Researchers find secret of beetle success: Stolen genes

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An acorn weevil beetle (Curculio sp.) stands on a sunflower (Helianthus sp.). Credit: Duane D. McKenna.

An international team of researchers has found what appears to be one of the secrets to evolutionary success for beetles—genes stolen from bacteria and fungi. In their paper published in *Proceedings of the National Academy of Sciences*, the group describes their study of the beetle genome and what they found.

As the researchers note, beetles have been remarkably successful—they currently represent approximately one-fourth of all animal species alive today, and 40 percent of all insects. To learn how beetles proved to be so successful, the researchers carried out a study inferring the phylogeny and evolution of beetles using data in genome databases. In all, they studied 146 beetle species using 4,818 genes. They also estimated timing and the rates of diversification for 512 beetle species using 89 genes which, they note, represent all major beetle lineages.

The researchers dated the origin of the beetles to the Carboniferous period about 327 million years ago; they found that over the course of their existence, beetles have twice stolen genes from bacteria and fungi that allowed them to digest plant material. More specifically, the new genes allowed them to digest enzymes that are used for degrading plant cell wall components such as pectin, hemicelluloses and cellulose. In so doing, the beetles developed the ability to consume what the researchers describe as the richest carbohydrate source on the planet.

They further note that they found that going back as far as the Mesozoic era, large numbers of beetle species evolved, which allowed them to

adapt to a large number of climate types. Some ate leaves, for example, others ate wood. They further note that approximately half of all beetle species in existence today are directly descended from ancestors in the middle part of the Jurassic period. They further note that they found evidence that suggests over the course of their long history, very few species of beetles have ever died out. They conclude by suggesting that beetle diversity has resulted from multiple factors—a low extinction rate over a very significant time frame, gene stealing from bacteria and fungi and adaptive radiations following the adoption of new genes.

A tropical weevil beetle (Lixus apterus). Credit: Duane D. McKenna.

More information: Duane D. McKenna et al. The evolution and genomic basis of beetle diversity, *Proceedings of the National Academy*

of Sciences (2019). DOI: 10.1073/pnas.1909655116