



## Wikiplantbase #Toscana, breaking the dormancy of floristic data

This is the peer reviewed version of the following article:

*Original:*

Bedini, G., Pierini, B., Roma-Marzio, F., Caparelli, K.f., Bonari, G., Dolci, D., et al. (2016). Wikiplantbase #Toscana, breaking the dormancy of floristic data. PLANT BIOSYSTEMS, 150(3), 601-610 [10.1080/11263504.2015.1057266].

*Availability:*

This version is available <http://hdl.handle.net/11365/1248598> since 2023-10-19T14:11:19Z

*Published:*

DOI:10.1080/11263504.2015.1057266

*Terms of use:*

Open Access

The terms and conditions for the reuse of this version of the manuscript are specified in the publishing policy. Works made available under a Creative Commons license can be used according to the terms and conditions of said license.

For all terms of use and more information see the publisher's website.

(Article begins on next page)



[Click for updates](#)

## Plant Biosystems - An International Journal Dealing with all Aspects of Plant Biology: Official Journal of the Societa Botanica Italiana

Publication details, including instructions for authors and subscription information:  
<http://www.tandfonline.com/loi/tplb20>

### Wikiplantbase #Toscana, breaking the dormancy of floristic data

G. Bedini<sup>a</sup>, B. Pierini<sup>b</sup>, F. Roma-Marzio<sup>a</sup>, K. F. Caparelli<sup>c</sup>, G. Bonari<sup>d</sup>, D. Dolci<sup>a</sup>, G. Gestri<sup>e</sup>, M. D'antraccoli<sup>a</sup> & L. Peruzzi<sup>a</sup>

<sup>a</sup> Dipartimento di Biologia, Unità di Botanica, Università di Pisa, via L. Ghini, 5 56126, Pisa, Italy

<sup>b</sup> via Zamenhof, 2 56127, Pisa, Italy

<sup>c</sup> p.za G. Guerra, 28 50053 Empoli, Firenze, Italy

<sup>d</sup> Dipartimento di Scienze della Vita, Università di Siena, via P.A. Mattioli, 4 53100, Siena, Italy

<sup>e</sup> via Bonfiglioli, 30 39100, Prato, Italy

Accepted author version posted online: 04 Jun 2015.

To cite this article: G. Bedini, B. Pierini, F. Roma-Marzio, K. F. Caparelli, G. Bonari, D. Dolci, G. Gestri, M. D'antraccoli & L. Peruzzi (2015): Wikiplantbase #Toscana, breaking the dormancy of floristic data, *Plant Biosystems - An International Journal Dealing with all Aspects of Plant Biology: Official Journal of the Societa Botanica Italiana*, DOI: [10.1080/11263504.2015.1057266](https://doi.org/10.1080/11263504.2015.1057266)

To link to this article: <http://dx.doi.org/10.1080/11263504.2015.1057266>

Disclaimer: This is a version of an unedited manuscript that has been accepted for publication. As a service to authors and researchers we are providing this version of the accepted manuscript (AM). Copyediting, typesetting, and review of the resulting proof will be undertaken on this manuscript before final publication of the Version of Record (VoR). During production and pre-press, errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal relate to this version also.

PLEASE SCROLL DOWN FOR ARTICLE

Taylor & Francis makes every effort to ensure the accuracy of all the information (the "Content") contained in the publications on our platform. However, Taylor & Francis, our agents, and our licensors make no representations or warranties whatsoever as to the accuracy, completeness, or suitability for any purpose of the Content. Any opinions and views expressed in this publication are the opinions and views of the authors, and are not the views of or endorsed by Taylor & Francis. The accuracy of the Content should not be relied upon and should be independently verified with primary sources of information. Taylor and Francis shall not be liable for any losses, actions, claims, proceedings, demands, costs, expenses, damages, and other liabilities whatsoever or howsoever caused arising directly or indirectly in connection with, in relation to or arising out of the use of the Content.

This article may be used for research, teaching, and private study purposes. Any substantial or systematic reproduction, redistribution, reselling, loan, sub-licensing, systematic supply, or distribution in any form to anyone is expressly forbidden. Terms & Conditions of access and use can be found at <http://www.tandfonline.com/page/terms-and-conditions>

**Publisher:** Taylor & Francis

**Journal:** *Plant Biosystems - An International Journal Dealing with all Aspects of Plant Biology*

**DOI:** <http://dx.doi.org/10.1080/11263504.2015.1057266>

Running title: **Wikipantbase #Toscana**

Corresponding author: Lorenzo Peruzzi, Dipartimento di Biologia, Unità di Botanica, Università di Pisa, via Luca Ghini 13, 56126 Pisa, Italy. E-mail: [lorenzo.peruzzi@unipi.it](mailto:lorenzo.peruzzi@unipi.it)

# Wikiplantbase #Toscana, breaking the dormancy of floristic data

G. BEDINI<sup>1</sup>, B. PIERINI<sup>2</sup>, F. ROMA-MARZIO<sup>1</sup>, K. F. CAPARELLI<sup>3</sup>, G. BONARI<sup>4</sup>,  
D. DOLCI<sup>1</sup>, G. GESTRI<sup>5</sup>, M. D'ANTRACCOLI<sup>1</sup>, L. PERUZZI<sup>1\*</sup>

<sup>1</sup>*Dipartimento di Biologia, Unità di Botanica, Università di Pisa, via L. Ghini, 5 56126 Pisa, Italy. e-mail: [lorenzo.peruzzi@unipi.it](mailto:lorenzo.peruzzi@unipi.it)*

<sup>2</sup>*via Zamenhof, 2 56127 Pisa, Italy*

<sup>3</sup>*p.za G. Guerra, 28 50053 Empoli (Firenze), Italy*

<sup>4</sup>*Dipartimento di Scienze della Vita, Università di Siena, via P.A. Mattioli, 4 53100 Siena, Italy*

<sup>5</sup>*via Bonfiglioli, 30 39100 Prato, Italy*

*\*corresponding author*

## Abstract

The online platform “[Wikiplantbase #Toscana](#)” provides a framework where the full set of georeferenced floristic records of Tuscany (central Italy) can be entered, stored, updated and freely accessed through the Internet. As of 5 January 2015, the database stores 67360 floristic records, referable to 3578 accepted specific and subspecific taxa. Most records are based on published data (80.6% of the total), then by published herbarium specimens (15.1%) and on unpublished field data (3.8%); unpublished herbarium records account only for 0.5% of the stored data. At present the most represented species is the fern *Pteridium aquilinum* (L.) Kuhn subsp. *aquilinum* (Dennstaedtiaceae) with 234 records for 219 localities, but 625 species are still represented only by one record for a single locality. Data acquisition is far from complete, but in slightly more than one year a massive amount of data was accumulated, and can be maintained up-to-date with relatively little effort. This could power several researches like e.g.: 1) taxonomic researches especially on species and genera in Tuscany and Italy; 2) studies on the distribution of diversity across administrative or ecological boundaries; 3) evaluation of conservation status of endangered taxa; 4) static and dynamic range modelling and evolution niche studies.

