



Improving Bio-security in the United Kingdom Overseas Territories: Identification service for invasive invertebrate plant pests

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1.0 Summary

Biodiversity in the UK Overseas Territories (UKOTs) is recognised as being under threat from non-native species. The Plant Pests and Diseases Programme at the Food and Environment Research Agency (Fera) provides diagnostic and training services for the England and Wales Plant Health Service and has a wealth of experience and expertise in the identification of all plant-feeding insect orders, plant-feeding mites and plant-parasitic nematodes.

The Entomology Team within the Programme led a Defra-funded project with the final aim of providing an identification service for invasive invertebrate plant pests for all the UKOTs. Contact was renewed with individuals in all of the seven territories included in the original assessment project, namely Anguilla, British Virgin Islands, Cayman Islands, Falkland Islands, Montserrat, Saint Helena, and Turks and Caicos Islands. Identifications were provided for the latter five territories. New contacts were established and discussions were had with individuals in the following additional territories: Ascension Island, Bermuda, SBA Cyprus, Pitcairn and Tristan da Cunha. Identifications were provided for Tristan da Cunha, and all of the other territories expressed an interest in receiving assistance with invertebrate identifications.

Six UKOTs submitted a total of 126 samples to Fera between April 2010 and March 2011 and a further six OTs expressed an interest in the service. The project highlighted a number of previously unreported non-native species introductions in the UKOTs.

- 128 species of invertebrate were examined (more than 1,500 individual organisms)
- Three species appear to be new to science
- 19 species are reported as new to the UKOTs (this figure may increase as some specimens are still being studied)
- On two occasions rapid emergency assistance was provided in the form of identifications and technical advice following bio-security threats in Tristan da Cunha and the Falkland Islands

2.0 Background

Between November 2009 and March 2010 the Entomology Team within the Plant Pests and Diseases Programme at the Food and Environment Research Agency (Fera) led a Defra-funded project (T5HZ1100) to assess the existing diagnostic capabilities of the relevant governmental and conservation authorities within selected UKOTs and established an identification service for invasive invertebrate plant pests for the UKOTs. The UKOTs selected for the initial project were: Anguilla, British Virgin Islands, Cayman Islands, Falkland Islands, Montserrat, Saint Helena, and Turks and Caicos Islands.

Strong expressions of interest in accessing Fera's diagnostic technical support were received from all the UKOTs contacted, and the diagnostic capabilities of all but two of the selected UKOTs were assessed. Through correspondence with the UKOTs it quickly became clear that technical assistance with pest diagnosis was much in demand. Three UKOTs submitted a total of 44 samples to Fera following the launch of the identification service; an additional 63 samples were processed through the South Atlantic Invasive Species Project.

Key achievements for the first year (2009/2010) project:

1. The existing capabilities for the identification of invasive invertebrate plant pests in the selected UKOTs were reviewed.
2. An action plan in support of their diagnostic requirements was agreed.
3. Protocols for sample processing were produced.
4. An identification service for the selected UKOTs had been established.
5. 56 species of invertebrate were identified from the submitted samples. Twenty three species were reported new to the UKOTs (excluding possible species new to science).

The project generated much valuable data on the invertebrate fauna of four of the UKOTs. It also highlighted a number of previously unreported non-native species introductions. The authors recommended that technical support in the identification of plant pest invertebrates should continue to be offered to protect biodiversity in its Overseas Territories and that the diagnostic service be extended to all UKOTs.

3.0 Introduction and Aims of the 2010/2011 project

The UKOTs are recognised as having a rich biodiversity that is under threat from non-native species. Non-native species are a major cause of the loss of biodiversity globally, and island ecosystems typical of UKOTs are particularly vulnerable (Cheesman *et al.*, 2003; Varnham, 2006). Accurate and rapid species identification for suspect non-native species is fundamental to the enforcement of eradication and quarantine measures to protect biodiversity and agriculture. The Plant Pests and Diseases Programme at the Food and Environment Research Agency (Fera) provides diagnostic and training services for the England and Wales Plant Health Service and has a wealth of experience and expertise in the identification of all plant-feeding insect orders, plant-feeding mites and plant-parasitic nematodes. This Defra-funded project was conducted to provide an identification service for invasive invertebrate plant pests that may threaten the biodiversity and agriculture in all of the UKOTs.

The Plant Pests and Diseases Programme at Fera has nearly 60 scientists dedicated to providing fast and accurate identifications of plant pests and diagnosis of plant diseases to an international standard. The Programme provides comprehensive technical support and advice to the Plant Health authorities of England and Wales, supporting the work of both Fera's Plant Health and Seeds Inspectorate (PHSI) and the Policy Programmes. This project was conducted by the Entomology Team, which is comprised of five specialist invertebrate diagnosticians plus support staff.

The aims of the project were to:

1. To continue to provide an identification service for invasive invertebrate plant pests for the United Kingdom Overseas Territories (UKOTs) selected and assessed in project T5HZ1100, namely the UKOTs in the Caribbean, the Falkland Islands and Saint Helena.
2. To review current capabilities for the identification of invasive invertebrate plant pests in Bermuda, the British Antarctic Territory, the British Indian Ocean Territory, Gibraltar, Saint Helena, Ascension and Tristan da Cunha, the Pitcairn Islands, South Georgia and South Sandwich Islands, and the Sovereign Base Areas on Cyprus.
3. To extend the identification service for invasive invertebrate plant pests to all UKOTs, where a need for the service is recognised, to assist with improvements in bio-security.

