EDITORIAL

We're back. I hope! More of that in a while. After one of the busiest few months that I have ever had – and one of the most interesting as far as bee science is concerned, we approach the middle of 2009 in the hope that much more will be found out about bees and other social insects. It usually takes a crisis to spur people on to accomplish great things – or even little things, and to unblock previously held beliefs as we have all seen lately and so it has been with bees – or the lack of them. The great bee decline is hurting, (in 2008 a 60% fall in honey harvest in Israel and 50% in the UK), and the problem is exacerbated by the lack of other pollinators which have lost their habitats over the years, or been poisoned out of existence.

But out of this dismal situation can only come good things I reckon in the form of a greater public awareness of the vital role of bees; greater government awareness of the same (although this will be a bit more difficult to get through as remember, we are dealing with politicians); more research on bee (and beekeeper) problems and perhaps even more interest shown in the research possibilities of bees by our universities.

In this issue we have some fascinating research pieces including information on how your morning cup of coffee can help or hinder the prosperity of bees and a fascinating look at how bees and cocaine can help us, and we look at which is more deadly for non target insects – BT crops designed to ward off pests or insecticides! The Ice Age is investigated and we note that perhaps pollen grains are telling us something different about the last Ice Age. Have we got it right? And we also look at some complex research concerning finches and bees that will help us understand ourselves better. And there is more so read on to find out what.

Our recipe comes this month from France. Somehow the French always seem to be able to combine the oddest ingredients and come up with something special and they've done it again here with chicory and a few other ingredients! But don't just read it, try it out. In Apis UK we try to bring you recipes beyond the ordinary honey crunches and salad dressings etc. Our recipes are special – and I'm still waiting for someone to report back on the bee grubs and onions recipe from two issues ago. (It was a genuine recipe).

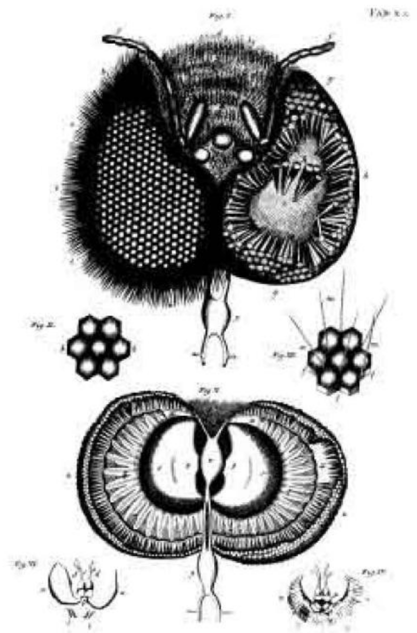
Our Historical Note concerns a great man indeed whose works were brilliant in their conception but equally deadly in their execution, Bishop Diego de Landa Calderón who taught us much of our knowledge about pre Columbian beekeeping in the Americas. Marcus Aurelius, the great Roman soldier, Stoic and emperor gives us our quote and yet again that peerless poet Emily Dickinson provides us with our poem of the month.

Apis has been off the air for some time now due to unavoidable problems but now I hope that we are on track to again build up a thriving and interesting, popular bee science magazine. I hope that you enjoy this first, very late 2009 issue of Apis. Let me know if you wish us to investigate any particular aspect of bee science or science news. Recipes(unusual) are welcome as are poems and quotes. Write in!

Best Regards David Cramp. Editor

BEES AND BRAINS

"A Treatise on the history of Bees; or an accurate description of their origin, generation, sex, oeconomy, labours and use"



The amazing complexity of the bee brain has fascinated scientists for hundreds of years. The great bee scientist jan Swammerdam's work on bees was begun in 1673 and completed in 1676-80. It contains around 57,000 words and includes 60 figures. It was finally published as part of "The Book of Nature" The most striking features of Swammerdam's work are his drawings of his dissections and these have been found to be detailed and accurate.

Swammerdam dissected the bee brain, showing the optic nerves projecting from the two compound eyes and the three ocelli.

His work has been followed by many scientists all over the world since then and in August 2008 saw the Queensland Australia Minister for Tourism Regional Development and Industry open The University of Queensland's new $2.5 million "All Weather Bee Flight Facility" at the **Queensland Brain Institute.**

With nearly 200m2 of useable flight space, it is the world's largest indoor, climate-controlled insect flight-testing facility, and will undoubtedly play a key role in helping scientists to better understand how complex brains function.

Built as part of QBI's ongoing investigations into the fundamental mechanisms that drive brain function, the facility is a high-tech rooftop structure with climate-control and abundant natural light, specially designed for studying bees and their behaviour.

QBI Director Professor Perry Bartlett said the humble honeybee offered neuroscientists

many unique insights into the mechanisms of brain function and brain development.
“Bees have an extensive behavioural repertoire, allowing scientists studying them to learn about vision, olfaction, memory and learning and even aggression – all human traits,” Professor Bartlett said. “They offer a good research model – because they are studied in a natural setting that is easily accessible to scientists.
“Importantly, from a neuroscience perspective, while the bee brain is only about the size a of a sesame seed, it has many of the characteristics of the human brain including complex behaviours such as advanced memory and learning.”

The higher brain centres of bees can expand five to six times in volume over the course of their adult life. In addition, because bees are relatively short-lived (about one month), researchers can study several generations a year.
This so-called “plasticity” is now understood to work the same way as it does in a vertebrate brain, involving processes such as the production of new nerve fibres, nerve synapses and even new nerve cells.

QBI's head of Visual Neuroscience Professor Mandyam Srinivasan said the facility would play an important part in his future research adding that, “Studying how bees control their flight speed, avoid collisions, and orchestrate smooth landings is providing valuable insights into the design of biologically inspired vision systems for unmanned aerial vehicles.”

