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The community concept in carabid studies. A short review

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On the basis of a review of the first thirteen European Carabidologists' Meetings we have analyzed how the community concept has been used in carabid studies. Four main approaches emerged from the analysis: the "community approach", when the study is based on a "classical" species-by-sites table; the "rational background approach", when, for interpreting study results, the community is treated more like an ecological functional unit than a simple statistical aggregate of populations; the "implicit condition approach", when the community is taken for granted, i.e. it is not demonstrated, and is meant as a statistical entity; and the "approach based on criticism", i.e. new ways of treating data on carabid communities.

Key words: carabids, ecological community

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INTRODUCTION

The community concept is one of the leading concepts in ecology, and in many papers (see References chapter) it has been demonstrated that the family of Carabidae is a taxon that can be easily used as a model for research on synecological units, either for theoretical or practical aims.

The debate that is going on since the beginning of the 20th century, both between the functional view (i.e. interaction among the components of the community) and the statistical view (i.e. recurring appearance of the same species in similar environments) (Jax 2006), and between the local and regional dimension whenever spatial limits are concerned (Ricklefs 2008), still lacks the definition of "ecological community". This debate is accompanied by the linguistic controversy on the use of the words "community", "coenosis", and "assemblage" (e.g. Looijen & Andel 1999), although it seems to be widely accepted to use "community" for a group of taxonomically related species, "coenosis" for a group of organisms at the ecosystem level, and species "assemblage" for a group of statistically recurring species.

From a practical point of view the problem does not resolve intuitively, because on the one hand it is possible to agree with Looijen & Andel (1999, 2002) on the definition of "community of individuals" (i.e., the set of individuals of species occurring in the intersection of the local populations of these species), considering the constraints of Looijen & Andel (2002) as well as Parker (2002), whereas on the other hand the problem partly remains on the geographical scale, even on the basis of the criterion of ecological and geographical gradients for shaping the distribution of populations as proposed by Ricklefs (2008).

One of the first approaches to carabid communities was presented in the paper of Verdier & Quezel (1951), apparently based on the formalization of the phytosociology given by Braun-Blanquet (1928) as carabids were treated in the same way as floristic syntaxa. This approach was not successful in carabid ecology, maybe because it was perceived as prone to a drift towards an unclear organismic view (i.e. the ontological approach criticized by Jax 2006).

The problem of carabid communities as detectable units was omitted by Thiele (1977), who wrote that "in a well-defined faunal region such as Central Europe it is possible to predict with some degree of certainty at least, which species of carabids can be expected to occur in a particular plant community" (i.e., autecological relationships are predictable).

It is likely that Thiele's book mirrored the general approach of his contemporaries, and maybe he even predicted future studies, because it seems that in the past European Carabidologists' Meetings the main question on the basis of a species-by-sites table, i.e. whether there is any possibility of finding groups of species that concentrate in groups of sample sites, has evoked direct and indirect answers not resolving the uncertainty of whether or not carabid communities are detectable units.

Studies on carabid communities published in the proceedings of the first thirteen European Carabidologists' Meetings are reviewed in the following text. Since most papers are not available on line, this short review is intended to give these fundamental scientific contributions an accessible platform.

RESULTS

The concept of community has been used in many different ways, but with a certain amount of fuzziness it was possible to group the papers as follows.

"Community approach" (species by sites table). The study is based on a "classical" species-by-sites table.

At the first European Carabidologists' Meeting (I-ECM) Neumann (1971) published a typical species-by-sites table for studying the carabid groupings along a succession of afforested environments of various ages.

The first papers with the main aim of finding groups of species that concentrate in groups of sample sites have been published in the proceedings of VII-ECM on the communities of Italian maquis, deciduous woods, waterside habitats and pastures (Comandini & Vigna 1990), as well as on the communities of European grasslands (Eyre & Luff 1990).

The "community approach" was applied by Främbs (1990) for the study of temporal dynamics of peat-bog species, by Mossakowski et al. (1990) for studying the consequences of anthropogenic disturbances, and by Gruttke (1990), who described the species groups of four vegetation types in a ruderal urban park.

At VIII-ECM the paper of Vigna & Felici (1994) clearly depicts the species that concentrate in groups of beech sites, while Asteraki (1994), by means of a species-by-site table, found different communities in sown margins around arable fields.

For XI-ECM, on the basis of the species-by-site approach, carabid communities of agricultural and forest sites (Serrano et al. 2005) and of a forest-to-rural urban gradient (Gaublomme et al. 2005) had been observed.