4.0 Methods

4.1 Existing contacts

We renewed existing contacts with relevant individuals in all of the seven territories included in the original assessment project, namely Anguilla, British Virgin Islands, Cayman Islands, Falkland Islands, Montserrat, Saint Helena, and Turks and Caicos Islands, and notified them of the continuation of the identification service.

4.2 Establishing new contacts

We compiled a list of contacts in the UKOTs not included in the initial project. Relevant government authorities and conservation bodies in the UKOTs were selected and notified of the proposed identification service. A reminder notification giving details of the project was later sent by email to the territories that had not yet responded (see Appendix 1). Many positive responses were received and the following authorities in the UKOTs expressed an interest in making use of the service:

Authority/ Organisation	Main Contacts
Ascension Island Government Conservation Department	Olivia Renshaw Assistant Conservation Officer
Department of Environmental Protection Bermuda	Claire Jessey Plant Protection Officer
Sovereign Base Area Cyprus Environment Department	Pantelis Charilaou Environment and Conservation Officer
Natural Resources Pitcairn Islands	Michele Christian Division Manager
RSPB Tristan da Cunha	Katrine Herian

4.3 Service launch

In July 2010 the main contacts within the UKOTs were notified that the pest identification service was officially launched, and they were provided with electronic copies of the Sample Submission Form, the Sample Submission Protocol, and Fera's Plant Quarantine Licence Letters of Authority to accompany samples.

4.4 Publicity

At the request of JNCC, a short project summary was produced for their website, which included details of how to submit samples to Fera for identification (see Appendix 4).

5.0 Results

5.1 Samples received

We provided identifications for six of the UKOTs during this project, a seventh UKOT (namely British Virgin Islands) submitted samples after the project deadline and these results will be reported in the 2011-2012 project report. Three UKOTs submitted samples directly to Fera following the re-launch of the service; one UKOT sent samples via Royal Botanical Gardens Kew that were then forwarded on to us; two further UKOTs sent pest photos via email.

Two samples were received from the Turks and Caicos Islands; 86 samples from the Cayman Islands; 35 from the Falkland Islands; one from Saint Helena; one from Montserrat and one from Tristan da Cunha (the latter two samples were photos of pests sent via email).

5.2 Summary of findings

Approximately 128 species of invertebrate were examined by Fera following the launch of the service in June 2010. They belonged to the following classes and orders: ARACHNIDA, Araneae (1 sp.), ACARINA, Prostigmata (7 spp.), Mesostigmata (1 sp.). CHILOPODA, Lithobiomorpha (2 spp.), ENTOGNATHA, Collembola (6 spp.). INSECTA, Blattodea (1 sp.), Coleoptera (20 spp.), Diptera (6 spp.), Hemiptera (66 spp.), Hymenoptera (9 spp.), Lepidoptera (4 spp.) Psocoptera (1 sp.) and Thysanoptera (3 spp.). NEMATODA, Tylenchida (1 sp.). In total more than 1500 individual organisms were examined from more than 60 host plants.

A full list of the species identified can be found in Appendix 2 and photographs of many of the organisms in Appendix 3. Some specimens are still being studied and so have not been listed at species level. World specialists for certain invertebrate groups were consulted when reliable keys or descriptions were not available. Further details regarding the individual samples, such as collector's name, location, date collected, has been recorded through Fera's Plant Health Information Warehouse Diagnosis Database and can be obtained by contacting the authors.

5.3 New geographical records

Published faunistic catalogues, regional checklists and taxonomic literature were examined to determine the validity of these new geographical records. For some groups, for example the scale insects (Hemiptera:Coccoidea), there are accurate, up-to-date catalogues available

online to check the distribution of species. It is important to note that a number of samples examined, particularly those sent to us by the Cayman Islands Department of Agriculture, were organisms intercepted on imported plants and produce, and are not necessarily native or invasive species.

Cayman Islands. Thirteen species were recorded for the first time:

Aleurotrachelus trachoides (Back) on *Capsicum*

Andaspis punicae (Laing) on *Punica granatum*, *Ruellia* and *Capsicum*

Aspidiotus destructor Signoret on *Cocos nucifera*

Clavaspis herculeana (Cockerell & Hadden) on *Manihot esculenta*

Dialeurodes schefflerae Hodges & Dooley on *Schefflera arboricola*

Furcaspis biformis (Cockerell) on Orchidaceae

Metaleurodicus cardini (Back) on *Psidium guajava*

Mycetaspis personata (Comstock) on *Cocos nucifera*

Parasaissetia nigra (Nietner) on *Blighia sapida*

Protopulvinaria pyriformis (Cockerell) on *Punica granatum*

Saissetia coffeae (Walker) on *Murraya paniculata*

Tetraleurodes acacia (Quaintance) on *Schizanthus pinnatus*

Trialeurodes variabilis (Quaintance) on *Carica papaya*

Falkland Islands. Five species were recorded for the first time:

Aegorhinus delfini (Germain)

Aegorhinus vitulus (Fabricius)

Ctenoderus maulicus (Molina); one adult found, presumed accidental introduction

Euophryum chilense Thompson in timber

Lithobius melanops Newport

Turks and Caicos Islands. One species recorded for the first time:

Dactylopius confusus (Cockerell) on *Consolea nashii*

5.4 Possibly undescribed species

1. **Henicopidae possibly undescribed** (Chilopoda: Lithobiomorpha) from the Falkland Island. Being studied by Anthony Barber

2. ***Allonychus* sp. possibly undescribed** (Prostigmata: Tetranychidae) on *Adonidia merrillii* from the Cayman Islands. Being studied by D. Pye at Fera
3. ***Oligonychus* sp. possibly undescribed** (Prostigmata: Tetranychidae) on *Cocos nucifera* (coconut palm) from the Cayman Islands. Being studied by J. Ostojá-Starzewski and D. Pye at Fera