BEE GUARDS

So you thought that honey bees were all about pollination? Well some interesting new research shows that the action of bees on fruit trees goes well beyond this.

Researchers, led by Jürgen Tautz of Biozentrum Universität Würzburg, Germany, have found that the insects' buzz in fact defends plants against the caterpillars that would otherwise munch the fruit. They found that many caterpillars possess fine sensory hairs on the front portions of their bodies that enable them to detect air vibrations, such as the sound of an approaching predatory wasp or honeybee. These sensory hairs cannot distinguish between hunting wasps and harmless bees. If an “unidentified flying object” approaches, generating air vibrations in the proper range, caterpillars stop moving or drop from the

plant. If caterpillars are constantly stressed by buzzing bees, as they likely are in fruiting trees heavily laden with blossoms, they will feed a lot less, he said.

In the study, the researchers found that bell pepper plants without fruit suffered 60 to almost 70 percent less damage to their leaves when confined in a tent with bees and caterpillars in comparison to those in a tent with caterpillars alone. The amount of leaf damage was less on fruit-bearing plants as the beet armyworm caterpillars moved into the maturing peppers, they report. Their findings indicate for the first time that visiting honeybees provide plants with a totally unexpected advantage. They not only transport pollen from flower to flower, but in addition also reduce plant destruction by herbivores.

The findings highlight the importance of indirect effects between apparently unrelated members of food webs in nature, Tautz said. They might also have some practical application for sustainable agriculture.

If crops are combined with attractive flowers in such a way that honeybees from nearby beehives constantly buzz around them, it may lead to significantly higher yields in areas with lots of leaf-eating pests—something Tautz's team intends to test. "Our finding may be the start of a totally new biological control method," he said.

BEES ON DRUGS? WHAT CAN THEY TELL US?

This research is extremely interesting and amply illustrates the potential for good, solid scientific research. As part of a joint project between Australia's Macquarie University, the Australian National University and University of Illinois, and led by the well known University of Illinois (USA) entomology and neuroscience professor Gene Robinson and in Australia by Doctor Andrew Barron at the Department of Brain, Behaviour and Evolution at Macquarie University in Sydney, challenges current ideas about insect brains. They found out that honey bees on cocaine tend to exaggerate!

As all beekeepers will know, normally, foraging honey bees alert their comrades to potential food sources only when they've found high quality nectar or pollen, and only when the hive is in need. They do this by performing their waggle or round dances, which give specific instructions that help the other bees find the food.

Foraging honey bees on cocaine are more likely to dance, regardless of the quality of the food they've found or the status of the hive, the authors of the study report.

The findings, detailed in the Journal of Experimental Biology, shed new light on the famous honey bee dance language, said who led the study. The research also supports the idea that in certain circumstances, honey bees, like humans, are motivated by feelings of reward.

“The honey bee dance is this incredibly complex set of activities,” Robinson said. “It’s a very integrated communication system, very elaborate and very elegant, one of the seven wonders of the animal behaviour world.” The dance is also an important tool for understanding social behaviour in animals – in particular altruism, the “social glue” in all societies, including our own, he said.

Robinson’s interest in the waggle dance led him to study octopamine, a neurochemical known to be important to insect behaviour – particularly in regard to movement and eating.

A variety of solitary insects respond to treatment with octopamine by eating more. Honey bees don’t eat more when treated with octopamine, but accept a lower quality of food. This fact led the research team to wonder whether octopamine also influenced the waggle dance, a behaviour unique to foraging honey bees. In an earlier study, Robinson found that foragers have higher levels of octopamine in the brain than all other bees in the hive and in a study published in 2007, Robinson and his colleagues reported that treatment with octopamine caused foraging honey bees to dance more often. This indicated that octopamine played a role in honey bee dance behaviour. It also suggested a framework for understanding the evolution of altruistic behaviour, Robinson said.

The idea behind that study was that maybe this mechanism that structures selfish behaviour – eating – was co-opted during social evolution to structure social behaviour – that is, altruistic behaviour. So if you’re selfish and you’re jacked up on octopamine, you eat more, but if you’re altruistic you don’t eat more but you tell others about it so they can also eat.

But it was not even known if insects have a bona fide reward system and so the question led the researchers to study the effects of cocaine on honey bee behaviour. Cocaine – a chemical used by the coca plant to defend itself from leaf-eating insects – interferes with octopamine transit in insect brains and has effects on reward systems in mammals, including humans. It does this by influencing the chemically related dopamine system. Dopamine plays a role in the human ability to predict and respond to pleasure or reward. It is also important to motor function and modulates many other functions, including cognition, sleep, mood, attention and learning. One aspect of reward in the human brain involves altruistic behaviour, Robinson said. Thinking about or performing an altruistic act has been found to excite the pleasure centres of the human brain.

“There are various lines of thought that indicate that one way of structuring society is to have altruistic behaviour be pleasurable,” he said. Because cocaine causes honey bees to dance more – an altruistic behaviour – the researchers believe their results support the idea that there is a reward system in the insect brain, something that has never before been shown. To determine whether the cocaine was merely causing the bees to move more or to dance at inappropriate times or places, the researchers conducted a second set of experiments. These tests showed that non-foraging honey bees don’t dance, even when exposed to cocaine. They showed that foragers on cocaine do not move more than other bees (except when dancing), and that they do not dance at inappropriate times or in locations other than the dance floor. The researchers also found that the bees on cocaine do not dance every time they go on a foraging excursion. And, most important, their dances are not distorted. This is a patterned response which gives distance information, location information. That information is intact.

In a final experiment that also shows parallels to human behaviour, the researchers found that honey bees on cocaine experience withdrawal symptoms when the drug is withheld.

