Classification of Biological Interactions:
Challenges in the field and in analysis

Rafael B. P. Pinheiro[‡], Leonardo R. Jorge[§], Thomas M. Lewinsohn[‡]

‡ Department of Animal Biology, Institute of Biology, University of Campinas, Campinas, Brazil
§ Biology Centre of the Czech Academy of Sciences, Inst. of Entomology, Ceske Budejovice, Czech Republic

Corresponding author: Rafael B. P. Pinheiro (rafael-bpp@hotmail.com)

Abstract

Within biological communities, species interact in a wide variety of ways. Species interactions have always been noted and classified by naturalists in describing living organisms and their ways. Moreover, they are essential to characterize ecological communities as functioning entities.

Biodiversity databases, as a rule, are comprised of species records in certain localities and times. Many, if not most, originated as databases of museum specimens and/or published records. As such, they provide data on species occurrences and distribution, with little functional information. Currently, online databases for species interaction data are being formed or proposed. Usually, these databases set out to compile data from actual field studies, and their design reflects the singularities of particular studies that seed their development. In two online databases: the Web of Life (2021) and the Interaction Web DataBase (2020) (IWDB), the categories of interactions are quite heterogeneous (Table 1). For instance, they may refer explicitly to certain taxonomic groups (e.g., anemone-fish), or do so implicitly (host-parasitoid; parasitoids are all holometabolous insects with arthropod hosts); conversely, they may encompass almost any taxon (food webs). In another example, the Global Biotic Interactions database (Poelen et al. 2014) (GloBI) offers a choice of relational attributes when entering data, ranging from undefined to quite restricted (Table 2).

Here we intend to contribute to the development of interaction databases, from two different points of view. First, what categories can be effectively applied to field observations of biotic interactions? Second, what theoretical and applied questions do we expect to address with interaction databases? These should be equally applicable to comparisons of studies of the same kind or mode of interaction, and to contrasts between interactions in multimodal studies.

Keywords

species interactions, ecological networks

Presenting author

Rafael B. P. Pinheiro

Presented at

TDWG 2021

Grant title

Conflicts of interest

References

- Interaction Web DataBase (2020) http://www.ecologia.ib.usp.br/iwdb/. Accessed on: 2021-8-04.
- Poelen J, Simons J, Mungall C (2014) Global biotic interactions: An open infrastructure to share and analyze species-interaction datasets. Ecological Informatics 24: 148-159. https://doi.org/10.1016/j.ecoinf.2014.08.005
- Web of Life (2021) http://www.web-of-life.es/. Accessed on: 2021-8-04.

Table 1.

Categories in the Web of Life (2021) and the Interaction Web DataBase (2020). Same categories with slightly different names (except for Host-parasitoid, absent in IWDB). Y = Yes; N = No. In trophic, "A" stands for Partial: trophic for ants (sometimes), pollinators and dispersers, not for plants.

Interaction type in Databases	Trophic	Taxon - specific
Anemone-fish	N	Y
Plant-ant	A	Y
Host-parasite	Y	N
Host-parasitoid	Y	Y
Predator-prey (Foodwebs)	Y	N
Plant-herbivore	Y	N
Pollination	A	N
Seed dispersal	A	N

Table 2.

Categories in GloBI (Poelen et al. 2014). The first two columns show the terms offered to characterize an interaction when entering data. Functional categories in the third column are added here for discussion.

Relation	Converse relation	Functional category
Interacts with	--	undefined
relate to	--	undefined
eat	get eaten by	antagonistic (predator-prey)
preys on	get preyed on by	antagonistic (predator-prey)
kill	is killed by	antagonistic (predator-prey)
parasitize	get parasitized by	antagonistic (host-parasite)
infect	get infected by	antagonistic (host-parasite)
visits flowers of	flowers visited by	undefined
pollinate	get pollinated by	mutualistic service
spread	get spread by	mutualistic service
hosts	get hosted by	co-occurrence (neutral)
is symbiont of	--	co-occurrence (neutral)
co-roosts with	--	co-occurrence (neutral)