5.5 New host plant records

Consolea nashii is a new host species for *Dactylopius confusus* in the Turks and Caicos

Schizanthus pinnatus is a new host species for *Tetraleurodes acacia* in the Cayman Islands

5.6 Significant identifications and advice provided

Probably the most significant identification made during the course of the project was in response to a suspected bio-security threat reported to us in February 2011 by Katrine Herion in Tristan da Cunha. The UKOT had concerns that a consignment of imported timber was infested with insects. We received an urgent phone call from Ms Herion on the 24th February who had concerns about some immature insects found within a very large quantity timber packaging imported from South Africa. The timber was destined to be used for a building project in Tristan. At our request Ms Herion emailed photographs of the pests to us and we confirmed that they were beetle larvae and pupae belonging to the family Cerambycidae, commonly called longhorn beetles. Non-indigenous wood-boring beetles such as the Cerambycidae are a potentially serious biosecurity threat. They develop in timber, growing trees and shrubs and are often difficult to detect, and are easily transported to new geographical areas in this way. Some species are unable to develop in a new area, whereas others succeed in establishing a population and can be considered potential pests. Throughout the world many species have established outside their native ranges and caused significant damage. In parts of Europe, the USA and Canada, two species of Asian Cerambycidae, namely *Anoplophora chinensis* and *A. glabripennis*, have established breeding populations and plant quarantine department in the countries affected are spending vast amounts of time and money controlling these pests with the aim of eradicating them.

Fera's principal entomological consultant Dr Ray Cannon provided technical advice to the territory and recommended action in the form re-export or destruction. He also consulted Sheila Inglis at the Forestry Commission in Edinburgh and she has confirmed that FC would

be very concerned if such a consignment arrived in the UK and agreed with the action that Dr Cannon proposed. Tristan da Cunha acted on Dr Cannon's advice and re-exported the infested timber to South Africa. We were unfortunately not able to obtain a sample of the insects from Tristan da Cunha due to difficulties in transporting live specimens via South African customs, therefore we were not able to determine the species of the pest.

We were also faced with a bio-security risk query from the Falkland Islands in March of this year. A consignment of wood and sawdust imported from China was infested with cockroaches, as this type of pest infestation does not fall in Fera's remit we put the Falklands in touch with a contact in the Forestry Commission who gave advice of a treatment.

The Falklands also had concerns about a potato crop that was dying and so submitted a series of samples. One of the pests detected was a plant pathogenic nematode, *Globodera pallida*, a major pest of potato. Fera nematologists identified the pest and gave control advice.

Further reports were received of a wood-boring beetle damaging timber structures in a number of buildings in the Falkland Islands. The weevils *Euophryum confine*, a pest indigenous to New Zealand, and *Euophryum chilense*, a Chilean native, were identified as the cause.

6.0. Conclusions

Strong expressions of interest in accessing Fera's diagnostic technical support were received from many of the new UKOTs contacted. The UKOTs that made use of the service during the initial project continued to make use of the service and expressed how beneficial it was. A direct quote from the Plant Protection Officer at the Department of Agriculture in the Cayman Islands:

“The Department is very appreciative of the excellent service we are receiving and the information is enabling updates to the Official Pest List for the Cayman Islands for reporting purposes as well as allowing us to plan more efficient management programmes for these pests.”

The Department of Agriculture in the Falkland Islands have also been very appreciative of our service and our contact there explained how they plan to proceed using the pest identifications and other biological information we have provided. They plan to carry out risk analysis for each pest and take appropriate action where necessary. They would like to provide information to the public on how to best to control pests should they wish to do so.

Key achievements:

1. Six UKOTs made use of the identification service during the course of the project; a further six expressed an interest in making use of the service.
2. 128 species of invertebrate were examined from the samples submitted. Nineteen species are reported new to the UKOTs (excluding possible species new to science).
3. As well as diagnostic support, Fera provided emergency assistance in the form of identifications and control/re-exportation advice (with the assistance from the Forestry Commission) for two territories facing bio-security threats.

7.0. Recommendations

A few of the UKOTs involved with the project sought advice on how to control pest problems and what to do when faced with a potential bio-security threat, and wherever possible Fera plant health consultants provided technical advice.

A few UKOT Agriculture Departments made us aware that they are in need of technical assistance to develop quarantine pest lists and produce risk assessments for pests.

7.1. Recommended extensions

1. Provide advice for invasive pest control and eradication wherever possible.
2. Extend the service to include technical support in the diagnosis of plant diseases.

7.2. Suggestions of possible further support

Subject to funding and resources being available:

1. Fera consultants could provide assistance in developing pest lists.
2. Fera consultants have prior experience of risk analyses in the UKOTs (Jones, MacLeod & Roy, 2006) and more generally assessing and managing the risks posed by invasive alien species (Baker *et.al.*, 2005, Smith *et.al.*, 2005).

8.0 Acknowledgements

The authors wish to thank Defra for funding the project and everyone within the UKOTs who submitted samples. Thanks are also due to those people who gave advice and support in compiling a list of contacts in the Overseas UKOTs, in particular Martin Hamilton (RBG Kew), Tara Pelembe and Elizabeth Moore (JNCC).

As well the entomology and Nematology diagnostic teams at Fera, thanks are also due to Sharon Shute, Richard Thompson, Malcolm Kerley and Gavin Broad (NHM, London); Lukas Sekerka (University of South Bohemia), Tony Barber and Paula Posadas (Argentina) with their assistance in identifying specimens. Thanks are also due to Fera plant health consultants, Roddie Burgess and Sheila Inglis (Forestry Commission) for their assistance in providing technical advice.

