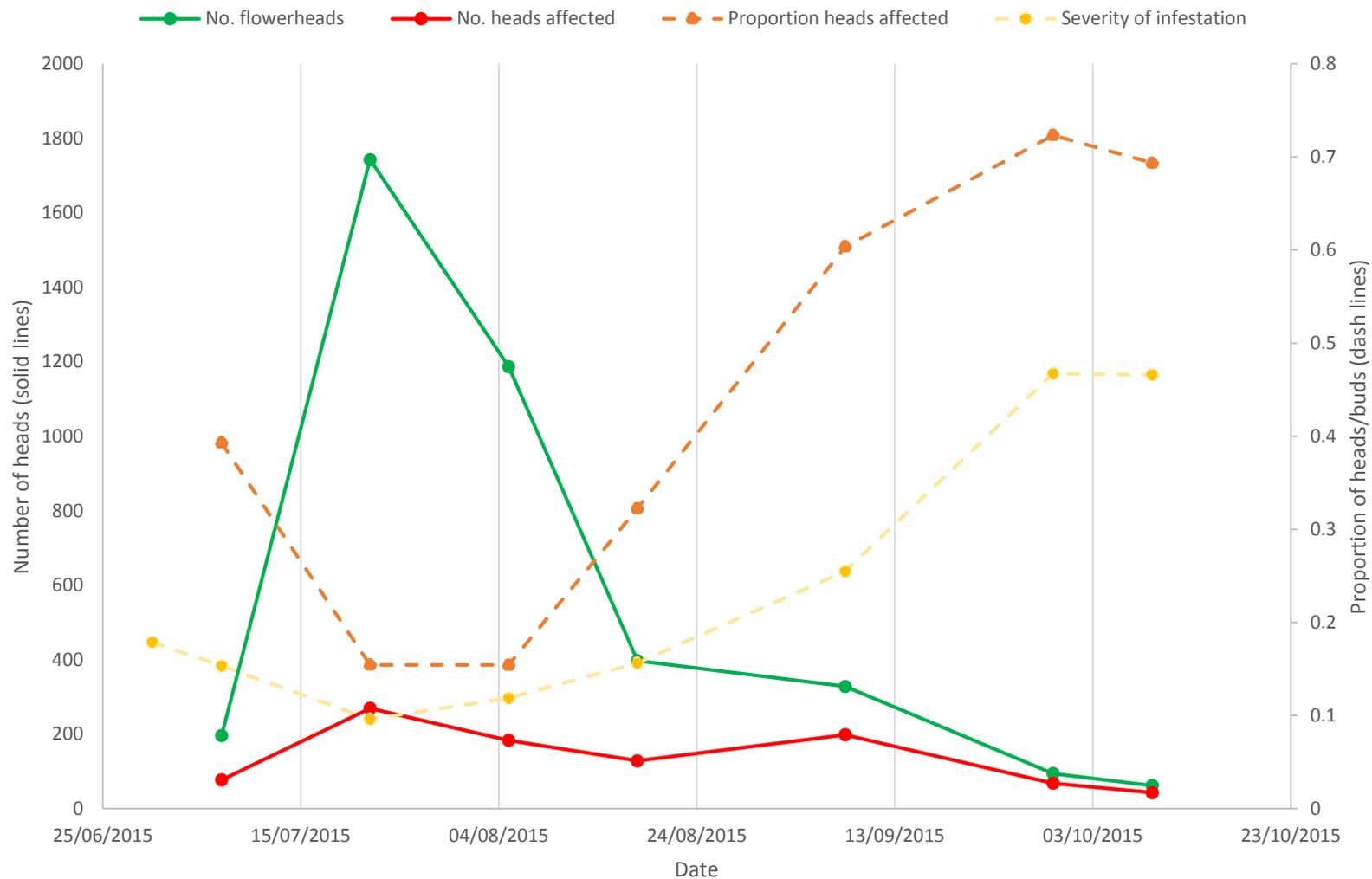


Figure 6. Line graph showing agapanthus gall midge infestation on the *Agapanthus* trial at RHS Garden Wisley: ‘No. flower heads’ number of flower heads available that could be infested by the gall midge. Flower heads were no longer counted if they had finished flowering or if the number of heads and level of infestation on a plant did not change between surveys; ‘No. heads affected’ – number of heads showing any symptoms of gall midge infestation; ‘Proportion heads affected’ – No. heads affected/No. flower heads; ‘severity of infestation’ – visual assessment of proportion of buds showing symptoms within a flower head, averaged over all flower heads showing symptoms.

