GLOBAL INVASIVE SPECIES DATABASE

FULL ACCOUNT FOR: ***Solenopsis invicta***

Solenopsis invicta 简体中文 正體中文

System: Terrestrial

Kingdom	Phylum	Class	Order	Family
Animalia	Arthropoda	Insecta	Hymenoptera	Formicidae

Common name rote importierte Feuerameise (German), red imported fire ant (RIFA) (English), fourmi de feu (French)

Synonym *Solenopsis wagneri* , (Santschi)
Solenopsis saevissima , var. *wagneri* (Santschi)

Similar species

Summary Solenopsis invicta is an aggressive generalist forager ant that occurs in high densities and can thus dominate most potential food sources. They breed and spread rapidly and, if disturbed, can relocate quickly so as to ensure survival of the colony. Their stinging ability allows them to subdue prey and repel even larger vertebrate competitors from resources.

view this species on IUCN Red List

Species Description
Workers in the *Solenopsis* genus are polymorphic, meaning they are physically differentiated into more than two different body-forms (Holway *et al*. 2002). Fire ants are quite small, varying from 2 - 6mm in length, and are predominantly reddish-brown in colour. Their nests vary in shape and size, but all have a honeycomb-like internal structure and are usually found in open areas including lawns, pastures, along roadsides and abandoned cropland. They may be 40cm high dome-shaped mounds without any obvious entrance/exit. Mounds may not be evident at all. The red imported fire ant should not be confused with those species which are commonly called fire ants.
Please click on *AntWeb: Solenopsis invicta* for more images and assistance with identification. The AntWeb image comparison tool lets you compare images of ants at the subfamily, genus, species or specimen level. You may also specify which types of images you would like to comare: head, profile, dorsal, or label.
Please see PaDIL (Pests and Diseases Image Library) Species Content Page *Ants: Red imported fire ant* for high quality diagnostic and overview images.
Please follow this link for a fully illustrated Lucid key to common invasive ants [Hymenoptera: Formicidae] of the Pacific Island region [requires the most recent version of Java installed]. The factsheet on *Solenopsis invicta* contains an overview, diagnostic features, comparision charts, images, nomenclature and links. (Sarnat, 2008)

Notes
In northern Alabama and Mississippi, where their ranges overlap the red imported fire ant (*S. invicta*) is known to hybridise with the black imported fire ant (*S. richteri*) (Holway *et al*. 2002).

Uses
The mound-building activities of non-native *Solenopsis* spp. alter physical and biogeochemical properties of soils, and can lead to increased soil aerationand infiltrability, elevated soil pH, increased phosphorous and potassium levels, lowered surface soil bulk density, change in organic matter, altered soil texture and enhanced fungal abundance. These influences are further enhanced by plant uptake and excretion in the rhizosphere, and cause other flow-on effects within ecosystems. This an area that has not been well studied, and more research is warranted (DeFauw *et al*. 2008 and references therein).

Habitat Description
S. invicta is a “hot climate specialist” and inhabits hot arid regions. Cold climates are unsuitable for its successful establishment in native ecosystems. However, it may survive in such climates in human habitations or infrastructure (such as climate-controlled buildings or greenhouses). Although its capacity for local spread will be restricted its continued presence is a threat as it provides a source from which long distance spread can occur (McGlynn 1999; Holway *et al*. 2002). It is estimated that continental areas receiving more than 510mm of precipitation per year will support *S. invicta* while areas receiving less than this will only support populations of the ant near sources of permanent water or in regularly irrigated areas. These include lakes, rivers, springs, lawns or agricultural areas (Morrison *et al* 2004).\nBoth the red imported fire ant and the tropical fire ant (*S. geminata*) are more likely to colonise open environments and are opportunistic exploiters of human associated habitats, such as the ones previously mentioned (Holway *et al*. 2002).
In general, invasive ants are usually more likely to establish in disturbed habitats, including the edges of forests or agricultural areas (Ness and Bronstein 2004). Deforested areas are particularly at risk of becoming colonised by red imported fire ants (Morrison *et al* 2004). *S. invicta* constructs earthen mounds for the purposes of brood thermoregulation, which are easier to build in open, sunny areas; so it is less abundant in, and in general poses a smaller threat to, densely wooded forest habitats (Tschinkel 1993; Porter and Tschinkel 1993, in Morrison *et al* 2004). Tropical regions that are warm and wet, but also densely forested do not represent a suitable habitat for fire ants (Morrison *et al* 2004).

