Linking Data and Descriptions on Moths Using the Wikimedia Ecosystem

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Abstract

Moths form a diverse group of species that are predominantly active at night. They are colourful, have an ecological role, but are less well described compared to their closest relatives, the butterflies. Much remains to be understood about moths, which is shown by the many issues within their taxonomy, including being a paraphyletic group and the inability to clearly distinguish them from butterflies (Fig. 1).

We present the Wikimedia architecture as a hub of knowledge on moths. This ecosystem consists of 312 language editions of Wikipedia and sister projects such as Wikimedia commons (a multimedia repository), and Wikidata (a public knowledge graph).

Through Wikidata, external data repositories can be integrated into this knowledge landscape on moths. Wikidata contains links to (open) data repositories on biodiversity like iNaturalist, Global Biodiversity Information Facility (GBIF) and the Biodiversity Heritage Library (BHL) which in return contain detailed content like species occurrence data, images or publications on moths.

We present a workflow that integrates crowd-sourced information and images from iNaturalist, with content from GBIF and BHL into the different language editions of Wikipedia. The Wikipedia articles in turn feed information to other sources. Taxon pages on iNaturalist, for example, have an "About" tab, which is fed by the Wikipedia article describing the respective taxon, where the current language of the (iNaturalist) interface fetches the appropriate language version from Wikipedia. This is a nice example of data reuse, which is one of the pillars of FAIR (Findable, Accessible, Interoperable and Reusable) (Wilkinson et al. 2016).

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Wikidata provides the linked data hub in this flow of knowledge. Since Wikidata is available in RDF, it aligns well with the data model of the semantic web. This allows

- rapid integration with other linked data sources, and
- provides an intuitive portal for non-linked data to be integrated as linked data with this semantic web.

Wikidata is includes information on all sorts of things (e.g., people, species, locations, events). Which is why it can structure data in a multitude of ways, thus leading to 9000+ properties. Because all those different domains and communities use the same source for different things it is important to have good structure and documentation for a specific topic so we and others can interpret the data.

We present a schema that describes data about moth taxa on Wikidata. Since 2019, Wikidata has an EntitySchema namespace that allows contributors to specify applicable linked-data schemas. The schemas are expressed using Shape Expressions (ShEx) (Thornton et al. 2019), which is a formal modelling language for RDF, one of the data formats used on the Semantic Web. Since Wikidata is also rendered as RDF, it is possible to use ShEx to describe data models and user expectations in Wikidata (Waagmeester et al. 2021). These schemas can then be used to verify if a subset of Wikidata conforms to an expected or described data model.

Starting from a document that describes an expected schema on moths, we have developed an EntitySchema (E321) for moths in Wikidata. This schema provides unambiguous guidance for contributors who have data they are not sure how to model. For example, a user with data about a particular species of moth may be working from a scientific article that states that the species is only found in New Zealand, and may be unsure of how to model that fact as a statement in Wikidata. After consulting Schema E321, the user will find out about Property P183 “endemic_to” and then use that property to state that the species is endemic to New Zealand. As more contributors follow the data model expressed in schema E321, there will be structural consistency across items for moths in Wikidata. This reduces the risk of contributors using different combinations of properties and qualifiers to express the same meaning. If a contributor needs to express something that is not yet represented in Schema E321 they can extend the schema itself, as each schema can be edited. The multilingual affordances of the Wikidata platform allow users to edit in over 300 languages. In this way, contributors edit in their preferred language and see the structure of the data as well as the schemas in their language of choice. This broadens the range of people who can contribute to these data models and reduces the dominance of English.

There are approximately 160K+ estimated moth species. This number is equal to the number of moths described in iNaturalist, while Wikidata contains 220K items on moths. As the biggest language edition, the English Wikipedia contains 65K moth articles; other language editions contain far fewer Wikipedia articles. The higher number of items on moths in Wikidata can be partly explained by Wikidata taxon synonyms being treated as distinct taxa.

Wikidata, as a proxy of knowledge on moths, is instrumental in getting them better described in Wikipedia and other (FAIR) sources. While in return, curation in Wikidata happens by a large community. This approach to data modelling has the advantage of allowing multilingual collaboration and iterative extension and improvement over time.

Keywords

Wikidata, data schemas

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Conflicts of interest

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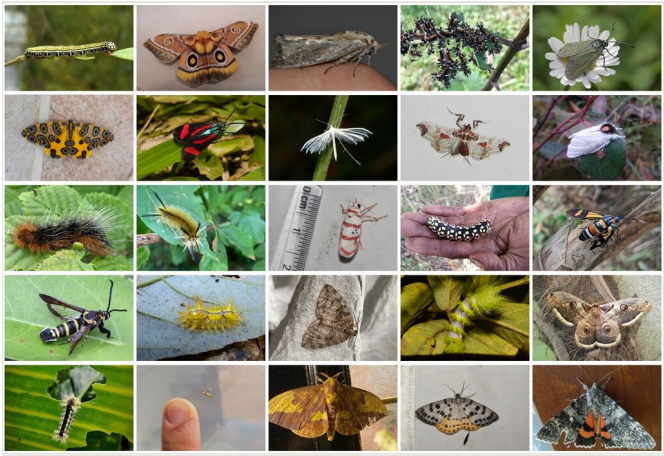


Figure 1.

Moths form a diverse group of species that are less well described compared to their closest relatives, the butterflies.