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Evaluation of the rappresentativeness of a colletion: informatic package (version beta 1)

Abstract

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A collection is the starting-point for various types of studies but it is also, and mainly, a remarkable didactic instrument. The knowledge of level of information (representativeness) contained in every sample is the first essential step in the process of the spreading of information of a collection.
The scope in this work is to present an informatic package that enables to evaluate the representativeness of the specimens and therefore of the whole collection.
A first practical approach has been conducted on a collection (forty eight samples) of geniculate *Corallinaceae*, known as "*Nova Collectio Corallinales* - TSB". The programme herewith presented reports all the expected characters, both determining (D) and descriptive (d), for the different species of calcareous algae (*Lithophylloideae* and *Corallinoideae*) present in the collection. The characters are arranged in sub-sections on the thallus, branching, branches, intergenicula and conceptacles.
To calculate the representativeness of the different samples, it is necessary to compare the number of expected (e) and observed (o) characters verifying, in the observed specimen, the presence (with a tick) of expected characters for that particular species. Assuming that in the "ideal specimen" the ratio Do/De and do/de equals 1, ratio calculated both at the sub-section level and at the level of species, is expressed by dispersion graphs that enable to determine immediately which sample is the most representative (x=1; y=1), therefore more suitable for a didactic-museum usage. The degree of representativeness of samples has been defined: at sub-section level, at level of species, at level of sub-family, at collection level.
The programme allows, in its complete version, to introduce new research criteria, varying both the "target species" and the level of accuracy aimed at during the screening of samples.
Such an approach may also be applied to other scientific areas; it leads to a deep understanding of the present collection and to fully exploit its potentialities, both as an historical archive and as a source of data for subsequent researches.

Introduction

Before the advent of computers, natural history collections were physical databases from which geographic or ecological analyses and reports could be extracted by human visitation and transcription. Computerization of label data makes such reports on distribution and ecology of species more readily available to potential users; they add value to the data

(Meredith 1996).

Collections, whether large or small, gain an even more noticeable role, becoming a necessary reference point for subsequent determinations when their specimens belonging to systematic groups are difficult to determine. An example is taken from the Corallinales, widely considered to be among the most diverse and taxonomically difficult orders of red algae (Johansen 1976, 1981; Woelkerling 1988; Bailey 1999) and where the interest has greatly increased all over the world (Woelkerling 1988).

Corallinales, difficult to determine by phenomena of intraspecifical polymorphism and rich of interspecific examples of morphologic convergence, are important reef-builders and the need for their identification is required not only by systematics, but also in the field of marine ecology (Cabioch 1971a, b, 1988). As too many species have been described in the past (Woelkerling 1984; Cabioch 1971a, b, 1988) many specialists must turn again to herbarium studies (Chamberlain 1983; Mendoza & Cabioch 1984, 1985, 1986; Woelkerling 1985; Woelkerling & al. 1985; Woelkerling & Irvine 1986a, b; Cabioch 1988) often far removed from nature, but as Woelkerling points out (1988): "Sometimes herbarium collections consist almost entirely of dried, unidentified material".

A collection is therefore the starting-point for various types of studies (systematic, ecological, phylogenetical, distributional, etc.) but it is also and mainly a remarkable didactic instrument. Collections are indeed for the student a ring of conjunction between theory (the study of the characterization of species) and practice (identifying and collecting on field). The knowledge of level of information (representativeness) contained in every sample is the first essential step in the process of the spreading of information of a collection.

Aim

The scope in this work is to present an informatic package (version beta1) that enables to evaluate the representativeness of the specimens and therefore of the whole collection.

Materials and methods

A first practical approach has been conducted on a collection (forty eight samples) of geniculate Corallinaceae, known as "*Nova Collectio Corallinales* - TSB". The samples studied belong to the following species: *Amphiroa beauvoisii* J. V. Lamouroux; *Amphiroa rubra* (Philippi) Woelkerling; *Amphiroa rigida* J. V. Lamouroux; *Corallina elongata* J. Ellis et Solander; *Corallina officinalis* Linnaeus; *Haliptilon attenuatum* (Kützing) Garbary et H. W. Johansen; *Haliptilon virgatum* (Zanardini) Garbary et H. W. Johansen; *Jania longifurca* Zanardini; *Jania rubens* (Linnaeus) J. V. Lamouroux var. *corniculata* (Linnaeus) Yendo; *Jania rubens* var. *rubens*.

The method to evaluate the representativeness of a collection has been elaborated (Coppola 1999; Bressan & Coppola 2000) and subsequently developed (Coppola & al. 2001) verifying which expected characters for a specific species were effectively observable in a particular sample.

The text of reference, used for the present work, is a key of determination (Bressan 1974) which is divided into two sections: one for identification and one for description,

where the determining (D) and the descriptive (d) characters have been taken from accordingly.

The programme herewith presented (available at the Software Library of the Department of Biology, University of Trieste) reports all the expected characters, both determining and descriptive, for the different species of calcareous algae (*Lithophylloideae* and *Corallinoideae*) present in the collection. The characters are arranged in sub-sections on the thallus, branching, branches, intergenicula and conceptacles.

To calculate the representativeness of the different samples, it is necessary to compare the number of expected (e) and observed (o) characters. The programme allows to verify, in the observed specimen, the presence (with a tick) of expected characters for that particular species. Since a determining character is also descriptive (but not vice versa) and giving more importance to the finding of a determining character, this will be counted twice in the calculation of the total "observed characters".