Reproduction
The queen produces from 800 to 2000 eggs per day. She produces sterile worker females and occasionally fertile females and males. Fertilised females may start new colonies. Uniclonal colonies are known to establish new colonies by budding. A queen or queens leave the nest with a cohort of workers, larvae, etc. and start a new colony. Mature fire ant colonies may contain up to 400,000 worker ants.

Nutrition
The red imported fire ant may gain nutrition from includes invertebrates, vertebrates and plants, and oily or sugary foods. However it is known to prefer protein-rich food sources and may be a great consumer of insects (Ness and Bronstein 2004). Studies suggest that *S. invicta* is not a great consumer of extra-floral nectar and rarely collects it (McLain 1983, in Ness and Bronstein 2004). *S. invicta* possess a venomous sting that increases its ability to consume large invertebrates (and potentially small vertebrates) (Holway *et al*. 2002). In terms of bait preference, the red imported fire ant prefers solid and protein-rich baits (Stein *et al*. 1990, Cherry and Nuessly 1992, Brinkman *et al*. 2001, in Ness and Bronstein 2004).

General Impacts
Please read *Invasive ants impacts* for a summary of the general impacts of invasive ants, such as their affect on mutualistic relations, the competitive pressure they impose on native ants and the effect they may have on vulnerable ecosystems. \r\n
There is conflicting evidence as to whether *S. invicta* inhibits the dispersal of ant-dispersed plants. In some cases, it may interrupt and reduce dispersal by competing with native ant dispersers, eating seeds whole or in-effectively dispersing seeds (ie: by leaving them exposed on the soil surface rather than protecting them by seed-burial). *S. invicta* may increase or decrease the survival of plant, depending on the species and other biotic variables. They may benefit a plant by killing, or at least deterring, insects that damage the plant (such as plant-feeding insects). Alternatively, or in addition, they may reduce numbers of insects that benefit the plant, such as plant mutualists that protect the plant or disperse plant seeds or carnivorous insects (that prey on plant-feeding insects). In fact, *S. invicta* is a notable example of an invasive ant which has negative effects on such insects, because it prefers a protein-rich diet (Ness and Bronstein 2004).\r\n
S. invicta reduces biodiversity among invertebrates and reptiles, and may also kill or injure frogs, lizards or small mammals. In particular the red imported fire ant has the potential to devastate native ant populations (McGlynn 1999). It is competitively dominant to most other invasive ant species; it has displaced the Argentine ant (*Linepithema humile*), but not *Monomorium minimum*, in areas in the USA where the species have been introduced (Holway *et al*. 2002). In the USA, it has been found to negatively impact at least fourteen bird species, thirteen reptile species, one fish species and two small mammal species (through predation, competition and/or stinging) (Holway *et al*. 2002). The current economic impact of *S. invicta* on humans, agriculture, and wildlife in the United States is estimated to amount to at least half a billion, if not several billion, dollars per year (Thompson *et al*. 1995, Thompson and Jones 1996, in Morrison *et al* 2004).\r\n
S. invicta may impact social and economic activities at all levels. They can sting people and may cause an allergic reaction. Public areas such as parks and recreational areas may become unsafe for children. They may infest electrical equipment (such as computers, swimming pool pumps, cars or washing machines) becoming a nuisance, or even a danger, to people. Agricultural impacts may include damage to crops, interference with equipment and the stinging of workers in the field. The costs associated with *S. invicta* in the United States, for example, have been estimated at $1 billion per year (Pimentel *et al*. 2000, Tsutsui and Suarez 2003). The Australian Bureau of Agriculture Resources Economics has estimated the losses procured in rural industries to amount to more than AU $6.7 billion over 30 years. According to a professor at the Texas Agricultural Extension (USA) the agricultural economic losses caused by the ant are an estimated US $90 million annually. In Texas at least US $580 million was spent in 2000 to control this pest. Gutrich *et al*. (2007) undertook a study to estimate the potential economic costs to Hawaii, in case of the introduction and establishment of the red imported fire ant. The authors of the study conclude that the estimated impact on various economic sectors in Hawaii would be around US $ 211 million/year. \r\n
\r\nClick here for Information about the relation between colony structure and level of threat