**Keywords:** biodiversity informatics, database, floristic data, georeferencing, Italy, online platform, phytogeography

## Introduction

Online databasing of plant diversity data became one of the major issues in biodiversity informatics in recent years. An increasing number of databases is now available concerning nomenclature and taxonomy (Euro+Med 2006 onwards, The Plant List 2013 onwards, IPNI 2014), herbarium specimens (anArchive 2003 onwards), invasive alien plant monitoring (SISSI 2014), ecology (Kleyer et al. 2008, Kattge et al. 2011), vegetation (Dengler et al. 2011, Landucci et al. 2012, Schaminée et al. 2012, Šibík 2012, Willner et al. 2012), chromosome numbers (Bedini et al. 2012, Peruzzi and Bedini 2014, Rice et al. 2014), plant rDNA sites (Garcia et al. 2012), genome size (Garcia et al. 2013), DNA sequences (Benson et al. 2013). On the contrary, there are still few publicly available databases storing floristic data, especially at local level: GBIF (<http://www.gbif.org/> – or the BioCASE – <http://www.biocase.org/>) aggregates a large number of primary biodiversity records for the whole world, yet when searching for floristic records (kingdom Plantae) in the minimum convex polygon enclosing Tuscany, only 2224 records are found. Floristic records provide baseline data for researches in plant biology, linking a certain systematic unit to the localities where it is known to occur. Traditionally, printed floras are the “one-stop-shop” to find floristic data for a territory; unfortunately, printed floras are quickly outdated. Therefore, researchers must look for updated data in the scientific literature and herbarium specimens: the longer the time elapsed since the issue of the flora, the heavier the effort. Tuscany (central Italy) is one of the richest Italian region on floristic grounds, either on quantitative or qualitative points of view. According to the figures presented by Peruzzi (2010), this region hosts not less than 3541 specific and subspecific vascular plant taxa, i.e. about 45% of the whole Italian flora (alien species included). 191 taxa are Italian endemics and 59 of them are narrow Tuscan endemics (Peruzzi et al. 2014). Despite this exceptional plant diversity richness, the last regional flora dates back to the mid-19th century (Caruel 1860-1864, integrated by Baroni 1897-1908), followed – during the 20th century up today, by dozens of partial contributions concerning limited geographical areas or single taxonomic groups. Furthermore, a vast body of unpublished, yet reliable, data has been produced in the last two decades by an array of amateur, non-academic botanists who began to explore the regional territory – either individually or as member of formally established associations – to record local floristic data. Hence, any attempt to update such a regional flora must take into account the

acquisition of a vast, heterogeneous and “dormant” documentation, both published and unpublished, as well as any future inclusion or exclusion of taxa, synonymizations, new taxa descriptions, and so on.

We have started the project “[Wikiplantbase #Toscana](#)” (Peruzzi and Bedini 2013 onwards; Fig. 1) to provide a framework where the full set of georeferenced floristic records of Tuscany can be entered, stored, updated and freely accessed through the Internet.

## Material and Methods

### *Data source*

Plant nomenclature follows the on-going update of the Checklist of the Italian vascular flora (Conti et al. 2005, 2007, F. Conti and collaborators, in preparation); consequently, only records of vascular flora are accepted. To implement an automatic connection with Checklist names, these have been stored in a relational Postgresql 8.2 database (TAXBASE), constantly updated by one of the authors (LP) and currently including 8595 accepted names and 5739 synonyms. TAXBASE consists of three tables (NAMES, GENERA, FAMILIES): a recursive relation on the NAMES tables allows to match any specific/subspecific name with its corresponding accepted name. Georeferencing is aided by a place names database fed from SIRA (<http://sira.arpat.toscana.it/sira/Toponomastica/COMUNI.htm>) and from our own datasets, including provinces (3rd-level NUTS; European Commission 2011), municipalities (2nd-level LAU; Eurostat 2015), toponyms and WGS84 geographic coordinates, expressed in decimal degrees. Source referencing is supported by a publication database covering the years 1950-2005 (Scoppola and Magrini 2005), continuously expanded by the collaborators.

A basic record of Wikiplantbase #Toscana includes source type, source, taxon name as reported in source, georeferenced collection/observation place. Whenever possible, the taxon name reported in the source is verified in TAXBASE: the corresponding accepted name is then automatically inserted in a separate field, with no action required to users; when this is not possible (e.g. due to misspelled names or incomplete names), the accepted name is left blank and flagged for subsequent check by a project coordinator.

Data is entered via a HTML data entry form (Fig. 2; see Table I for a list of the entry fields) compatible with any common web browser. Several Javascript functions, linked to entry fields, enforce data homogeneity and integrity. All entered data are validated by a project coordinator. Upon validation, data are freely accessible through the Internet. Data storage is provided free by Google Drive fusion tables in a single flat-file type table, periodically downloaded as an offline backup file. Besides the data provided by the users, the software stores accessory data such as primary key of taxa, user id, date and time of data entry, that are used for data analysis. Thanks to the user-friendly interface, data entry is easily accomplished by people with basic computing skills, allowing a quick increase of records stored in the database. Another form is used to query the dataset. The HTML forms connect with the Fusion Tables data and TAXBASE tables through PHP 5.0 scripts. The platform code was written by the senior author (GB).

#### *Data analysis*

Sampling density across all Tuscan municipalities was represented by a thematic map, with colour intensity proportional to the number of records located within the territories of each municipality. Municipal boundaries were downloaded from ISTAT (<http://www.istat.it/it/archivio/24613>).

Accepted names were plotted against record number, by random subsampling of the dataset and subsequent count of accepted names in the subsample. Curves (inverse-Harris, Michaelis-Menten) were fitted with nls package of R software (R Development Core Team 2014).

#### **Results**

[Wikiplantbase #Toscana](#) has been online since 15 June 2013; its current holdings (updated as of 5 January 2015) are summarised in Table II. They result from the coordinated effort of 19 out of 30 registered users, including several non-academic collaborators. Sampling density across Tuscan territory is heterogeneous (Fig. 3), with four municipalities currently lacking any floristic record: Bucine, Marciano della Chiana, Monte San Savino, Ortignano Raggiolo (all within the province of Arezzo). On the contrary, floristic data are present for all 10 provinces, ranging from 14333 records

for 2162 taxa in the province of Grosseto to 3508 records for 1194 taxa in the province of Prato (data not shown). Most records are based on published data (80.6% of the total), then on published herbarium specimens (15.1%) and so-far unpublished field data (3.8%); unpublished herbarium records account only for 0.5% of the stored data. Figs. 4 and 5 show an example of the output of taxon- and location- based queries. There is a large variation in the number of records species-wise: the fern *Pteridium aquilinum* (L.) Kuhn subsp. *aquilinum* (Dennstaedtiaceae) is represented by 234 records for 219 localities, but 625 species are still represented only by one record for a single locality. According to our subsampling analysis, the number of accepted names is still increasing in a quasi-linear way with the number of records (Fig. 6). The best-fit inverse Harris curve has no upper bound, while second best-fit Michaelis-Menten curve is bound by its asymptote at 3821 taxa.

