Scales, crazies, parasites and meltdown, at Christmas

In mid-2016, we flew from Canberra completely across Australia to Perth, then a further 2,600 km (3 hrs) northwest towards Indonesia. Our destination was Christmas Island ("C.I."), which despite its proximity to Java is administratively part of Australia. We were joining a group of volunteers/nature tourists attending Bird o’ Nature Week to learn about and modestly assist with bird research on Christmas Island - but with a sub-agenda that included sighting the 10–11 endemic species or subspecies of birds. Australian birders know the destination well as it is close to Asia, and thus receives interesting migratory over-shoots (‘vagrants’) far more often than the main continent. The island makes the news also for it being a target for migrant humans seeking entry to Australia by boat, and for the highly controversial ‘detention centre’ that continues but perhaps may close.

Although it was not strictly part of our visit, we were interested to see an insect-driven phenomenon that exemplifies the term invasional meltdown in the ecological literature. This term was invoked by Daniel Simberloff and Betsy von Holle (1999) for the induction of negative impacts on native ecosystems by an invading non-indigenous species being aggravated by positive interactions among exotic species. The un-impacted Christmas Island ecosystem was unusual in its domination by land crabs, notably the abundant red crab, Gecarcoidea natalis, and the largest terrestrial arthropod in the world, the robber or coconut crab, Birgus latro (Fig. 1). In the presence of abundant crabs the forest floor is clear of leaf litter and most seedlings and crab burrowing maintains uncompacted soil in an open, diverse forest (O’Dowd & Lake 1989). Estimates of numbers of robber crabs are one million and the
meet. Scale insects, particularly a species of lac scale insect (Kerridace) and several species of soft scale insects (Coccidae), became abundant within the native forest where their waste products provide carbohydrate-rich honeydew to other insects, especially ants. With the invasion of the yellow crazy ant (Anoplolepis gracilipes) last century, a species capable of forming supercolonies of billions of individuals met a perfect carbohydrate food source in the scale insect honeydew. As studies by scientists at La Trobe University and Monash University (Melbourne) have shown, these supercolonies of yellow crazy ants incapacitate crabs by spraying formic acid into the crabs’ joints and eyes, thus rendering millions of them moribund or dead, available as food for the ants. After ant invasion, the numbers of crabs plummeted, with commensurate changes in the forests, where leaf litter accumulated and the understory grew dense. The consequent reductions in crab migrations meant that no spectacle to draw tourists.

All was not lost - what we viewed in mid-2016 included some substantial areas of clear understory, numerous burrows, quite abundant crabs and very few scale insects. This resulted from the Federal Government agency, Parks Australia, in collaboration with academic researchers at La Trobe and Monash Universities, using a range of chemical control baiting techniques against the yellow crazy ants as documented by Green & O’Dowd (2009). However, this is very expensive, time-consuming and controversial with residents. Furthermore, it would need to continue in perpetuity simply to lower the ant numbers since eradication by baiting is deemed impossible. So what next? The demonstration that ant numbers reduced dramatically if ants were excluded from the scale insects and their honeydew led to suggestions that control of scales alone ought to reduce ant numbers. The main honeydew-producer used by the yellow crazy ants on Christmas Island is the yellow lac scale insect (Tachardina aurantiaca) (Fig. 2) and so it became the target of a control effort.

In the country that introduced cane toads to 'control' cane grubs 80 years ago, biological control remains controversial and not only in public perception. Although ants appear impervious to biological control, some biocontrol successes involve scale
insects, such as the control of the native Australian cottony cushion scale (Icerya purchasi) worldwide by Rodolia cardinalis, an Australian ladybird. For the Christmas Island lac scale insect problem, researchers studied Tachardina aurantiaca in its native range in South East Asia. This lac is rare there, but diligent searching in Malaysia revealed a microparasitic encyrtid wasp Tachardiaephagus somerviliei that was controlling lac numbers. Given past errors, but with ongoing success with other wasps as biocontrol agents, trials were undertaken in Malaysia across potential non-target scale insects. All reliable historical records suggest that Tachardiaephagus are specialists on family Kerriidae (Keria and Tachardina, with one record on Paratakardina). Scientific and public reviews of the proposal to release this wasp species to target yellow lac scale were well received. During our visit we saw the rearing facility (Fig. 3) containing plants of several native species infested with scale insect populations into which the encyrtids were to be released to deliver large numbers of cultivated encyrtids for release in the wild. Official approval in the form of an Import Permit came shortly thereafter and release into the facility from insects reared in Malaysia commenced in early December 2016. Over Christmas the first generation of C.I. raised encyrtids appeared. Field releases at 4 sites in January 2017 are being monitored and compared to 4 established control sites imminently. Let's keep our fingers crossed for a successful biological control story - we need more!

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References


