PROJECT SUMMARY

RURAL INDUSTRIES
Research & Development Corporation

Attractant and preference of *Apis cerana* Java

The issue

Following the accidental introduction of *Apis cerana* Java in Australia in 2007, the question of its eradication and later of its control has been put forward within the constraint of Australia legislation. The first efficient method developed was bee lining. This method proved successful, although it was later abandoned due to the cost, but was dependent upon public sighting of *Apis cerana*. Focusing on public sighting limited the effectiveness of the method to populated areas and had very limited application in areas such as tropical forests, where detection of the presence of *Apis cerana* would be unlikely and in the case of detection, following forager bees to their nest was greatly impeded by the terrain to the point that localisation of the nest was extremely low. One possible method that could overcome these problems was to develop baiting stations that would attract specifically *Apis cerana* to the exclusion of *Apis mellifera* and local ***Tetragonula sp.***.

This project attempted to develop an attractant derived from the *Cymbidium floribundum* orchid aroma. The Orchid is known to mimic *Apis cerana* in order to facilitate its pollination. Furthermore, keeping in mind the ultimate goal of designing an effective baiting station, colour and shape preference were investigated. Also tested were readily available flora scents and two commercially available products claiming attractiveness to *Apis cerana*.

Small swarm congregating on a hybrid of Cymbidium floribundum.

Outcomes

The project highlighted differences and similarities in sugar concentration and sugar type between *Apis cerana* Java and *Apis mellifera* as well as unexpected preferences in solution viscosity. The optimum recruitment to a baiting station of *Apis cerana* Java, both in term of number and speed, was achieved using 50–60 weight/weight sucrose solution. *Apis cerana* Java in Cairns showed strong preferences to the yellow colour as well than heptagonal shapes, in terms of landing propensity. This clear preference may be of interest for an optimum design of baiting station. However one needs to remember that preference is not automatically equivalent to attractiveness. It was also demonstrated that based on the flora scents tested (8 in total), coconuts essence both induced the collection of the largest amount of sucrose solution compared to the other scents tested when mixed with the sucrose solution, but also showed a marked preference in term of landing in the absence of reward. However, this "preference" for coconut essence may be learned and not spontaneous. *Apis cerana* is a known pollinator of coconuts palms, and due to the fact that coconut palms are distributed throughout the Cairns region and in flower most of the year, it is likely that foragers have associated its smell/taste with reward. Nonetheless, this likely learned preference may be put to good use. After testing that *Cymbidium floribundum* is indeed attractive to *Apis cerana* in Cairns both at the forager level and the swarm level, we finally tested the effect of two known aromas extracted from *Cymbidium floribundum* (also present in its attractive hybrids), and the attractants of *Apis cerana* commercially available from the CSIRO. After testing forager landing preference, it was found that out of two attractants developed by CSIRO only the 6 compound product seems to induce significant landing preference. In a similar fashion only one of the two chemicals extracted from the aroma of the *Cymbidium* orchid demonstrated an increase in landing preference of

Apis cerana foragers (the chemical name is the R-3 Hydroxy Octanoic Acid). The same chemical extracted from the orchid aroma was also able to significantly attract the forager visits to a feeder bearing its sent (out of 4 feeders including the control feeder not carrying any scent). However, none of the odour like attractants demonstrated long distance attraction to *Apis cerana* Java in Cairns. This suggests that this chemical may not be of great use as the base for a baiting station campaign. However, they may be useful to improve recruitment to the baiting station once the foragers have found them. Nonetheless the R-3 Hydroxy Octanoic Acid in itself or in conjunction with the CSIRO 6 compound lure, or the whole orchid, have shown to facilitate swarm capture and thus could be used as a means of control by capturing swarms, which in turn may limit the spread of the species.

Apis cerana forager visiting Miss Muffet flowers (hybrid of Cymbidium Floribundum)

Implications

The design of *Apis cerana* baiting station may be improved by the inclusion of a heptagonal yellow target with star like UV nectar guide, scented with either natural coconut essence, R-3-Hydroxy Octanoic acid or the 6 compound lure of CSIRO. For best effect the olfactory attractant should not be mixed with the provided sucrose solution but delivered separately. However coconut essence could be added to the sucrose solution to facilitate rapid and specific recruitment. The difference in viscosity preference of *Apis cerana* and *Apis mellifera* could be used to good effect but requires further research. However, the viscosity preference of *Tetragonula sp*. is too similar to the one displayed by Apis cerana to be of any use to keep away this stingless bees from baiting stations. However, exclusion of *Tetragonula* species could be achieved by moving the baiting stations every week due to their slow recruitment (baiting stations should also be washed to remove the sticky residues deposited on the feeders by this species). Finally the Orchid, the R-3-hydroxy Octanoic acid and the 6 compound lure of CSIRO could be put to good use by facilitating the capture of swarms to limit the further spread of *Apis cerana* Java in Australia.

Future needs

Some observations made during the conduct of this project have revealed new avenues of research that could be pursued. First, it was found that it was reliably possible to detect *Apis cerana* foragers by sound alone. Thus it may be important to develop parabolic sound system allowing for distance localisation and identification of *Apis sp*. to use in possible port of entry elsewhere. Second, it would be worth investigating the use of β-ocimene, which appears to enable the attraction of *Apis cerana* foragers from far away. In the course of this project, it was also observed that *Apis cerana* stop foraging for a given value of relative humidity. This should be investigated further and if confirmed, it could be used to better predict the likely spread of this strain of *Apis cerana* in Australia.

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