## Discussion

Our results suggest that data acquisition is far from complete – in agreement with the low frequency of unpublished herbarium records – and that the Tuscan flora is expected to exceed the 3541 units reported in Peruzzi (2010; current figure: 3810 taxa, L. Peruzzi and B. Pierini, unpublished data). Presently, about 30% of the data published in the early seminal works of Caruel (1860-1864) and Baroni (1897-1908) were entered in the database, and we seek for a completion during the next one/two years. On the contrary, the insertion of several other important literature sources is already completed, such as Fiori (1943), Marchetti (1992), Chiarucci et al. (1993), Baldini (1998, 2001), Selvi (1998), Mazzeschi and Selvi (1999), Garbari (2001), Angiolini et al. (2002), Biagioli et al. (2002), Selvi and Bettini (2004), Gabellini et al. (2006), Lastrucci and Raffaelli (2006), Venturi (2006), Foggi et al. (2007), Frignani et al. (2004, 2008), Pierini et al. (2009), Mereu et al. (2010), Rizzotto (2010), Peruzzi et al. (2011), Gestri & Peruzzi (2012).

The need of further data is even more evident if the provincial level is considered. For instance, in a recent survey of the vascular flora in the province of Lucca, Pierini and Peruzzi (2014) recorded 2333 taxa. In our dataset, only distributive data for 1746 taxa (ca. 75%) are available for this area. However, for certain taxonomic groups (i.e. lycophytes, ferns and fern allies) we can retain the coverage as nearly complete.



Despite these shortcomings, Wikiplantbase #Toscana is currently the web site with the largest amount of publicly accessible primary biodiversity data for vascular plants in Tuscany. With its >67,000 records, it is still growing rapidly, and is on its way towards the full representativeness of the Tuscan vascular flora.

We speculate that about 300K records are needed to have a nearly complete coverage of the data available in literature, requiring a continuing effort in data entry from users and possibly from batch operations enabled by collaborative agreements with individuals and institutions wishing to share large amounts of data.

Such a massive dataset, updated with relatively little effort as regards data entry, could power several lines of research, such as: 1) taxonomic and floristic studies, especially on species and genera in Tuscany and Italy; 2) studies on the distribution of diversity across administrative or ecological boundaries; 3) evaluation of conservation status of endangered taxa; 4) static and dynamic range modelling and evolution niche studies. Thanks to the localisation on the map, our platform provides an instantaneous geographic pattern at both regional and local scale if desired. This important feature will constantly improve with the continuous input of new records. Furthermore, with minor software tweaking, the online platform [Wikiplantbase #Toscana](#) might be adopted in other contexts, resulting in a well connected network of regional floristic databases suited to exploit the involvement – still largely untapped – of non-academic collaborators, as advocated by citizen science (Cohn 2008, Bonney et al. 2009, Silvertown 2009). As a demonstration of this, during summer 2014, we were contacted by researchers from University of Sassari (Sardinia), interested to replicate our platform for their region. As a result, since 17 November 2014, [Wikiplantbase #Sardinia](#) is available online, with 1020 records available as of 5 January 2014 (Bagella et al. 2014 onwards).

Future developments will a) improve the integration between floristic records and TAXBASE, b) provide a number of geographic query options, such as what and how many species are bound by a polygon (for instance an administrative border or an ecological boundary), by a fixed-radius circle within any point on the map, or by a fixed-size grid, like e.g. the grid used to assess IUCN risk category in the Red List of the Italian Flora (Rossi et al., 2013), and c) support a broader geographic scope of the database. This will require moving the data from the current FusionTables database to a

more powerful, SQL-compliant database engine with support for geographic queries. This transition, enabling a stronger support to floristic, taxonomic, and conservation projects at national level, is already in progress and will be completed by June 2015. Following this upgrade, it will be possible to link the database to the Italian National Biodiversity Network (Martellos et al., 2011).

### Acknowledgements

The authors wish to thank the registered users: Giuliano Pacifico, Antonino Messina, Antonio Zambrini, Mairo Mannocci, Massimo Mirabile, Angelino Carta, Angius, Roberto Dell'Orso, Duccio Tampucci and Ugo Macchia, who all contributed with less than 500 records entered in the database, to date, and Gabriele Cacialli, Lorenzo Cecchi, Mauro Contorni, Umberto Ferrando, Giulio Ferretti, Michele Fiorentino, Marco La Rosa, Simonetta Peccenini, Rossana Poli, Alessandra Sani, Adriano Soldano, Paolo Emilio Tomei, who have not yet entered data. Thanks are due also to Enio Nardi for useful suggestions which greatly improved the design of entry form structure.

### References

- anArchive 2003 onwards. anArchive. [www.anarchive.it](http://www.anarchive.it). Accessed 5 January 2014.
- Angiolini C, Riccucci C, De Dominicis V 2002. La Flora vascolare della Riserva Naturale Lago di Burano (Grosseto, Toscana meridionale). *Webbia* 57(1): 115-152.
- Bagella S, Filigheddu R, Peruzzi L, Bedini G (eds) 2014 onwards. Wikipantbase #Sardegna v. 1.0. [www.biologia.uniroma3.it/ortobotanico/FloraSardegna/flosar\\_start.html](http://www.biologia.uniroma3.it/ortobotanico/FloraSardegna/flosar_start.html). Accessed 5 January 2014.
- Baldini RM 1998. Flora vascolare dell'Isola del Giglio (Arcipelago Toscano): revisione tassonomica ed aggiornamento. *Webbia* 52(2): 307-404.
- Baldini RM 2001. Flora vascolare dell'Isola di Giannutri (Arcipelago Toscano). *Webbia* 56(1): 69-125.
- Baroni E 1897-1908. Supplemento generale al "Prodrromo della Flora Toscana di T. Caruel". Firenze.
- Bedini G, Garbari F, Peruzzi L 2012. Karyological knowledge of Italian vascular flora as inferred by the analysis of "Chrobase.it". *Plant Biosyst* 146(4): 889-899.
- Benson DA, Cavanaugh M, Clark K, Karsch-Mizrachi I, Lipman DJ, Ostell J, Sayers EW 2013. GenBank. *Nucleic Acids Res* 41(Database issue): D36-D42. doi:10.1093/nar/gks1195
- Biagioli M, Gestri G, Acciai B, Messina A 2002. Fiori sulla pietra. Flora vascolare illustrata delle ofioliti e delle altre terre del Monteferrato in Toscana. Gramma Perugia, Ed. Com. Montemurlo.
- Bonney R, Cooper CB, Dickinson J, Kelling S, Phillips T, Rosenberg KV, Shirk J 2009. Citizen science: a developing tool for expanding science knowledge and scientific literacy. *BioScience* 59(11): 977-984.
- Caruel T 1860-1864. Prodrromo della Flora Toscana. Firenze.
- Chiarucci A, Mariotti MG, De Dominicis V 1993. Ricerche geobotaniche in Val di Merse (Toscana meridionale).4. Contributo alla conoscenza della Flora della Val di Farma. *Webbia* 47(2): 277-311.

