EXTENSION OF THE BIOSECURITY MONITORING PROGRAMME IN FRENCH POLYNESIA AND ITS TRADING PARTNERS, WITH A FOCUS ON THE LITTLE FIRE ANT

Report to the Secretariat of the Pacific Regional Environment Programme
Casper Vanderwoude
Vanderwoude Consulting LTD. Hawai'i USA
31 July, 2013




CONTENTS

EXECUTIVE SUMMARY

Little Fire Ants (*Wasmannia auropunctata*) are an established and expanding invasive pest in French Polynesia. This species poses a serious threat to the economy, ecological health and social well-being of this country and its inhabitants. As Little Fire Ants spread, impacts will become more severe leading to an urgent need for action on the part of authorities. Addtionally, the presence of Little Fire Ants poses a biosecurity threat to countries receiving goods from French Polynesia, potentially causing rejection of commodities and additional export costs for shippers.

Two islands, Tahiti and Moorea, are infested with Little Fire Ants with the remaining 130 or so islands currently free of this pest. However, without a comprehensive management strategy, this species will spread throughout the country in future years, most likely infesting a majority of inhabited islands. Proactive planning now will have the best potential to minimize these impacts and ensure resources are used in the most efficient and effective manner.

This report provides an overview of current biosecurity practices and discusses options for strengthening domestic and international biosecurity systems. The specific topics addressed are:

- An analysis of French Polynesia's main trading partners in the Pacific region
- A description of current biosecurity practices of French Polynesia's main trading partners
- A description of inter-island and international biosecurity practices in French Polynesia
- Discussion of methods to strengthen biosecurity systems for invasive ants
- Recommendations and cost estimates for implementation.
- Development of standard operating procedures for monitoring, surveillance and response activities

The following actions are recommended to address the growing impacts of Little Fire Ants:

1. Development of an early detection program which includes regular and systematic surveillance of international points of entry for travelers and commodities.
2. Development of a national emergency response plan for invasive ants.
3. Establishment of a biosecurity strategy that minimizes the inter-island spread of Little Fire Ants. This should include:
    a. Mandatory fumigation of high-risk commodities before movement to other islands
    b. Enhanced quarantine inspection of travelers to neighbor islands and their possessions
    c. Increased public awareness and outreach on the risks and impacts of invasive ants.
4. Develop and implement an eradication program for known infestations on Moorea.
5. Identify the distribution of "secondary" invasive ant species for main islands within French Polynesia.
6. Develop and implement a mitigation strategy for Little Fire Ants on the island of Tahiti
    a. focus eradication efforts on eliminating small (<1 hectare) infestations and if resources permit, infestations sized 1-5 hectares.
    b. Attempt to contain larger (>5 hectare) infested sites.
    c. Conduct research to quantify the rates of spread for Little Fire Ants on Tahiti.
    d. Monitor known pathways and vectors for spread of Little Fire Ants within Tahiti.
    e. Develop and implement a targeted outreach strategy designed to identify new infestations and reduce the risks associated with known Little Fire Ant vectors.

    f. Assist affected residents by providing practical extension advice on how to manage ant populations.
7. The Service du Developpement Rural should formally approach quarantine agencies of New Zealand and Australia in order to develop off-shore hygiene partnerships between themselves and relevant industry partners.
8. Options for increased out-bound biosecurity inspections of shipments of household goods be explored by Service du Developpement Rural management.

A full-time team of at least four specialist staff dedicated to coordination and implementation of these recommendations should be established within the Service du Developpement Rural, liaising closely with the quarantine service of that agency. Additional external support may be needed to develop an national emergency response plan, form an eradication plan for Moorea, provide training for surveillance, treatment and other specialized activities, and the conduct of applied research on basic biology and efficacy studies for control products.

BACKGROUND

Little Fire Ants (*Wasmannia auropunctata*) are an established and expanding invasive pest in French Polynesia. This species poses a serious threat to the economy, ecological health and social well-being of French Polynesia and its inhabitants. Once established, Little Fire Ants form dense three-dimensional supercolonies that cover the ground, vegetation and tree canopies. Ants nesting in trees are easily dislodged by wind and other minor disturbance and often fall from their arboreal homes onto people and animals below, stinging their victims and causing blindness in domestic animals. In natural ecosystems, they prey on, or drive out native fauna, leaving an ecosystem depleted of much of its pre-existing animal life. The mutualisms formed between Little Fire Ants and Homoptera cause crop losses in agriculture and declines in plant health for native ecosystems. The presence of Little Fire Ants poses a biosecurity threat to countries receiving goods from French Polynesia, potentially causing rejection of commodities and additional export costs for shippers.

Two islands, Tahiti and Moorea, are infested with Little Fire Ants. Tahiti is the most populated of the 130 or so islands that make up French Polynesia and ten of its 13 municipalities are infested to varying degrees. Almost all cargo entering and leaving the country is shipped to and from the port of Papeete. This species will spread throughout the country in future years, most likely infesting a majority of inhabited islands.

REPORT SCOPE

This report is one of several reports prepared for this project. One report (Vanderwoude, 2013a) details the current extent of Little Fire Ant distribution in French Polynesia. A second report (Vanderwoude, 2013b) provides a basis for a monitoring and mitigation strategy for the island of Tahiti and neighbor islands. This report aims to provide an overview of current biosecurity practices and discusses options for strengthening domestic and international biosecurity system. The specific topics addressed are:

1. An analysis of French Polynesia's main trading partners in the Pacific region.
2. A description of current biosecurity practices of French Polynesia's main trading partners.
3. A description of inter-island and international biosecurity practices in French Polynesia.
4. Discussion of methods to strengthen biosecurity systems for invasive ants.
5. Recommendations and cost estimates for implementation.
6. Development of standard operating procedures for monitoring, surveillance and response activities.

PACIFIC REGION TRADING PARTNERS FOR FRENCH POLYNESIA

The majority of goods and other cargo moving between countries in the Pacific region and French Polynesia are sourced from, or destined for, New Zealand, Australia, New Caledonia, Wallis & Futuna, the Cook Islands and Fiji.

Trade data for French Polynesia were obtained from the United Nations Commodity Trade Statistics Database (http://comtrade.un.org/db/) for the 2012 reporting year. The total value of all exports to Pacific countries and Australia were USD6.6 million and the total value of imports was USD 218.9 million (Table 1). This comprised 4.2% of total exports and 11.9% of total imports for French Polynesia.

The four main Pacific destinations for exports were New Caledonia (45.9%), New Zealand (25.78%), Australia (16.97%) and Wallis&Futuna (7.1%). Imported commodities were almost entirely sourced from New Zealand (65.6%) and Australia (31.4%).