The collected data for each sample, linked to the position it holds in the collection (specimen ID), are listed automatically in tables (one for each species). These tables allow to view the "number of expected characters" (De and de) vs. "number of observed characters" (Do and do) situation. In this frame data are still subdivided in sub-sections and therefore the arrangement allows to read them both vertically and horizontally analyzing the representativeness of all sub-sections of a sample or of one sub-section in all samples.

Assuming that in the "ideal specimen" the ratio Do/De and do/de equals 1, ratio calculated both at the sub-section level and at the level of species, is expressed by dispersion graphs drawn according to the above mentioned tables, where x = do/de and y = Do/De. The graphs enable to determine immediately which sample is the most representative (x = 1; y = 1), therefore more suitable for a didactic-museum usage.

Thanks to a summary table, the programme finally produces to a set of graphs which give a view of the representativeness of: single species, single sub-families, the whole collection.

Results and discussion

The degree of representativeness of samples has been defined: at sub-section level, at level of species, at level of sub-family, at collection level.

At collection level (i.e.) the following situations have been raised (Fig. 1):

- an error of determination regarding four samples of *Amphiroa beauvoisii*;
- two species, *Corallina officinalis* and *Jania rubens* var. *rubens* for which it would be desirable to collect more samples for didactic/museum usage;
- a highly representative section (*Amphiroa rigida*);
- five samples (*Amphiroa rigida*, samples 1b and 4a; *Haliptilon attenuatum*, sample 1a; *Haliptilon virgatum*, sample 1a; *Jania longifurca*, sample 1a) totally correspondent to the expected data (1, 1).

From the practical point of view this programme enables to determine directly:

- the most representative samples (x=1; y=1), complete in all their parts and corresponding to the description taken from literature, to be used for didactical purposes;
- the most representative samples for a specific character or group of characters (sub-sections);
- samples where there has been no correspondence to some characters (determining)

suggesting a revision of the determination;
- species for which it would be better to collect new specimens due to their little representativeness;

and indirectly:
- characters that, being more constant and easily traceable than others from the practcal point of view, result more reliable as far as the determination is concerned;
- possible characters which show intraspecific variability.

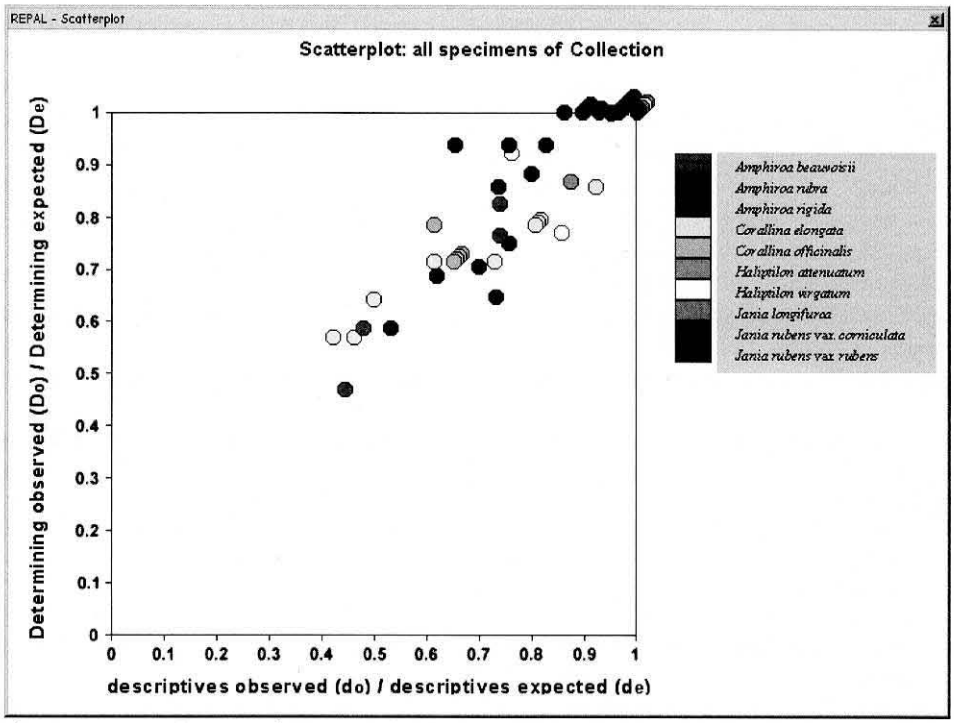

Fig. 1. representativeness of "Nova Collectio *Corallinales* - TSB" (geniculate section).

The present programme allows, in its complete version, to introduce new research criteria, varying both the "target species" and the level of accuracy aimed at during the screening of samples. In fact for this presentation we stopped at the macroscopic characters, but the analysis of representativeness could have been studied further, including the microscopic characters as well as the ultramicroscopic.

Conclusions

The analysis of the representativeness of specimens may become a starting-point to simplify the work of research during the creation of an images-bank. The data collected in this

manner may even be used for other purposes, e.g.: a study on constancy/variability of some characters according to the environment where the specimens have been developed in.

Such an approach may also be applied to other scientific areas; it leads to a deep understanding of the present collection and to fully exploit its potentialities, both as an historical archive and as a source of data for subsequent researches.

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