This study provides strong support for the idea that bees have a reward system, that it's been co-opted and it's now involved in a social behaviour, which motivates them to tell their hive mates about the food that they've found.

The findings also indicate that honey bees will make good subjects for substance-abuse research. Barron said he hoped to identify the neural pathways that cocaine targets in bees to find out more about the mechanisms involved in human addiction and to find out whether the drug has as devastating an effect on bee society as it does on humans.

"If we could do that, we could possibly develop new treatments to prevent or treat addiction," he said, adding that the bees used in the experiment were not harmed.

This article was written using materials provided by University of Illinois at Urbana-Champaign,

BEES AND COFFEE

MAKE SURE THAT YOUR CUP OF COFFEE BENEFITS THE BIRDS AND THE BEES

In a fascinating study published by University of Michigan researchers Shalene Jha and Christopher Dick in the Dec. 23 issue of the journal Current Biology, it was explained why shade coffee farms, which grow coffee under a canopy of multiple tree species, not only harbour native birds, bats and other beneficial creatures, but also maintain genetic diversity of native tree species and can act as focal points for tropical forest regeneration.

The aim of the investigation was to find

Make sure it's 'Shade Grown'

out whether shade coffee farms nurture native pollinators such as the local stingless bees. When Shalene Jha began her fieldwork in Chiapas, Mexico, she focused on a particular tree, Miconia affinis, which is pollinated by an unusual method known as buzz pollination. In order to release pollen from its flowers, bees grab hold and vibrate their flight muscles, shaking the pollen free. Non-native species such as Africanized honeybees don't perform buzz pollination, but native bees do. Therefore it was proposed that Miconia, which requires buzz pollination and is common both in forests and on coffee farms, could be a bio-indicator of how well native bees are pollinating native plants.

As she spent time in the field, however, Jha realized that she firstly needed to find out more about the Miconia trees and how they spread into coffee farms and how their dispersal affects the tree population's genetic diversity. With guidance from Professor Dick, the assistant professor of ecology and evolutionary biology she collected and analyzed DNA samples from Miconia trees growing in a network of coffee farms and forest fragments.

The three farms in the study were clear-cut and burned in the late 1930s and immediately replanted with coffee bushes and canopy tree species, including nitrogen-fixing legumes and fruit trees. Since then, farmers have allowed understory trees such as Miconia to invade because they help prevent soil erosion. The trees spread into the farms when birds and bats carry their seeds from "mother trees." By performing a genetic analysis, the scientists were able to determine whether trees growing near one another were all siblings from the same mother tree or a genetically diverse assortment from multiple mothers. They found that clustered trees in the forest were highly related to one another, suggesting that the seeds are not moving far from the mother trees. In the coffee farms, however, even in close clusters, the trees were very distinct from one another genetically, indicating that the seeds came from multiple mothers. The difference probably occurs because small, forest-dwelling birds like the chestnut-sided warbler are the main seed carriers in forested areas, while large, ubiquitous birds like the clay-coloured thrush spread seeds throughout coffee farms.

A concern in agricultural areas is that increasingly fragmented landscapes isolate native plant populations, eventually leading to lower genetic diversity. But this study shows that shade coffee farms, by being hospitable to birds, support widespread dispersal of native trees, in effect connecting patches of surrounding forest.

In addition, shade coffee farms may serve as reservoirs for future forest regeneration, as the farms typically fall out of production in less than a century. Given that potential---as well as their roles in connecting habitat patches, preserving genetic diversity and sheltering native wildlife---it is important to encourage this traditional style of agriculture. Shade coffee is currently a fashionable trend in many areas of the USA but , the enormous demand is pressuring some farmers into converting their traditional farms to intensive, industrialized plantations where far more coffee can be produced.

Thus many rustic coffee farms are turning into sun-intensive operations, where farmers cut down the overstory and try to level out the fields so it's easier to get machines in. Because of this trend, it's more essential than ever to pay attention to the ecological benefits shade coffee farms provide.

So next time you go out for a coffee, insist on 'Shade Grown' and if they haven't got it, go somewhere else.

This article was written using materials provided by University of Michigan.

Reference:
University of Michigan (2008, December 22). Shade Coffee Benefits More Than Birds

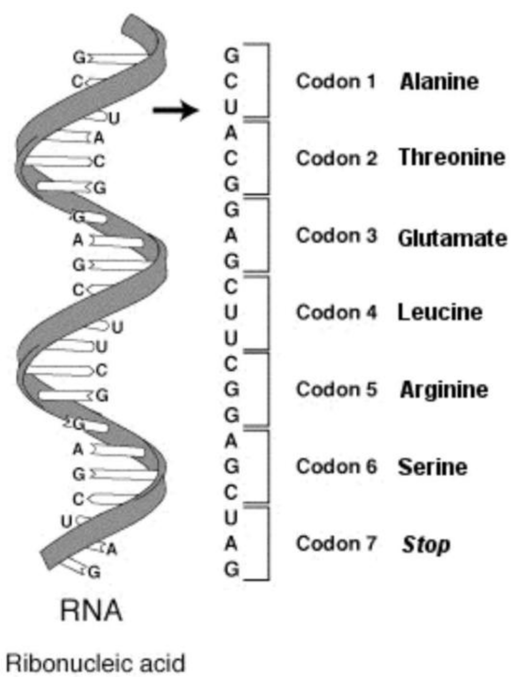
Editor's Note: If you want to know more about Shade Coffee plantations please see the informative Pdf article from the US Fish and Wildlife Service at: http://training.fws.gov/library/Pubs4/Shade_Coffee.pdf

It is also worth seeing www.shadecoffee.org

Photo by: Julius Schorzman

BEES, FINCHES, GENES AND BEHAVIOUR

Our DNA determines a lot about who we are and how we play with others, but recent studies of social animals (birds and bees, among others) show that the interaction between genes and behaviour is more of a two-way street than most of us realize and that social interactions can alter gene expression in the brain, and vice versa . This interesting piece of research has been a long time in the making but will be of interest to all beekeepers as yet again the birds and the bees are able to tell us something about ourselves.



