A state of knowledge on the distribution of Carabids in Belgium and northern France

by Konjev DESENDER, Michel BAGUETTE, Marc DUFRÊNE & Jean-Pierre MAELFAIT

Summary

A short historical overview illustrates the continuous increase in knowledge concerning the distribution of carabid beetles in Belgium. Although the cumulative number of species known from this region has not augmented much during recent decades, a lot of additional distributional as well as ecological data have been gathered recently.
Especially due to intensive pitfall trapping campaigns (year cycles), performed by our respective study groups all over our country, we have been able to add data on more than 200,000 specimens belonging to about 250 species. These data, also used in bio-monitoring studies within the framework of nature conservation, are now being incorporated into the distributional database in the context of a national project between different institutions. Within this project, financed by the National Fund for Scientific Research (Belgium), there is also a collaboration with entomologists of northern France in order to complete distributional data for that badly investigated region too. In recent years, we have also made special efforts to sample a lot of only poorly known Belgian UTM squares.
Key words : distribution, faunistics, ecology, Carabidae

Introduction

Carabid beetles, also known as ground and tiger beetles, belong to the most popular, diversified and studied insect groups, certainly in Europe, and at least in Belgium. The most recent estimates on world scale mention up to 50,000 different species which would rank carabids amongst the most diversified insect families. In Belgium, the study of these beetles started in about the middle of the 19th century and has, ever since, been continued intensively.

In this communication we will briefly : (1°) overview the history of knowledge on the distribution of carabids in Belgium, (2°) elaborate on the more recent use of these beetles in ecological research and how such data are now also incorporated in a distributional database and (3°) summarize the actual state of knowledge on the distribution of carabids in Belgium.

Results and discussion

1. Historical overview (Fig. 1)

Already in 1857, MATHIEU published the first checklist on these beetles for our country. Although it contains a lot of nomenclatorical problems, this catalogue already mentioned no less than about 80 % of the carabid fauna presently known from Belgium. Since that first catalogue, updated checklists have appeared on several occasions.

After a list had been published in 1880 by KERREMANS - a list which contained a lot of synonyms and a lot of very doubtful species names - PREUDHOMME DE BORRE published a corrected version

in 1886. This list was slightly more detailed in that it also mentioned the different Belgian provinces in which every species had been found.

Due to subsequent efforts by many other well-known amateur as well as professional Belgian entomologists (like DERENNE, DE RUETTE, GUILLEAUME and FAGEL to name only a few) the next updated catalogue was published by the late DERENNE in 1957. He mentioned 399 species, corresponding to about 370 of the actually accepted species.

