Briefing note

Strategies for the control of tobacco whitefly on poinsettia crops

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Background

Tobacco whitefly (*Bemisia tabaci*) continues to be brought into the UK on imported poinsettia cuttings. The level and frequency of this pest varies from year to year, but the threat is always present, as all poinsettia cuttings are produced in regions in which *Bemisia* is endemic in the environment.

Defra Plant Health inspectors took a strong line last season when the pest was found, and as well as inspecting UK grown crops, they checked finished poinsettias imported from the Netherlands and Germany. Confirmation of *Bemisia* resulted in over 80,000 plants being destroyed with consequent financial losses. Therefore the control of this pest is very important.

Recent research has indicated the development of insecticide resistance by the pest which means that control will become even more difficult. Therefore, control strategies based on current scientific knowledge should be planned, regardless of whether the control programme is based solely on biological control agents, an integrated pest management (IPM) programme incorporating biological control agents and compatible insecticides or a chemical programme.

Understanding the biology of the pest

Bemisia tabaci is controlled at the propagation stage with a range of insecticides and overall such programmes generally achieve good levels of control as gross contamination of cuttings is rare. However, the eggs and young scale stages are very hard to spot at low levels and they may easily be missed when cuttings are inspected.

After delivery, cuttings are usually potted up and grown on at temperatures of around 20-25°c. The life cycle of the whitefly at these temperatures takes around 28 days from egg to adult. Unless intensive monitoring is carried out, the pest may not be detected for the first 4-6 weeks after potting because levels of infestation are initially low. But since the poinsettia crop may be on site for a further 16-18 weeks, under warm conditions, there is plenty of time for populations to increase.

The worst case scenario is for whitefly populations to be either ignored or missed, until the crop is well grown and nearing bract colouration. At this stage control is extremely difficult, due to the dense crop canopy impeding spray coverage and the increased risk of plant phytotoxicity. Therefore, monitoring should be carried out routinely, using yellow sticky traps hung just above the crop about every $50m^2$ and trap catches recorded weekly. Plants should also be randomly inspected for signs of the pest, especially early in the life of the crop when adult numbers may be very low. Where ‘hot spots’ of pest activity are found, badly infested plants should be immediately disposed of into sealed bags or bins and the amount of biological control agents introduced should be increased and/or chemical controls applied, as necessary.

The glasshouse whitefly (*Trialeurodes vaporariorum*) may also be present in crops and so any control programme will need to deal with this species too. In recent years, the cabbage whitefly (*Aleyrodes proletella*) has also been a problem, sometimes alone or sometimes in combination with the tobacco whitefly. This species can fly into glasshouses from nearby fields of brassicas, including oil seed rape. The cabbage whitefly is easy to recognize as it is larger than the other two whitefly species, has two pale brown patches on each wing and secretes copious amounts of wax which covers the eggs and scales. The presence of more than one whitefly species can present a problem if using biological pest control programmes, but rigorous chemical based spray programmes should be able to deal with all three species effectively.

The three main whitefly species found on poinsettias in the UK, from left to right: tobacco whitefly, glasshouse whitefly and cabbage whitefly

Control programmes for tobacco whitefly

1. Biological control programmes

These programmes can be quite complex and should always be discussed in detail with either an appropriate consultant or a representative of one of the bio-control companies beforehand. The table below summarises the biological control agents that are available in the UK and their main characteristics.

Biological control agents for whitefly control in poinsettias

Bio-control agent	Latin name	Pest control 'mode of action'	Product	Comments
Parasitic wasp	*Encarsia formosa*	Scale parasite	Available as parasitised pupae on cards, loose pupae in dispensers, or for application via a mechanical dispenser (Aerobug)	Only scale stages are attacked. Pupae of tobacco whitefly turn pale brown when parasitised, while glasshouse whitefly pupae turn black. Less effective against tobacco whitefly, although can 'host feed' on this species, causing mortality of scales and pupae in some circumstances. Does not affect cabbage whitefly.

Bio-control agent	Latin name	Pest control 'mode of action'	Product	Comments
Parasitic wasp	*Eretmocerus eremicus*	Scale parasite	As for *Encarsia*, but available either alone or in a mixture with *E. formosa*	Parasitises tobacco whitefly better than *E. formosa*, but can 'host feed' well on both species. Not effective against cabbage whitefly.
Predatory mite	*Amblyseius swirskii*	Predator of eggs and 1st instar scales	Available in slow release sachets, shaker bottles, or for application via a mechanical dispenser (Aerobug)	A very active mite which can also feed on other prey such as thrips larvae. Needs temperatures of 20°C plus to be effective. Active against glasshouse and tobacco whitefly, but not effective against larger scales, pupae or adults.
Predatory mite	*Amblyseius montdorensis*	Predator of eggs and 1st instar scales	Available as loose product in shaker bottles, slow release sachets, or as Bugline (sachets strung together on a line to aid placement in the crop)	This species is also a very active mite, but it is active at lower temperatures than *A.swirskii*. It can also feed on young thrips larvae and other prey. Experience to date is limited.