- Cohn JP 2008. Citizen science: can volunteers do real research? *BioScience* 58(3): 192-197.
- Conti F, Abbate G, Alessandrini A, Blasi C (eds) 2005. An annotated checklist of the Italian vascular flora. Palombi Editori, Roma.
- Conti F, Alessandrini A, Bacchetta G, Banfi E, Barberis G, Bartolucci F, Bernardo L, Bouvet D, Bovio M, Del Guacchio E, Frattini S, Galasso G, Gallo L, Gangale C, Gottschlich G, Grünanger P, Gubellini L, Lucarini D, Marchetti D, Moraldo B, Peruzzi L, Poldini L, Prosser F, Raffaelli M, Santangelo A, Scassellati E, Scortegagna S, Selvi F, Soldano A, Tinti D, Ubaldi D, Uzunov D, Vidali M 2007. Integrazioni alla checklist della flora vascolare italiana. *Natura Vicentina* 10 (2006): 5-74.
- Dengler J, Jansen F, Glöckler F, Peet RK, De Cáceres M, Chytrý M, Ewald J, Oldeland J, Lopez-Gonzalez G, Finckh M, Mucina L, Rodwell JS, Schaminée JHJ, Spencer N 2011. The Global Index of Vegetation-Plot Databases (GIVD): a new resource for vegetation science. *J Veg Sci* 22(4): 582-597.
- Euro+Med 2006 onwards. Euro+Med PlantBase – the information resource for Euro-Mediterranean plant. [www2.bgbm.org/EuroPlusMed/](http://www2.bgbm.org/EuroPlusMed/). Accessed 5 January 2014.
- European Commission 2011. Nomenclature of territorial units for statistics. NUTS 2010/EU-27. Publications Office of the European Union, Luxembourg. doi:10.2785/15544
- Eurostat 2015. Local Administrative Units. [http://ec.europa.eu/eurostat/c/portal/layout?p\\_l\\_id=345247&p\\_v\\_l\\_s\\_g\\_id=0](http://ec.europa.eu/eurostat/c/portal/layout?p_l_id=345247&p_v_l_s_g_id=0). Accessed 5 January 2015.
- Fiori A 1943. *Flora Italica Cryptogama. Pars V: Pteridophyta*. Società Botanica Italiana, Firenze.
- Foggi B, Gennai M, Gervasoni D, Ferretti G, Rosi C, Viciani D, Venturi E 2007. La carta della vegetazione del SIC Alta Valle del Sestaione (Toscana nord-occidentale). *Parlatorea* 9: 41-78.
- Frignani F, Angiolini C, Selvi F, De Dominicis V 2004. La Flora vascolare della Riserva Naturale Regionale "Cornate - Fosini" (Toscana Meridionale). *Webbia* 59(1): 395-455.
- Frignani F, Giallonardo T, Angiolini C, Selvi F 2008. La Flora vascolare della Riserva Naturale "Monte Penna" (Grosseto, Toscana meridionale). *Webbia* 63(1): 81-107.
- Gabellini A, Viciani D, Lombardi L, Foggi B 2006. Contributo alla conoscenza della vegetazione dell'alta Garfagnana Appenninica (Toscana Settentrionale). *Parlatorea* 8: 65-98.
- Garbari F 2001. La flora di S. Rossore (Pisa) aggiornata al 1999. *Atti Soc Tosc Sci Nat, Mem, Ser B* 107 (2000): 11-42.
- Garcia S, Garnatje T, Kovařík A 2012. Plant rDNA database: ribosomal DNA loci information goes online. *Chromosoma* 121(4): 389-394.
- Garcia S., Leitch I.J., Anadon-Rosel A., Canela MÁ, Gálvez F, Garnatje T, Gras A, Hidalgo O, Johnston E, Mas de Xaxars G, Pellicer J, Siljak-Yakovlev S, Vallès J, Viales D, Bennett MD 2013. Recent updates and developments to plant genome size databases. *Nucleic Acids Res* 42(Database issue): D1159-D1166. doi:10.1093/nar/gkt1195
- Gestri G, Peruzzi L 2012. La flora vascolare del Monte Pelato (Colline Livornesi, Toscana). *Atti Soc Tosc Sci Nat, Mem, ser B* 118 (2011): 25-38.

