Bioassay analysis using R

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Background

Herbicides are designed to kill plants and their selective use in crops is based on rates that do not harm the crop but effectively control the weeds. Use of dose-response curves and subsequent definitions of relative potency, no observable effect level, estimation of selectivity index are pivotal for the safe and cost-effective use of herbicide in agriculture.
Various dose-response curves have been used to describe plant response. The objective of this abstract is to present an R application that makes it easy to analyse bioassays and subsequently performs tests of biological relevance not only in herbicide research and development, but also in other branches of the biological sciences, e.g. toxicology and ecotoxicology.

R application

In order to automate the fitting and testing of various hypotheses of the dose-response curves we have developed the package "drc" which can handle most of the situations common for bioassay work:

- Simultaneously fitting of numerous curves.
- Testing for similar parameters among some or all simultaneously fitted curves.
- Reducing numbers of parameters using likelihood ratio tests.
- Calculating relative potencies (comparison of parameters).

The non-linear least squares estimation is performed using the `base` function `optim`. The resulting fit is an object of class "drc". In addition to some more specialised functions, the package provides `anova`, `plot` and `summary` (`print.summary`) methods for objects of class "drc".
The framework can easily be extended to other situations of non-linear regression with parameters depending on some factors. It requires that the non-linear mean function and (preferably) an accompanying self start function are supplied.

References

Finney, D. J. (1979). Bioassay and the Practice of Statistical Inference. *Int. Statist. Rev.* **47**, 1–12.

Ritz, C. and Streibig, J. C. (2004). Bioassay analysis using **R**. *Manuscript.*