Species-by-site tables have been used by Eyre (1994) and Eyre & Luff (1994) for the study of relationships between disturbances and species assemblages.

Rational background. The community, for interpreting study results, is treated more like an ecological functional unit than a simple statistical aggregate of populations.

The community is used by Gruem (1986) as a rational background, but he actually studied the flux of energy resources through detritivores to higher consumers.

Loreau (1987) followed a theoretical approach and observed that the dimensions of a species niche can impose mutual constraints at the community level.

Pizzolotto (1994) treated the community as the rational background in an environmental-impact-assessment study in a natural area, where an Index of the Faunistic Value (IFV) based on carabid biological characteristics was applied.

Implicit condition. The community is taken for granted, i.e. it is not demonstrated, and is meant as a statistical entity (Ricklefs 2008: a "distribution of species within a region, from which local assemblages of species derive").

In many studies the presence of a community is an implicit condition for studying the species relationships either with main ecological factors of the sample sites (Baguette 1987), or with agricultural or other anthropogenic activities (Desender et al. 1987, Lebrun et al. 1987, Niemelä et al. 1987, Tietze 1987).

The presence of communities is an implicit condition for describing the carabid biological characteristics in agricultural fields (Lövei & Sarospataki 1990) or in wet habitats (Casale 1990), the habitat preference of species sampled in grassland and arable fields (Luff 1990), or the activity patterns of carabids in different areas (Dufrene et al. 1990). Moreover, they allow for speculations on the historical environmental conditions of Mediterranean mountains (Pizzolotto & Brandmayr 1990).

The carabid community is the (implicit) basis for finding dramatic effects on the dominant guilds after improvement of upland pasture (McFerran et al. 1994), differences between flooded and non-flooded environments (Šustek 1994), or differences between cultivated and non-cultivated carrot fields (Bovin & Hance 1994). Bohàč & Fuchs (1994) described the general features of carabid communities in Bohemian villages, while Schnitter (1994) described the communities variation following succession in uncultivated fields and meadows.

Schwerk (2000) linked the carabid-species groupings to the Mean Individual Biomass (MIB) index for studying ecological succession on industrial fallow grounds.

The presence of a carabid community is an implicit condition for describing general features of carabid assemblages in road vegetation median strips (Koivula & Kotze 2005) or across a forest rural-urban gradient (Magura et al. 2005). Andorkó & Kádár (2006), who studied the structural characteristics and the habitat preferences of the carabid communities in woodland habitats, and Skłodowski (2006), who linked carabid assemblages to various types of forest management, came to similar conclusions.

The very frequent approach in which the community presence is an implicit condition was shown at XII-ECM by Schwerk & Szyszko (2008), describing succession in post-industrial areas by means of MIB, and by Penev et al. (2008), who studied carabid assemblages across a forest rural-urban gradient.

Different point of views. Criticism, new ways of treating data on carabid communities.

Rueda & Montes (1987) suggest a different point of view showing that it is possible to describe a carabid community of saline environments mainly on the basis of the biology and life history of the species.

The first, and the only, criticism on the community concept has been proposed at the third International Symposium of Carabidology by Penev (1996), who outlined the pros and cons when applying the conceptual points of "species assemblage", "community", and "local fauna".

A suggestion of a more informative way of treating communities was published at XII-ECM by

Cole et al. (2006), who, by means of a species-by-sites table, showed that it is possible to describe carabid groupings on the basis of functional groups rather than species diversity.

CONCLUSION

Through the first thirteen European Carabidologists Meetings few papers dealing with carabid communities have been structured in a "classical" way, i.e. with the aim of finding a group of carabid species to be linked with a floristic syntaxon (Comandini & Vigna 1990, Eyre & Luff 1990, Vigna & Felici 1994), while in most papers studies are based on the community taken as a synecological unit existing a priori. Moreover, in some papers the results are based on the community concept taken as the rational background rather than study subject.

New ways on how to approach the study and analysis of carabid communities have not clearly emerged while synthesis indices for supplementing the species-by-sites method have been proposed (e.g., Mean Individual Biomass by Szyszko et al. 2000 and Schwerk 2000, Index of the Faunistic Value by Pizzolotto 1994) on the basis of biological characteristics analyses. The latter seems to be the most promising way of finding a common biological scale for data comparison when studying carabid-species groupings in biogeographically complex environments.

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