- Klattge J, Díaz S, Lavorel S, Prentice IC, Leadley P, Bönisch G, Garnier E, Westoby M, Reich PB, Wright IJ, Cornelissen JHC, Violle C, Harrison SP, Van Bodegom PM, Reichstein M, Enquist M, Soudzilovskaia NA, Ackerly DD, Anand M, Atkin O, Bahn M, Baker TR, Baldocchi D, Bekker R, Blanco CC, Blonder B, Bond WJ, Bradstock R, Bunker DE, Casanoves F, Cavender-Bares J, Chambers JQ, Chapin III FS, Chave J, Coomes D, Cornwell WK, Craine JM, Dobrin BH, Duarte L, Durka W, Elser J, Esser G, Estiarte M, Fagan WF, Fang J, Fernández-Méndez F, Fidelis A, Finegan B, Flores O, Ford H, Frank D, Freschet GT, Fyllas NM, Gallagher RV, Green WA, Gutierrez AG, Hickler T, Higgins SI, Hodgson JG, Jalili A, Jansen S, Joly CA, Kerkhoff AJ, Kirkup D, Kitajima K, Kleyer M, Klotz S, Knops JMH, Kramer K, Kühn I, Kurokawa H, Laughlin D, Lee TD, Leishman M, Lens F, Lenz T, Lewis SL, Lloyd J, Llusà J, Louault F, Ma S, Mahecha MD, Manning P, Massad D, Medlyn BE, Messier J, Moles AT, Müller SC, Nadrowski K, Naeem S, Niinemets Ü, Nöllert S, Nüske A, Ogaya R, Oleksyn J, Onipchenko VG, Onoda Y, Ordoñez J, Overbeck G, Ozinga WA, Patiño S, Paula S, Pausas JG, Peñuelas J, Phillips OL, Pillar V, Poorter H, Poorter L, Poschlod P, Prinzing A, Proulx R, Rammig A, Reinsch S, Reu B, Sack L, Salgado-Negret B, Sardans J, Shiodera S, Shipley B, Siefert A, Sosinski E, Soussana J-F, Swaine E, Swenson N, Thompson K, Thornton P, Waldram M, Weiher E, White M, Wright SJ, Yguel B, Zaehle S, Zanne AE, Wirth C 2011. TRY – a global database of plant traits. *Global Change Biol* 17(9): 2905-2935.
- Kleyer M, Bekker RM, Knevel IC, Bakker JP, Thompson K, Sonnenschein M, Poschold P, Van Groenendael JM, Klimeš L, Klimešová J, Klotz S, Rusch S, Hermy M, Adriaens D, Boedeltje G, Bossuyt B, Dannemann A, Endels P, Götzenberger L, Hodgson JG, Jackels A-K, Kühn I, Kunzmann D, Ozinga WA, Römermann C, Städler M, Schlegelmilch J, Steedam HJ, Tackenberg O, Wilmann B, Cornelissen JHC, Eriksson O, Garnier E, Peco B 2008. The LEDA Traitbase: a database of life-history traits of the Northwest European flora. *J Ecol* 96(6): 1266-1274.
- IPNI 2014. The International Plant Names Index. [www.ipni.org](http://www.ipni.org). Accessed 5 January 2014
- Landucci F, Acosta ATR, Agrillo E, Attorre F, Biondi E, Cambria VE, Chiarucci A, Del Vico E, De Sanctis M, Facioni L, Geri F, Gigante D, Guarino R, Landi S, Lucarini D, Panfilì E, Pesaresi S, Prisco I, Rosati L, Spada F, Venanzoni R 2012. VegItaly: the Italian collaborative project for a national vegetation database. *Plant Biosyst* 146(4): 756-763.
- Lastrucci L, Raffaelli M 2006. Contributo alla conoscenza della flora delle zone umide planiziarie e collinari della Toscana orientale: la provincia di Arezzo (Italia centrale). *Webbia* 61(2): 271-304.
- Martellos S, Attorre F, De Felici S, Cesaroni D, Sbordoni V, Blasi C, Nimis PL 2011. Plant sciences and the Italian National Biodiversity Network. *Plant Biosyst* 145(4): 758-761.
- Mazzeschi A, Selvi F 1999. The vascular flora of Monte Cetona (SE Tuscany, Italy). *Fl Medit* 9:185-214
- Mereu L, Lastrucci L, Viciani D (2010) Contributo alla conoscenza della vegetazione del fiume Pesa (Toscana, Italia centrale). *Stud Bot* 29: 105-143.
- Peruzzi L 2010. Segnalazioni floristiche per le regioni italiane 2005-2010: una prima analisi dei dati a 5 anni dalla pubblicazione della Checklist della flora vascolare italiana. In: Peccenini S., Domina G., Salmeri C (eds) *La biodiversità vegetale in Italia: aggiornamenti sui gruppi critici della flora vascolare*. Società Botanica Italiana, Firenze, pp. 9-10.

- Peruzzi L, Barbo M, Bartolucci F, Bovio M, Carta A, Ciccarelli D, Conti F, Costalonga S, Di Pietro R, Galasso G, Gestri G, Lattanzi E, Lavezzo P, Marsili S, Peccenini S, Pierini B, Tardella FM, Terzo V, Turrisi RE, Bedini G 2011. Contributo alla conoscenza floristica delle Colline Pisane: resoconto dell'escursione del Gruppo di Floristica (S.B.I.) nel 2009. *Inform Bot Ital* 43(1): 3-27.
- Peruzzi L, Bedini G (eds) 2013 onwards. *Wikiplantbase #Toscana* v. 1.0. [www.biologia.unipi.it/ortobotanico/FloraToscana/flotos\\_start.html](http://www.biologia.unipi.it/ortobotanico/FloraToscana/flotos_start.html). Accessed 5 January 2014.
- Peruzzi L, Bedini G 2014. Online resources for chromosome number databases. *Caryologia* 67(4): 292-295.
- Peruzzi L, Conti F, Bartolucci F 2014. An inventory of vascular plants endemic to Italy. *Phytotaxa* 168(1): 1-75.
- Pierini B, Garbari F, Peruzzi L 2009. Flora vascolare del Monte Pisano (Toscana nord-occidentale). *Inform Bot Ital* 41(2): 147-213.
- Pierini B, Peruzzi L 2014. Prodrómo della flora vascolare della provincia di Lucca. *Inform Bot Ital* 46(1): 3-16 + online appendix (500 pp.)
- R Development Core Team 2014. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. <http://www.rproject.org/>. Accessed 5 January 2014.
- Rice A, Glick L, Abadi S, Einhorn M, Kopelman NM, Salman-Minkov A, Mayzel J, Chay O, Mayrose I 2014. The Chromosome Counts Database (CCDB) – a community resource of plant chromosome numbers. *New Phytol*: in press. doi:10.1111/nph.13191
- Rizzotto M 2011. Flora of the Island of Gorgona. *Webbia* 66(1): 85-118.
- Rossi G, Montagnani C, Gargano D, Peruzzi L, Abeli T, Ravera S, Cogoni A, Fenu G, Magrini S, Gennai M, Foggi B, Wagensommer RP, Venturella G, Blasi C, Raimondo FM, Orsenigo S (eds) 2013. Lista Rossa della Flora Italiana. 1. Policy Species e altre specie minacciate. Comitato Italiano IUCN e Ministero dell'Ambiente e della Tutela del Territorio e del Mare, 54 pp.
- Schaminée JHJ, Hennekens SM, Ozinga WA 2012. The Dutch National Vegetation Database. *Biodiv Ecol* 4:201-209.
- Scoppola A, Magrini S (eds) 2005. Floristic references: a 1950-2005 database. In: Scoppola A, Blasi C (eds) *Stato delle conoscenze sulla flora vascolare d'Italia*. Palombi editori, Roma, CD-ROM attached.
- Selvi F 1998. Flora vascolare del Monte Leoni (Toscana Meridionale). *Webbia* 52(2): 265-306.
- Selvi F, Bettini D 2004. La flora di Monterufoli-Caselli in Val di Cecina (Toscana): un'area protetta di rilevante interesse botanico. *Webbia* 59(2): 349-393.
- Šibík J 2012. Slovak Vegetation Database. *Biodiv Ecol* 4: 429.
- Silvertown J 2009. A new dawn for citizen science. *Trends Ecol Evol* 29(9): 467-471.
- SISSI 2014. SISSI. Sistema di Segnalazione delle Specie Invasive. [sissi/divulgando.eu](http://sissi/divulgando.eu). Accessed 5 January 2014.
- The Plant List 2013 onwards. Version 1.1. [www.theplantlist.org](http://www.theplantlist.org). Accessed 5 January 2014.
- Thiers B 2015. Index Herbariorum: A global directory of public herbaria and associated staff. New York Botanical Garden's Virtual Herbarium. <http://sweetgum.nybg.org/ih/>. Accessed 5 January 2015.