This is not a new idea to neuroscience, but one that is gaining strength, said University of Illinois entomology and neuroscience professor Gene Robinson, lead author of a review on the subject this week in the journal 'Science'. Stanford University biology professor Russell Fernald and Illinois cell and developmental biology and neuroscience professor David Clayton are co-authors. Genes in the brain are malleable, turning on or off in response to internal and external cues. While genetic variation influences brain function and social behaviour, the authors write, social information also alters gene expression in the brain to influence behaviour.

Thanks to the newly sequenced genomes of several social animals, including honey bees and zebra finches, and new technologies such as microarrays (which allow researchers to glimpse the activity of thousands of genes at a time) neuroscientists are gradually coming to understand that "there is a dynamic relationship between genes and behaviour," Robinson said. "Behaviour is not etched in the DNA."

A critical insight came in 1992, in a study of songbirds led by David Clayton. He and his colleagues found that expression of a specific gene increases in the forebrain of a zebra finch or canary just after it hears a new song from a male of the same species. This gene, egr1, codes for a protein that itself regulates the expression of other genes.

The finding was not unprecedented; previous studies had shown that genes switch on and off when an animal is trained to perform a task in the laboratory, Robinson said.

But when Clayton's team found this change in gene expression in response to a social signal – a song from a potential competitor, something the bird would likely hear in nature – it drew attention to how powerfully social interactions can alter gene expression in the brain.

"What's more significant to a bird than hearing another bird singing?" Clayton said. "This is going on in the equivalent of our auditory cortex and association cortex, so this is pretty high-level stuff going on in the brain. And this was happening in more or less real time by very naturalistic stimuli."

Reading Clayton's 1992 paper "was a eureka moment for me," Robinson said. "This just brought it out into the social world, saying that this occurred in animals that have to make a living in the real world and pay attention to a lot of nuanced stimuli," he said. "So I think that was really a very important step in our understanding."

In his own work, Robinson has used microarrays to study this phenomenon on a larger scale and has found that literally thousands of genes turn on or off in the honey bee brain in response to social stimuli. One such gene, called for (for foraging), was originally discovered in fruit flies by Marla Sokolowski at the University of Toronto. Flies that carry different versions of for show different types of foraging behaviour. Each version gives its bearer a behavioural advantage in certain environmental conditions.

Robinson knew that honey bee workers start out working in the hive as nurses and only later graduate to the role of foragers. Perhaps, he reasoned, even though the differences in for are etched in the DNA in flies, this same gene in the bee might be more dynamic and help influence the transition from hive work to foraging.

In a study published in 2002, Robinson and his colleagues reported that expression of for did in fact increase in the brains of honey bees as they developed into foragers, and manipulating its expression caused bees to forage precociously.

The researchers also found that social factors, in the form of chemical signals called pheromones, induced this "upregulation" of for. Foragers produce a pheromone that signals to the younger bees that there are enough foragers. If the foragers are removed from the hive, some young bees develop into foragers much earlier in life than usual.

Sokolowski's work indicated that for had changed over evolutionary time, producing two varieties of fruit flies that differed in their behaviour. Robinson had found that social information altered expression of the same gene over a much shorter timescale – within the lifespan of a honey bee – also changing its behaviour.

"An appreciation of the idea that differences in gene expression can occur over vastly different time scales helps understand some of the complex relationships between genes, brain and behaviour," Robinson said. The picture that is emerging from these and other studies suggests that social signals can have a profound effect on when and how genes function. An organism's genes, its environment, the social information it receives, "all these things interact," said Clayton. "Experience is constantly coming back in to the level of the DNA and twiddling the dials and the knobs."

This article was adapted from materials provided by University of Illinois at Urbana-Champaign.

Reference: University of Illinois at Urbana-Champaign (2008, November 7). Social Interactions Can Alter Gene Expression In Brain, And Vice Versa. ScienceDaily.

HEALTHY, BRAINY BUMBLEBEES

According to scientists at London University's Queen Mary College and the University of Leicester, bumblebee colonies which are fast learners can fight off infection better.

Is this bumble bee a fast learner? His health could depend upon the

Dr Nigel Raine from Queen Mary's School of Biological and Chemical Sciences, and Akram Alghamdi, Ezio Rosato and Eamonn Mallon from the University of Leicester tested the learning performance and immune responses of bumblebees from twelve colonies.

The researchers tested the ability of 180 bees to learn that yellow flowers provided the biggest nectar rewards, and to ignore blue flowers. To test the evolutionary relationship between learning and immunity, they also took workers from the same colonies and tested their immune response against bacterial infection. Like humans, bees' ability to learn appears reduced when they are ill. The prediction was that good learners would be worse at fighting infections – but surprisingly, this was not the case.

The team reports a positive relationship between a bumblebee colony's learning performance and their immune response. They found that bees from fast learning colonies are not only the best nectar collectors, but also better able to fight infections. These colonies are probably much better equipped to thrive under difficult conditions.

The team expected that immunity is likely to be a really important trait in social species (like bumblebees, honeybees and ants) that have high-contact rates with closely related individuals leading to a greater chance of infection. There were big differences between colonies in how well they could fight off a bacterial infection, but these differences did not affect learning performance as previous studies had predicted.

