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News

Parasitic wasps' DNA laid bare

Nasonia wasp genomes should improve agricultural biological control.

Brendan Borrell

Scientists have sequenced the genomes of three species of *Nasonia*, a tiny parasitic wasp that is increasingly being used by biologists as a model organism. The genomes will help with agricultural biological-control efforts, along with fundamental studies of development and genetics.

Once Nasonia wasps have mated, the female (bottom) injects her fertilized eggs into insect hosts.

Michael Clark/University of Rochester

"The important thing is there has never been a natural enemy sequenced," says Kevin Hackett, head of biological control at the US Agricultural Research Service in Beltsville, Maryland. "Conservatively, we get $20 billion in value from biological control in this country alone."

Nasonia females inject their eggs inside developing flies, leaving the young wasps to eat their way out. Studying *Nasonia* could help to improve the agricultural use of other wasps that behave in similar ways. *Trichogramma*, for example, is used to control pests on tomatoes, corn (maize) and apples.

The *Nasonia* genomes indicate that the wasps lack the genes required to synthesize certain amino acids, possibly owing to their exclusively carnivorous feeding habits. That finding could help researchers to develop artificial diets to rear wasps for large-scale pest-control efforts. "That would be an incredible breakthrough down the line," says Hackett.

Move aside, *Drosophila*

The *Nasonia* Genome Working Group, which includes 157 authors affiliated with 70 departments or institutions, came together in 2004 — shortly after the draft sequence of the honeybee was published — to push for the sequencing of a second hymenopteran through the National Human Genome Research Institute in Bethesda, Maryland.

But *Nasonia* is not just the 'lab rat' for parasitic wasp studies. John Werren, an evolutionary geneticist at the University in Rochester in New York and one of the leaders of the sequencing project, thinks that *Nasonia* will advance fundamental genetics research.

The three species can be bred to create hybrids, allowing researchers to identify species-specific genes involved in functions such as host selection. And, like other hymenopterans, male *Nasonia*

are haploid — they have just one copy of the genome — which makes it easier to analyse the genome and to study gene interactions. Finally, the wasps have a key advantage over that laboratory workhorse, the *Drosophila* fly. RNA interference techniques must be applied cell by cell in *Drosophila*, whereas in *Nasonia* they can be applied to all tissue types in the animal, allowing the development of develop high-throughput assays of gene function.

"Until recently, many people were concentrated on flies," says developmental geneticist Claude Desplan of New York University. "Now, with more and more genome sequences available, researchers are using new systems such as *Nasonia*."

Focus on the ladies

The *Nasonia* genome, published this week in *Science*[1], has already provided some biological surprises. For instance, the wasp produces 79 candidate venom proteins, some of which are new to science. Unlike the honeybee, which uses its venoms for pain, the venoms in parasitic wasps are used to control the behaviour of the host for their eggs. These compounds may hold promise as drug candidates.

Curiously, the *Nasonia* genome contains gene regions originally derived from the Pox virus, and these were transferred from *Wolbachia* bacteria into the wasp genome. These genes express proteins during many different stages of the wasp's development, demonstrating the importance of horizontal gene transfer in animal evolution.

Richard Stouthamer, an entomologist at the University of California at Riverside, says that he is particularly excited by the possibility of uncovering genes for sex determination. "In biological control," he says, "you want to have more females because they are the ones that are going to go out and kill other insects."

References

1. The Nasonia Genome Working Group *Science* **327**, 343-348 (2010). | **Article** | **ChemPort** |

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