Management Info
Preventative measures: Early detection by active surveillance and subsequent nest treatment is the best way to prevent any ant species from establishing in novel environments. Pitfalls and attractant baits are both methods that can yield good results.(Simon O'Connor pers.comm). *The Pacific Ant Prevention Programme* is a proposal prepared for the Pacific Plant Protection Organisation and Regional Technical Meeting for Plant Protection. This plan aims to prevent the red imported fire ant and other invasive ant species with economic, environmental or social impacts from establishing within or spreading between countries in the Pacific.
Integrated management: The potential of invasive ants to reach high densities is greater in human-modified ecosystems; this is particularly evident with respect to land that is intensely utilised for primary production. For example, the little fire ant (*Wasmannia auropunctata*) is a great problem in areas in its native South America that have been over-exploited by humans, including in sugarcane monocultures and cocoa farms in south Colombia and Brazil, respectively (Armbrecht and Ulloa-Chacón 2003). Similarly, the Argentine ant (*Linepithema humile*) reaches high densities in agricultural systems such as citrus orchards (which host mutualistic honeydew producing insects) (Armbrecht and Ulloa-Chacón 2003; Holway *et al.* 2002). Improved land management, including a reduction in monoculture and an increase in the efficiency of primary production, may help invasive ant prevent population explosions (alleviating the problems caused by high densities of ants) and could reduce potential sources from which new infestations could occur.\r\n
Biological: Parasitic phorid flies have been introduced to control *S. invicta*. Multiple species of these parasitic flies (originally from Argentina and Brazil) have been released by researchers at the Brackenridge Field Laboratory (BFL). The fly larvae develop inside the ants and kill their host. *Pseudacteon tricuspis*, was introduced to several locations in Texas beginning in 1999 with BFL in central Austin. Flytraps have been used to map the spread of the first species of phorid fly introduced. It is found that the inrtroduced phorid flies have spread to more than 12 counties and 3.5 million acres in Central Texas and seven counties and 1.5 million acres in the Coastal Bend region of Texas, speading at 3 to ten miles per year from the initial introduction areas. Two other phorid flies have been introduced since 2004. For more details please see *Using phorid flies in the biocontrol of imported fire ants in Texas*.\r\n
For details on preventative measures, chemical and biological control options, please see *management information*.

Pathway
Fire ants are found near areas of permanent water, such as dams, rivers, ponds and aquaculture containers. Because of this they may be spread by the associated trade industries.Fire ants often establish themselves in pot-plants in contact with the ground, in stores of topsoil, mulch and potting mixes and under landscaping materials.The red imported fire ant is able to rapidly colonise disturbed areas and may be spread by the movement of soil or plant material (Morrison *et al* 2004). Deforested areas are at great risk considering the high level of movement of materials and equipment to and from such sites and the suitability of the disturbed environment for fire ant establishment. The movement of agricultural equipment or associated plants and planting material within or from infested areas risks the spread of the red imported fire ant, which often colonises these microhabitats in disturbed areas.The red imported fire ant is able to rapidly colonise disturbed areas and may be spread by the movement of soil or plant material (Morrison *et al* 2004). Deforested areas are at great risk considering the high level of movement of materials and equipment to and from such sites and the suitability of the disturbed environment for fire ant establishment. Fire ants often establish themselves in pot-plants in contact with the ground, in stores of topsoil, mulch and potting mixes and under landscaping materials.

Principal source:

Compiler: IUCN/SSC Invasive Species Specialist Group (ISSG) with support from the Ministry of Agriculture and Forestry (MAF)- Biosecurity New Zealand
Updates with support from the Overseas Territories Environmental Programme (OTEP) project XOT603, a joint project with the Cayman Islands Government - Department of Environment

Review: Neil Reimer, Ph.D. Plant Quarantine Branch Chief Hawaii Department of Agriculture