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Defra Biodiversity Project

Improving bio-security in the United Kingdom Overseas Territories: identification service for invasive invertebrate plant pests

We would like to remind you of the free invertebrate plant pest identification service Fera are offering all UK Overseas Territories and invite you to submit specimens you require identifying. This is a Defra funded service provided by entomologists at The Food and Environment Research Agency (Fera) in the United Kingdom. The pilot service received much positive feedback and a large number of invertebrate samples were submitted to Fera. The second phase of the project is now in progress and the scope has been widened to include all UK Overseas Territories. The duration of the project was extended until April 2011, but we would like to continue offering the free identification service for at least another year.

Some of our successes:

Thus far the project has generated many valuable contributions to our knowledge of the invertebrate fauna of four of the UK Overseas Territories. It has highlighted a large number of previously unreported non-native species introductions, and perhaps more surprising, approximately eight species apparently new to science have been discovered.



Photograph: An undescended species of *Eurypepla*, a tortoise beetle, from the Cayman Islands
© Fera

Submitting samples:

If you would like to receive support in the diagnosis of plant pest invertebrates please contact us by email at ukot@fera.gsi.gov.uk and we will provide you with details of how to prepare samples and where to send them. We aim to provide at least a provisional diagnosis to you within 3 working days from receipt of sample. We always identify to species level where possible, and provide biological information such as host preference, distribution etc. when known.

New pests of pine in the Turks and Caicos Islands

The destructive pine tortoise scale, *Toumeyella parvicornis* was until very recently the only insect pest known to be causing losses to the Caicos pine, *Pinus caribaea* var. *bahamensis* in the Turks and Caicos Islands. Samples submitted through this project have identified three other scale insect species on this host, and at least two are non-native and are likely to be contributing to the serious and rapid decline of the pine forests.



Photograph: Barnacle scale *Ceroplastes cirripediformis*, one of the newly discovered pests attacking Caribbean pine in the Turks and Caicos
© Eric Salamanca, DECR (TCI)



Photograph: Close up of a mature adult female barnacle scale, *Ceroplastes cirripediformis*
© Fera

Appendix 2. Table listing species identified

Table 1. Invertebrate species identified from samples submitted to Fera by UK Overseas Territories between July 2010 and April 2011.

Not all of the identifications have been completed and some are awaiting further literature or reference material for comparison.

Species	Common Name	Host plant	Fera Sample Reference
Turks and Caicos Islands			
<i>Dactylopius confusus</i> (Hemiptera: Dactylopiidae)	Cochineal scale	<i>Consolea nashii</i>	21104545
<i>Thyridopteryx ephemeraeformis</i> (Lepidoptera: Psychidae)	Bagworm	<i>Limonium bahamense</i>	21015115
Cayman Islands			
<i>Acizzia</i> sp. (Hemiptera: Psyllidae)	Psyllid	<i>Acacia memosa</i>	21103502
<i>Aleurocanthus woglumi</i> (Hemiptera: Aleyrodidae)	Citrus blackfly	<i>Citrus</i>	21020148
<i>Aleurodicus dispersus</i> (Hemiptera: Aleyrodidae)	Spiralling whitefly	<i>Psidium guajava</i>	21103554
<i>Aleurodicus dispersus</i> (Hemiptera: Aleyrodidae)	Spiralling whitefly	<i>Chrysophyllum cainito</i>	21103552
<i>Aleurodicus dispersus</i> (Hemiptera: Aleyrodidae)	Spiralling whitefly	<i>Cocos nucifera</i>	21009797
<i>Aleurothrixus floccosus</i> (Hemiptera: Aleyrodidae)	Woolly whitefly	<i>Bidens pilosa</i>	21020153
<i>Aleurothrixus floccosus</i> (Hemiptera: Aleyrodidae)	Woolly whitefly	<i>Citrus</i>	21020148
<i>Aleurothrixus floccosus</i> (Hemiptera: Aleyrodidae)	Woolly whitefly	<i>Psidium guajava</i>	21020147
<i>Aleurothrixus floccosus</i> (Hemiptera: Aleyrodidae)	Woolly whitefly	<i>Swietenia</i>	21020145
<i>Aleurotrachelus trachoides</i> (Hemiptera: Aleyrodidae)	Solanum whitefly	<i>Capsicum</i>	21009796
<i>Aleurotrachelus trachoides</i> (Hemiptera: Aleyrodidae)	Solanum whitefly	<i>Capsicum</i>	21020149
<i>Aleurotrachelus trachoides</i> (Hemiptera: Aleyrodidae)	Solanum whitefly	<i>Ruellia</i>	21009799
<i>Aleurotrachelus trachoides</i> (Hemiptera: Aleyrodidae)	Solanum whitefly	<i>Ruellia</i>	21020151
Aleyrodidae (Hemiptera)	Whitefly	<i>Psidium guajava</i>	21009798
<i>Allonychus</i> sp. (Prostigmata: Tetranychidae)	Spider mite	<i>Adonidia merrillii</i>	21009793
<i>Andaspis punicae</i> (Hemiptera: Diaspididae)	Litchi scale	<i>Punica granatum</i>	21020137
<i>Aonidiella orientalis</i> (Hemiptera: Diaspididae)	Oriental scale	<i>Cocos nucifera</i>	21103560
<i>Aonidiella orientalis</i> (Hemiptera: Diaspididae)	Oriental scale	<i>Cocos nucifera</i>	21009787
<i>Aonidiella orientalis</i> (Hemiptera: Diaspididae)	Oriental scale	<i>Cocos nucifera</i>	21009797
<i>Aonidiella orientalis</i> (Hemiptera: Diaspididae)	Oriental scale	<i>Cocos nucifera</i>	21020144