Table 1. summary of global trade for French Polynesia and the rest of the world for 2012 (data in US$, sourced from United Nations community trade statistics databases).

trading partner	exports	percent (Pacific)	imports	percent (Pacific)
New Caledonia	$ 3,014,032.00	45.90	$ 1,165,133.00	0.53
New Zealand	$ 1,692,648.00	25.78	$ 143,734,662.00	65.65
Australia	$ 1,107,811.00	16.87	$ 68,800,158.00	31.43
Wallis and Futuna	$ 462,776.00	7.05	$ -	0.00
Cook Isds	$ 180,263.00	2.75	$ -	0.00
Fiji	$ 84,456.00	1.29	$ 4,888,066.00	2.23
Tonga	$ 9,262.00	0.14	$ 179.00	0.00
Vanuatu	$ 8,331.00	0.13	$ 35.00	0.00
Samoa	$ 7,376.00	0.11	$ 63,860.00	0.03
Papua New Guinea	$ -		$ 273,327.00	0.12
Guam	$ -		$ 2,883.00	
Solomon Islands	$ -		$ 782.00	
Pacific region total	$ 6,566,955.00		$ 218,929,085.00	
rest of the world	$ 143,250,906.00		$ 1,408,797,872.00	
total	$ 156,384,816.00		$ 1,846,656,042.00	

Many Pacific countries including French Polynesia are net importers of commodities. Total exports to the Pacific region are extremely low, amounting to less than USD7 million. The risks posed by commodities leaving French Polynesia is therefore proportionally low. Additionally, most export commodities are unlikely to harbor Little Fire Ants. For example, over half of exports were natural and cultured pearls (Table 2)

Table 2. main commodities exported from French Polynesia during 2012 categorized by international "Harmonized Tariff" codes (data sourced from United Nations community trade statistics databases).

HS code	description	percent of total
7101	Pearls, natural or cultured	54.8
0302	Fish, fresh or chilled	6.9
1513	Coconut, palm kernel or babassu oil	5.5
2007	Jams, fruit jellies, marmalades, fruit or nut pastes	3.9
0304	Fish fillets and other fish meat	2.8
0508	Coral and similar materials, unworked or simply prepared	2.1
0905	Vanilla	1.7
8802	Other aircraft	0.4
8411	Turbo-jets, turbo-propellers and other gas turbines	0.3

Of the four main trading partners, New Caledonia (Fabres and Brown jnr 1978) and Wallis&Futuna (Jourdan 1997) are already infested with Little Fire Ants. Australia also has Little Fire Ants, however, distribution is limited to the Cairns area and this population is under active suppression (www2). Movement of infested commodities to New Caledonia and Wallis&Futuna, poses a low risk as Little Fire Ants are already present in those countries. Therefore, in terms of export risks within the Pacific region, Australia and New Zealand are at the greatest risk.

The remaining Pacific destinations with any significant imports from French Polynesia are the Cook Islands (2.75%) and Fiji (1.29%). Although total exports to these countries combined have a total value less than USD $300,000, these exports do carry a biosecurity risk.

Other biosecurity risks related to trade

Invasive ants, including Little Fire Ants are categorized as "hitch-hiker" pests. Their presence is not related to the commodity being transported. Any cargo can potentially carry hitch-hiker pests and this confounds commodity-based risk assessment techniques used by most biosecurity agencies.

The majority of commodities are transported by ship, packed in steel shipping containers. An imbalance between imports and exports leads to a surplus of these shipping containers in locations that export less products that they receive. In the case of French Polynesia, there is a trade imbalance of 33:1 for movement of goods to and from countries in the Pacific region. For shipping lines, this means empty containers need to be returned to the exporting country, and 97% of shipping containers leave French Polynesia unladen.

Although empty shipping containers do not carry commodities, they can, and do, harbor invasive species and other contaminants. Often, shipping containers are transported to the importer's (consignee) premises, unpacked, and left for long periods of time at these premises before being returned to the ports. During this time, invasive species, including ants, can colonize these containers and be transported to new locations. Biosecurity authorities in New Zealand and Australia have recognized this pathway as a major biosecurity concern. (see (Nendick 2006)). As a

result, empty shipping containers being returned to these countries are also subjected to biosecurity inspections.

Biosecurity risks associated with cargo are often determined by the commodity being transported. For example, a shipment of a particular agricultural product could trigger a search for pests and diseases specific to that product. The movement of personal belongings (household goods etc) from one country to another can potentially escape this biosecurity profiling. The long-term relocation of people and their personal possessions to and from French Polynesia is likely to reflect its cultural/political ties to France and the economic relationships with Australia and New Zealand. It is likely that there would be an exchange of business personnel between major trading partners and regular relocation of civil servants between French administrations within the Pacific region. The movement of personal possessions therefore comprises part of the total biosecurity risk for Little Fire Ants between these countries.

BIOSECURITY PRACTICES OF MAJOR TRADING PARTNERS

The two major trading partners for French Polynesia are Australia and New Zealand. These countries both have robust biosecurity systems that are broadly held as "International Best Practice" benchmarks by other jurisdictions.

New Zealand

The New Zealand Ministry for Primary Industries implements its biosecurity system through a sub-agency named Biosecurity New Zealand. New Zealand has a robust biosecurity system which includes a specific focus on trade within the Pacific region (see www3). The focus on biosecurity within the Pacific region includes active collaboration with trading partners, providing opportunities for assistance and training, off-shore risk management and active participation in regional initiatives such as the Pacific Ant Prevention Plan (IUCN/SSC Invasive Species Specialist Group 2004).

One such initiative has been the development of off-shore risk reduction strategies which include formal hygiene programs for New Zealand-Bound cargo and empty shipping containers at ports of origin. New Zealand biosecurity agencies conduct both species-based, commodity-based and country-based risk assessments to target biosecurity activities.

Biosecurity New Zealand is very active in the Pacific region, especially in relation to the spread of invasive ants. In recent years it has been involved in several projects to strengthen the region's capacity for detection and response to this issue. Some of the activities French Polynesian biosecurity staff participated in include:

- In-country training for invasive ant surveys at points of entry for Tahiti
- Development of a generic emergency response plan for invasive ants
- Provision of advanced taxonomic training to increase diagnostic capacity

Australia

The Australian Department of Agriculture, Forestry and Fisheries (DAFF) implements Australia's biosecurity program. Until recently this task was undertaken by the Australia Quarantine Inspection Service (AQIS), however, this agency is currently being restructured. Additionally, the

Quarantine Act (1908) is in the process of being replaced with new quarantine legislation. Australia's biosecurity system. Australia's biosecurity threat assessments include species, commodity and country-based risk assessments.

In addition to an active biosecurity system, the Australian Department of Sustainability Environment, Water, Population and Communities has prepared a number of threat abatement plans for potential and existing invasive species. One of these plans focuses on invasive ants (Commonwealth of Australia 2006).

New Caledonia, Wallis and Futuna

Smaller Pacific nations appear to be mostly influenced by restrictions placed on their exports by their trading partners. In-bound biosecurity systems are often limited by available resources and low funding levels. Almost all pacific nations are members of the Secretariat of the Pacific Community (SPC). The Land Resources division of SPC assists and coordinates biosecurity activities, policy, training and knowledge exchange for participating member countries which includes French Polynesia through its biosecurity and trade section. This section also administers the Pacific Plant Protection Organization which is a regional policy and information exchange body.

CURRENT BIOSECURITY PRACTICES IN FRENCH POLYNESIA

International biosecurity

Traditionally, the biosecurity strategy of a given country is entirely focused on incoming goods, with little attention or mandate for out-bound biosecurity. (A notable exception to this is the Brown Tree Snake detection activities conducted in Guam. Here the United States Department of Agriculture, through the Animal and Plant Health Inspection Service, conduct an extensive inspection and removal program of this species for outbound cargo and vessels.)

For French Polynesia, the national biosecurity program is focused on preventing entry of new pests and diseases. "Out-bound" biosecurity activities are the responsibility of individual exporters and are usually prescribed by agencies in receiving countries. As an example, recyclable waste such as scrap steel and aluminum are exported to several countries including New Zealand. These products are treated in accordance with prescribed "Import Health Standards" determined by Biosecurity New Zealand which include treatment of the commodity with pesticides.

