

Economists at Texas A&M University estimate an annual impact to quality of life from *S. invicta* in Texas to be \$1.2 billion and \$6 billion through the Texas Agricultural Statistics Service of 54 rural counties in northeast Texas. Costs and benefits directly associated with *S. invicta*. Results indicate that heaviest losses occur to pastures (10.86%), forage and hay (7.9%) and livestock (5.23%) production. On a per farm basis, heaviest losses occur to the farmstead (\$388), with production losses (\$264), equipment losses (\$231), cost of control (\$122), control equipment (\$92), and medical costs (\$36) combining to total \$1,122 in losses per unit. Benefits from *S. invicta* totaled \$82 per farm and included reduction of insects, rodents, and reptiles, in addition to increased soil aeration. Estimates of on-farm losses from imported fire ants can help justify expenditures in management or suppression efforts which can include broadcast applications of fire bait costing \$10 or more per acre (\$24.7 per hectare) or target-specific programs consisting of a combination of control approaches to specific sites or areas to prevent ant economic losses.

## 222 - FIRE ANTS IN AUSTRALIA: A HISTORY OF THE INVASION

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In February 2001, the red imported fire ant, *Solenopsis invicta*, was discovered at two sites in Brisbane Australia: Fisherman Islands, a port facility, and suburban Richlands-Wacol some 30 km away. They were estimated to have arrived only 3 to 5 years earlier, but already occupied in excess of 40,000 ha, with the potential to spread to more than 95% of urban Australia. Efforts to control the spread of fire ants in Australia require a better understanding of the history of their introduction. Using four microsatellite loci and the protein marker Gp-9, we compared the two infestations with each other, and with potential source populations in North and South America to determine which social forms occurred at each of the Australian sites, whether the two sites were the result of separate introductions, and the most likely source populations from which fire ants were introduced. Based on Gp-9 genotypes, as well as relatedness, we found that all of the colonies at the Fisherman Island site were monogynous while the Richlands-Wacol site contained a mixture of both monogynous and polygynous colonies. The colonies at each of the sites were genetically distinct from colonies at the other site but similar to other colonies at the same site, regardless of social form, suggesting that the two infestations probably resulted from two separate introductions. Both of the introduced populations are more similar genetically to North American populations than to South American populations at both the microsatellite loci, as well as Gp-9, indicating that fire ants were most likely introduced multiple times from established North American populations. These findings have important implications for efforts to control the spread of fire ants in Australia, as well as efforts to prevent further introductions.

## 223 - POPULATION GENETICS OF THE INVASIVE FIRE ANT *SOLENOPSIS INVICTA* IN THE U.S.A

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Analyses of population genetic variation in invasive species can provide information on the history of the invasions, breeding systems, and gene flow patterns. Genetic variation was surveyed in both social forms of the red imported fire ant, *Solenopsis invicta*, throughout the species' introduced range in the U.S.A. to learn how the unique breeding biology of each form shapes genetic structure at various scales, to discern genetic footprints of the invasion process, and to reconstruct the origin and spread of each form. These analyses revealed significant local mtDNA differentiation in the polygyne (multiple colony queens) but not the monogyne (single colony queen) social form, as well as pronounced mtDNA differentiation coupled with weaker nuclear differentiation between sympatric populations of the two forms. At a larger scale, no mtDNA but significant nuclear regional differentiation was found. In general, populations were most similar to other populations of the same social form at their mtDNA genomes. These higher-level patterns of structure are consistent with the spread of the ant by long-distance, human-mediated dispersal, with sub-founder populations of each form typically established by queens of the same form. Bayesian analyses showed that study populations most distant from the claimed site of entry, Mobile, Alabama, have diverged most from the hypothetical founder population, consistent with an

invasion scenario in which the ants spread outward from Mobile through repeated sub-founder events. Several lines of evidence raise the possibility of secondary introductions of *S. invicta* into the U.S.A. Finally, elucidation of the large-scale genetic structure of introduced *S. invicta* provides a necessary framework for future efforts aimed at pinpointing the native source population(s), a task crucial to focusing biological research aimed at developing new methods of control of this invasive pest.

## 224 - SPREAD OF WASMANNIA AUROPUNCTATA IN THE PACIFIC. A COMPARISON OF INTERACTIONS WITH LOCAL ANT FAUNA AT LOW ALTITUDES IN TAHITI AND NEW CALEDONIA

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In New Caledonia, 40 years after its first establishment, *Wasmannia auropunctata* is still spreading in the archipelago. Human disturbed and native contexts are both concerned. To date, this ant seems unable to establish populations in an altitude higher than 700m and unable to sustain populations in areas where annual rainfalls are below 750 mm or over 2.8 m. In French Polynesia, the little fire ant has been identified in October 2004, but it seems to spread there for at least 10 years. To date, it is only recorded from Tahiti, at low altitude (under 400 m), mostly in human modified habitats. We present here genetic evidences showing that the Tahitian propagule is closely related to New Caledonian invasive population. Thus, this situation provides us the opportunity to look at the success of a same invasive population in two contrasted insular contexts (an old terrestrial island versus a young oceanic island, respectively New Caledonia and Tahiti). Then, we study the interactions between local ants and *W. auropunctata*. We compare results regarding interactions and species succession on food baits in different habitat conditions. According to the context, we discover that only tramp ants may resist to little fire ant, but that the hierarchy between them vary according to the islands and the ecosystem. *Pheidole megacephala* and *Solenopsis geminata* especially exhibit different behaviour against little fire ant between Tahiti and New Caledonia. Our results provide interesting insights on how local conditions shape and regulate dominance in insular assemblages. So that dominance appears as a balance between intrinsic factors (interference abilities) and extrinsic factors (abiotic factors suitability).

## 225 - GENETIC STRUCTURE AND REPRODUCTIVE MODES IN INVASIVE POPULATIONS OF THE LITTLE FIRE ANT

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A unique reproduction system in which males are produced clonally, female queens are parthenogens and female workers are produced sexually has been described in *Wasmannia auropunctata*, a widespread invasive ant species. However, these findings were mostly based on samples originating from only a limited part of the native range of the species. Moreover, populations may theoretically benefit from a mix of clonal and sexual reproduction systems, especially when introduced in new ecological contexts. We used microsatellite markers to uncover the reproductive modes displayed by a large number of nests collected in various invasive *W. auropunctata* populations introduced 40 years ago into New Caledonia, where the species now forms a single 450 km-long supercolony. Although the main reproduction system in New Caledonia remained clonality for both male and female sexuals, we found evidences of rare sexual reproduction events that led to the production of both new queen and male clonal lineages. All clonal lineages observed over New Caledonia potentially derived from a number of sexual reproduction, recombinaison and mutation events from a single female and a single male genotype. Hence, the male and female gene pools are not strictly separated in New Caledonia and the two sexes do not follow independant evolutionary trajectories. Our results also suggest genetic determinism for both parthenogenesis and caste. We discuss the evolutionary implications of the emergence of sex in the clonal reproduction system of introduced populations of *W. auropunctata* and the possible effect of sexual reproduction events on the durability of the New Caledonian supercolony.