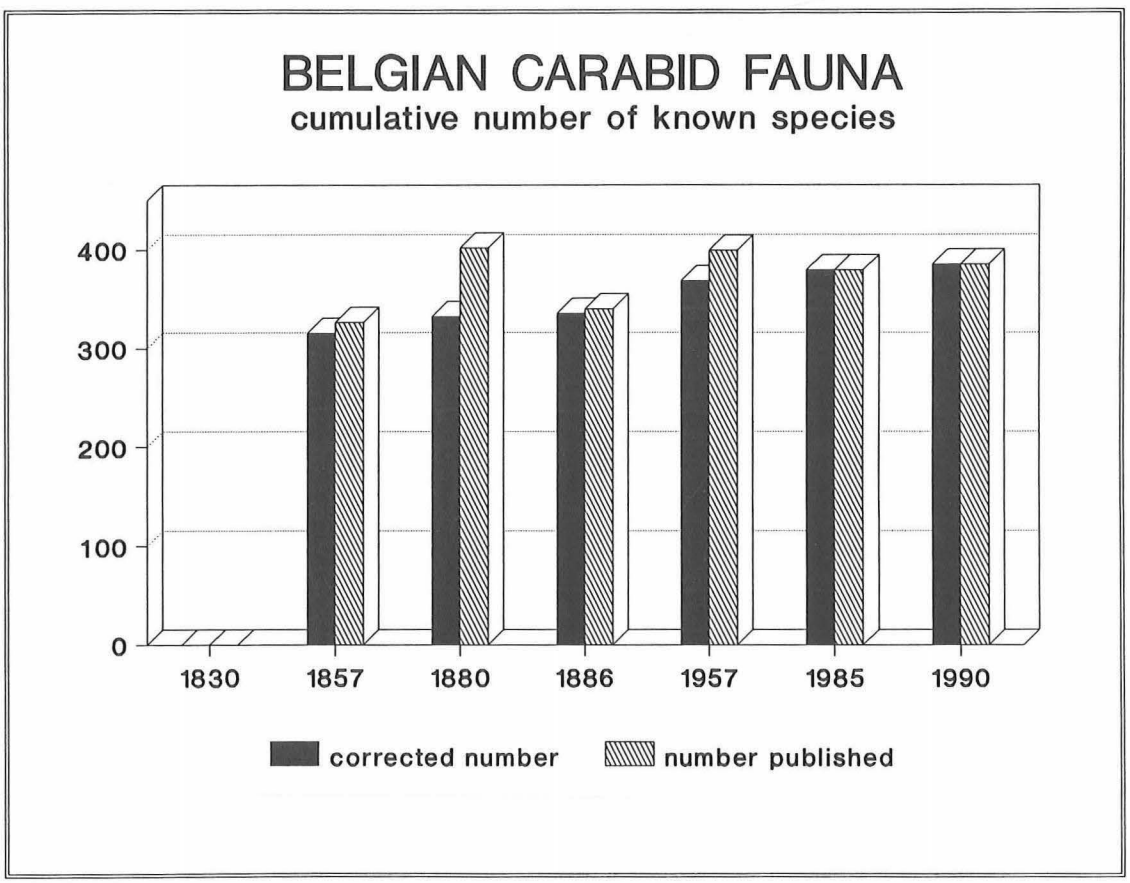

Fig. 1. Historical overview of the knowledge on the Belgian carabid fauna (number published and our correction) summarized from different checklists (see text for further explanation).

More recently, several changes have been made to the preferred nomenclature and especially to the currently used systematic classification of carabid beetles. In the seventies, some excellent identification handbooks and revisions were also published, f.e. by FREUDE *et al.* (1976) and by the late LINDROTH (1974).

In 1979, the first author started to study the Belgian carabid fauna. The approach of our studies was first ecological but gradually also included systematics and faunistics. While using these beetles in fundamental and more applied ecological and site-assessment studies, we also started a revision of all available specimens from museum as well as private collections and gathered data

from nearly half a million specimens. Soon it became clear that several modifications were necessary to the 1957 catalogue of DERENNE : some species were not in his list (genuine new species for Belgium) or only recently accepted as such (f.e. some sibling species), other species had been recently synonimized or redefined in a systematic revision, while still other species of DERENNE's list were not accepted as belonging to our fauna due to the lack of reference specimens.

Our first contribution was an updated checklist, which appeared in 1985 (DESENDER, 1985). It was a revised list mentioning 379 species, with comments on those doubtfully established in Belgium and on species raising identification problems.

This checklist in turn formed the basis of a series of contributions on the detailed distribution and ecology of the Belgian carabid beetles, publications which appeared in 1986 (DESENDER, 1986a-d). For every species raw distribution data were first grouped per locality and per year, reducing the number of records, known to us at that time, to about 60,000. These records were grouped once again per UTM-10 km square and in two periods (before and/or since 1950) and these data were finally mapped. So, at the end, we obtained atlases in which all known distribution data of the entire Belgian carabid fauna were summarized on a UTM-10 km grid scale. In these, we also presented a compilation of our knowledge on the different species : for each carabid species we tabulated data and analysis results concerning many aspects of biology, ecology an distribution, f.e. number of UTM squares, number of records, temporal analysis results whether the species is recently statistically significantly decreasing or not, total distribution area, beetle size, wing developmental type, reproductive period, habitat preference codes, as well as statistical results of distribution analyses (f.e. reaction to altitude, soil type, woodland cover and type, annual precipitation, relative aridity, temperature ranges and so on).

Since 1985 we have added 6 more carabid species to the checklist of the Belgian fauna : 3 species confirmed older doubtful data, 3 others concerned sibling species only recently recognized as such (DESENDER, 1987, 1990).

This short historical overview illustrates the continuous increase in knowledge concerning the distribution of carabid beetles in Belgium. The cumulative number of species known has not augmented much during the last decades, and it is unlikely that many species will have to be added in the future. As already mentioned above, the accent has shifted more recently to the use of these beetles in quantitative ecological studies.

2. The use of carabids in ecological studies and the incorporation of such data in a distributional database

The Carabidae are an extremely speciose beetle family. They are nevertheless mostly characterized by a relatively simple body shape, while macromorphological adaptations would have occurred to a relatively small degree during their evolutionary history. Despite this seeming constraint they have radiated into nearly every terrestrial biotope. The high degree of habitat or even microhabitat preference, as exhibited by a lot of species, would mainly have evolved through ecophysiological adaptations. Microclimatological and edaphic factors would function as the main cues in their habitat preference. It is this high degree of habitat preference, the high species-diversity of ground beetles as well as their occurrence in nearly every terrestrial biotope, which make carabids so useful in ecological and bio-monitoring studies.