Inter-island biosecurity

French Polynesia has an extensive and sophisticated internal biosecurity program administered through its Agriculture Department, Service du Developpement Rural. The backbone of this system is the provision of free fumigation services for any commodities at risk of vectoring plant or animal pests. The Service du Developpement Rural manages a fumigation facility adjacent to the main shipping port of Papeete. This consists of fumigation chambers which use methyl bromide fumigant – a highly effective quarantine treatment for both plant and animal pests. It is staffed by well-trained trained operators and complies with international quarantine standards..

However, this service is not mandatory and relies on voluntary compliance by travelers, who may choose not to make use of it. Further there are no systematic inspections of inter-island travelers or their personal possessions.

RECOMMENDATIONS ON ACTIONS TO IMPROVE BIOSECURITY WITH A FOCUS ON SPREAD OF INVASIVE ANTS

French Polynesia faces several distinct threats from the entry and spread of invasive ants:

1. Entry of invasive ant species not already present in the country,
2. Spread of existing invasive ant species (eg, *Wasmannia auropunctata*) between the 130 or so islands that make up the archipelago,
3. Spread of existing species (eg, *Wasmannia auropunctata*) within the municipalities of Tahiti.
4. Becoming a vector for the spread of *Wasmannia auropunctata* within the Pacific Region.

Entry of new species of invasive ants

Most common tramp ant species are already present in French Polynesia. These include:

- *Pheidole megacephala* – big-headed ant
- *Solenopsis geminata* – tropical fire ant
- *Monomorium destructor* – Singapore Ant
- *Anoplolepis gracilipes* – yellow crazy ant
- *Paratrechina longicornis* – brown crazy ant
- *Technomyrmex albipes* – white-footed ant
- *Tapinoma melanocephalum* – ghost ant
- *Wasmannia auropunctata* – little fire ant

With the exception of the Little Fire Ant, these species have a broad pan-Pacific distribution and in some cases, a worldwide distribution. They are species very common throughout the Pacific region. Although these species do have some economic, social and ecological impacts, they pale into insignificance when compared with the Little Fire Ant. Invasive ants not present here, and with known major impacts include the Red Imported Fire Ant (*Solenopsis invicta*), the Tawny Crazy Ant (*Nylanderia fulvus*) and the Argentine Ant (*Limepithema humile*).

The strategy to exclude or minimize the risk of the entry of invasive ants must therefore focus on these three species. Early detection and response is the recommended strategy for addressing risks from invasive species and this requires two important and inter-connected programs:

- An early detection system coupled with country-specific risk analyses for Red Imported Fire Ants, Tawny Crazy Ants and Argentine Ants.
- A viable emergency response plan to address any incursions that are detected.

The following actions are recommended:

Recommendation 1: development of an early detection program which includes regular and systematic surveillance of international points of entry for travelers and commodities.

Recommendation 2: Development of a national emergency response plan for invasive ants.

Mitigating the spread of existing invasive ant species (*Wasmannia auropunctata*) between the islands of French Polynesia

The main species of concern is the Little Fire Ant. However, little is known about the distribution of other common invasive ant species within the islands of French Polynesia. Little Fire Ants are restricted to the islands of Tahiti and Moorea. On Moorea, only two small infestations have been recorded. Preventing further spread of this species, and attempting the eradication of Little Fire Ants from Moorea should be the highest mitigation priority. A second priority should be to identify the distribution of invasive ants of secondary importance for each main island. The following actions are recommended to address this threat:

Recommendation 3: Establishment of a biosecurity strategy that minimizes the inter-island spread of Little Fire Ants. This should include:

1. **Mandatory fumigation of high-risk commodities before movement to other islands**
2. **Enhanced quarantine inspection of travelers to neighbor islands and their possessions**
3. **Increased public awareness and outreach on the risks and impacts of invasive ants.**

Recommendation 4: develop and implement an eradication program for known infestations on Moorea.

Recommendation 5: identify the distribution of "secondary" invasive ant species for main islands within French Polynesia.

Limit the spread of Little Fire Ants within Tahiti

As Little Fire Ants spread throughout Tahiti, impacts to the economy, people and the environment will become more severe. Additionally, the risk of transfer to other islands within French Polynesia and the Pacific region will increase in direct proportion to the degree of infestation. The topic of mitigating impacts for Tahiti are covered in a separate report and recommendations included:

1. Eradication efforts should focus on eliminating small (<1 hectare) infestations and if resources permit, infestations sized 1-5 hectares.
2. Containment activities should focus on larger (>5 hectare) infested sites.
3. Further research is needed to quantify the rates of spread for Little Fire Ants on Tahiti.
4. Known pathways and vectors for spread of Little Fire Ants on Tahiti should be monitored and risk minimization efforts should target these pathways.
5. Resources should be allocated to enhanced domestic quarantine inspections for risk items being transported to neighbor islands.

6. Domestic points of departure, especially the sea port and cargo handling facilities should be surveyed frequently to ensure these sites are free of Little Fire Ants
7. International points of departure, especially the sea port, airport and cargo handling facilities should be surveyed frequently to ensure these sites are free of Little Fire Ants
8. Resources should be made available for enhanced international out-bound quarantine activities to monitor and inspect cargo, personal possessions and empty shipping containers bound for international destinations.
9. Resources should be allocated to the development and implementation of a targeted outreach strategy designed to identify new infestations and reduce the risks associated with known Little Fire Ant vectors.

Recommendation 6: develop and implement a mitigation strategy for Little Fire Ants on the island of Tahiti

Reducing spread of Little Fire Ants within the Pacific region and Australia

Biosecurity agencies are rarely mandated to maintain "outbound" biosecurity programs as it is the responsibility of receiving jurisdictions to protect their own borders. However, French Polynesia could consider extending its biosecurity mandate to include such activities. The two most important pathways for the international spread of Little Fire Ants from French Polynesia are through the return of empty shipping containers and the transport of shipments of household goods for people moving between countries within the Pacific region.

One way to reduce the risks associated with shipping containers would be to participate and regulate off-shore risk reduction programs. This would involve a collaboration between exporting businesses, port authorities, shipping companies and the biosecurity agencies of trading partners. Both Australian and New Zealand agencies are likely to be very receptive to these concepts. The majority of compliance costs would be borne by private businesses however, the returns in lower compliance costs are likely to off-set and even exceed program costs.

The government of French Polynesia could consider implementing additional procedures and inspections for household items being shipped between Tahiti and other Pacific countries. This activity is not currently within the charter of the Service du Developpement Rural and may require legislative and resourcing changes in order for it to be implemented.

Recommendation 7: the Service du Developpement Rural formally approach quarantine agencies of New Zealand and Australia in order to develop off-shore hygiene partnerships between themselves and relevant industry partners.

Recommendation 8: Options for increased out-bound biosecurity inspections of shipments of household goods be explored by Service du Developpement Rural management.

PRIORITIZED RECOMMENDATIONS AND COST ESTIMATES

It is a difficult task to prioritize the recommendations outlined in this report. Priorities will differ for many stakeholder groups, especially when movement of Little Fire Ants from French Polynesia to other jurisdictions is considered. Recommendations to reduce the risk of entry and spread of invasive ants and to minimize their impacts to the economy, people and environment of French Polynesia are listed below in three categories: high, moderate and low priority. These priorities are based on the benefits expected for French Polynesia. An attempt at providing estimates of the costs associated with their implementation are included.