Cultivar variation

There is some indication from observation on the *Agapanthus* trial that there may be some differences in midge infestation between different cultivars of *Agapanthus*. Three individual plants from 149 cultivars were grown on the trial field. Of these 16 failed to produce any flowers (grey in Figure 7) and 25 cultivars showed no symptoms (green) although a number of these had only one or two flower heads that could be assessed. The majority of cultivars (108) showed symptoms of gall midge infestation, of which 40 were severe (greater than 25% of buds affected within a flower head). This means that 81% of assessable cultivars showed some symptoms of agapanthus gall midge. The midge therefore has a broad range of host cultivars indicating it is likely to become a very widespread problem.

No direct conclusions on different cultivars can be drawn from this because it was not a replicated experiment, so no cultivar names are included in this report. However, this information could provide a starting point from which research on cultivar susceptibility could be based.

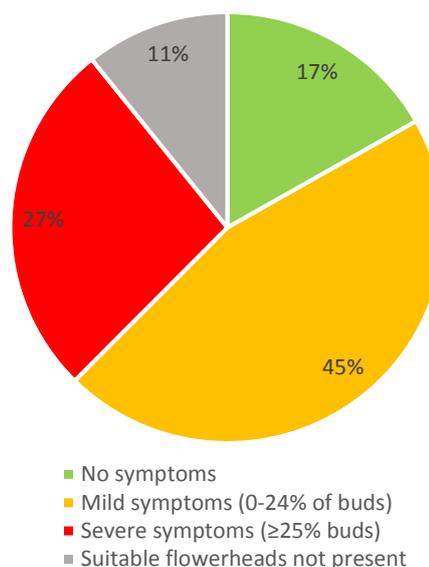


Figure 7. Pie chart showing proportions of cultivars showing different levels of agapanthus gall midge symptoms. 149 cultivars were observed.

Control

Information gathered this year has provided few insights into effective control. The protracted and consistent presence of larvae means there is no obvious time to target pesticide application or other control measures. Further detailed experimentation is necessary to deduce appropriate control which may include timed application of pesticide aided by pheromone trapping, development of biological control or using cultivars less susceptible to attack.

Statutory action

Defra added the agapanthus gall midge to the UK Plant Health Risk Register in late July 2015. They are developing actions and recommendations to manage the incursion of this pest. Due to the restricted distribution, statutory action will be taken on commercial premises where the midge is found to prevent the movement to the rest of the country, and into other EU countries. The statutory action will depend on the situation, but may include destruction of affected flower heads and treatments as they become available. Infested stock may not be moved or sold. No statutory action will be taken in the wider environment, as eradication is considered impossible.

RHS Research

In winter 2015-16 the first aim is to extract and sequence DNA from samples of the midge. This will enable us to deduce how this midge is related to other flies in the Cecidomyiidae,

and will contribute to the description and naming of the insect. Samples of larvae from nine different locations have been gathered for this purpose. Keith Harris, an international expert on cecidomyiid flies, will lead the species description process.

Research plans for 2016 are being developed, including application for research funding. Articles in *The Garden* and other horticultural press are being arranged for May/June 2016 to increase awareness and repeat the call for records and samples before the start of *Agapanthus* flowering.

Further observations on plants in the garden at RHS Wisley and on infested plants housed in the RHS Field Research Facility will be carried out. Additionally a laboratory population of midges is being developed, starting with larvae gathered in summer 2015. This will enable study of the life cycle of the midge and description of the appearance of all life stages, such as the eggs and pupae, which currently have not been observed. We will also be looking for the emergence of natural enemies such as parasitoid wasps.

In order to develop appropriate controls for home gardeners the RHS Plant Health team will develop a replicated experiment on pesticide application to assess timing and products appropriate to achieve some level of control. If funding can be obtained this experiment will be extended to include control options for commercial growers. There is also the possibility to collaborate with other research institutes to develop a pheromone trap for the midge, which may help time efficient pesticide application.

Figure 8. Field and laboratory facilities at RHS Wisley



Contact

Growers should report any suspected cases of agapanthus gall midge infestation to their local APHA inspectors in the first instance.

The Royal Horticultural Society would be happy to receive samples of infested flower heads in 2016. Please send any samples in sealed bags or containers to: Entomology, RHS Garden Wisley, Woking, Surrey, GU23 6QB

Alternatively images with location information (postcode) will contribute to the UK distribution mapping and can be sent to: advisory_entomology@rhs.org.uk

Further information

Agapanthus gall midge problem profile page for gardeners:
<https://www.rhs.org.uk/advice/profile?PID=742>

Project page: <https://www.rhs.org.uk/agapanthusmidgeproject>

Agapanthus gall midge Plant Health Risk Register entry:
<https://secure.fera.defra.gov.uk/phiw/riskRegister/viewPestRisks.cfm?cslref=27376>