Pubblication date: 2010-10-04

ALIEN RANGE

[1] ANTIGUA AND BARBUDA
[7] BAHAMAS
[20] CHINA
[2] MALAYSIA
[1] PARAGUAY
[1] SINGAPORE
[1] TRINIDAD AND TOBAGO
[15] UNITED STATES
[1] VIRGIN ISLANDS, U.S.
[2] AUSTRALIA
[3] CAYMAN ISLANDS
[1] HONG KONG
[2] NEW ZEALAND
[1] PUERTO RICO
[3] TAIWAN
[2] TURKS AND CAICOS ISLANDS
[2] VIRGIN ISLANDS, BRITISH

Red List assessed species 3: CR = 1; VU = 1; NT = 1;

Cyclura lewisi **CR**
Holbrookia lacerata **NT**
Podomys floridanus **VU**

BIBLIOGRAPHY

53 references found for **Solenopsis invicta**

Managment information
AntWeb, 2006. *Solenopsis invicta*
Summary: AntWeb illustrates ant diversity by providing information and high quality color images of many of the approximately 10,000 known species of ants. AntWeb currently focusses on the species of the Nearctic and Malagasy biogeographic regions, and the ant genera of the world. Over time, the site is expected to grow to describe every species of ant known. AntWeb provides the following tools: Search tools, Regional Lists, In-depth information, Ant Image comparision tool PDF field guides maps on AntWeb and Google Earth and Ant genera of the world slide show.
AntWeb is available from: http://antweb.org/about.jsp [Accessed 20 April 2006]
The species page is available from:
http://antweb.org/getComparison.do?rank=species&genus=solenopsis&name=invicta&project=&project= [Accessed 2 May 2006]
Brackenridge Field Laboratory (BFL) The University of Texas at Austin 2001. Using Phorid flies in the biocontrol of imported fire ants in Texas
Summary: Available from: http://uts.cc.utexas.edu/~gilbert/research/fireants/fireant.html [Accessed 27 September 2006]
Carmichael, A. 2006. Red imported fire ant (*Solenopsis invicta*) Pest and Diseases Image Library. Updated on 29/08/2006 12:06:03 PM.
Summary: PaDIL (Pests and Diseases Image Library) is a Commonwealth Government initiative, developed and built by Museum Victoria s Online Publishing Team, with support provided by DAFF (Department of Agriculture, Fisheries and Forestry) and PHA (Plant Health Australia), a non-profit public company. Project partners also include Museum Victoria, the Western Australian Department of Agriculture and the Queensland University of Technology. The aim of the project is: 1) Production of high quality images showing primarily exotic targeted organisms of plant health concern to Australia. 2) Assist with plant health diagnostics in all areas, from initial to high level. 3) Capacity building for diagnostics in plant health, including linkage developments between training and research organisations. 4) Create and use educational tools for training undergraduates/postgraduates. 5) Engender public awareness about plant health concerns in Australia. PaDIL is available from : http://www.padil.gov.au/aboutOverview.aspx, this page is available from:
http://www.padil.gov.au/viewPestDiagnosticImages.aspx?id=93 [Accessed 6 October 2006]
Commonwealth of Australia. 2006a. Threat abatement plan to reduce the impacts of tramp ants on biodiversity in Australia and its territories, Department of the Environment and Heritage, Canberra.
Summary: This plan establishes a national framework to guide and coordinate Australia's response to tramp ants, identifying the research, management, and other actions necessary to ensure the long term survival of native species and ecological communities affected by tramp ants. It identifies six national priority species as an initial, but flexible, list on which to focus attention. They are the red imported fi re ant (*Solenopsis invicta*), tropical fire ant (*S. geminata*), little fire ant (*Wasmannia auropunctata*), African big-headed ant (*Pheidole megacephala*), yellow crazy ant (*Anoplolepis gracilipes*), and Argentine ant (*Linepithema humile*).
Available from: http://www.environment.gov.au/biodiversity/threatened/publications/tap/pubs/tramp-ants.pdf [Accessed 17 November 2009]
Commonwealth of Australia. 2006b. Background document for the threat abatement plan to reduce the impacts of tramp ants on biodiversity in Australia and its territories, Department of the Environment and Heritage, Canberra.
Summary: This background document to the Threat abatement plan to reduce the impacts of tramp ants on biodiversity in Australia and its territories provides supporting information on a range of issues such as tramp ant biology, population dynamics, spread, biodiversity impacts and management measures.
Available from: http://www.environment.gov.au/biodiversity/threatened/publications/tap/pubs/tramp-ants-background.pdf [Accessed 17 November 2009]
Core, J. 2004. *First Virus to Infect Red Imported Fire Ants Discovered.* Agricultural Research Service (US Department of Agriculture).
Summary: Available from: http://www.ars.usda.gov/is/pr/2004/041130.htm [Accessed 8 March 2005]