High priority recommendations

Recommendation 3: Establishment of a biosecurity strategy to minimize inter-island spread of Little Fire Ants

The nation of French Polynesia is comprised of approximately 130 separate islands known worldwide for their extraordinary natural beauty. A large proportion of Tahiti's inward currency flow is driven by tourism, and one of Tahiti's main tourist draw-cards is the unspoiled nature of these islands. The spread of Little Fire Ants throughout French Polynesia threatens both environmental values and economic prosperity.
Preventing the spread of Little Fire Ants to uninfested islands should therefore be one a high priority goal. A biosecurity strategy to achieve this will require resources including:

- Planning and development of a quarantine strategy
- Between two and four additional Service du Developpement Rural inspection officers and/or trained detector dogs
- Additional supplies of methyl bromide and fumigation operators

Recommendation 4: develop and implement an eradication program for known infestations on Moorea.

There are only two known infestations on the island of Moorea: one approximately 0.5 hectare and one approximately 5 hectares in size. Untreated, these will invariably spread to the rest of Moorea, with impacts and economic costs consistent with total infested area. It is technically feasible to eradicate these infestations. The benefit to cost ratio of such a project is likely to be high.

The following resources are needed to achieve this:

- A commitment to long-term funding of the project (at least six years)
- Development of an eradication plan based on world best practice. This plan should include provision for at least three years post-eradication monitoring to ensure pest-free status. Plan development will require extensive input from scientific personnel and operational managers.
- Allocation of human resources, chemicals and other materials necessary to implement the plan
- Training of operatives in treatment methods, data collection and surveillance.

Recommendation 6: develop and implement a mitigation strategy for Little Fire Ants on the island of Tahiti

The continued spread of Little Fire Ants within Tahiti is inevitable, and an attempt at eradication is unlikely to succeed without a substantial economic investment. However, both impacts and spread can be minimized by a targeted approach. Recommendations for developing this strategy is outlined in more detail in another report and are summarized below:

1. focus eradication efforts on eliminating small (<1 hectare) infestations and if resources permit, infestations sized 1-5 hectares.
2. Attempt to contain larger (>5 hectare) infested sites.
3. Conduct research to quantify the rates of spread for Little Fire Ants on Tahiti.
4. Monitor known pathways and vectors for spread of Little Fire Ants within Tahiti.
5. Develop and implement a targeted outreach strategy designed to identify new infestations and reduce the risks associated with known Little Fire Ant vectors.
6. Assist affected residents by providing practical extension advice on how to manage ant populations.

Moderate priority recommendations

Recommendation 1: development of an early detection program which includes regular and systematic surveillance of international points of entry for travelers and commodities.

An early detection programme should be implemented to prevent entry and spread of new invasive ant species. This will require regular (4 times per year) surveys at all international points of entry by trained surveillance staff and provision of taxonomic and data management support. Resources needed include:

- Survey staff (approximately 180 person-days),
- taxonomic support (90 person-days)
- data management staff (30-60 person days)
- Provision of training for survey staff, possibly taxonomic staff.
- Survey materials, microscope, GPS units, computer, vehicle

Recommendation 2: Development of a national emergency response plan for invasive ants.

A well-developed emergency response plan for invasive ants will ensure any new incursions are managed efficiently and effectively. Such a plan should be developed by a contractor in collaboration with key personnel from relevant agencies.

Recommendation 7: the Service du Developpement Rural formally approach quarantine agencies of New Zealand and Australia in order to develop off-shore hygiene partnerships between themselves and relevant industry partners.

The cost of biosecurity inspections and treatment for goods arriving in Australia and New Zealand are borne directly by the shipping lines (empty containers) and shipping agents (commodities). The operational cost of off-shore hygiene programs are normally paid for by the users and are

potentially off-set by lower inspection and treatment costs. Active endorsement and collaboration by quarantine agencies therefore have few costs, but do require some staff time for oversight and audit tasks.

Recommendation 8: Options for increased out-bound biosecurity inspections of shipments of household goods be explored by Service du Developpement Rural management.

Outbound inspections for biosecurity purposes are not normally within the mandate of biosecurity agencies. Implementation of such a programme will require allocation of additional inspection staff.

Low priority recommendations

Recommendation 5: identify the distribution of "secondary" invasive ant species for main islands within French Polynesia.

A comprehensive island survey to identify which species are present and absent on each island within French Polynesia will support efforts to limit the spread of invasive ant species within the archipelago. The probable impacts of these "secondary" ant species is likely to be substantially less than those for Little Fire Ants and therefore of lower priority.

SUGGESTIONS FOR IMPLEMENTATION AND COST ESTIMATES

The Hawaiian archipelago has a similar history of invasion by Little Fire Ants, however, the invasion there has been present longer. As Little Fire Ants spread within Hawai'i, the resources needed to manage impacts have increased steadily. Currently, there are four people employed on a full-time basis to coordinate mitigation, eradication, outreach and extension activities. French Polynesia is likely to need similar resources.

Most high and moderate priority recommendations in this report could be addressed by a combination of the following:

1. The formation of a dedicated team of 4 staff (with supplementary field support), managed from within the Service du Developpement Rural agency.
2. Additional input and resourcing from the biosecurity section within the Service. This may require hiring of additional staff, especially inspectors. Trained detector dogs should be considered as an inspection tool.

External needs include expert assistance with:

- Development of an emergency response plan,
- Formation of an eradication plan for Moorea
- Training for surveillance, treatment and other specialized activities.
- Conduct of applied research on basic biology and efficacy studies for control products

Conformance with the Pacific Ant Prevention Plan (PAPP)

The recommendations in this report are closely aligned with the objectives of the Pacific Ant Prevention Plan which is a regional strategy document that supports a coordinated approach to the issue of invasive ants in the Pacific region. It recommends:

- appropriate legislation, regulations or standards to deal with invasive ants pre-border and at the border;
- risk analysis that covers the region but which can be adapted for implementation to each
- country or territory;
- regional trade agreements which accommodate risks associated with invasive ants; and
- operational measures which can be applied to each territory and will actually prevent ants gaining entry.
- a range of surveillance measures appropriate to quickly identify the presence of a new
- invasive ant in each territory;
- appropriate incursion response procedures and the capability to enact them;
- a regional public awareness strategy to ensure the ant species concerned have appropriate public profiles so the risks of their establishment are well understood by sections of the community; and
- an active research programme to ensure the measures used to prevent establishment have a sound scientific base and thus will have the greatest likelihood of success.

REFERENCES

Commonwealth of Australia. 2006. Threat abatement plan to reduce the impacts of tramp ants on biodiversity in Australia and its territories. Department of the Environment and Heritage, Canberra.

Fabres, G. and W. Brown jnr. 1978. The recent introduction of the pest ant *Wasmannia auropunctata* into New Caledonia. Journal of the Australian Entomological Society **17**:139-142.

IUCN/SSC Invasive Species Specialist Group. 2004. Pacific Ant Prevention Plan. International Union for the Conservation of Nature.

Jourdan, H. 1997. Threats on Pacific islands: the spread of the tramp ant *Wasmannia auropunctata* (Hymenoptera: Formicidae). Pacific Conservation Biology **3**:61-64.

Nendick, D. 2006. Pacific Off-Shore Container Management Programme reduces biosecurity risks and industry compliance costs. Page 3 Biosecurity Magazine. New Zealand Ministry of Agriculture and Forestry.

Vanderwoude, C. 2013a. Little Fire Ants in French Polynesia: distribution, impacts and estimated population growth. Report to the Secretariat of the Pacific Regional Environment Programme, March 2013.