The team found a positive correlation between the ability of a colony's workers to learn and the strength of their immune response, so there was no evidence for an evolutionary trade-off between these traits. Dr Raine adds*: "Once again the humble bee is proving more complex than most people thought. These essential pollinators learn many things in short their life and fight off a range of infections to survive."*

This research was sponsored by the Natural Environment Research Council (NERC).

Reference:

Alghamdi et al. No evidence for an evolutionary trade-off between learning and immunity in a social insect. Biology Letters, November 29, 2008; 1 (-1): -1 DOI: 10.1098/rsbl.2008.0514

The article was adapted from materials provided by Queen Mary, University of London.

I'LL REMEMBER YOU

In another piece of research which debunks the myth that insects run off instinct alone, researchers at the University of Michigan have found that paper wasp can remember individuals for at least a week, even after meeting and interacting with many other wasps in the meantime.

Despite their tiny brains which are les than a millionth the size of a human brain it seems astonishing that these wasps could have the capacity to remember other wasps for this length of time. The new research however suggests that the wasps' social interactions are based on memories of past encounters rather than on rote adherence to simple rules. The research, by graduate student Michael Sheehan and assistant professor of ecology and evolutionary biology Elizabeth Tibbetts was published in the September 23rd issue of the journal Current Biology.

Will these wasps remember each other tomorrow?

What's impressive about the wasps' abilities is not simply that they can remember past events. Honeybees, after all, can remember where they've found nectar. "But those memories are pretty fleeting," Sheehan said. "There seems to be a limit to the number of things they can juggle in their head at one time." Until now it was assumed that all social insects had similarly limited memories. But the new work shows that at least one species of paper wasp, Polistes fuscatus, has a strong, long-term memory and bases its behaviour on what it remembers of previous social interactions with other wasps. In earlier research, Tibbetts showed that these wasps recognize individuals by variations in their facial markings and that they behave more aggressively toward wasps with unfamiliar faces. If their memories are robust, the researchers reasoned, wasps should be less aggressive toward individuals they met even some time ago than toward new social partners. To test the notion, Sheehan measured aggression between 50 wasp queens in four different encounters over eight days. On the first day, two wasps that never had met were placed in an observation chamber for a day and their initial interactions videotaped. Then the pair was separated, and each wasp was put in a communal cage with 10 other wasps. A week later, the pair met again, and again their behaviour was videotaped.

When the researchers analyzed the videotapes, scoring the wasps' social interactions on a scale of zero (no aggression) to four (all-out grappling), it was clear that the wasps treated each other better during their second encounter than when they were strangers, suggesting they remembered each other. Instead of trying to bite each other and really have a rough-and-tumble encounter, they just sort of hung out next to each other when they met the second time.

To make sure that any differences in aggression between the first and second encounters actually were based on memory, not just some general mellowing over time, the researchers introduced each wasp to a new stranger on the day before and the day after the encounter with its old familiar social partner. As expected, the wasps were just as nasty to total strangers as they had been to each when they first met.

The interesting aspect of this work is not just that the wasps have a good memory, but that it's social memory, the researchers say. Sheehan adds that "it seems that their specific social history with particular individuals is something they're keeping track of and that it matters to their lives."

It matters because Polistes fuscatus females often share nests. Remembering who they've already settled their differences with makes for a more harmonious home life and keeps them from wasting energy on repeated aggressive encounters. The findings also challenge assumptions about social cognition, Sheehan said. Scientists have thought the ability to form social memories and use them as the basis for complex relationships was a driving force behind the evolution of large brains. But if tiny-brained wasps have such ability, perhaps it doesn't demand as much brainpower as previously thought. Sheehan and Tibbetts received funding for this project from the University of Michigan.

This article was adapted from materials provided by University of Michigan.

Pollinator decline not reducing crop yields just yet

The well-documented worldwide decline in the number of bees and other pollinators is not, at this stage, limiting global crop yields, according to the results of an international study published in the latest edition of the respected science journal, Current Biology.

Photo © CSIRO Australia 10 November 2008

Co-author, CSIRO Entomology's Dr Saul Cunningham, says however that the study detected warning signs that demand for pollinators is still growing and some highly pollinator-dependant crops are suffering.

"The research team scored crops on how much they depend on pollinators for maximum production," Dr Cunningham says. "Depending on the crop, this dependence ranges from zero to 100 per cent. For example, cereal crops like wheat don't need to be pollinated but at the other end of the scale, unpollinated almond trees produce no nuts."

The team found that between 1961 and 2006 the yields of most crops have consistently grown at about 1.5 per cent a year because of improvements in agriculture. There was also no difference in yield growth between crops that require pollinators and those that do not

"While this is a positive finding, the interaction between yields and pollination is a hugely complex issue which needs to be teased-out further," Dr Cunningham says. "Global summaries can also hide local stories. In some places, local pollinator shortages are affecting local production. While these don't threaten overall global food supplies, they can have very significant impacts on local communities and their economies."

"While this is a positive finding, the interaction between yields and pollination is a hugely complex issue which needs to be teased-out further," Dr Cunningham says.

The researchers were surprised to discover that there has been a global increase in the growing of pollinator-dependent crops, particularly in the developing world.

"The fact that, while pollinators are declining in various parts of the world, global agricultural systems are becoming more dependent on pollinators, could create serious problems in the future," Dr Cunningham says.

When the group looked at pollinated crops in more detail, they found that pollinator shortages might be beginning to affect crops that rely heavily on pollination because their yield growth was lower than for crops that were less dependent.

Dr Cunningham says they now want to examine how declining pollinator supply might be increasing the costs of production. Increased yields are usually the result of increasing farm inputs such as fertiliser, labour and water. For some crops, this increasingly intensive management may have, for now, overcome any losses in pollinator service, but it also increases production costs. There is also evidence that one response to lower yield growth for highly pollinator dependent crops is a growing demand for land.