DOA (Department of Agriculture). 2006. Prevention and Control of Red Fire Ant in China. (Original Chinese language document) (English translation of original document by Jia Ren, 2006)
Summary: This source provides detailed information about the distribution, prevention and control management of red fire ants in China.
Drees, B.M. & Knutson , A.E. (2002). Potential Biological Control Agents for the Red Imported Fire Ant. Fire Ant Plan Fact Sheet #009. Accessed 27 March, 2008 from http://fireant.tamu.edu/materials/factsheets_pubs/pdf/fapfs009.2002rev.pdf
Forgie, A. Shaun., Kathryn O Halloran, Darren, F. Ward, Margaret Stanley, Jo S. Rees and Christine Daly., 2006. Environmental Impact Assessment for baits used during RIFA (red imported fire ant, *Solenopsis invicta*) incursions. Landcare Research Contract Report: LC0607/046
Greensmiths, Inc: Fire Ants.
Summary: Impacts, identification and control.
Gutrich, J.J., Ellen VanGelder and Lloyd Loope., 2007 In press. Potential economic impact of introduction and spread of the red imported fire ant, *Solenopsis invicta*, in Hawaii. Environ. Sci. Policy, doi:10.1016/j.envsci.2007.03.007
Harris, R.; Abbott, K.; Barton, K.; Berry, J.; Don, W.; Gunawardana, D.; Lester, P.; Rees, J.; Stanley, M.; Sutherland, A.; Toft, R. 2005: Invasive ant pest risk assessment project for Biosecurity New Zealand. Series of unpublished Landcare Research contract reports to Biosecurity New Zealand. BAH/35/2004-1.
Summary: The invasive ant risk assessment project, prepared for Biosecurity New Zealand by Landcare Research, synthesises information on the ant species that occur in New Zealand (native and introduced species), and on invasive ants that pose a potential threat to New Zealand.
There is a great deal of information in this risk assessment on invasive ant species that is of global interest, including; biology, distribution, pest status, control technologies.
The assessment project has five sections.1) The Ants of New Zealand: information sheets on all native and introduced ants established in New Zealand 2) Preliminary invasive ant risk assessment: risk scorecard to quantify the threat to New Zealand of 75 ant species. 3) Information sheets on invasive ant threats: information sheets on all ant species scored as medium to high risk (n = 39). 4) Pest risk assessment: A detailed pest risk assessment for the eight species ranked as having the highest potential risk to New Zealand (*Anoplolepis gracilipes*, *Lasius neglectus*, *Monomorium destructor*, *Paratrechina longicornis*, *Solenopsis geminata*, *Solenopsis richteri*, *Tapinoma melanocephalum*, *Wasmannia auropunctata*) 5) Ranking of high risk species: ranking of the eight highest risk ant species in terms of the risks of entry, establishment, spread, and detrimental consequences.
NB. The red imported fire ant (*Solenopsis invicta*) is considered to be the worst ant pest in the world. However, *Solenopsis invicta* was specifically excluded from consideration in this risk assessment as this species has already been subject to detailed consideration by Biosecurity New Zealand
(This invasive ant pest risk assessment was funded by Biosecurity New Zealand and Foundation for Research, Science and Technology. Undertaken by Landcare Research in collaboration with Victoria University of Wellington and Otago Museum)
Available from: http://www.landcareresearch.co.nz/research/biocons/invertebrates/Ants/ant_pest_risk.asp [Accessed 20 May 2007]
Holway, D.A., Lach, L., Suarez, A.V., Tsutsui, N.D. and Case, T.J. 2002. The Causes and Consequences of Ant Invasions, *Annu. Rev. Ecol. Syst. 33*: 181-233.
IUCN/SSC Invasive Species Specialist Group (ISSG)., 2010. A Compilation of Information Sources for Conservation Managers.
Summary: This compilation of information sources can be sorted on keywords for example: Baits & Lures, Non Target Species, Eradication, Monitoring, Risk Assessment, Weeds, Herbicides etc. This compilation is at present in Excel format, this will be web-enabled as a searchable database shortly. This version of the database has been developed by the IUCN SSC ISSG as part of an Overseas Territories Environmental Programme funded project XOT603 in partnership with the Cayman Islands Government - Department of Environment. The compilation is a work under progress, the ISSG will manage, maintain and enhance the database with current and newly published information, reports, journal articles etc.
Jetter, K. M., Hamilton, J. and Klotz, J. H. 2002. Red imported fire ants threaten agriculture, wildlife and homes. California Agriculture 56(1): 26-34.
Summary: Estimating the costs of eradicating RIFA in California.
McGlynn, T.P. 1999. The Worldwide Transfer of Ants: Geographical Distribution and Ecological Invasions, *Journal of Biogeography 26*(3): 535-548.
Ministry of Agriculture of the People s Republic of China. Official announcements about occurrences and control of RIFA in China.
Summary: Available from: http://www.agri.gov.cn [Accessed 13 September 2006]
Morrison, L.W., Porter S.D., Daniels, E. and Korzukhin, M.D. 2004. Potential Global Range Expansion of the Invasive Fire Ant, *Solenopsis invicta*), *Biological Invasions 6*: 183&#65533;191.
Summary: Available from: http://cmave.usda.ufl.edu/publications_2004.html [Accessed 8 March]
National Agricultural Pest Information System: Imported Fire Ant.
Summary: Fire Ants (various spp.) in the United States
Ness, J.H and Bronstein, J.L. 2004. The Effects of Invasive Ants on Prospective ant Mutualists, *Biological Invasions 6*: 445-461.
Pacific Ant Prevention Programme, March 2004. Pacific Invasive Ant Group (PIAG) on behalf of the IUCN/SSC Invasive Species Specialist Group (ISSG).
Summary: A proposal prepared for the Pacific Plant Protection Organisation and Regional Technical Meeting For Plant Protection. This plan aims to prevent the red imported fire ant and other invasive ant species with economic, environmental and/or social impacts, entering and establishing in or spreading between (or within) countries of the Pacific Region.
Pascoe, A. 2001. Turning up the heat on fire ants. In Issue 32 (15 December 2001) of Biosecurity. Ministry of Agriculture and Forestry. NZ.
Summary: Available from: http://www.biosecurity.govt.nz/publications/biosecurity-magazine/biosecurity-32.pdf
Red Imported Fire Ants in Australia.
Summary: Queensland eradication program.