Venturi E 2006. Flora vascolare delle valli della Limentra Orientale e della Limentrella (Province di Pistoia e Prato). *Parlatorea* 8: 11-46.

Willner W, Berg C, Heiselmayer P 2012. Austrian Vegetation Database. *Biodiv Ecol* 4: 333.

Accepted Manuscript

TABLE I. Fields of the online entry form to record floristic data into Wikiplantbase #Toscana.

1.record kind (3 fields)	observation; literature; published herbarium specimen; unpublished herbarium specimen	present; doubtful; to be excluded	native; invasive alien; naturalized alien; casual alien; cultivated
2.original name used for the record (3 fields)	Family	Genus	Species/subspecies
3.accepted name (3 fields, automatically filled)	Family	Genus	Species/subspecies
4.record date		day, month, year	
5a.Locality (3 fields)	province	municipality	locality toponym
5b.locality as reported in the original source		copied exactly from the source	
6a.coordinates (WGS84, automatically filled if the toponym is in the database)		decimal degrees	
6b.accuracy		1.low (region or a very large geographical portion of the region) 2.above 50 Km (but still a restricted portion of the region) 3.between 10 and 50 Km 4.between 1 and 10 Km 5.less than 1 Km	
7.habitat (optional, 3 fields)	Corine code L1	Corine code L2-3	free text
8.elevation (optional)		m a.s.l.	
9.herbarium (2 fields)	herbarium acronym (Thiers 2015)	official collector(s)	
10.literature reference (automatically filled if the reference is in the database)	Surname N., Year. Title. Journal volume(issue): initial page-end page.		
11.notes (optional)	free text		
12.additional literature reference (optional)	Surname N., Year. Title. Journal volume(issue): initial page-end page.		

TABLE II. Current holdings stored in Wikiplantbase #Toscana.

N° stored records	67360
N° accepted specific and subspecific taxa	3578
N° genera	994
N° families	154
N° localities	5906
N° literature references	779





# Wikiplantbase #Toscana

**Editori:**  
L. Peruzzi, G. Bedini, Università di Pisa



**Wikiplantbase #Toscana**  
verso un catalogo collaborativo, online e gratuito delle piante vascolari di Toscana

**67360**  
segnalazioni archiviate

#### RICERCA

- [ [segnalazioni](#) ]
- [ [toponimi](#) ]\*
- [ [fonti bibliografiche](#) ]\*

#### INSERIMENTO DI DATI

- [ [Inserisci nuove segnalazioni](#) ]\*
- [ [Rivedi le tue segnalazioni](#) ]\*
- [ [Non ho i codici di accesso, come faccio?](#) ]
- [ [Guida all'inserimento di nuove segnalazioni](#) ]
- [ [Verifica segnalazioni](#) ] (riservato ai curatori)

#### IL PROGETTO

- [ [Sommaro](#) ]
- [ [Statistiche](#) ]
- [ [Densità delle segnalazioni](#) ]

#### Collaboratori:

Gianni Bedini (gianni); Gianmaria Bonari (bonari); Gabriele Cacialli (gabriele); Katia Caparelli (katia); Angelino Carta (apicolo); Lorenzo Cecchi (lorec); Mauro Contorni (mauro); Marco D'Antraccoli (marco); Roberto Dell'Orso (roberto); David Dolci (david); Umberto Ferrando (umberto); Giulio Ferretti (ferretti); Michele Fiorentino (michele); Giovanni Gestri (giovanni); Marco La Rosa (quindici); Ugo Macchia (mare); Mairo Mannocci (mairo); Antonino Messina (nino); Massimo Mirabile (mm70it); Giuliano Pacifico (giuliano); Simonetta Peccenini Gardini (pecce); Lorenzo Peruzzi (lorenzo); Brunello Pierini (brunello); Rossana Poli (rossana); Francesco Roma-Marzio (marzio); Alessandra Sani (ale); Adriano Soldano (adriano); Duccio Tampucci (duccio); Paolo Emilio Tomei (paolo); Antonio Zambrini (antonio).

Trovaci su Facebook



Flora della Toscana  
✓ Mi piace Ti piace.

Flora della Toscana piace a te e altre 566 persone.

Plugin sociale di Facebook

Colladato per [Mozilla Firefox](#) e [Google Chrome](#). Citazione suggerita: Peruzzi L., Bedini G (eds), 2013. Wikiplantbase #Toscana v1.0. [http://www.biologia.unipi.it/ortobotanico/FloraToscana/flotos\\_start.html](http://www.biologia.unipi.it/ortobotanico/FloraToscana/flotos_start.html) Informazioni [Lorenzo](#)

Peruzzi, Gianni Bedini Ultimo aggiornamento: 23 agosto 2014

Fig. 1. Wikiplantbase #Toscana homepage as of 5 January 2015 ([http://www.biologia.unipi.it/ortobotanico/FloraToscana/flotos\\_start.html](http://www.biologia.unipi.it/ortobotanico/FloraToscana/flotos_start.html)).

INSERIMENTO DI NUOVA SCHEDA: inserire i dati e cliccare sul pulsante "Invia" in fondo alla scheda

**1. Tipo di reperto:** Scegli il tipo!

*Inserire il tipo di reperto tramite l'elenco a tendina di sinistra. Se la segnalazione si riferisce a un'esclusione dalla flora, selezionare "esclusione" dall'elenco a tendina di destra.*

**2. Sub:** \*\*\*Scegli famiglia  \*\*\*Scegli specie

*Inserire il nome indicato sul quaderno di campagna, sul cartellino d'erbario o nella fonte bibliografica*

**3. Nome scientifico:** \*\*\*Scegli famiglia  \*\*\*Scegli specie

*Inserire il nome oggetto di segnalazione secondo la Checklist e successivi aggiornamenti*

**4. Data del reperto:**

*Inserire la data di raccolta/osservazione in base al reperto (g/mmm/aaaa, es: 17 Mar 1861; 2 Jun 1946)*

**5a. Prov., comune, loc.:** \*\*\*Scegli provincia  \*\*\* Località

**5b. Località precisa:**

*Inserire provincia, comune tramite l'elenco a tendina e la località nella casella di testo. Eventuali precisazioni sulla località vanno nella seconda riga*

**6a. Coordinate:**

**6b. Accuratezza:**  1 (Reg)  2 (> 50 km)  3 (> 10 km)  4 (> 1 km)  5 (< 1 km)

*Inserire lat e long nel formato decimale, di Google Maps (meglio se con "copia e incolla")*

**7. Ambiente:** \*\*\*Cod. Corine L1

*Inserire informazioni sull'ambiente di raccolta/osservazione*

**8. Quota:**

*Inserire la quota in m sul livello del mare*

**9. Erbario** \*\*\* Sigla IH  \*\*\* Legit

*Per i campioni d'erbario inserire la sigla internazionale dell'erbario e il nome dei raccoglitori*

**10. Fonte bibliografica:** \*\*\* Fonte bibliografica della segnalazione (per esteso)

**11. Note:**

**12. Bibliografia suppl.:** \*\*\* Fonti bibliografiche supplementari

Fig. 2. Data entry form. See Table 1 for more information about the fields.