We started such studies in Belgium during the 70's, within the pedobiological section of the Laboratory of Animal Ecology at the State University of Ghent. Later, similar studies and sampling campaigns were started in other institutions too. These intensive pitfall trapping campaigns (year cycles), performed all over the country (as illustrated on a map, Fig. 2) yielded data on more than 200,000 carabids belonging to about 250 species and have been already analyzed and used in many different ways. The most important of these topics are summarized as follows : our studies range from *ecology and biology* (with population and reproductive biology, activity cycles, dynamics, f.e. in some long-term studies, dispersal power, habitat preference, community structure and so on), to the use of carabids in *nature conservation* (species diversity studies, bio-indicators in monitoring, site assessment and management studies) and to *biogeography* (faunistics, distribution patterns and other cartographic analyses, temporal evolution analyses). These pitfall trapping data are indeed now also being incorporated into the distributional database within the context of a national project between different institutions. Within this project, financed by the National Fund for Scientific Research (Belgium), there is also a collaboration with entomologists of northern France in order to complete distributional data for this badly investigated region as well. In recent years, we have also made special efforts to sample a lot of poorly known Belgian UTM squares.

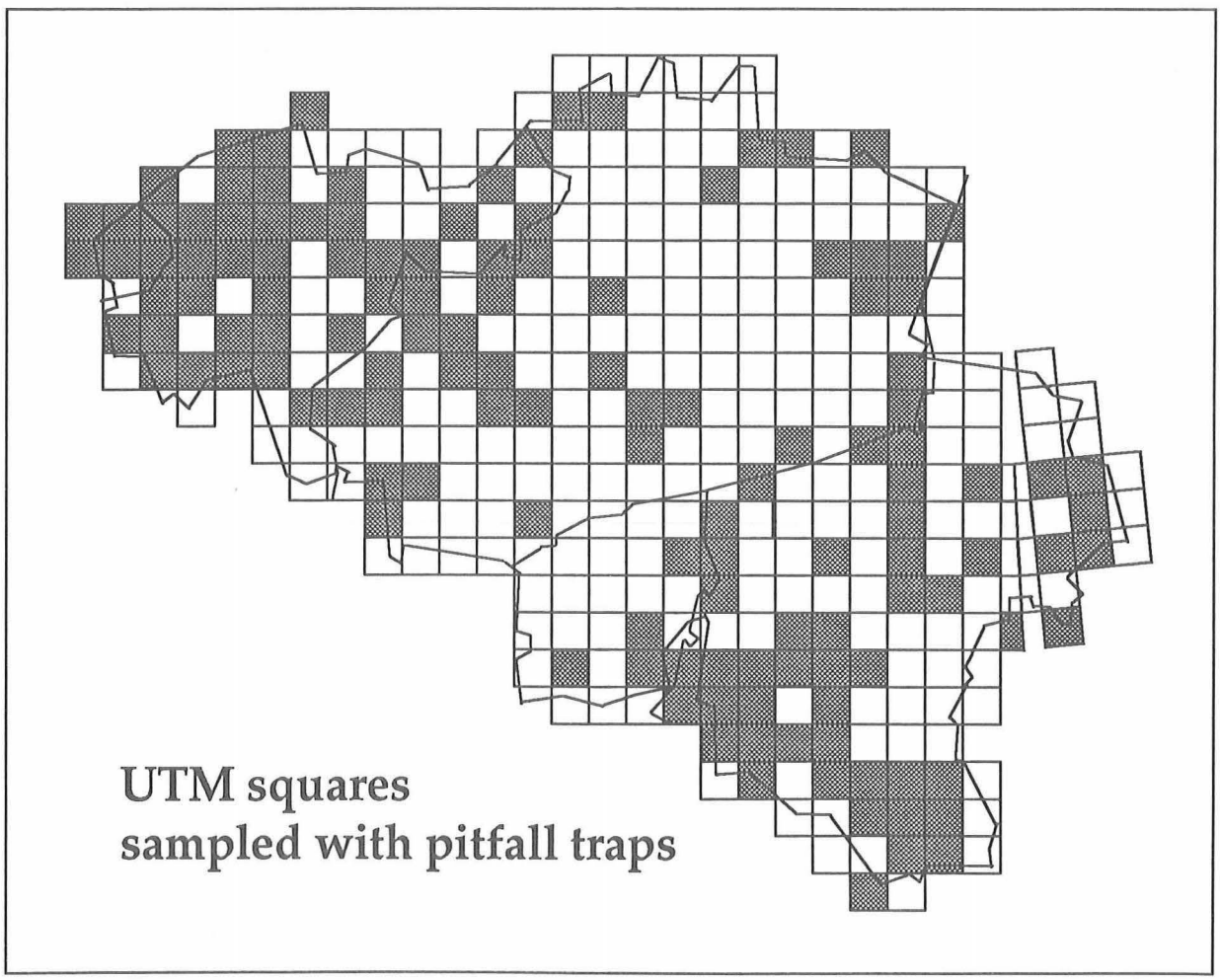

Fig. 2. UTM squares sampled by means of pitfall trap year cycles in Belgium (I.N., Hasselt; K.B.I.N., Brussel; R.U.G., Gent; U.C.L., Louvain-la-Neuve).

These efforts already yielded a lot of new distributional data, as can be deduced from Fig. 3, which presents the number of carabid species that were added per UTM square since the publications in 1986 (DESENDER, 1986a-d) and within the context of our interinstitutional project.

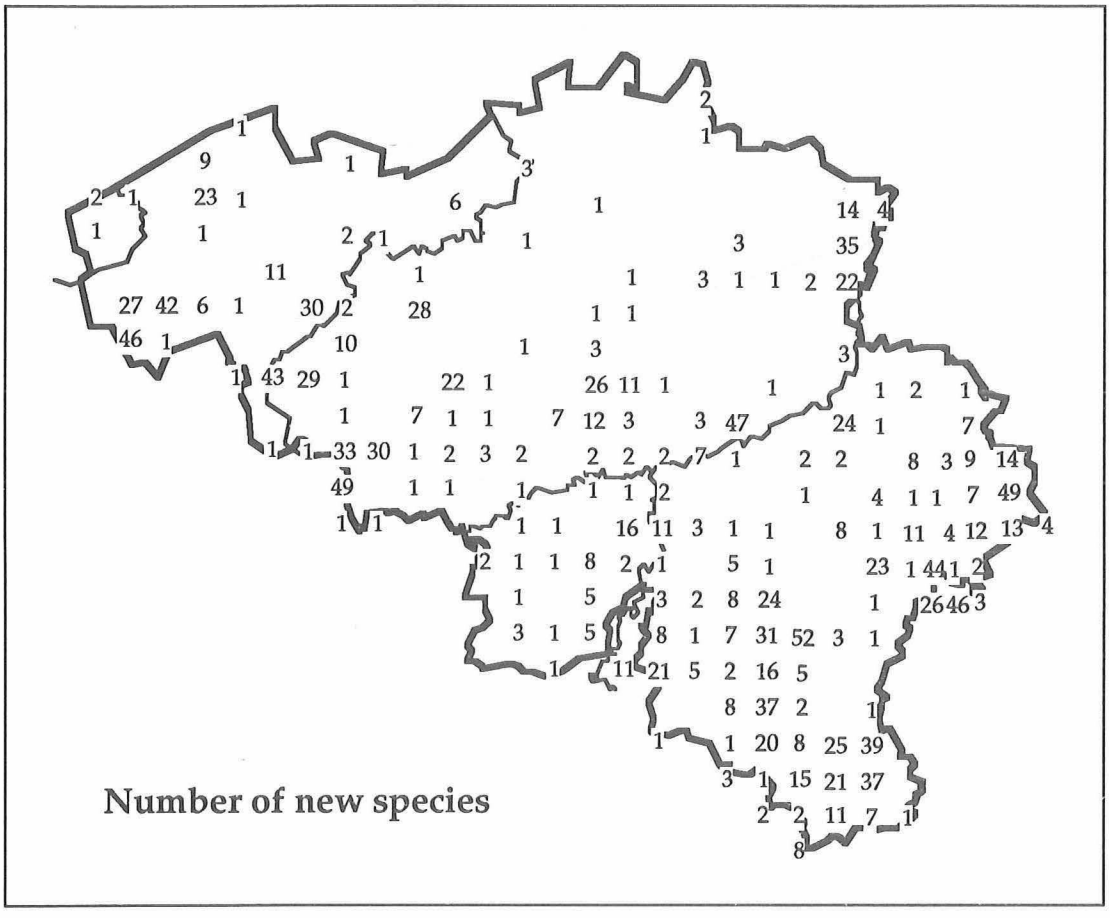

Fig. 3. Number of carabid species added per UTM square since DESENDER (1986a-d) within the context of an interinstitutional project.