Sarnat, E. M. (December 4, 2008) PIAkey: Identification guide to ants of the Pacific Islands, Edition 2.0, Lucid v. 3.4. USDA/APHIS/PPQ Center for Plant Health Science and Technology and University of California Davis.
Summary: PIAkey (Pacific Invasive Ant key) is an electronic guide designed to assist users identify invasive ant species commonly encountered in the Pacific Island region. The guide covers four subfamilies, 20 genera and 44 species.
The primary tool offered by PIAkey is an interactive key designed using Lucid3 software. In addition to being fully illustrated, the Lucid key allows users to enter at multiple character points, skip unknown characters, and find the most efficient path for identifying the available taxa. Each species is linked to its own web page. These species pages, or factsheets, are linked to an illustrated glossary of morphological terms, and include the following seven sections: 1) Overview of the species; 2) Diagnostic chart illustrating a unique combination of identification characters; 3) Comparison chart illustrating differences among species of similar appearance; 4) Video clip of the species behavior at food baits (where available); 5) Image gallery that includes original specimen images and live images (where available); 6) Nomenclature section detailing the taxonomic history of the species, and 7) Links and references section for additional literature and online resources.
Available from: http://www.lucidcentral.org/keys/v3/PIAkey/index.html [Accessed 17 December 2008]
Stanley, M. C. 2004. *Review of the efficacy of baits used for ant control and eradication*. Landcare Research Contract Report: LC0405/044. Prepared for: Ministry of Agriculture and Forestry.
Summary: Available from: http://www.landcareresearch.co.nz/research/biocons/invertebrates/ants/BaitEfficacyReport.pdf [Accessed 10 December 2005]
Taipei Times, May 7th 2004. Agencies will collaborate to control outside species.
Texas A&M University: Red Imported Fire Ants.
Summary: Red imported fire ant research.
The Invasive Species Initiative, 2005. The Nature Conservancy *Solenopsis invicta, S. richteri* (Red Imported Fire Ants)
Summary: Avaiable from: http://tncweeds.ucdavis.edu/esadocs/soleinvi.html [Accessed 2 May 2005]
Tunnel Vision: RIFA newsletters
Summary: Tunnel Vision is the quarterly newsletter produced by the Cooperative Extension Service, University of Arkansas. The purpose of the newsletter is to inform people about the red imported fire ant and what is being done throughout the U.S. on this pest insect.
Varnham, K. 2006. Non-native species in UK Overseas Territories: a review. JNCC Report 372. Peterborough: United Kingdom.
Summary: This database compiles information on alien species from British Overseas Territories.
Available from: http://www.jncc.gov.uk/page-3660 [Accessed 10 November 2009]
Vogt, J.T. & Wallet, B. (2008). Feasibility of using template-based and object-based automated detection methods for quantifying black and hybrid imported fire ant (*Solenopsis invicta* and *S. Invictaxrichteri*) mounds in aerial digital imagery. *The Rangeland Journal 30*: 291-295.
Zhong Xifa. 2006. Prevention Activities in Ganzhou City against Fire Ant Invasion. Jiangxi Province Agriculture information website. (Original Chinese language document) (English translation of original document by Jia Ren, 2006)
Summary: This source provides information about prevention activities against red fire ants in Ganzhou, a city in the Jiangxi province of China.