Recent commercial introductions of novel predatory mites such as *Amblyseius swirskii* and *Amblyseius montdorensis* show promise. The most reliable programmes for whitefly control usually involve their use together with parasitoids such as *Encarsia formosa* and *Eretmocerus eremicus.* Whichever organisms are used, regular introductions (usually weekly) are vital. Sticky traps used for pest monitoring should not be placed near to parasitoid release points.

When areas of whitefly activity are detected, high volume sprays of insect pathogenic fungal products, such as *Lecanicillium muscarium* (Mycotal) or *Beauveria bassiana* (Naturalis-L) can be safely applied to try and bring the population under control.

2. Integrated pest management (IPM) programmes

These programmes can also be complex, but usually either involve applying insecticides that are compatible with biological control agents to reduce the whitefly population initially and then following on with introductions of the agents, or alternatively, biological control agents are used throughout and compatible insecticides are used only if pest 'hot spots' are identified or if the whitefly population increases.

Compatible insecticides include the physically acting products such as: Agri 50E, Eradicoat, Majestik, Savona, SB Plant Invigorator and Spraying Oil. Insect pathogenic fungal products such as Mycotal and Naturalis-L are also compatible within IPM programmes and are widely used.

Certain conventional insecticides such as flonicamid (Mainman), pymetrozine (Chess WG), and newer products such as spiromesifen (Oberon) and spirotetramat (Movento) can also be used within biological pest control programmes, as long as the label instructions and the data from the bio-control companies is followed. Foliar applied neonicotinoid insecticides including: Calypso and Gazelle SG may be compatible with biological pest control agents, as long as an interval of about four weeks is maintained between their use and the introduction of any agents. However, recent confirmation of resistance to this group of insecticides means that they should not be relied on for control (see next section).

3. Chemical control programmes

Before planning any chemical programme, it is important to be aware of the resistance status of the target pest and also to conform to IRAC (Insecticide Resistance Action Committee) guidelines to reduce the development of resistance (see http://www.irac-online.org for further information). The table below summarises many of the products currently available for use, but is not meant to be a complete list of potential products.

Insecticide approval status and IRAC grouping (June 2012)

Product	IRAC code	Approval status	EAMU details	Comments
Agri 50E	N/A	Exempt		Good spray coverage required
Calypso	4A	EAMU	3728/2006	Systemic activity
Chess WG	9B	EAMU	2834/2008	Systemic activity
Couraze	4A	Label		Systemic activity
Dynamec	6	Label		Approved only for control of two-spotted mite and thrips
Eradicoat	N/A	Label		Good spray coverage required
Exemptor	4A	Label		Systemic activity
Gazelle SG	4A	Label		Systemic activity
Imidasect 5GR	4A	Label		Systemic activity
Intercept 5GR / 70WG	4A	Label		Systemic activity
Mainman	9C	EAMU	0620/2012	Systemic activity
Majestik	N/A	Label		Good spray coverage required
Movento	23	EAMU	1987/2011	Systemic activity, limited experience in practice
Mycotal	N/A	Label		Needs high humidity and 15-20°C after application
Naturalis-L	N/A	Label		Needs high humidity and 15-20°C after application
Oberon	23	EAMU	1718/2004	Contact action only, no resistance detected to date
Savona	N/A	LTAEU		Contact acting only, protected ornamentals not on label
SB Plant Invigorator	N/A	Exempt		Contact acting only
Spraying Oil	N/A	Exempt		Can cause phytotoxicity to some crops, needs care in use

EAMU - Extension of Authorisation and Consent for a Minor Use of a Plant Protection Product (ex SOLA)
LTAEU - Long Term Arrangements for Extension of Use

Within a spray programme products should be selected from chemical groups with differing IRAC codes to prevent the development of resistance. Note that the 11 coded products listed in the table actually belong to only 4 different IRAC code groups. Physically acting and biological products are not coded.