Vanderwoude, C. 2013bConsiderations for eradication, containment and long-term monitoring of Little Fire Ants in Tahiti. Report to the Secretariat of the Pacific Regional Environment Programme, July 2013.

www1 United Nations Community Trade Database http://comtrade.un.org/db/ (data accessed 10 July 2013)

www2 Department of Agriculture Fisheries and Forestry (Queensland) Electric Ant Eradication programme http://www.daff.qld.gov.au/plants/weeds-pest-animals-ants/invasive-ants/electric-ants/eradication-program (page accessed 12 July 2013)
www3 Biosecurity New Zealand Pacific Activities Advisory Group http://www.biosecurity.govt.nz/biosec/pacific-portal (page accessed 26 July 2013)

APPENDIX 1: STANDARD OPERATING PROCEDURE - APPLICATION OF GRANULAR BAITS TO CONTROL LITTLE FIRE ANTS

PURPOSE AND SCOPE

This standard operating procedure describes recommended methods for treating Little Fire Ant (*Wasmannia auropunctata*) nesting on the ground or in vegetation under 1.5 metres in height.

INTRODUCTION

Little Fire Ants nest on the ground, around houses and other structures and in vegetation, including the canopy of mature trees. Treatment for control of colonies nesting on the ground or in low vegetation (less than 1.5 metres) is accomplished most easily with granular baits. For treatment of colonies nesting in trees and vegetation, please refer to the standard operating procedure for gel baits.

MATERIALS

- Granular ant bait (see below)
- Hand held or motorized bait spreader
- Nitrile or latex gloves
- Long pants, long sleeved shirt, shoes and socks (mandatory)[1]
- Dust mask and eye protection (if desired)

METHOD

The intent of treatment with granular baits is to deliver an even distribution of the bait over the soil surface at an approximate rate of 2 kilograms per hectare. Most, but not all, granular baits manufactured for control of Red Imported Fire Ants (*Solenopsis invicta*) are suitable for control of Little Fire Ants.

Granular baits are mostly manufactured using similar ingredients for the bait matrix with the active ingredient differing from brand to brand. The matrix is comprised of corn grits and vegetable oil. The oil is soaked into the grits resulting in light, fine granules 1mm – 3mm diameter. The product is usually a bright yellow color and has a faint odor of vegetable oil. Once the bait container has been opened, the unused product will degrade over approximately 3 months, eventually spoiling. Opened bait containers should be stored in a cool dry location. unopened containers more than two years old are likely to be spoiled also. Bait that is spoiled will have a rancid odor and should not be used.

[1] Some bait products may have additional safety equipment mandated on the product label.

Application

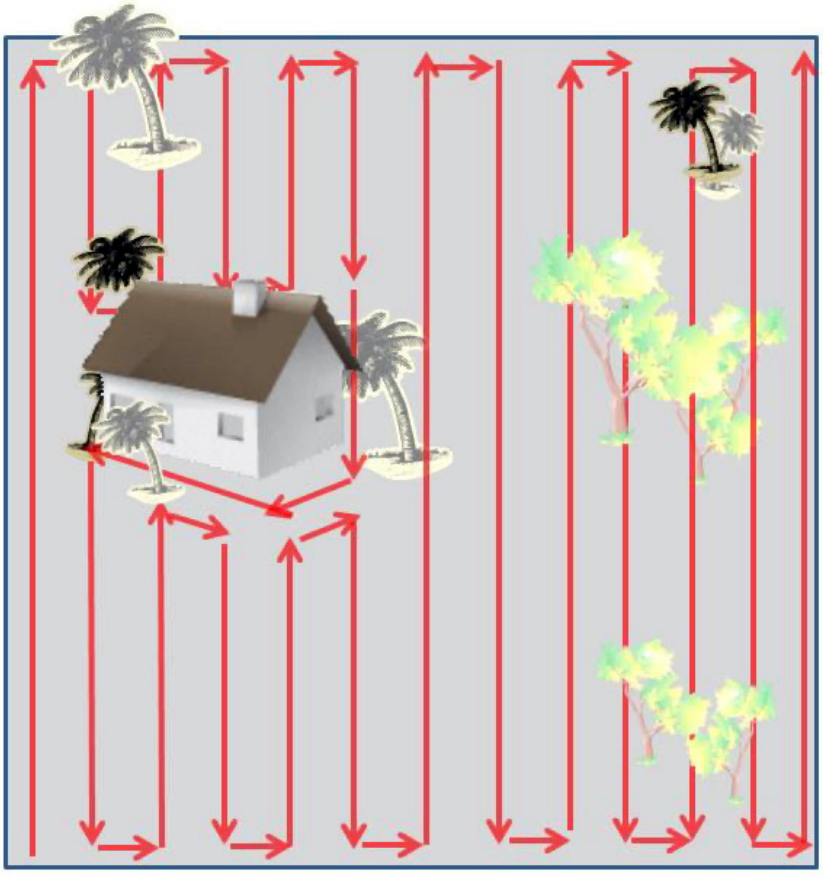
Two main application methods are used: hand-held spreaders and motorized blowers. There are also spreaders that can be attached to tractors or ATV vehicles for treatment of larger areas.

Hand-held spreaders

These are available at low cost from hardware and pesticide stores. They feature a hopper for holding the bait, a winding handle that agitates the bait and scatters it over the ground, and an adjustable aperture that is used to calibrate output. These spreaders are also used to scatter seeds and fertilizer.

Typical hand held bait spreader showing the winding handle (a), the aperture adjustment (b) and correct grip. Set the aperture at "1".

With the aperture set at "1" (see above) the operator winds the spreader handle at approximately 60 rpm while walking at 2-3 mph. The swath width thus created is approximately 4 yards. When applying the bait over the target area, an overlapping series of parallel swathes is recommended. This is accomplished by starting on one boundary of an infested site and proceeding 1 yard inside the boundary. Once the operator reaches the end of the treatment area, he or she takes 2-3 paces towards the untreated area and returns parallel to the original path, working around buildings and other obstacles (see below). Continuing this process, the designated area can be systematically covered. It is important that all ground is treated including spaces between buildings and corners of gardens. An additional sweep around buildings, garden edges and other structures is recommended. Rainfall within 12 hours of treatment will reduce effectiveness so plan to conduct treatment when rain is not expected for 12 hours.



Example of a treatment path taken by an operator treating around an urban structure.

Improving the agitator

Ant bait is light and fluffy. Often it does not feed through spreaders evenly, and two main alterations should be considered: The agitator is the orange plastic "T" shaped device in the bottom of the hopper. This can easily be pulled out. Wrap a small cable tie around the stem and tighten the tie as tightly as possible. Then cut it down so an inch or so is left sticking out. The cable tie should wrap around the stem in an anti-clockwise direction when viewed from above so when it is in the hopper, it is wrapped the way shown in the figures below. Cut the cable tie down to leave a one inch end after placing it onto the stem so it will be easier to tighten. This will assist the bait to flow more evenly.

Cable tie ready for placement (left) with agitator re-attached (right)

Holding the aperture adjuster open for long periods can cause discomfort and fatigue for operators. The trigger can be locked in place simply by inserting a self-tapping screw through the assembly while holding the aperture open at the desired setting. Usually #1 is sufficient, but a better position is half way between #1 and #2. Drill a small pilot hole and drive a self tapping screw through the assembly so the trigger remains open.

Screw holding the trigger permanently open.

