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Creation on-line illustration keys of polar brittlestars with help WebKey-X system

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Identification keys are created by those,
who don't need them,
for those who can't use them.

Unknown author

ABSTRACT: Possibilities, granted by computer technologies allow to use multientry polytomic keys, which essentially change the procedure of identification as qualitative and quantitatively; interactive keys also allow to identify animals based on separate organs or without of some organs, carrying important diagnostic characters. It is supposed, that the created programs will not use algorithm of reduction of taxa set, but recalculation of probability of belonging to each taxon of an "image" of identified specimen based on accumulated steps. Such approach allows more precise identification even with user errors in a character state choice.

1 INTRODUCTION

Arctic and Antarctic ophiuroids are one of the prominent groups of benthos (Djakonov, 1954; Smirnov A. and Smirnov I., 1990, 1994; Smirnov A., 1994; Piepenburg, 2000; Piepenburg, Voß and Gutt, 1997; and others). Their correct identification are very important for marine ecological research in the polar seas (Smirnov I. et al., 1995, 1996). For the first time in 1994 the authors began works on creation of a computer keys for identification of arctic and antarctic brittlestars.

2 MATERIAL AND METHODS

The system BIKEY was used to construct computer identification keys. The first versions of a dialogue computer identification system "Diagnostics-1" and "Diagnostics-2" were developed by A. Lobanov in 1974 for a "NAIRI" computer (Lobanov, 1975a). Later on the system was transferred to more advanced types of computers. Since version 5 created at the Zoological Institute, Russian Academy of Sciences, for the IBM personal computers (programming languages FoxPro and FORTRAN), the system has received the new name BIKEY (for the words – Biological Identification KEYs). The latest version of the system – BIKEY6, oriented to work with both textual descriptions such as images of taxa, was developed together with M.B.Dianov (Lobanov & Dianov 1994, 1995, Lobanov et al. 1995).

The BIKEY6 system is intended for automation of processes of work with the diagnostic information about biological taxa and executes the following functions (formulated before in Lobanov 1972, 1974, 1975b, 1983; Lobanov et al. 1981):

1. Accumulation and storage on magnetic carriers in the compact form of the information about diagnostic features of various taxa (including images of organisms and their parts or fragments).
2. Editing and addition of the initial diagnostic information in mode convenient for user.
3. Comprehensive analysis of this information, its logic control and evaluation of diagnostic completeness.
4. Execution of optimized identification of objects on machine keys created by system through an interactive dialogue ("person – computer"). Path of identification is formed dynamically during dialogue, concluded in choice by the the person of the most convenient attributes in view of recommendations of the program, which aims to reduce length of a way of identification.
5. Automatic generation of optimized mono-entry textual keys on a computer (from the computered matrix it is possible to generate variants of textual keys by setting different weights for different attributes).
6. Printing of data about one taxon or group of taxa in the form of a description (standard diagnosis in the natural language).
7. Analysis of parameters of conventional mono-entry textual keys, created outside the BIKEY system.

On the base of BIKEY the picture identification key for the Arctic brittle stars (OPHiuroids of

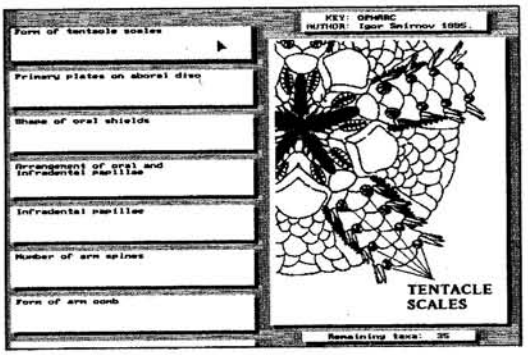

Figure 1. The first working screen with names of characters (left frames) and general drawings of characters (right frame). The current character is pointed by means of the cursor.

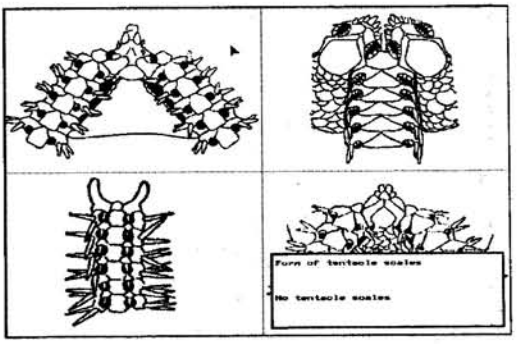

Figure 2. The second working screen with the illustrations for the states of the choosen character. The cursor points the choosen state.

ARCtic – OPHARC) was created. The ophiuroid list includes 34 species and subspecies which live in the Arctic seas and adjacent waters (Smirnov, Lobanov and Dianov, 1996).

3 RESULTS AND DISCUSSION

The OPHARC key was based on the Dijakonov's monograph on brittlestars of the USSR seas (1954) and other literature and materials of Zoological Institute. At first a list of 38 characters and states was created.

Each character comprises 2–9 states. Using this list a matrix of characters was filled in.

The OPHARC key was created using the taxon-character matrix. This matrix may serve as a key itself.

The process of computer identification consists of a number of steps. At each step the user has to specify the most convenient character for observation and to select a state of the specified character corresponding to the properties of the examined specimen. The first program screen (Fig. 1) comprises text frames with the names of characters, frames with the name of the key and the number of taxa included in the list.

The major part of the screen is occupied by a frame containing the illustrations of the current character which are shifted by the cursor. The second operational screen (Fig. 2) is separated into several equal areas (between two and nine) filled with illustrations of states of the selected character. The user analyses the relevant element for a specimen identification and chooses the image most similar to the specimen.

The program selects the taxa possessing the specified state of the character from the list (at the first step the selection is made from the complete list of taxa included into the key). In case of two or more taxa included, the program proceeds with the next step. At each step the program proposes the list of characters in the order of decreasing diagnostic value, which is calculated for a particular step by a unique algorithm. It is more advisable to make use of the characters presented by computer in the first place; however, the final decision is taken by the user as a trade-off between safety, accessibility and value of the character.

An important advantage of this key is a possibility of its application for identifying damaged specimens. Even separate fragments (for example, only a disc or arm) can be identified to species if they have retained at least one or several morphological parts showing some matrix characters.

The system BIKEY can generate automatically a monoentry key and subsequently introducing the key itself into the text file in a form adequate for publication.

Possibilities, granted now by computer technologies allow to use multientry polytomic keys, which essentially change the procedure of identification as qualitative (it is possible to use only some of available diagnostic characters in any combination), and quantitatively (it reduces time usually spent on identification with the help of traditional keys); interactive keys also allow to identify animals based on separate organs or without of some organs, carrying important diagnostic characters. It is supposed, that the created programs will not use algorithm of reduction of taxa set, but recalculation of probability of belonging to each taxon of an "image" of identified specimen based on accumulated steps. Such approach allows more precise identification even with user errors in a character state choice.

Of special interest are the keys, which appeared last years, which use possibilities, granted by the Internet protocols. The monoentry keys are constructed easily by tools of the hypertext. Effective key can be constructed using only minimum set of tags of the HTML language. Such key can be supplement by Java-scripts and applets by very useful possibilities.

Unfortunately, still attempts are limited to create the Internet multientry key working with the standard database, for example, through the interface CGI or ODBC. But fast development of tools of the global network, Internet creates new possibilities for new and interesting implementations of multientry keys essentially raising efficiency of diagnostics (Lobanov et al., 2006).

It makes attempt to create webkey for arctic and antarctic brittlestars on web-site of ZIN in Internet (http://www.zin.ru/projects/webkey-x/index.html).

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