Article adapted from materials supplied by CSIRO Australia

Reference:

Aizen Marcelo A, Garibaldi Lucas A, Cunningham, Saul A & Klein Alexandra M. (2008) *Long-Term Global Trends in Crop Yield and Production Reveal No Current Pollination Shortage but Increasing Pollinator Dependency*. Current Biology 18: 1572-1575.

PESTICIDE BUILD UP IN THE HIVE

Pesticide build up in the hive, especially in the wax is a problem that is difficult to evaluate and equally difficult to correct but Penn State researchers in the USA appear to have an innovative approach to the problem which may mitigate at least some beeswax contamination.

The research results show unprecedented levels of fluvalinate and coumaphos—pesticides used in the hives to combat varroa mites—in all comb and foundation wax samples. They also found lower levels of 70 other pesticides and metabolites of those pesticides in pollen and bees. Most researchers realised that the acaricides (anti-varroa mite chemicals) would be present in the wax because the wax is reprocessed to form the structure of the hives, but they found it a shock to see the levels and the widespread presence of these pesticides.

While the researchers expected the presence of the chemicals available to treat varroa mites in the hives, the other pesticides' levels were also surprising. All of the bees tested showed at least one pesticide and pollen averaged six pesticides with as many as 31 in a sample.

“We already had in place ways to test for viruses, bacteria and fungi, but it was difficult to find an analytical laboratory that could analyze for unknown pesticides,” says Christopher A. Mullin, professor of entomology. “We needed them to take a comprehensive look at all pesticides, not just those associated with beekeeping.”

They eventually turned to the National Science Laboratory of the U.S. Department of Agricultural Marketing Service that already tests commodities such as milk and fruits and vegetables to allow them to meet national and international standards.

“When we began doing this work, honey was not regularly analyzed, and bee pollen was not a commodity and so was not analyzed,” says Mullin. “We decided to go with the types of screening the lab does for milk and apples which look at over 170 pesticides. Now, honey is included in the commodities to be analyzed.” The researchers, decided on a modified QuEChERS (Quick, Easy, Cheap, Effective, Rugged, and Safe) method because it uses smaller samples. They coupled this with gas and liquid chromatography to develop methods of analyzing pollen, bees and wax.

“Simplicity was important because there were many people across the country sampling for us,” says Maryann Frazier. “Now rather than having them collect 15 grams of pollen they need only collect 3 grams.” This method also uses less solvent and generates data in the parts per billion range.

While beekeepers will have a difficult time controlling pesticide exposure outside the hive, the researchers tested a method for reducing the acaricide load in beeswax. Using gamma radiation from a cobalt 60 source, they irradiated the sheets of beeswax that beekeepers use as the structural foundation for the bees to build their combs. They used radiation levels at the high end of that used to irradiate foods. Irradiation broke down about 50 percent of the acaricides in the wax. “Gamma radiation is often used to kill viruses and other disease causing agents,” says James L. Frazier, professor of entomology, Penn State. “Commercial irradiation firms usually decontaminate medical instruments or foods.” The researchers tried irradiation at a commercial plant and though some modifications were necessary to irradiate the wax sheets, it is possible. Some beekeepers already irradiate their equipment to get rid of any disease causing agents. **However, it might be more efficient if the wax sheet suppliers irradiated their product before sale to the beekeepers.**

Environmental pesticides

Beekeepers cannot manage the environmental pesticide contamination as easily as the wax contamination. The U. S. Environmental Protection Agency does regulate and monitor pesticides, but they do not have the ability to monitor the interaction of these chemicals. With the large number of pesticides found in bees and pollen, interactions are likely.

For example, the researchers are finding fungicides that function by inhibiting the steroid metabolism in the fungal diseases they target, but these chemicals also affect similar enzymes in other organisms, but these fungicides, in combination with pyrethroids and/or neonicotinoids can sometimes have a synergistic effect 100s of times more toxic than any of the pesticides individually.

Colony Collapse Disorder Association

For CCD, bees are not dying in their hives, but are not returning to their hives and it is difficult to observe bees outside the hive. The U.S. EPA only looks at acute exposure to individual pesticides, but chronic exposure may cause behavioural changes that are unmonitored. "We do not know that these chemicals have anything to do with Colony Collapse Disorder, but they are definitely stressors in the home and in the food sources," says Dr. Frazier. "Pesticides alone have not shown they are the cause of CCD. We believe that it is a combination of a variety of factors, possibly including mites, viruses and pesticides."

The researchers have a team uniquely suited to looking at the honey bee pesticide problem because they combine a toxicologist, a physiologist and someone with connections to beekeepers across the country. "We now want to look at small versus large operations and organic versus non-organic operations to see if there are differences," says Maryann Frazier.

The U.S. Department of Agriculture, the National Honey Board, beekeeper organizations and concerned individuals supported this work.

Pollinator decline not reducing crop yields just yet

The well-documented worldwide decline in the number of bees and other pollinators is not, at this stage, limiting global crop yields, according to the results of an international study published in the latest edition of the respected science journal,

Current Biology.

Photo © CSIRO Australia 10 November 2008

Co-author, CSIRO Entomology's Dr Saul Cunningham, says however that the study detected warning signs that demand for pollinators is still growing and some highly pollinator-dependant crops are suffering.

"The research team scored crops on how much they depend on pollinators for maximum production," Dr Cunningham says. "Depending on the crop, this dependence ranges from zero to 100 per cent. For example, cereal crops like wheat don't need to be pollinated but at the other end of the scale, unpollinated almond trees produce no nuts."