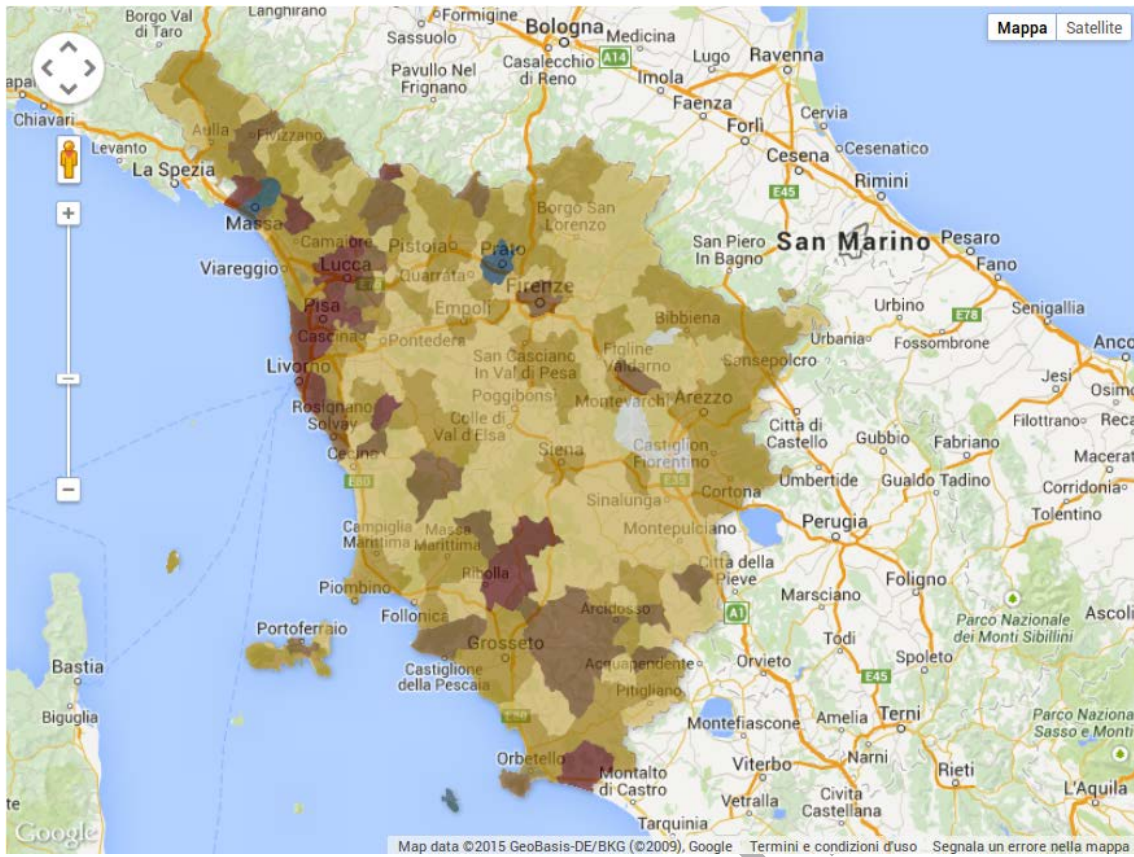


Fig. 3. Floristic records in Tuscan municipalities. White = 0; shades of brown = 1-100; 101-500; 501-1000; 1001-2000; blue => 2000.



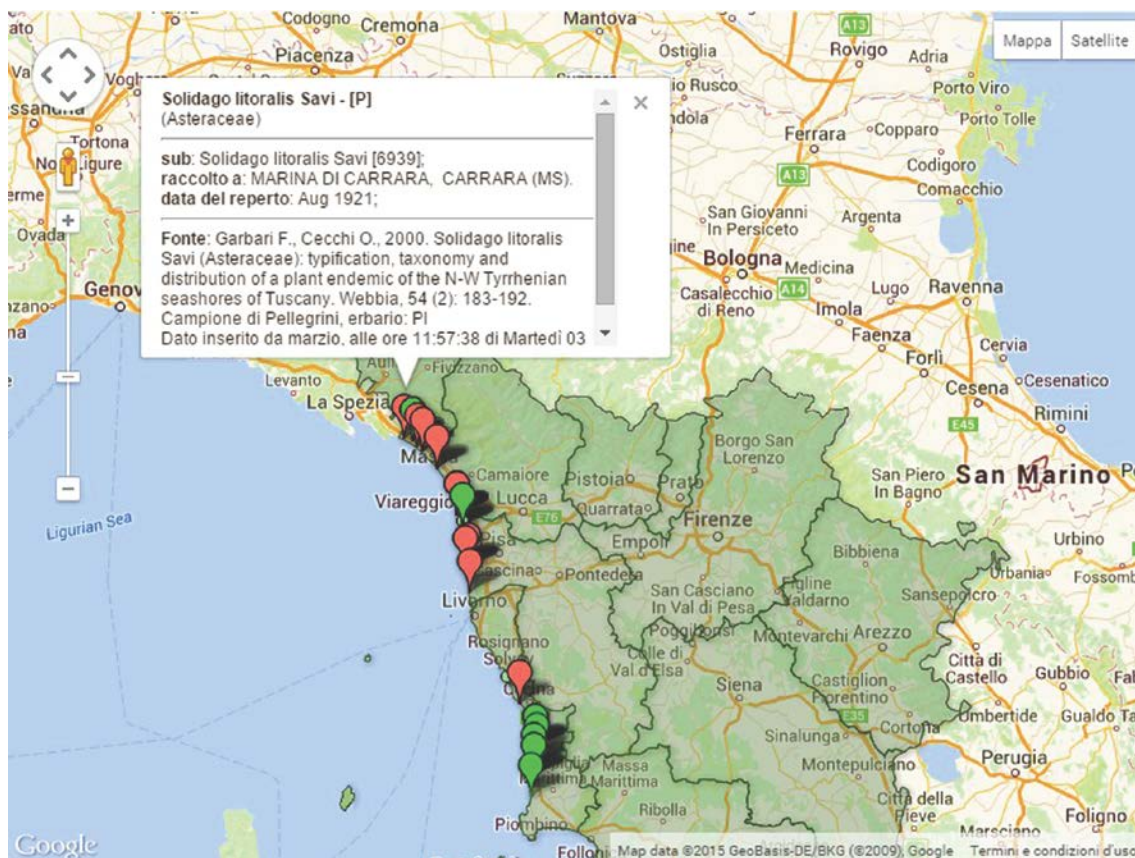


Fig. 4. Map output for a taxon-based query, showing georeferenced records for the narrow endemic *Solidago litoralis* Savi (Asteraceae). Red drop: herbarium/bibliographic record  $\leq$  1950; green drop: herbarium/bibliographic record  $>$  1950. Note the balloon graphic with record data, activated by clicking on the drops. A textual output is also produced, not shown here.