3. Conclusion : actual state of knowledge on the distribution of the Belgian carabid fauna

To conclude we present a summary of the number of carabid species per UTM square actually known to us (Fig. 4). On average nearly 70 species are reported per UTM square. Note the regions which are still probably not well sampled, especially in the western and southern part of Limburg. These regions are presently being sampled by means of pitfall traps.

Although we are convinced that new studies, especially on monitoring, will always be necessary, we think it is not exaggerated to say that the study of carabids in Belgium has reached an advanced stage, thanks also to our predecessors and to the work of so many interested people. It is our hope to complete this continuously growing database within a couple of years, in order to provide us with a firm basis for future studies on biogeography, ecology and biology of carabid beetles as well as for bio-indicator or site-assessment studies within the framework of nature conservation. Our main goal at the moment is to compile all the available information and to computerize all distribution data.

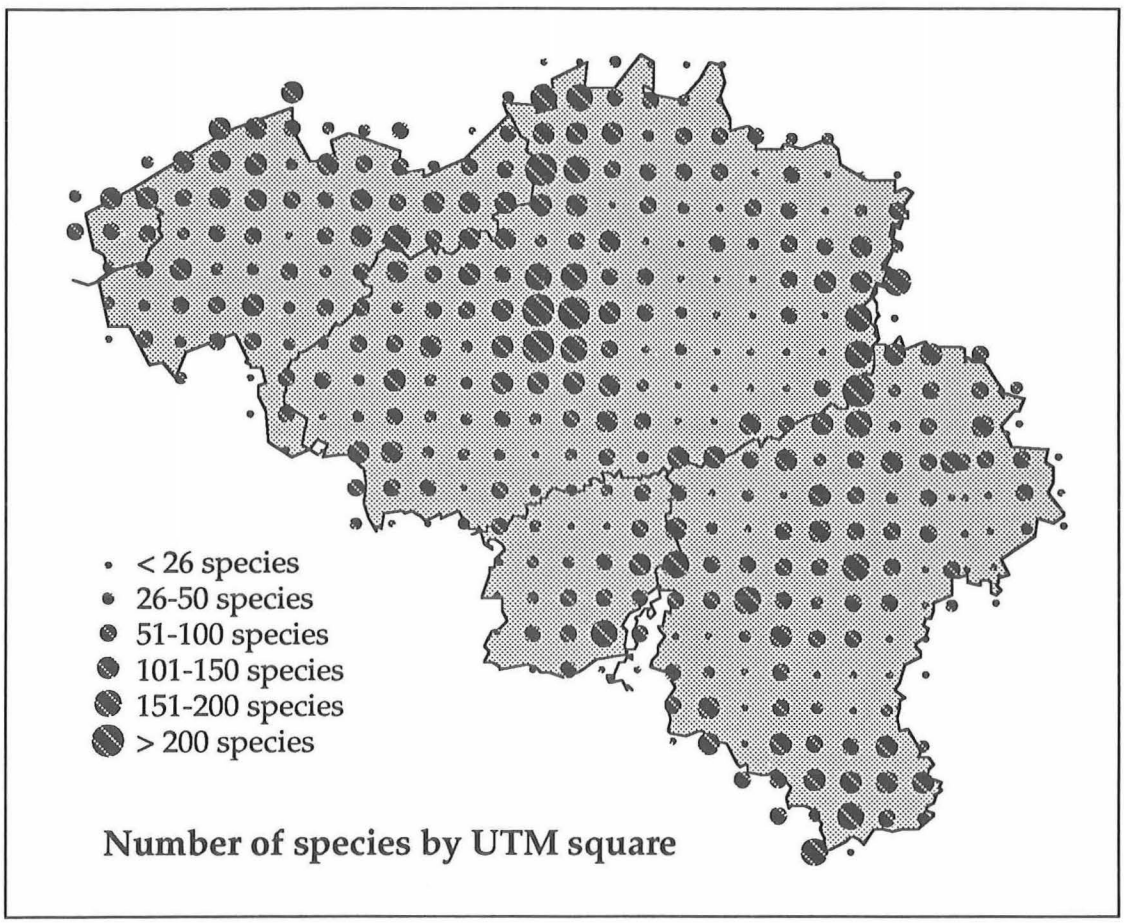

Fig. 4. Number of carabid species actually known from each UTM square in Belgium.

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