Motorized blowers

Motorized blower-misters can be used to cover large areas quickly and offer several advantages:

- Blowers can project granular baits more than six metres
- An operator can cover much greater area in the same time, and
- Granules can be blown into areas that are not easily accessible

Their disadvantages include high purchase costs, a requirement for gasoline and specialized maintenance, additional weight and difficulty calibrating output. Several manufacturers produce these machines, with a common one being made by Maruyama.

A Maruyama MD155DX blower-mister

Choosing baits for control of Little Fire Ants

Many baits manufactured for control of Red Imported Fire Ants are effective against Little Fire Ants. However, some are not attractive to Little Fire Ants and these should not be used. Both the Hawai'i Ant Lab and Dr Arnold Hara of the University College of Tropical Agriculture and Human Resources have tested many baits available in USA. Together, their research shows that baits containing methoprene or pyriproxifen as the active ingredient are NOT effective against Little Fire Ants, while those containing hydramethylnon, indoxacarb and fipronil work best. Below is a table of ant bait formulations that are attractive to Little Fire Ants and therefore recommended. There may be other bait products available from other countries, however, use this as a guide for baits sourced from the United States.

Some product formulations suitable for control of Little Fire Ants.

Product brand	Manufacturer	Active ingredient	Concentration	EPA registration number
Amdro Block® Amdro Fire Ant Bait®	BASF	Hydramethylnon hydramethylnon	0.880% 	73342-2
Probait®	Zoecon	hydramethylnon	0.730%	73342 -1-2724
Maxforce Complete® Maxforce Fire Ant Killer	Bayer	Hydramethylnon hydramethylnon	1.000% 1.000%	432-1265 432-1265
Advion fire ant bait®	Dupont	indoxacarb	0.045%	352-627
Maxforce FC Fire Ant Killer®[2]	Bayer	fipronil	0.00045%	71106-GA-001

.

[2] This has not been tested against Little Fire Ants but should work very well.

APPENDIX 2: STANDARD OPERATING PROCEDURE - TREATMENT OF LITTLE FIRE ANTS WITH GEL BAITS

PURPOSE AND SCOPE

This standard operating procedure describes recommended methods for treating vegetation and structures within a designated outbreak of Little Fire Ant (*Wasmannia auropunctata*). Little Fire Ants nest on the ground and in vegetation. This means all vegetation needs to be treated in addition to ground treatment

MATERIALS

- Gel baits (see mixing instructions in separate operating procedure)
- ZEP brand spray bottle or good quality 2 gallon pump-up sprayer
- Nitrile or latex gloves
- Long pants, long sleeved shirt, shoes and socks
- Hat and eye protection

METHOD

The intent of treatment with gel baits is to ensure areas not adequately covered by granular baits are also treated. Little Fire Ants are like to nest in trees, vegetation and even the crowns of coconuts. Worker ants from these colonies do not forage great distances and may not always reach the ground-applied bait granules.

The gel bait is made mostly from water and vegetable oil. It is the texture of ketchup and sticks to vegetation when sprayed. The bait is easily applied to cracks, crevices, branches, vertical surfaces etc and it is therefore very suitable for use on trees, shrubs and buildings. The recommended application rate is 10kg per hectare depending on how much vegetation cover is present. Rainfall within 12 hours of treatment could reduce effectiveness, however, most of the gel baits will remain unless rainfall is very heavy.

Aim to produce spatters – small drops of bait between 5-10 mm in diameter, with at least one drop of bait every 30 centimetres.

Bait applied to a banana leaf. Some of the droplets are highlighted with arrows, and ants can be seen feeding on the bait.

Every tree, shrub, structure building within the treated area will need to be treated as follows:

Trees

Vegetation under 6 metres in height can be treated from the ground. Shoot 1-2 squirts onto every limb, branch junctions, hollows, areas with dead wood, areas where debris has collected and along branches. Large trees like coconuts may need to be climbed. Go as high as it is safe to do so and apply several shots into the crown of each coconut, in foot holds and hollows of the trunk. If Little Fire Ants are seen, place additional amounts of bait along foraging trails. The bait should be placed at approximately 1 meter intervals.

Bananas

Banana clumps are perfect habitat for Little Fire Ants. In infested areas, almost all the spaces between leaf axils and the stem will house a small colony. Spray bait in the areas of the stem where green or dying leaves are attached. Also spray the trash around the banana clump and place some bait along fallen or cut trunks.

Shrubs and small trees

Flowering plants, fruit bearing trees and small shrubs are often used by Little Fire Ants for food gathering. These are generally too fragile to climb but spray across these with an even coverage of "splatters". If a foraging trail is seen, follow it to the ground and/or to the nest and place some bait there also.

Buildings and structures

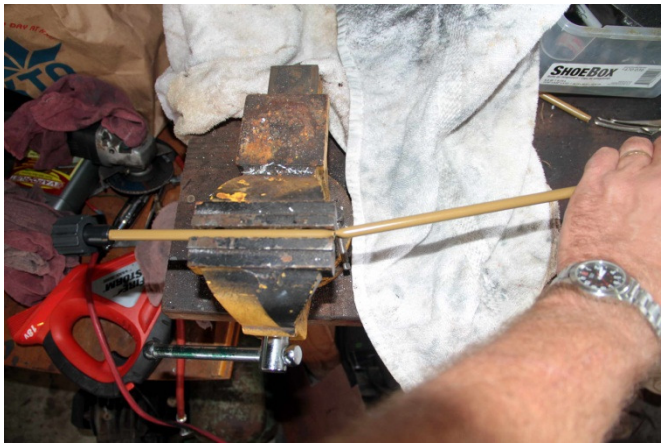
The bases of buildings and other structures are places where Little Fire Ants will be found. Work around each building, placing splatters of bait every 30 centimetres or so. The best spots to place baits are cracks crevices, hollows and places where foraging trails can be seen. If ants are seen foraging up walls or posts, place additional bait as high as can be safely reached. Always choose the shady side of posts to place bait as Little Fire Ants prefer to forage in shady locations.

Spray tools

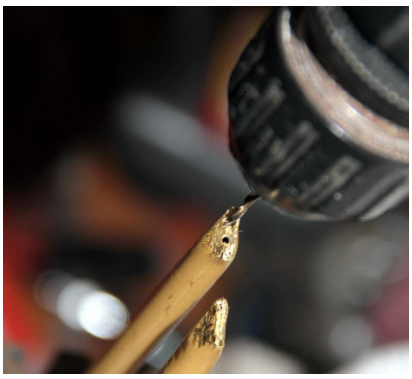
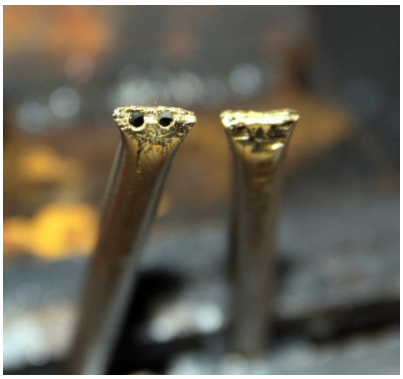
Gel baits can be sprayed with good quality squirt bottles (not the cheap kind). With these sprayer types, it is possible to shoot a thin stream of gel 6-6 metres. This is very handy for spraying vegetation or covering larger areas. As you depress the trigger, wave the wand or bottle in the air to form a shower of smaller droplets. ZEP brand spray bottles work very well, however, different brands may also be available. Often these sprayers have a small filter at the bottom of the inlet tube. This needs to be removed prior to use.