Aphididae (Hemiptera)	Aphid	<i>Abelmoschus esculentus</i>	21020142
Aphididae (Hemiptera)	Aphid	<i>Ixora</i>	21103487
Aphididae (Hemiptera)	Aphid	<i>Ixora</i>	21103499
Aphididae (Hemiptera)	Aphid	<i>Mussaenda</i>	21103489
Aphididae (Hemiptera)	Aphid	<i>Protea</i>	21103504
<i>Aphis craccivora</i> (Hemiptera: Aphididae)	Cowpea aphid	<i>Phaseolus vulgaris</i>	21103496
<i>Aphis gossypii</i> (Hemiptera: Aphididae)	Melon-cotton aphid	<i>Capsicum</i>	21009796
<i>Aphis gossypii</i> (Hemiptera: Aphididae)	Melon-cotton aphid	<i>Capsicum</i>	21020149
<i>Aphis gossypii</i> (Hemiptera: Aphididae)	Melon-cotton aphid	<i>Ixora chinensis</i>	21103490
<i>Aphis gossypii</i> (Hemiptera: Aphididae)	Melon-cotton aphid	<i>Ixora coccinea</i>	21103491
<i>Aphis gossypii</i> (Hemiptera: Aphididae)	Melon-cotton aphid	<i>Mussaenda</i>	21103489
<i>Aphis gossypii</i> (Hemiptera: Aphididae)	Melon-cotton aphid	<i>Salvia texana</i>	21103497
<i>Aphis nerii</i> (Hemiptera: Aphididae)	Oleander aphid	<i>Oleander</i>	21103498
<i>Aphis</i> sp. (Hemiptera: Aphididae)	Aphid	<i>Oleander</i>	21103500
<i>Aphis</i> sp. (Hemiptera: Aphididae)	Aphid	<i>Rosmarinus officinalis</i>	21103486
<i>Aphis spiraeicola</i> (Hemiptera: Aphididae)	Green citrus aphid	<i>Citrus</i>	21009781
<i>Aphis</i> sp. (Hemiptera: Aphididae)	Aphid	Unknown	21103488
<i>Aphis</i> sp. (Hemiptera: Aphididae)	Aphid	<i>Campsis radicans</i>	21020154
Araneae (Arachnida)	Spider	<i>Concarpus erectus</i>	21103514
<i>Artipus</i> sp. (Coleoptera: Curculionidae)	Weevil	<i>Citrus</i>	21009783
<i>Aspidiotus destructor</i> (Hemiptera: Diaspididae)	Coconut scale	<i>Cocos nucifera</i>	21009788
<i>Bemisia</i> sp. (Hemiptera: Aleyrodidae)	Whitefly	<i>Gerbexa jemesonii</i>	21103553
<i>Bemisia tabaci</i> (Hemiptera: Aleyrodidae)	Tobacco whitefly	<i>Mussaenda</i>	21103489
<i>Brevipalpus</i> sp. (Prostigmata: Tenuipalpidae)	False spider mite	<i>Bidens pilosa</i>	21020153
Carabidae (Coleoptera)	Ground beetle	<i>Balsam</i>	21103544
<i>Cardiocondyla</i> sp. (Hymenoptera: Formicidae)	Ant	<i>Cassia</i>	21020150
Cercopidae (Hemiptera)	Frog hopper	<i>Bidens pilosa</i>	21020153
Cercopidae (Hemiptera)	Frog hopper	<i>Campsis radicans</i>	21020154
<i>Ceroplastes sinensis</i> (Hemiptera: Coccidae)	Chinese wax scale	<i>Protea</i>	21103559
<i>Ceroplastes sinensis</i> (Hemiptera: Coccidae)	Chinese wax scale	<i>Gliricidia sepium</i>	21009790
<i>Ceroplastes</i> sp. (Hemiptera: Coccidae)	Wax scale	<i>Cocos nucifera</i>	21009789
<i>Cheletogenes ornatus</i> (Prostigmata: Cheyletidae)	Cheyletid mite	<i>Cocos nucifera</i>	21103560
<i>Cheletogenes ornatus</i> (Prostigmata: Cheyletidae)	Cheyletid mite	<i>Cocos nucifera</i>	21009787
<i>Cheletogenes ornatus</i> (Prostigmata: Cheyletidae)	Cheyletid mite	<i>Cocos nucifera</i>	21020144
<i>Cheletogenes</i> sp. (Prostigmata: Cheyletidae)	Cheyletid mite	Orchidaceae	21020140
<i>Chrysomphalus aonidum</i> (Hemiptera:)	Citrus black	<i>Citrus</i>	21103513

