



What Kind of Bee Is That?

NBII Supports Development of Online Bee Guide

Scientists and taxonomists are working together to create online identification guides for the bees of North America.

The Value of Bees?

Bees are important because they are the primary pollinators of all flowering plants. Without bees, many of the world's plants and crops would simply disappear. The activities of bees are required for reproduction in many species of wild and cultivated flowering plants, enhancing fruit set and size, seed production and viability, seedling vigor, and genetic diversity. More than 66 percent of the world's 1500 crop species have one or more cultivars that require visits by bees (Roubik 1995). And it is estimated that bees are required in some way for 15–30 percent of worldwide food production (McGregor 1976). Approximately 20000 species of bees have been described to date (Michener 2000) and of these, approximately 4000 provide pollination services to agricultural crops and wild plants in North America. In 2000, the value of the increased yield and quality achieved for all US agricultural crops through pollination by honey

bees alone was estimated at 14.6 billion (Morse and Calderone, 2000).

Research in Europe and the Americas has concluded that declines are evident in wild and farmed bee populations and that more bee population monitoring data are needed. Bees and other insects are especially difficult challenging when it comes to effective monitoring and identification. They are small, difficult to mark or tag, and often too quick for the human eye to follow. Effective monitoring and identification tools are not well developed for this group, which stifles bee research. However, a collaborative project to develop online bee identification guides and monitoring techniques is working to overcome this obstacle to effective bee research and conservation.

The Bee Team

Led by Sam Droege with the United States Geological Survey (USGS), scientists and taxonomists from the American Museum of Natural History and the University of Georgia-Athens are working together to create online identification guides for the bees of North America based on specimens and Charles Duncan Michener's *The Bees of the World* (2000).

The guides are being developed using technology provided by The

Polistes Foundation, a 501C-3 non-profit organization that coordinates the Discover Life project online at <http://www.discoverlife.org/>.

The Discover Life project provides free, online tools to identify species, share ways to teach and study nature's wonders, report findings, build maps, process



Confusing bumble bee (Bombus perplexus) on a musk or nodding thistle (Carduus nutans) flower

Photo credit: Elizabeth A. Sellers

images, and contribute to and learn from a growing encyclopedia of life that now contains almost 2 million species pages.

What Bee Guides Are Available?

Bee identification guides have been built for Eastern North American bees (states and provinces east of the Mississippi River) and, for some genera, the guides cover the entire continent, covering nearly 1000 bee species. Most of the guides feature a single genus of bees. If there are a large number of species present in a single genus, the guides are often divided into two guides, one for

each sex, as characters useful for identifying species are often gender specific. Guides now also exist for yellowjackets and hornets, cuckoo wasps, and some Sphecid wasps.

Inside the Bee Guides

The guides can be accessed online at <http://www.discoverlife.org/20/q?search=Apoidea>. Each guide consists of a list of identification questions, a species list, and navigation tools. In contrast to a dichotomous guide that requires the user to answer the first question in order to move forward to the next question, these bee guides are polychotomous, allowing the user to enter the guides at any point and choose multiple criteria to narrow down the list of species that match the one they are trying to identify. The list of species and the list of questions interact with each other. Answering any question (in any order) narrows the list of candidate species. Similarly, one can reverse the process and have the tool narrow the set of questions for you, based on the species that remain on the list. As the user answers questions or selects criteria, the list of candidate species is narrowed until, in most cases, the list of possible species resolves to a single name.

Each guide includes high-quality photographs contributed by individual photographers and organizations. Some of the images were produced using the automontage technique of combining multiple images taken at different focus depths into a single, clear, three-dimensional image of the subject. Many species names can also be clicked on to reveal additional pictures and information on the natural history or identification of that species.

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In addition to the bee identification guides, visitors to the Discover Life Web site can find instructions for using the guides, techniques for collecting and preparing bee specimens, a glossary of bee identification terms, a guide to pronunciation of the names of bee genera, a video describing how to take better bee or insect photographs at flowers, and access to a bee monitoring discussion group hosted by the USGS.

The Future

Online identification guides have been developed for the 65 genera found east of the Mississippi River. Future work will involve expanding the coverage of the guides to include genera from the central and western United States, Mexico, and Canada. As new species are described and new characteristics are recorded, existing guides will also be improved and tested.

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Contact

For more information or to contribute or participate in this project, please contact:

Sam Droege
United States Geological Survey
Patuxent Wildlife Research Center
12100 Beech Forest
Laurel, MD 20708-4083 USA
Phone: 301-497-5840
Fax: 301-497-5624
E-mail: sdroege@usgs.gov

Elizabeth Sellers
Manager, Pollinators Project
National Biological Information
Infrastructure
12201 Sunrise Valley Drive, Mail
Stop 302
Reston, VA 20192 USA
Phone: 703-648-4385
Fax: 703-648-4224
E-mail: esellers@usgs.gov

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