Good quality spray bottles

Another way to spray larger areas is with a pump-up sprayer. The cheaper types do not work very well. Search for a sturdy model with a wide (13mm) outlet hose that connects to the bottom of the sprayer. The pump assembly must also be good quality as high pressure is needed. The Redmax brand sprayers work well. Make sure the one you purchase has a metal wand or purchase a metal wand separately because it will need to be modified as follows:





First, hold the wand in a vice and bend until it snaps. This should leave it almost closed at the tip. Squeeze the tip almost closed with a pair of pliers or vice grips. You can drill two very narrow holes in the tip or leave it as it is. Either way, it will need more crimping to get the spray pattern right. Experiment with a batch of blank gel bait. You will need to adjust the tip until the bait squirts out in a nice thin stream. After carefully adjusting it, this should be able to spray around 5-6 metres, or even further.

Cleaning and maintenance

The gel baits used in this standard operating procedure is viscous and oily. Equipment must be thoroughly cleaned with an industrial degreaser to remove all residues inside the bottles, plungers and wands. If equipment is not carefully cleaned on a daily basis, any remaining oil will harden and block the wand, nozzles and other pump components. It is recommended to use a heavy-duty degreaser to thoroughly rinse the tank and spray through the nozzle until only clear soapy liquid emerges. Then rinse out old cleaner, re-fill with new detergent and allow some to be sprayed through the wand. Leave the degreaser standing in the hoses, tank and wand, and thoroughly rinse immediately before the next time the sprayer is used.

APPENDIX 3: STANDARD OPERATING PROCEDURE - MIXING GEL BAITS FOR CONTROL OF LITTLE FIRE ANTS

PURPOSE AND SCOPE

This standard operating procedure describes recommended methods for mixing a Gel bait for control of Little Fire Ant (*Wasmannia auropunctata*). Gel baits are easier to apply to vegetation where ants frequently nest and are less affected by rain than conventional baits

INTRODUCTION

The Little Fire Ant (*Wasmannia auropunctata*) is very difficult to control. They have many small colonies, each with many queens, and will have nests on the ground as well as in trees and other vegetation. All these small colonies are inter-connected and if some die out, they are re-populated by neighboring colonies. One management problem is that virtually all commercial baits consist of small granules. These are easy to spread on the ground, but can not be applied to vegetation. If only the colonies on the ground are treated, neighboring ants living in trees will quickly spread back to the ground. The bait granules are also inactivated by rainfall. Once the granules become soggy, they are no longer attractive to ants. Tahiti experiences regular and frequent rain. In some locations it is difficult to predict if it will rain on any given day.

Contrary to popular belief, ants do not eat solids - they only consume liquids. Granular baits are made from corn granules soaked with vegetable oil, and when a worker ant finds a bait granule, she sucks the oil out of the granule and leaves the rest behind. Ants can consume a gel bait far more easily than a granular product, so in theory, gels should be more effective than granules.

Baits in liquid or gel form do not have the same limitations as granular products. They can be applied to vegetation where they will stick to the leaves and branches and are not affected as quickly by rainfall. They are, however, a bit more difficult to apply compared with granular baits. Also, gel baits suitable for control of Little Fire Ants are not available commercially and need to be prepared before treatment can begin.

METHOD

Ingredients

1. Toxicant
2. Corn, safflower or similar vegetable oil
3. Water
4. Xanthan gum
5. Peanut butter (creamy)
6. Dye or coloring agent if desired

Mixing equipment

1. 20 litre plastic bucket with tight fitting lid
2. Electric or battery drill
3. Whisk or paint mixer
4. Measuring jugs
5. Scales
6. Chemical resistant apron or similar
7. Rubber gloves
8. Eye protection

Choice of toxicant

The following pesticides have been used experimentally in gel baits against Little Fire Ants[3]

Product name	Manufacturer	Active ingredient	Concentration in product	Amount **product** needed per kg bait
Provaunt® Avaunt®	Dupont	indoxacarb	300 g/kg (wettable powder)	6.0 grams
Termidor®	BASF	fipronil	100 g/kg (suspension concentrate)	0.5 grams
Tango®	Wellmark International	S-methoprene	49 g/kg (suspension concentrate)	51 grams
various	various	Boric acid	99.9 g/kg powder	20 grams

Vegetable oil

Most edible vegetable oils used in cooking appear to be suitable. It is easy to compare palatability of various oil options be presenting foraging Little Fire Ants with a choice of several types and recording which type attracts more ants.

Xanthan gum

Xanthan is an emulsifier and thickener used in cooking. Addition of this product is necessary to mix the oil and water in a way that does not cause the ingredients to separate before use. It also mixes the toxicant with the oil. Normal xanthan gum is a powder and can be difficult to mix with water. Hot (60-70° C) water will mix a little more readily. Bulk "rapid dispersal" xanthan gum is preferred and is much easier to mix. It is available from Philoutlet, email philoutlet@gmail.com or phone +1 312 733 0000. Normal xanthan is available elsewhere through health food stores and pharmacies.

Peanut butter

Any creamy or smooth variety is acceptable. The cheaper brands are best as they are already homogenized making them easier to mix.

Coloring

[3] Mixing and use of gel baits with these active ingredients may require approval from pesticide regulators in French Polynesia

It may be desirable to add food coloring or other edible dye to make it easier to observe where treatment has taken place. However, colorings may also stain structures, concrete and plants.

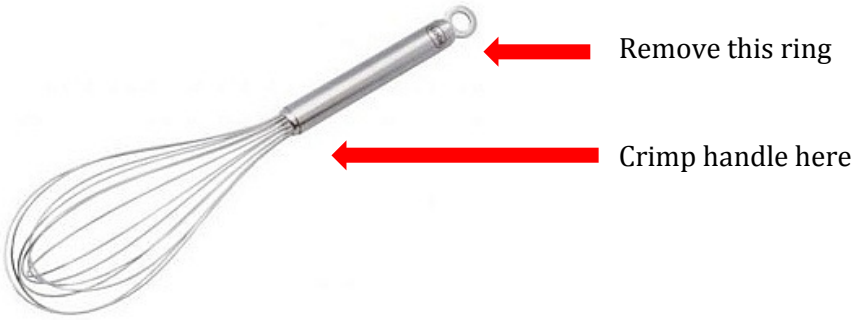
MIXING PROCEDURE

This method uses quantities sufficient to make 8 kilograms of gel bait. Make the bait mixture the afternoon before it is needed. The mixture will not keep fresh for more than 2-3 days.

- Add 4.8 litres of water and toxicant to the bucket.
- Mix with drill and whisk until thoroughly incorporated.
- Slowly add 64 grams of xanthan gum to the water while mixing. Make certain to add the xanthan powder slowly so that it does not form lumps. Continue to mix until a uniform jelly-like consistency is achieved.
- Add 2.8 kg oil and 240g peanut butter. Continue to mix until all the oil is combined with the water and a consistent color and texture is achieved.
- Sometimes small lumps form in the mixture despite best efforts to avoid them. In this case, leave the mixture overnight and mix again in the morning just prior to use.

Mixing devices

A battery or electric drill with a kitchen whisk or a paint mixer works best for mixing. The best type of drill is one with higher speed (RPM). Standard type paint mixers work well. Others prefer a kitchen whisk modified to fit into the drill chuck.



APPENDIX 4: STANDARD OPERATING PROCEDURE - SURVEILLANCE AND MONITORING METHODS FOR LITTLE FIRE ANTS

PURPOSE AND SCOPE

This standard operating procedure outlines procedures and specifications for detection, delimitation and quarantine inspection of commodities for *Wasmannia auropunctata* (Little Fire Ants).