General information

Callcott, A. A. and Collins, H. L. 1996. Invasion and range expansion of imported fire ants (Hymenoptera: Formicidae) in North America from 1915-1995. Florida Entomologist 79(2): 240-251
Summary: Summarises the expansion of fire ants (*S. invicta* and *S. richteri*) across North America.
Chen, J., Cantrell, C.L., Duke, S.O. & Allen, M.L. (2008). Repellency of Callicarpenal and Intermedeol Against Workers of Imported Fire Ants (Hymenoptera: Formicidae). *Journal of Economic Entomology 101*(2): 265-271.
Summary:
Collins, L. & Scheffrah, R. H. (2008). Red imported fire ant. University of Florida. Accessed 27 March, 2008 from http://entomology.ifas.ufl.edu/creatures/urban/ants/red_imported_fire_ant.htm
CONABIO. 2008. Sistema de informaci n sobre especies invasoras en M xico. Especies invasoras - Insectos. Comisi n Nacional para el Conocimiento y Uso de la Biodiversidad. Fecha de acceso.
Summary: English:
The species list sheet for the Mexican information system on invasive species currently provides information related to Scientific names, family, group and common names, as well as habitat, status of invasion in Mexico, pathways of introduction and links to other specialised websites. Some of the higher risk species already have a direct link to the alert page. It is important to notice that these lists are constantly being updated, please refer to the main page (http://www.conabio.gob.mx/invasoras/index.php/Portada), under the section Novedades for information on updates.
Invasive species - insects is available from: http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Insectos [Accessed 30 July 2008]
Spanish:
La lista de especies del Sistema de informaci n sobre especies invasoras de m xico cuenta actualmente con informaci n aceca de nombre cient fico, familia, grupo y nombre com n, as como h bitat, estado de la invasi n en M xico, rutas de introducci n y ligas a otros sitios especializados. Algunas de las especies de mayor riesgo ya tienen una liga directa a la p gina de alertas. Es importante resaltar que estas listas se encuentran en constante proceso de actualizaci n, por favor consulte la portada (http://www.conabio.gob.mx/invasoras/index.php/Portada), en la secci n novedades, para conocer los cambios.
Especies invasoras - Insectos is available from: http://www.conabio.gob.mx/invasoras/index.php/Especies_invasoras_-_Insectos [Accessed 30 July 2008]
Davis, L. R., Vander Meer, R. K. and Porter, S. D. 2001. Red imported fire ants expand their range across the West Indies. Florida Entomologist 84(4): 735-736.
Summary: Biogeographic description of red imported fire ant range expansion across the West Indies.
DeFauw, S. L., Vogt, J.T. & Boykin, D. L. (2008). Imported Fire Ant (Hymenoptera: Formicidae) Bioturbationand Its Influences on Soils and Turfgrass in a Sod Production Agroecosystem. *Journal of Entomological Science 43*(1): 121-127.

