**Printed Identification Key or Web-Based Identification Guide: An Effective Tool for Species Identification?**

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**INTRODUCTION**

As pointed out by Randler (4), species identification is necessary for a clearer understanding of the different aspects of the living world. Our understanding of an ecosystem is thereby limited by our knowledge of the species present. Species identification is a crucial step in any taxonomical studies. Thus, it is a skill needed to learn by students taking up biology.

Species identification is often done with the aid of traditional dichotomous keys. This printed material is based on one’s decision between two alternatives, which is followed by another pair of alternatives until the final species name is reached. However, Varese et al. (6) noted these traditional keys are rigid and can easily be outdated. With the advent of internet technology, the use of an online database offers an alternative approach to species identification. These computer-based tools can be corrected and updated in real time (6). Varese and colleagues further noted that databases are also accumulative, and thus, will contain in time a huge amount of information which can better identify species as exemplified by the interactive tool they developed to identify airborne and food fungi. It can also be accessed anytime, and this is very useful for fast-changing groups of organisms. Several web-based databases with interactive keys were created and made available on-line for the identification of many groups of organisms including lichens on twigs (3), mushrooms (2), protostelids (7), and myxomycetes or slime molds (1, 7).

In this paper, we report the preference of sophomore Bachelor of Science (B.Sc.) in Microbiology students to two identification guides as a tool in taxonomy. We wish to test our hypothesis that today’s students will prefer to use web-based ID guides over printed dichotomous keys. We also describe how these printed dichotomous key and web-based ID guides were used by the students as one of their laboratory activities in the course Biology of Algae and Fungi.

**PROCEDURE**

**Study group**

Thirty-nine sophomore B.Sc. Microbiology students were part of the study group. The students were enrolled in the introductory course Biology of Algae and Fungi. Twenty-three were female, 16 were male. The students were between 17 and 19 years old. Students were informed of the purpose of the activity and the survey and that participation in the survey would not in any way affect their grade. All consented to participate in the study.

**Test organisms**

Of particular interest in our study are the plasmodial myxomycetes or slime molds. These fungus-like, phagotrophic, eukaryotic protists have a distinct plasmodial stage and a reproductive stage of a somewhat fungus-like fruiting body. Fruiting bodies form spores that are often dispersed through wind. Morphological descriptions of the fruiting bodies and the spores are used in the identification of species.

**Student activity**

Taxonomic descriptions of 20 species of myxomycetes were selected and obtained from the book *Myxomycetes of New Zealand* (5). Ten species descriptions were given to the students during the first laboratory period. They were asked to identify the species. A printed dichotomous key from the same book was also provided to the students. The students were given one hour to identify the species. At the end of the activity, the correct identities of the unknown species were then provided. A questionnaire survey was given to assess their usage of the printed dichotomous key. On the second laboratory period, the remaining 10 taxonomic species descriptions of myxomycetes were finally given to the students. They were again asked to identify these using web-based identification key available online at http://www.discoverlife.org/20/q?guide=Mycetozoa_GSMNP (7). This online ID key identifies species of myxomycetes by clicking on the different features of their fruiting body and searching for species match. As an added feature, the search key can also compare images of different species simultaneously.
The students were also given one hour to complete the task. Following the activity, the correct identities were also given and the students were asked to complete the same questionnaire survey. Since this was part of their course activity, points were given for every specimen of mxyomycetes correctly identified using the two ID keys. Participation in the survey was voluntary. Students were given the choice to answer the survey anonymously. This was made clear to the participating students prior to the conduct of the student activity.

**CONCLUSION**

Our survey showed that majority of the 39 respondents found the web-based ID guide as more appealing (87%, n = 34) as it contains photographs of species, and more user-friendly (72%, n = 28) than the printed guide (Fig. 1). Perhaps this can be attributed to the visuals often associated with online guides. The availability of internet connection almost anywhere contributed also to the perception of the students on the web-based ID guides as accessible and easy to use. However, the students noted the printed dichotomous key as more effective and accurate in its identification (87%, n=34) than the web-based key (Fig. 1). This is because students can clearly see all species present in the ID tool, which allows them to make quick comparisons with other species. Students also found both tools as easy and inexpensive to create or develop (Fig. 1). Finally, when all 39 students were asked for their preference between the two species identification guides, more students (62%, n = 24) preferred to use online database as an identification tool than printed key (38%, n = 15). It is suggested therefore that printed identification keys be made more appealing by incorporating images of the species. Students of today are more inclined to visual stimulus due to their exposure to varied visual technologies. In the study, students clearly prefer a tool with more photographs than the plainly written ID key. An example of a modified dichotomous key is shown in Figure 2. This modified key contains important morphological features that can be used to differentiate closely related species. Photographs of species and their key morphologic features were also provided in the key to allow easy comparison and checking by the students. It is hoped that through this modified dichotomous key, students will find species identification easy, appealing, and using keys more effective than other means of species identification.

**FIGURE 1.** Responses of students (n = 39) to the survey on their perception of the printed dichotomous key and web-based ID guide. Note: values are expressed in percentages.

1. a. Fruitimg body plasmodiocarpous go to 4
1. b. Fruitimg body sporangiaste go to 2
2. a. Sporocarps globose Arcyria globosa
2. b. Sporocarps cylindrical go to 3
3. a. Capillitial net rather wide-meshed Arcyria affinis
3. b. Capillitial net rather dense Arcyria denudata

**FIGURE 2.** A sample dichotomous key for the identification of species of *Arcyria.*
Photo Credit: S. L. Stephenson, University of Arkansas, USA.
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REFERENCES