The team found that between 1961 and 2006 the yields of most crops have consistently grown at about 1.5 per cent a year because of improvements in agriculture. There was also no difference in yield growth between crops that require pollinators and those that do not

“While this is a positive finding, the interaction between yields and pollination is a hugely complex issue which needs to be teased-out further,” Dr Cunningham says. “Global summaries can also hide local stories. In some places, local pollinator shortages are affecting local production. While these don’t threaten overall global food supplies, they can have very significant impacts on local communities and their economies.”

“While this is a positive finding, the interaction between yields and pollination is a hugely complex issue which needs to be teased-out further,” Dr Cunningham says.

The researchers were surprised to discover that there has been a global increase in the growing of pollinator-dependent crops, particularly in the developing world.

“The fact that, while pollinators are declining in various parts of the world, global agricultural systems are becoming more dependent on pollinators, could create serious problems in the future,” Dr Cunningham says.

When the group looked at pollinated crops in more detail, they found that pollinator shortages might be beginning to affect crops that rely heavily on pollination because their yield growth was lower than for crops that were less dependent.

Dr Cunningham says they now want to examine how declining pollinator supply might be increasing the costs of production. Increased yields are usually the result of increasing farm inputs such as fertiliser, labour and water. For some crops, this increasingly intensive management may have, for now, overcome any losses in pollinator service, but it also increases production costs. There is also evidence that one response to lower yield growth for highly pollinator dependent crops is a growing demand for land.

Article adapted from materials supplied by CSIRO Australia

Reference:

Aizen Marcelo A, Garibaldi Lucas A, Cunningham, Saul A & Klein Alexandra M. (2008) *Long-Term Global Trends in Crop Yield and Production Reveal No Current Pollination Shortage but Increasing Pollinator Dependency*. Current Biology 18: 1572-1575.

THE ICE AGE   A NEW PICTURE GIVEN BY POLLEN GRAINS

In order to try and understand long term climate change occurrences the study of past occurrences is important and if we get them wrong, we may interpret present changes wrongly. It seems that pollen grains can help in this important research. Indeed a pollen grain study has yielded a new picture of the ice age.

The research was carried out by scientists at Stockholm University in Sweden and is based on analyses of deposits of pollen grains. It is possible that all of Sweden was virtually free of ice for long periods during the latest ice age and the findings show that the glaciation might have started some 20,000 later than was previously assumed.

When was it?

Martina Hättestrand, a doctoral candidate at the Department of Physical Geography and Quaternary Geology says that, “It’s important that we get to the bottom of when the great ice sheets covered Sweden and how warm it might have been when there was no ice. At present there are two extremely different hypotheses, which makes it difficult to study how the ice age climate relates to various parameters in the climate system, such as the earth’s relation to the sun,”

In order to understand the climate system of the earth, researchers today are studying the climatic variations of ice ages. Since we have the most land forms and geological traces preserved from the latest ice age, much of the research focuses on that particular period. An important aspect of the research is to study when the huge continental ice sheets grew and when they melted away, and to study the environment and climate of the areas that were free of ice. The size and movement patterns of the ice sheets can be calculated by studying land forms and moraine deposits. The ice-free periods can be studied by pollen analysis, among other methods. Pollen analysis is a method in which scientists use pollen grains preserved in ancient sediment to create a picture of what plants once grew in the area and what the climate was like.

Martina Hättestrand’s dissertation is based on studies of pollen grains that were deposited more than 40,000 years ago in small lakes during the ice-free phases of the latest glaciation. During the warm phases of the Ice Age, high amounts of birch pollen were deposited, which indicates that summer temperatures were around 10 degrees centigrade in northern Sweden. During cold ice-free phases, mostly grass and herbal pollen was deposited.

The findings from my dissertation indicate that the first icing up phase of the latest Ice Age may in Scandinavia have started about 95,000 years ago – which is some 20,000 years later than was previously thought,” says Martina Hättestrand. According to the previously accepted hypothesis, Sweden was covered with ice 75,000-20,000 years ago. The new hypothesis is that Sweden may have largely been ice-free between 59,000 and 40,000 years ago. If this is true, the last ice sheet of the Ice Age formed much more rapidly than was previously believed in order to have reached all the way down to northern Germany during the maximum phase about 22,000 years ago.

The latest Ice Age is called the Weichselian glacial (glaciation) in northern Europe. It started roughly 120,000 years ago and ended about 10,000 years ago.

The definition of an ice age is that it has a colder climate than an interglacial period, which is the type of climate we live in today. The climate varied a great deal during the ice ages.

HISTORICAL NOTE

Diego de Landa Calderón (1524 – 1579) was the Bishop of Yucatán in Mexico. His writings contain much valuable information on pre-Columbian Maya civilization and traditions including beekeeping. His legacy however is mixed for apart from his valuable historical records he was also instrumental in destroying many of those same traditions about which he writes. Here is an example of his clear, explanatory prose.

"There are two kinds of bees, and both are very much smaller than ours. The larger kind of these breeds in hives, which are very small. They do not make honeycomb as ours do, but small blisters like walnuts of wax all joined one to the other and full of honey. To cut them away, they do nothing more than to open the hives and break the blisters with a small stick and thus the honey runs out and they take the wax when they please. The rest breed in the woods in hollows of trees and of stones and there they search for the wax in which, and in honey, this land abounds, and the honey is very good..... These bees do not sting, nor do they harm when the honeycombs are cut out."

In these few sentences he accurately described pre-European beekeeping in the Americas. He was of course describing beekeeping with stingless bees, and these, in the Yucatan peninsula of present day Mexico as practised by those arch exponents of the art, the Maya; “the people of the land, the bee, and honey.” The bees that the Maya used were and still are, native 'honeybees' of the Americas.