Diaspididae)	scale		
Cicadellidae (Hemiptera)	Leafhopper	<i>Amaranthus caudatus</i>	21103508
Cicadellidae (Hemiptera)	Leafhopper	Unknown	21103483
<i>Clavaspis herculeana</i> (Hemiptera: Diaspididae)	Cassia bark scale	<i>Manihot esculenta</i>	21020143
Coccidae (Hemiptera)	Soft scale	<i>Capsicum</i>	21009796
Coccinellidae (Coleoptera)	Ladybird	<i>Rosmarinus officinalis</i>	21103545
<i>Coccus viridis</i> (Hemiptera: Coccidae)	Green coffee scale	<i>Psidium guajava</i>	21103554
<i>Coccus viridis</i> (Hemiptera: Coccidae)	Green coffee scale	<i>Chrysophyllum cainito</i>	21103552
Coleoptera	Beetle	<i>Psidium guajava</i>	21009798
<i>Deloyala fuliginosa</i> (Coleoptera: Chrysomelidae)	Tortoise beetle	<i>Ipomoea batatas</i>	21009784
Delphacidae (Hemiptera)	Delphacid planthopper	Unknown	21103484
Derbidae (Hemiptera)	Derbid planthopper	<i>Coccoloba uvifera</i>	21103482
<i>Dialeurodes schefflerae</i> (Hemiptera: Aleyrodidae)	Schefflera whitefly	<i>Schefflera arboricola</i>	21020152
<i>Diaphorina citri</i> (Hemiptera: Psyllidae)	Psyllid	<i>Citrus</i>	21103505
Diptera	Fly	<i>Swietenia</i>	21020145
Ectopsocidae (Psocoptera)	Barklouse	<i>Pinus</i>	21103547
Entomobryidae (Collembola: Entomobryomorpha)	Slender springtail	<i>Hypnum curvifolium</i>	21103516
Entomobryidae (Collembola: Entomobryomorpha)	Slender springtail	<i>Protea</i>	21103504
Entomobryidae (Collembola: Entomobryomorpha)	Slender springtail	<i>Aphelandra squarrosa</i>	21103546
<i>Eurypepla</i> sp. (Coleoptera: Chrysomelidae)	Tortoise beetle	<i>Cordia sebestena</i>	21009782
Fulgoridae (Hemiptera)	Fulgorid planthopper	<i>Coccoloba uvifera</i>	21103482
Fulgoridae (Hemiptera)	Fulgorid planthopper	Unknown	21103485
Fulgoridae (Hemiptera)	Fulgorid planthopper	Unknown	21103548
<i>Furcaspis biformis</i> (Hemiptera: Diaspididae)	Red orchid scale	Orchidaceae	21020140
Gelechiidae (Lepidoptera)	Moth	Unknown	21103550
Halictidae (Hymenoptera)	Sweat bee	Unknown	21103550
<i>Hemiberlesia lataniae</i> (Hemiptera: Diaspididae)	Latania scale	<i>Punica granatum</i>	21020137
<i>Heteropsylla</i> sp. (Hemiptera: Psyllidae)	Psyllid	<i>Lysiloma sabicu</i>	21103515
<i>Heteropsylla</i> sp. (Hemiptera: Psyllidae)	Psyllid	<i>Lysiloma sabicu</i>	21103507
Hymenoptera	Parasitic wasp	<i>Concarpus erectus</i>	21103514
<i>Karnyothrips flavipes</i> (Thysanoptera: Phlaeothripidae)	Predatory thrips	<i>Gliricidia sepium</i>	21009790
Lachesillidae (Psocoptera)	Barklouse	<i>Pinus</i>	21103547
<i>Lepidosaphes</i> sp. (Hemiptera: Diaspididae)	Armoured scale	<i>Swietenia</i>	21020145
<i>Lipaphis pseudobrassicae</i> (Hemiptera: Aphididae)	Turnip aphid	<i>Brassica rapa chinensis</i>	21009780

<i>Metaleurodicus cardini</i> (Hemiptera: Aleyrodidae)	Cardin's whitefly	<i>Psidium guajava</i>	21009798
<i>Metaleurodicus cardini</i> (Hemiptera: Aleyrodidae)	Cardin's whitefly	<i>Psidium guajava</i>	21020138
<i>Milviscutulus mangiferae</i> (Hemiptera: Coccidae)	Mango shield scale	<i>Mangifera</i>	21103555
Miridae (Hemiptera)	Plant bug	<i>Calaloo</i>	21103509
Miridae (Hemiptera)	Plant bug	<i>Calaloo</i>	21103510
Miridae (Hemiptera)	Plant bug	<i>Lysiloma sabicu</i>	21103515
Miridae (Hemiptera)	Plant bug	<i>Lysiloma sabicu</i>	21103511
<i>Mycetaspis personata</i> (Hemiptera: Diaspididae)	Masked scale	<i>Cocos nucifera</i>	21009787
Myrmicinae (Hymenoptera: Formicidae)	Ant	<i>Lysiloma sabicu</i>	21103507
<i>Myzus persicae</i> (Hemiptera: Aphididae)	Green peach aphid	<i>Mussaenda</i>	21103489
<i>Myzus persicae</i> (Hemiptera: Aphididae)	Green peach aphid	<i>Plantus barbatus</i>	21103501
<i>Myzus</i> sp. (Hemiptera: Aphididae)	Aphid	<i>Coccoloba uvifera</i>	21103503
Nabidae (Hemiptera)	Predatory bug	<i>Balsam</i>	21103549
<i>Oligonychus</i> sp. (Prostigmata: Tetranychidae)	Spider mite	<i>Cocos nucifera</i>	21009795
<i>Paraleyrodes</i> sp. (Hemiptera: Aleyrodidae)	Whitefly	<i>Ruellia</i>	21009799
<i>Parasaissetia nigra</i> (Hemiptera: Coccidae)	Nigra scale	<i>Blighia sapida</i>	21020141
<i>Parasaissetia nigra</i> (Hemiptera: Coccidae)	Nigra scale	<i>Ficus</i>	21103561
Phoridae (Diptera)	Humpbacked flies	<i>Ixora</i>	21103487
<i>Pinnaspis aspidistrae</i> (Hemiptera: Diaspididae)	Fern scale	<i>Platyterium</i>	21103557
<i>Pinnaspis aspidistrae</i> (Hemiptera: Diaspididae)	Fern scale	<i>Platyterium</i>	21103558
<i>Protopulvinaria pyriformis</i> (Hemiptera: Coccidae)	Pyriform scale	<i>Punica granatum</i>	21020137
Pseudococcidae (Hemiptera)	Mealybug	<i>Citrus</i>	21020148
Pseudococcidae (Hemiptera)	Mealybug	<i>Cocos nucifera</i>	21009797
Pseudococcidae (Hemiptera)	Mealybug	<i>Murraya paniculata</i>	21009786
Pseudococcidae (Hemiptera)	Mealybug	<i>Psidium guajava</i>	21009798
Psocoptera	Barklouse	<i>Swietenia</i>	21020145
<i>Pulvinaria psidii</i> (Hemiptera: Coccidae)	Green shield scale	<i>Blighia sapida</i>	21103556
<i>Saissetia ?oleae</i> (Hemiptera: Coccidae)	Black scale	<i>Protea</i>	21103559
<i>Saissetia coffeae</i> (Hemiptera: Coccidae)	Hemispherical scale	<i>Murraya paniculata</i>	21009786
<i>Saissetia miranda</i> (Hemiptera: Coccidae)	Mexican black scale	<i>Blighia sapida</i>	21020141
<i>Saissetia miranda</i> (Hemiptera: Coccidae)	Mexican black scale	<i>Cocos nucifera</i>	21009797
<i>Saissetia miranda</i> (Hemiptera: Coccidae)	Mexican black scale	<i>Manihot esculenta</i>	21020143
<i>Saissetia</i> sp. (Hemiptera: Coccidae)	Soft scale	<i>Bidens pilosa</i>	21020153
Sciaridae (Diptera)	Fungus gnats	<i>Coccoloba uvifera</i>	21103482
<i>Solenopsis</i> sp. (Hymenoptera: Formicidae)	Ant	Unknown	21103488
<i>Stenodontes chevrolati</i> (Coleoptera: Cerambycidae)	Longhorn beetle	Not applicable	21009785

