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The Estonian eFlora

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Abstract — The Estonian eFlora is an example of the new e-learning tools prepared by the *KeyToNature* consortium. It is an interactive digital identification key for more than 1000 plant species recorded from Estonia. The tool is freely available on the internet - in Estonian and English - and has two interfaces (dichotomous and multi-entry), which allow the identification of species using different approaches. Another tool developed by *KeyToNature*, the OpenKeyEditor, allows users not only to edit the text of the existing master key, but also to produce mini-keys restricted to smaller subsets of taxa (e.g. the plants of a park, or a scool garden), and to add user-generated content to them. The reaction to these tools from public media and educational circles has been very positive.

Index Terms — education, Estonia, e-tools, identification, key, plants.

1 Introduction

In the framework of the three-year EU project *KeyToNature* (http://www.keytonature.eu/), where partners from eleven European countries collaborate to produce practical, user-friendly identification tools targeted at the wide audience of teachers and learners, national and/or local keys have been developed for each participating country. Many digital interactive keys for vascular plants and lichens were created using software FRIDA (FRiendly IDentificAtion) and the databases for Italian plants (*Dryades*) and lichens (*Italic*) developed at the University of Trieste, Italy [1], [2].

The new e-learning tools produced by *KeyToNature* have several advantages when compared to the traditional key-books, allowing to widen the users' circle considerably. The new tools can be produced automatically and rapidly by a computer, since the characters are stored in a database. They are created giving more weight to those easy-to-observe characters which make the identification easier to laypersons, such as the colour of flowers, the position and shape of leaves, etc. Once published online, the resulting keys can be updated or edited easily and in real time. Furthermore, there are almost unlimited possibilities to use pictures and drawings to illustrate both the diagnostic characters and the species.

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Estonia is a small North-European country (ca 45 000 km^2, population ca 1,4 million, with a vascular flora of about 1500 species) which was selected as a case study. We wanted to test: 1) whether the database of Italian plants of *Dryades*, including ca 7000 species, is suitable for creating identification keys in other parts of Europe (especially in its northern areas), and 2) whether a digital national-level identification tool would be accepted and practically used by a wide circle of professional and non-professional users, including schoolchildren and students.

2 The Estonian eFlora

2.1 General data

The Estonian eFlora is an interactive digital identification key for ca 1100 plant species (out of ca 1500 native taxa recorded from Estonia [3]). The key also includes, besides indigenous and naturalised taxa, ca. 70 species of introduced trees and shrubs for allowing users to get acquainted with the urban forests. Some taxa which are difficult to separate even for specialists (e.g. species from the genera *Alchemilla, Crataegus, Hieracium, Rosa, Salix, Taraxacum* etc.) are excluded from this key, as well as several very rare species.

The key is currently freely available online in Estonian and in English (http://dbiodbs.univ.trieste.it/carso/chiavi_pub21?sc=368). It has both a dichotomous and a multi-entry interface, which allow identification using different approaches.

2.2 Dichotomous interface

The dichotomous interface is the main instrument of the key, that permits determination of taxa by selecting step by step between two states of a character. For making a selection, one has to click on the corresponding statement-button, after which the next pair of statements is displayed, and so on. A great advantage for beginners is that most character states are richly illustrated by drawings and pictures. At every step of the identification process one can see the number of remaining taxa; clicking on this number, the list of remaining taxa is displayed. At the end of the identification process, the name and a picture of the identified species are shown, and by clicking on the name a taxon page will open.

2.3 Multi-entry interface

In the multi-entry interface the user can choose several characters of a plant in a single step. One just has to specify the characters, click ‘submit’ and wait for a few seconds. The system “filters” the key and gives back a usually strongly reduced list of taxa and – upon request - a smaller dichotomous key for them. This interface can be particularly useful for more expert users, e.g. those who already know the family or the genus of a plant, since it can also produce keys for all species within a family or a genus. It is also the quickest way to go directly to a taxon page by just typing a species’ name.