Shown left is an image of the page from Diego de Landa's 16thC. manuscript, *Relación de las Cosas de Yucatán*, in which he describes the famous "de Landa alphabet". This "alphabet" shows the letters of the Spanish language and the Maya hieroglyphics symbols which were supposed to correspond with them (according to de Landa's interpretation).

This alphabet would later prove to be instrumental in the decipherment of the Maya civilization's script, once interpreted correctly as essentially a syllabary by the Russian linguist, Yuri Knorosov.

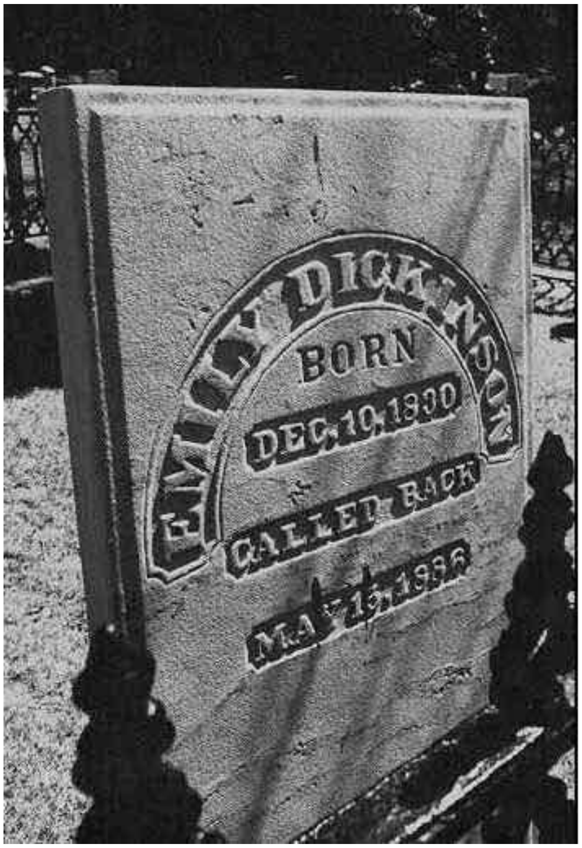
As reproduced originally in Charles Etienne Brasseur de Bourbourg's 1863 republication.

Poem of the Month

This month’s poem is another classic from that great poet Emily Dickinson. Her poetry shows what an extraordinary mind this woman had and like Sylvia Plath is almost attaining genius status in my mind.

The Bee

by Emily Dickinson

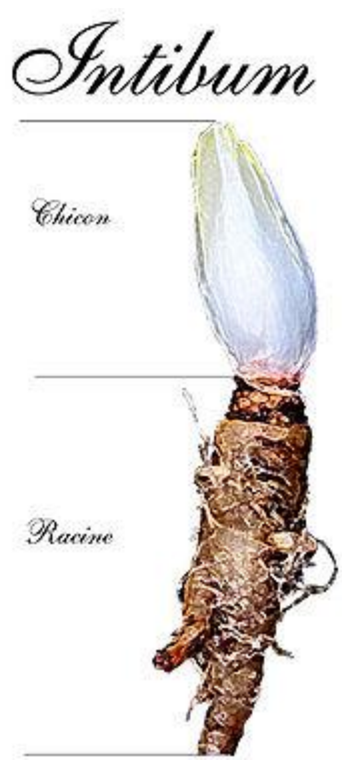


Like trains of cars on tracks of plush
I hear the level bee:
A jar across the flowers goes,
Their velvet masonry
Withstands until the sweet assault
Their chivalry consumes,
While she, victorious, tilts away
To vanquish other blooms.
Her feet are shod with gauze,
Her helmet is of gold;
Her breast, a single onyx
With chrysoprase, inlaid.
Her labor is a chant,
Her idleness a tune;
Oh, for a bee's experience
Of clovers and of noon!

Because I could not stop for Death-
He kindly stopped for me--
The Carriage held but just Ourselves--
and Immortality.

RECIPE OF THE MONTH

This year we start the year off with a really tasty recipe from the home of good cooking – France. Some how the French always seem to be able to combine the oddest ingredients and come up with something special. I tried this recipe after reading it at http://www.aftouch-cuisine.com/recipe/braised-chicory-with-emmental-cheese-141.htm
It's easy to make and as I said, well worth it.



Braised Chicory with Emmental Cheese with Honey and Cuminseed

The Recipe will serve 4 guests
Preparation time: 20 minutes

Ingredients:
100 g of French Emmental cheese, diced
3 chicories
2 tbsp. of peanut oil
2 tbsp. of honey
1 pinch of cumin seeds
Salt and pepper

Direction :
1. Wash the chicories and slice them lengthwise very thinly. Fry them in a very hot pan for several seconds with 2 tablespoons oil. Once the chicories have become transparent, set aside and keep them hot.

2. Pour the honey and add the cumin in the frying pan. Let reduce for 3 minutes.

3. Next, add the chicories and the Emmental cheese.

3. Cook gently for 2 minutes. Add salt and pepper and serve immediately.

Quote of the Month

This quote from a most remarkable Roman shows the depth of his understanding of nature even in those early days.

"What is not good for the swarm is not good for the bee."

Marcus Aurelius quotes (Roman emperor, best known for his Meditations on Stoic philosophy, AD 121-180)

Marcus Aurelius

Caesar 139-161 AD

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Marcus Aurelius was the last of the five ‘good’ emperors. A skilled soldier, administrator and emperor, his work ‘**Meditations**’**,** written in Greek while on campaign between 170 and 180, is still revered as a literary monument to a government of service and duty and has been praised for its "exquisite accent and its infinite tenderness." [3]

A final note from the publisher

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