<i>Tapinoma</i> sp. (Hymenoptera: Formicidae)	Ant	<i>Oleander</i>	21103498
<i>Tetraleurodes acacia</i> (Hemiptera: Aleyrodidae)	Acacia whitefly	<i>Cassia</i>	21020150
<i>Tetraleurodes acacia</i> (Hemiptera: Aleyrodidae)	Acacia whitefly	<i>Desmodium</i>	21103551
<i>Tetraleurodes acacia</i> (Hemiptera: Aleyrodidae)	Acacia whitefly	<i>Schizanthus pinnatus</i>	21020139
Tetranychidae (Prostigmata)	Spider mite	<i>Cocos nucifera</i>	21009794
<i>Tetranychus urticae</i> (Prostigmata: Tetranychidae)	Two-spotted spider mite	<i>Rosa</i>	21009791
<i>Tetranychus urticae</i> (Prostigmata: Tetranychidae)	Two-spotted spider mite	<i>Rosa</i>	21009792
Thripidae (Thysanoptera)	Thrip	<i>Lysiloma sabicu</i>	21103515
<i>Trialetrodes variabilis</i> (Hemiptera: Aleyrodidae)	Whitefly	<i>Carica papaya</i>	21020146
Falkland Islands			
<i>Aegorhinus delfini</i> (Coleoptera: Curculionidae)	weevil	<i>Solanum tuberosum</i>	21105589
<i>Aegorhinus delfini</i> (Coleoptera: Curculionidae)	weevil	Not applicable	21105598
<i>Aegorhinus vitulus</i> (Coleoptera: Curculionidae)	weevil	<i>Lactuca sativa</i>	21105595
<i>Aegorhinus vitulus</i> (Coleoptera: Curculionidae)	weevil	Not applicable	21105597
<i>Agrius cingulata</i> (Lepidoptera: Sphingidae)	Pink-spotted hawkmoth	<i>Solanum tuberosum</i>	21105585
<i>Alophosphion</i> sp. (Hymenoptera: Ichneumonidae)	Parasitic wasp	Not applicable	21015606
<i>Aphis</i> sp. (Hemiptera: Aphididae)	Aphid	<i>Solanum tuberosum</i>	21105992
<i>Astylus</i> sp. (Coleoptera: Melyridae)	Soft-winged flower beetle	Not applicable	21026724
<i>Aulacorthum</i> sp. (Hemiptera: Aphididae)	Aphid	<i>Solanum tuberosum</i>	21105992
Blattodea	Cockroach	Not applicable	21105094
Calliphoridae (Diptera)	Blue bottle	Not applicable	21015609
Carabidae (Coleoptera)	Ground beetle	Not applicable	21026723
<i>Coccinella ?undecempunctata</i> (Coleoptera: Coccinellidae)	11-spot ladybird	Not applicable	21105586
Coleoptera	Beetle	Not applicable	21015613
<i>Ctenoderus maulicus</i> (Coleoptera: Buprestidae)	Jewel beetle	Not applicable	21015608
Curculionidae (Coleoptera)	Weevil	Not applicable	21105600
Entomobryidae (Collembola: Entomobryomorpha)	Springtail	Not applicable	21105587
<i>Eristalis croceimaculata</i> (Diptera: Syrphidae)	Hover fly	Not applicable	21105599
<i>Euophryum chilense</i> (Coleoptera: Curculionidae)	Weevil	Timber	21008166
<i>Euophryum chilense</i> (Coleoptera: Curculionidae)	Weevil	Not applicable	21026728
<i>Globodera pallida</i> (Tylenchida: Heteroderidae)	Potato Cyst Nematode	<i>Solanum tuberosum</i>	21105990
Henicopidae (Chilopoda: Lithobiomorpha)	Centipede	Not applicable	21105588
Hymenoptera	Wasp	Not applicable	21026722
Ichneumonidae (Hymenoptera)	Parasitic wasp	Not applicable	21015607
Ichneumonidae (Hymenoptera)	Parasitic wasp	Not applicable	21105590
<i>Lithobius melanops</i> (Lithobiomorpha: Lithobiidae)	Centipede	Not applicable	21026721
<i>Malvinus compressiventris</i> (Coleoptera: Curculionidae)	Weevil	Not applicable	21015611