2.4 Taxon pages

Taxon pages have been compiled for each species to provide important information. The pages in Estonian are more informative than those in English, since they contain short descriptions with the main diagnostic characters, distributional and ecological data, as well as the conservation status of the plant. For most species, distribution maps from the Atlas of the Estonian flora [4] are also displayed. Another attractive feature of the key is that numerous illustrations are available for each species. By clicking on an image, this is strongly magnified, showing even the smallest details. The *Dryades* picture archive presently includes ca. 63.000 pictures of ca. 7300 infrageneric taxa, and is being continuously enriched with new photos and drawings, which in real time become visible also in the online version of the Estonian key.

2.5 OpenKeyEditor

One of the main aims of *KeyToNature* is that of introducing computer-aided identification tools in the educational systems of Europe, including elementary schools. Therefore, one of the main goals is that of rendering our tools as easy as possible. The “difficulty” of a key depends on several factors, such as the selection of characters, the type of interface, the terminology which is used. However, it is obvious that smaller keys (those with fewer species) are generally easier than larger ones. We can now automatically produce identification tools restricted to small subsets of taxa, thanks to the OpenKeyEditor, which we are using also for the Estonian eFlora. This tool allows users to:

1. view and edit the text of the key;
2. add or remove a dichotomy;
3. create smaller keys which are filtered from the master key;
4. automatically generate stand-alone keys for computers and/or smartphones;
5. add user-generated content to the new mini-keys (e.g. adding photos, inserting new text, modifying the terminology, etc.).

Modifying the text of an existing key is easy: it does not require any knowledge of informatic codes or languages, but just the use of a common web browser: one has just to type the changes into the appropriate window. A further function of the OpenKeyEditor permits to create a filter for generating a mini-key (e.g. a key to the plants found in a region of Estonia or in a pond near a school). The filter is just a list of species. To create it, one has just to flag them in a page which lists all taxa included in the Estonian eFlora. The generation of a new mini-key from a filter is easy as well: once the filter is ready, with a single command (“make a key from a filter”) the mini-key is generated in a few seconds.

The filtered mini-keys are visible online in real time, since they are produced and hosted by a *KeyToNature* server. However, users may want a stand-alone version of their mini-key. The OpenKeyEditor of *KeyToNature* can produce three different types of stand-alone versions: 1) a CD-Rom version, usable on any computer, 2) a version for PDAs, 3) A version for the i-Phone, which can be disseminated via iTunes.

The use of the OpenKeyEditor for the Estonian eFlora has - for the time being - a restricted access. If you want to use it, please send an e-mail to the Estonian *KeyToNature* contact person (andres.saag@ut.ee).

3 Users' feedback

The Estonian eFlora online was first presented to a wide audience of students, teachers and citizens in Tartu (September 2009), on the occasion of a yearly meeting of *KeyToNature*. The presentation was broadly and positively reflected in the national media [5], [6], [7], contributing considerably to the progress of public interest. In the first week only, more than 1700 users (or just watchers) visited our site.

The first part of the eFlora, limited to woody plants, was available online much earlier, with applications for iPhone, iPodTouch and iPad from iTunes [8], which fostered a great interest of media.

The Estonian eFlora was mainly created for teachers and their students. Teachers - from school teachers to university professors - feedbacked us through questionnaires on their experience with the eFlora. Altogether, 19 using events with about 350 participants have been officially recorded in Estonia on three different educational levels (primary and secondary schools, and universities). However, the actual number of users in school lessons is probably much higher, as not all teachers have filled the questionnaire. According to the answers in the questionnaire, the computer-based activities for identifying organisms are very much appreciated by both teachers and students (based on teachers' judgements). The huge amount of images connected to the keys was seen as a primary positive aspect. Problems with scientific terms used in the keys but not understood by pupils occurred especially in the younger classes. Several teachers had solved the problem by preparing an introductory part to the lesson, during which specific terms were explained. As the identification practices were much acknowledged, it has been often proposed to include these activities in the context of the schools' official curriculum.

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