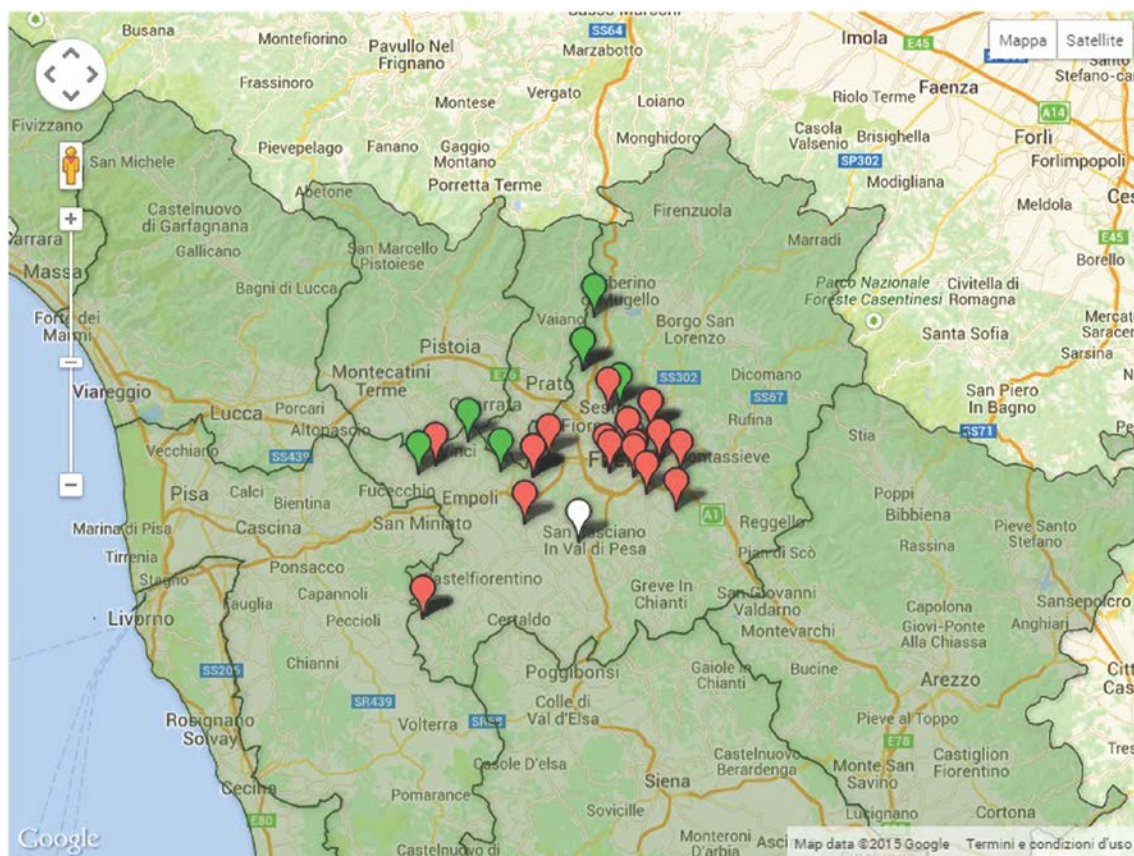


Fig. 5. Map output for a location-based query, showing georeferenced records for species of the genus *Sternbergia* (Amaryllidaceae) in the province of Florence. Red drop: herbarium/bibliographic record  $\leq 1950$ ; green drop: herbarium/bibliographic record  $> 1950$ ; white drop: herbarium/bibliographic record without date available.

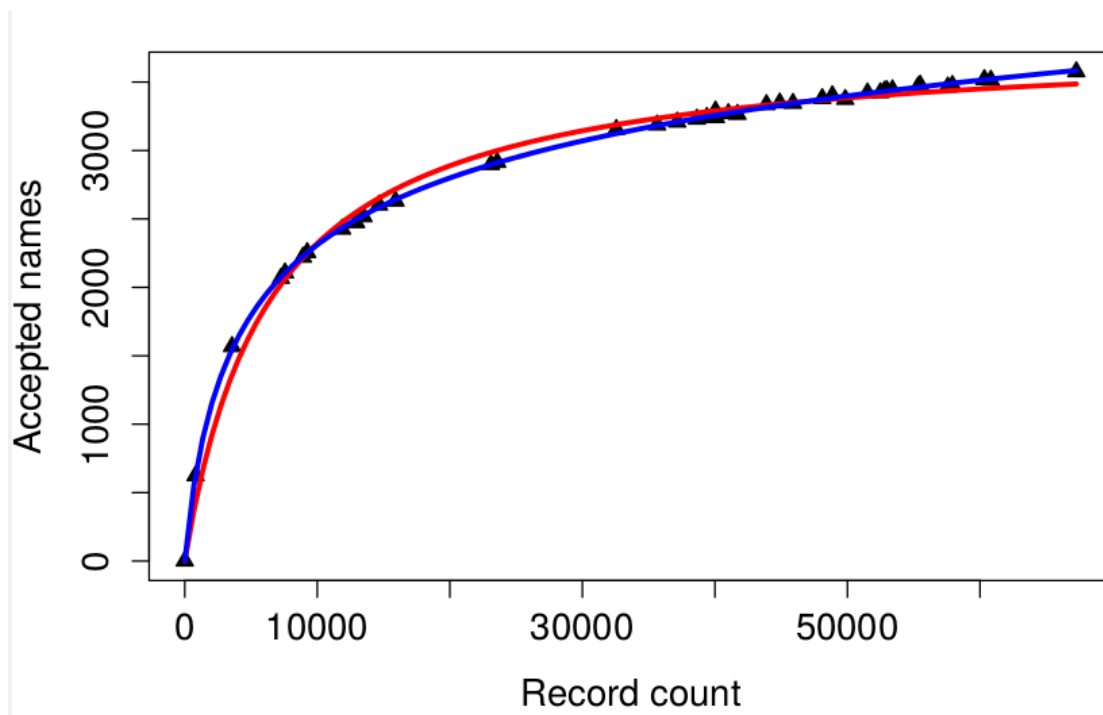


Fig. 6. Plot of accepted names ( $n$ ) against record number. Triangles: experimental data obtained by random subsampling of the dataset and subsequent count of accepted names in the subsample. Lines: fitted functions, blue = inverse Harris  $f(x) = x / (0.9112 + 0.0012 * x^{0.8675}) + 0.4519$  (RSE = 13.85, df = 37), red = Michaelis-Menten  $f(x) = 3821.28 * x / (6456.74 + x)$  (RSE = 65.39, df = 39).