Mesostigmata	Mite	<i>Solanum tuberosum</i>	21105991
<i>Microplophorus magellanicus</i> (Coleoptera: Cerambycidae)	Longhorn beetle	Not applicable	21105095
<i>Microplophorus magellanicus</i> (Coleoptera: Cerambycidae)	Longhorn beetle	Not applicable	21105594
<i>Nabis paranensis</i> (Hemiptera: Nabidae)	Predatory bug	Not applicable	21105593
Poduridae (Collembola: Poduromorpha)	Springtail	<i>Solanum tuberosum</i>	21105991
<i>Ptinus tectus</i> (Coleoptera: Anobiidae)	Spider beetle	Not applicable	21105596
Sciaridae (Diptera)	Fungus gnat	Not applicable	21015610
Staphylinidae (Coleoptera)	Rove beetle	Not applicable	21105591
Tenebrionidae (Coleoptera)	Darkling beetle	Not applicable	21105592
<i>Tuberolachnus salignus</i> (Hemiptera: Aphididae)	Large willow aphid	Not applicable	21015612
Saint Helena			
<i>Hercinothrips bicinctus</i> (Thysanoptera: Thripidae)	Banana thrips	<i>Musa</i>	Not applicable
Tristan da Cunha			
Cerambycidae (Coleoptera)	Longhorn beetle	Timber	Not applicable
Montserrat			
<i>Horama</i> sp. (Lepidoptera: Arctiidae)	Wasp/Tiger moth	Not applicable	Not applicable

Appendix 3. Photographs of some of the Invertebrates identified



Fig. 1 *Dactylopius confusus* , Turks & Caicos Islands



Fig. 2 *Aleurocanthus woglumi* , Cayman Islands



Fig. 3 *Aleurodicus dispersus* puparium, Cayman Islands



Fig. 4 *Aleurodicus dispersus* adults, Cayman Islands



Fig. 5 *Aleurotrachelus trachoides* pupal empty cases and hatched eggs, Cayman Islands



Fig. 6 *Aonidiella orientalis* adult female, Cayman Islands



Fig. 7 *Aphis nerii*, Cayman Islands



Fig. 8 *Artipus* sp, Cayman Islands



Fig. 9 *Deloyala fuliginosa*, Cayman Islands



Fig. 10 *Furcaspis biformis* adult females, Cayman Islands



Fig. 11 *Saissetia miranda*, Cayman Islands



Fig. 12 *Stenodontes chevrolati*, Cayman Islands



Fig. 13 *Aegorhinus delfini*, Falkland Islands



Fig. 14 *Aegorhinus vitulus*, Falkland Islands



Fig. 15 *Malvinus compressiventris*, Falkland Islands



Fig. 16 *Ctenoderus maulicus*, Falkland Islands



Fig. 17 *Eristalis croceimaculata*, Falkland Islands



Fig. 18 *Globodera pallida*, Falkland Islands



Fig. 19 *Microplophorus magellanicus*, Falkland Islands



Fig. 20 *Nabis paranensis*, Falkland Islands

Defra Biodiversity Project

Improving Bio-security in the United Kingdom Overseas Territories: Identification service for invasive invertebrate plant pests

Accurate and rapid identification is fundamental for the enforcement of quarantine measures to prevent the introduction of, or to effectively control, invasive species in the UKOTs. Entomologists at The Food and Environment Research Agency (Fera) are conducting a Defra funded project to provide a free Invertebrate Pest Identification Service for government authorities and conservation bodies in the UKOTs.

During the initial phase of the project, the diagnostic capabilities within selected UKOTs were assessed, and an identification service established. The pilot service received much positive feedback and a large number of invertebrate samples were submitted to Fera. The second phase of the project is now in progress and the scope has been widened to include **all** UKOTs. The duration of the service has been extended until at least April 2011.

Thus far the project has generated many valuable contributions to the invertebrate fauna of four of the UKOTs. It has highlighted a large number of previously unreported non-native species introductions, and perhaps more surprising, approximately eight species apparently new to science have been discovered.

If you would like to receive support in the diagnosis of plant pest invertebrates please contact us by email (ukot@fera.gsi.gov.uk) and we will provide you with details of how to preserve samples and where to send them. We aim to provide at least a provisional diagnosis to you within 3 working days from receipt of sample. We always identify to species level where possible, and provide biological information such as host preference, distribution etc. when known.

It is important to clarify that we have a wealth of experience and expertise in the identification of all plant-feeding insect orders, plant-feeding mites and plant-parasitic nematodes, but may not be able to assist with the identification of other invertebrates.

New pests of pine in the Turks and Caicos Islands

The destructive pine tortoise scale, *Toumeyella parvicornis* was until very recently the only insect pest known to be causing devastating losses to the Caicos pine, *Pinus caribaea* var. *bahamensis* in the Turks and Caicos Islands. Samples submitted through this project have identified three other scale insect species on this host, and at least two are non-native and are likely to be contributing to the serious and rapid decline of the pine forests.



Close up of a mature adult female barnacle scale, *Ceroplastes cirripediformis*, one of the newly discovered pests attacking Caribbean pine