INTRODUCTION

There are three main survey types: detection surveys, delimiting surveys and inspection for quarantine purposes. (The standard operating procedure for quarantine inspection can be found in a separate document). Each survey type has a different aim and the type of information that needs to be gathered is also different. In a detection survey, the objective is to determine if a site does, or does not, have an invasive ant. This is the easiest type of survey to conduct because all that is needed to confirm presence of the ant is a single specimen. In delimiting surveys, the purpose is to map the extent of an infestation. For quarantine detections, the goal is to determine if a commodity is infested with the target species.

Detection of ants can be accomplished by several means including visual searches, placement of long term trapping devices like pitfall traps or by placing lures of attractive food items within the survey area. The use of lures has several advantages for most survey types including low cost, ease of deployment and systematic nature. Briefly, lures that are attractive to the target species are deployed in a grid pattern over the search area, left exposed for sufficient time to be discovered by the target species, then collected and the specimens identified by a trained taxonomist.

Little Fire Ants are consistently attracted to peanut butter, so this makes a good lure. Depending on the nature of the survey, there are two recommended lure designs: a bait stick, or a vial. Preparation of these two lure types are detailed below.

Planning the survey

When planning the survey, work out the area to be covered and obtain a map or aerial image of the site. Google Earth is a good source of maps but most ports have port plans which can also be used. Contact site management at least a day before the survey to make sure you have permission to enter and arrange any passes etc that might be needed. In the case of an airport or sea port, try to pick a time when no planes are expected or ships are being loaded/unloaded. Also, plan to conduct the survey during clear weather when rain is not expected.

Lure preparation (bait stick method)

When field identification is possible, or only a few specimens are anticipated, surveys can be conducted with the bait stick method. This is the most rapid survey method but is least accurate if detailed information such as ant density is needed.

Materials

1. Disposable chopsticks (cut in half), disposable coffee stirrers or popsicle sticks
2. Bright-coloured spray paint
3. Smooth peanut butter
4. Zip-lock bags
5. Marking pen
6. GPS unit

Preparation and deployment

Paint both sides of the chopsticks or coffee stirrers with bright-coloured spray paint (this makes locating deployed sticks much easier). Once the paint has dried, grab a handful of sticks and dip them into the jar of peanut butter. Withdraw the sticks and place them into a zip-lock or other plastic bag with the peanut butter end inside the bag. Pull the sticks out one by one as needed, making sure to leave only a thin smear of peanut butter on each stick. Place the sticks in specified locations and at a spacing determined by the type of survey to be conducted.

Collection

Leave the lures in the field for 45-90 minutes and then retrieve them. If the collector can identify Little Fire Ants in the field, take a GPS waypoint at every location where Little Fire Ants are detected. If the samples are to be returned to the laboratory for identification, place the sticks individually into a zip-lock bag. Seal the bag, take a waypoint and write the waypoint number onto the bag. This way, positive samples can be mapped after they have been identified. Place samples in a freezer at -18^{o}C until ready for identification.

Lure preparation (vial method)

When all samples need to be returned to a laboratory for identification, the vial method may be the best alternative.

Materials

1. Clear plastic vials (30-60 CC) with lids.
2. Smooth peanut butter
3. Marking pen
4. GPS unit

Preparation and deployment

Its best to make only enough baits for a day's work. This way the baits will be fresh and attractive to ants (ants are not as interested in old baits). If possible, make them up the day before and store them in a refrigerator overnight.

Smear a thin layer of peanut butter onto the inside of each vial. Replace the caps and store prepared samples in a carry bag ready to take into the field. Place the vials in specified locations and at a spacing determined by the type of survey to be conducted.

Collection

Leave the vials in the field for 45-90 minutes and then retrieve them. Take a GPS waypoint at every location where a vial has been placed and write the waypoint number onto the vial. Make certain to keep one collector's vials separate from other collector's vials and ensure a record of waypoint numbers and GPS coordinates accompany the vials to the laboratory. This way, positive samples can be mapped after they have been identified. Place samples in a freezer at -18^{o}C until ready for identification.

Conducting the survey

The aim of the survey is to thoroughly sample the ants at the site. This is done by placing baits in a grid pattern over the entire area, placing protein baits and sugar baits alternately. The spacing between baits should be around 10 paces for general detection surveys. It is not important to have the grids at **exactly** this spacing as long as they are approximately correct. See Table 3 for survey specifications for different types of survey. Sections of the survey site that are all concrete or asphalt do not need to be sampled because few ants nest in these locations. Common ant habitats are listed in Table 4 and it is important that these are all sampled.

Bait vials should be collected 45-90 minutes after placement. It takes much less time to retrieve vials than it does to deploy them. As a guide, teams should place vials for one hour, then stop and retrieve the vials they have deployed in the order they were deployed. This way, the vials placed at the beginning will have been out for 60 minutes and the ones deployed last will have been exposed for about 45 minutes depending on ant species. Try to plan out a route that will take you back to the point where you started – it saves extra walking.

Surveillance should not occur during or after rain when the ground surface is still wet, or on windy days. Also no rain should fall between placement of bait traps and their retrieval. If rain is imminent, it is a good idea to stop deploying baits and retrieve the ones already out. If this is not possible, collect the baits one hour after the rain has stopped. If not many ants are at the baits, it might be necessary to re-survey the rain-affected section.

Bait vials should be placed in the shade where possible. Remember the sun might have moved by the time you collect the vials so place them carefully to avoid this. As a hint place your vials with the opening away from prevailing wind and angle the entrance slightly to the ground. This helps prevent vials filling with water and debris if you encounter a sudden down pour.

Any unusual ants (that look different from common established species) sighted while conducting surveillance should also be collected.

Table 3. specifications for surveys

	Detection survey	Delimiting Surveys	Commodity inspection
Methods	Vials	Vials or bait sticks	Bait sticks or visual
lure spacing	200-400/ha, 1 vial every 5-7m depending on available resources	100/ha, 1 vial every 10m. Once no ants detected, switch to 1 vial every 5 m at least 20m beyond the limits of detection	Visual inspection of 1% of commodity or bait sticks in 1-10% of pots for potted plants
Frequency/ length of program	Six monthly annually (2 rounds per year)	Immediately, if results negative follow up every six months for 2 years If results positive, treat and monitor out to delimiting boundary	As needed
Buffer zone	50m	20m	
Visual Surveillance	Very efficient in high density areas especially if surveyors are familiar with the ant. Habitat is 3 dimensional- in soil, intermediate canopy, vegetation, target bananas and coconut trees first. A good visual method is to use a smear of peanut butter on a bait stick.		

Table 4. list of common ant habitats

1.	Tree trunks (visual inspection and bait at base if appropriate)
2.	Flowers and trunks of trees
3.	Shrubs and poles
4.	Building edges and foundations
5.	Concrete slab edges
6.	Cracked concrete
7.	Disturbed sites
8.	Drains and culverts
9.	Electrical generators and fittings
10.	Exposed rocks
11.	Fence palings
12.	Grass areas

13.	Verges
14.	Hot water pipes and heaters
15.	Isolated weeds
16.	Logs
17.	Loose gravel
18.	Low vegetation (including grass)
19.	Plant pot bases
20.	Road margins
21.	Rubbish piles
22.	Soil
23.	Tree crotches and hollows
24.	Vertical surfaces
25.	Weed and plant re-growth
26.	Wooden structures
27.	Underneath stones or concrete rubble