The recent granting of an EAMU (1987/2011) for spirotetramat (Movento) is very useful to UK poinsettia growers. Evidence shows that this systemic product is active against tobacco, glasshouse and cabbage whitefly. It is in the same chemical group as spiromesifen (Oberon) which has proven safe to use on poinsettias in several research projects. There is only limited crop safety trials information for this active ingredient on ornamentals (see http://ir4.rutgers.edu/ir4_pdf/default.aspx?pdf=http://ir4.rutgers.edu/Ornamental/SummaryReports/SpirotetramatCropSafety2010.pdf for further detail, including work on poinsettias using the U.S. product Kontos) and it is suggested small scale trials are undertaken before the product is used on a commercial level. Please be aware application under an EAMU (or LTAEU) is at grower's own risk.

Recent Defra funded research undertaken at Fera laboratories in Sand Hutton, York examined various strains of *Bemisia* coming into the UK on poinsettia cuttings. The results showed that the 'Q strain' was dominant and caused the most difficulties in terms of control. This was a major change from previous years, when the 'B strain' or silver leaf whitefly was dominant. The 'Q strain' was tested for susceptibility to a range of insecticides and strong resistance to the neonicotinoid group (which includes: Calypso, Couraze, Exemptor, Gazelle SG, Imidasect 5GR and Intercept 5GR/70WG) was found, along with resistance to Chess WG. A summary of the results of this work is presented below. Due to the high level of resistance, neonicotinoids should not be relied upon for the control of this pest and products should be rotated based on their chemical group to reduce resistance build up.

Results of strain testing at Fera laboratories, Sand Hutton, York, using the 'Q strain' of whitefly isolated from a UK poinsettia crop

Product	LD 50 'laboratory reference strain'	LD 50 'Q strain' from UK poinsettia crop	Resistance factor calculated
Gazelle SG	0.59	18.81	32
Intercept 70WG	0.70	23.00	33
Chess WG	1.17	41.50	36
Teppeki WG	1.46	0.67	0.46

LD 50 refers to the dose needed to kill 50% of the whitefly population

The results show a high level of resistance to both the neonicotinoid compounds tested and Chess WG. However, the 'Q strain' was more susceptible to the product Teppeki (marketed as Mainman for use on protected ornamentals) than the laboratory strain. (Mainman possesses an EAMU for use in protected ornamental plant production (0620/2012) and can be used on poinsettia crops at growers own risk).

The strain composition of *Bemisia* for this coming season is not known, but all the evidence points towards the 'Q strain' continuing to dominate due to its strong resistance to a range of insecticide groups.

HDC research results

The recent HDC project PO 003 'Development of safe and effective programmes for the early control of whitefly on poinsettia crops' tested sequential applications of a range of chemicals in the laboratories at Fera, Sand Hutton, York on the pest. The same treatments were tested for crop safety on four varieties of poinsettia grown on a commercial nursery. The project used a strain of tobacco whitefly which was obtained from a UK nursery that had proven difficult to control.

The premise upon which the treatment programmes were based was that early control of *Bemisia* was the best option and therefore the treatments were applied within the first few weeks after potting. All treatments were applied either at label rate or the rate specified on the EAMU. A summary of the various treatments examined is presented below:

Sequential insecticide treatments tested for *Bemisia tabaci* control

Crop Stage	**3 days after potting**	**7 days after potting**	**14 days after potting**	**20 days after potting**
Treatment				
1 (Control)	*Water only*	*Water only*	*Water only*	*Water only*
2	Majestik	Oberon + Mycotal + Addit	Spraying oil	Dynamec + Chess WG
3	SB Plant Invigorator	Oberon + Mycotal + Addit	Oberon + Mycotal + Addit	Spraying Oil
4	Spraying Oil	Majestik	Savona	Agri 50E
5	Savona	Spraying Oil	Dynamec + Chess WG	Gazelle SG
6	SB Plant Invigorator	Majestik	Dynamec + Chess WG	Gazelle SG
7	Naturalis-L	Naturalis-L	Naturalis-L	Naturalis-L

The results showed that all the sequential programmes tested gave complete control of the 'Q strain' of tobacco whitefly by the end of the trial. All the programmes were also designed to include products from different chemical groups, so as to minimise resistance build up according to IRAC guidelines. Therefore any of these programmes could be selected for immediate commercial use. Results from the nursery based crop safety trial did not show any incidence of plant phytotoxicity from any of the sequential programmes, on the poinsettia varieties 'Champion', 'Infinity red', 'Infinity white' and 'Scandic'.

Further HDC information

The grower summary and full project report for HDC project PO 003 are available on the HDC website, log onto www.hdc.org.uk to access the report. The HDC Factsheet 14/05 'Control of whiteflies on protected ornamentals' provides further information on the biology and control of the whitefly species.

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