Gotelli, N. J. and Arnett, A. E. 2000. Biogeographic effects of red fire ant invasion. Ecology Letters 3: 257-261.
Summary: Effects of red fire ant invasion on native ant fauna across a 2000km transect.
Hashimoto, Y. & Valles, S. M. (2008). Infection characteristics of *Solenopsis invicta* virus 2 in the red imported fire ant, *Solenopsis invicta*. *Journal of Invertebrate Pathology 99*: 136-140.
Hawaiian Biological Survey: Red Imported Fire Ants.
Summary: Modelling potential distributions of red imported fire ant on Hawai i.
Hawaiian Ecosystems At Risk (HEAR): Red Imported Fire Ants.
Summary: General information, fact sheets and links on red imported fire ants.
Heraty, J. M. 1994. Biology and importance of two eucharitid parasites of Wasmannia and Solenopsis. In Williams, D. F. (ed.) Exotic ants: Biology, impact, and control of introduced species, Westview Press, Boulder, CO.: 104-120.
ITIS (Integrated Taxonomic Information System), 2005. Online Database *Solenopsis invicta*
Summary: An online database that provides taxonomic information, common names, synonyms and geographical jurisdiction of a species. In addition links are provided to retrieve biological records and collection information from the Global Biodiversity Information Facility (GBIF) Data Portal and bioscience articles from BioOne journals.
Available from:
http://www.cbif.gc.ca/pls/itisca/taxastep?king=every&p_action=containing&taxa=Solenopsis+invicta&p_format=&p_ifx=plglt&p_lang=
[Accessed March 2005]
Morrison, L. W. 2002. Long-term impacts of an arthropod-community invasion by the imported fire ant, *Solenopsis invicta*. Ecology 83(8): 2337-2345.
Summary: Long term follow-up (1999) to one of the most in-depth and well-known studies to document the impact of the imported red fire ant on the native ant and arthropod fauna of a biological field reserve in central Texas (USA) during the initial invasion in the late 1980s.
Morrison, L. W. and Gilbert, L. E. 1998. Parasitoid-host relationships when host size varies: the case of Pseudacteon flies and Solenopsis fire ants. Ecological Entomology 23(4): 409–416.
Na, Julie P.S. & C.Y. Lee., 2001. Identification key to common urban pest ants in Malaysia. Tropical Biomedicine 18(1): 1-17 (2001)
Summary: Available from: http://idisk.mac.com/chowyang/Public/037.pdf [Accessed 24 October 2008]
Sokolova, Y.Y. & Fuxa, J.R. (2008). Biology and life-cycle of the microsporidium *Kneallhazia solenopsae* Knell Allan Hazard 1977 gen. n., comb. n., from the fire ant *Solenopsis invicta*. *Parasitology 135*: 903-929.
Species Profile: Red Imported Fire Ants.
Summary: Numerous links to information on red imported fire ants including management information.
Vanderwoude, C. and Numbuk, S. 2006. Preliminary Report on Infestation of Little Fire Ant (*Wasmannia auropunctata*) at Kreer Heights, Wewak. AntiAnts.
Varone, L. & Briano, J. 2009. Bionomics of *Orasema simplex* (Hymenoptera: Eucharitidae), a parasitoid of Solenopsis fire ants (Hymenoptera: Formicidae) in Argentina. *Biological Control 48*: 204–209.
Wild, A.L. (2007). A catalogue of the ants of Paraguay (Hymenoptera: Formicidae). *Zootaxa 1622*: 1–55.
Yang, C.C., Shoemaker, D., Wu, J.C., Lin, C.C., Wu, W.J., & Shih, C.J. (2009). Successful establishment of the invasive fire ant Solenopsis invicta in Taiwan: Insights into interactions of alternative social forms. ARS/USDA. Retrieved 27 March, 2009 from: http://www.ars.usda.gov/research/publications/Publications.htm?seq_no_115=233337