

New high-tech method for assessing functional Arthropod biodiversity



A practical experience of technology development and transfer between researchers and agricultural sector players in France

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We have developed a reliable, convenient and fast method accessible to non-specialists to **monitor predominant functional guilds of arthropods** in French agrosystems.

The methodological framework is partly based on **classification by morphospecies** according to the Rapid Biodiversity Assessment (RBA).

Our final aim is to provide professional end-users from the agricultural sector with an **innovative Android tablet application InsectFinder©** that facilitates data collection and calculation of indicators for biodiversity monitoring. The generated tool is currently being tested for its performance in field conditions. This innovative project brings together biologists, computer scientists, sociologists and agricultural professionals.

“Whatever the spatial scale considered, arthropods largely contribute to species richness. They are thus more representative for organismal biodiversity than any other group of organisms.”

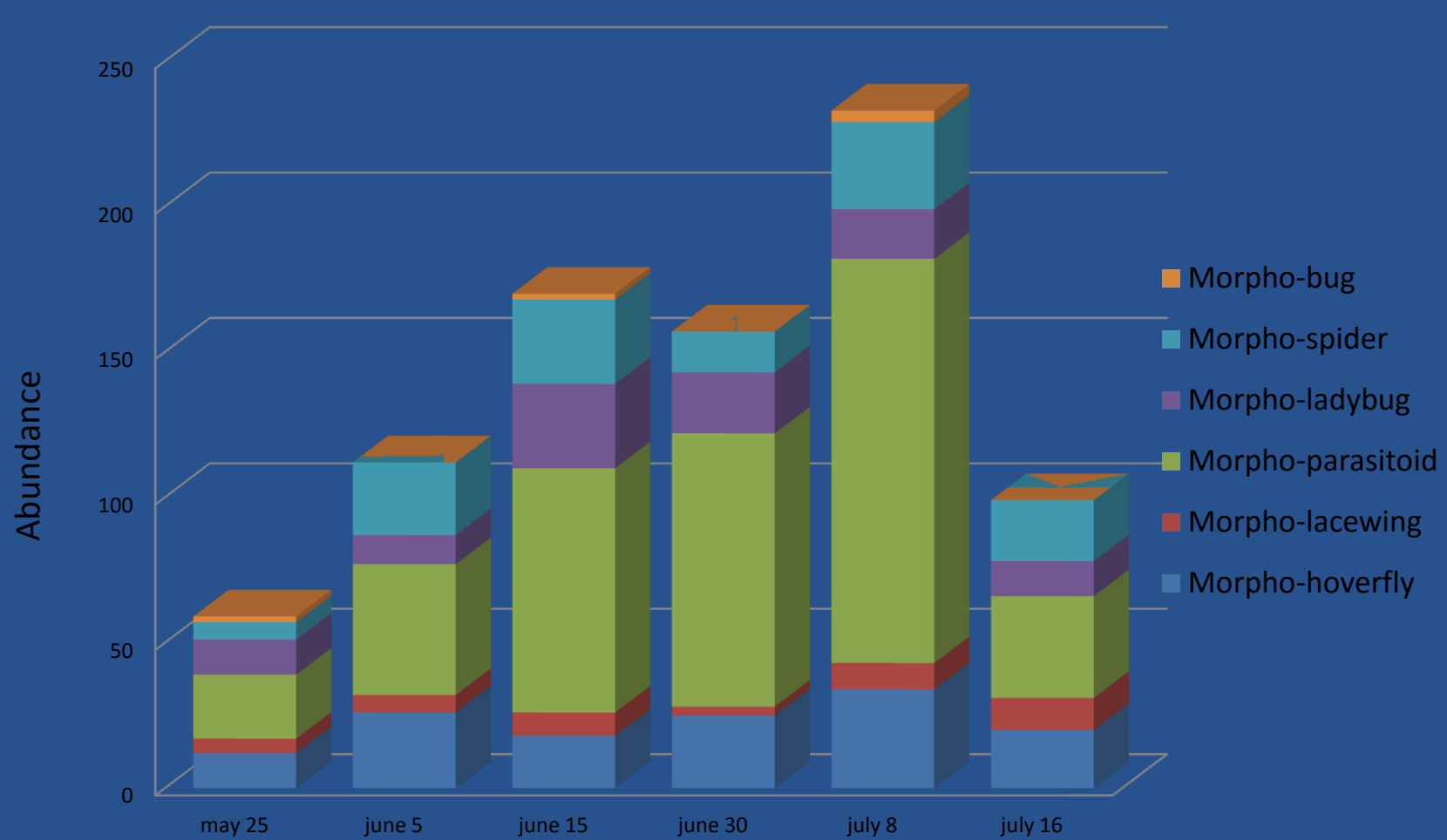


Testing the morphospecies (MS) approach in field conditions

A standardized sampling protocol has been set up and tested in ten different vineyards in Saumur-Champigny appellation and Flowered strip in Tours (France). At each experimental site, the average number of MS per location was estimated. In vineyards, each trap station consisted of one pitfall trap and one Combi trap. In flowered strips, sticky cards and butterfly nets are used. All monitored during two months. Collected specimens were classified in MS and then determined at the species or genus level by expert entomologists using morphological determination, to estimate the reliability of the MS approach compared to classical identification tools.

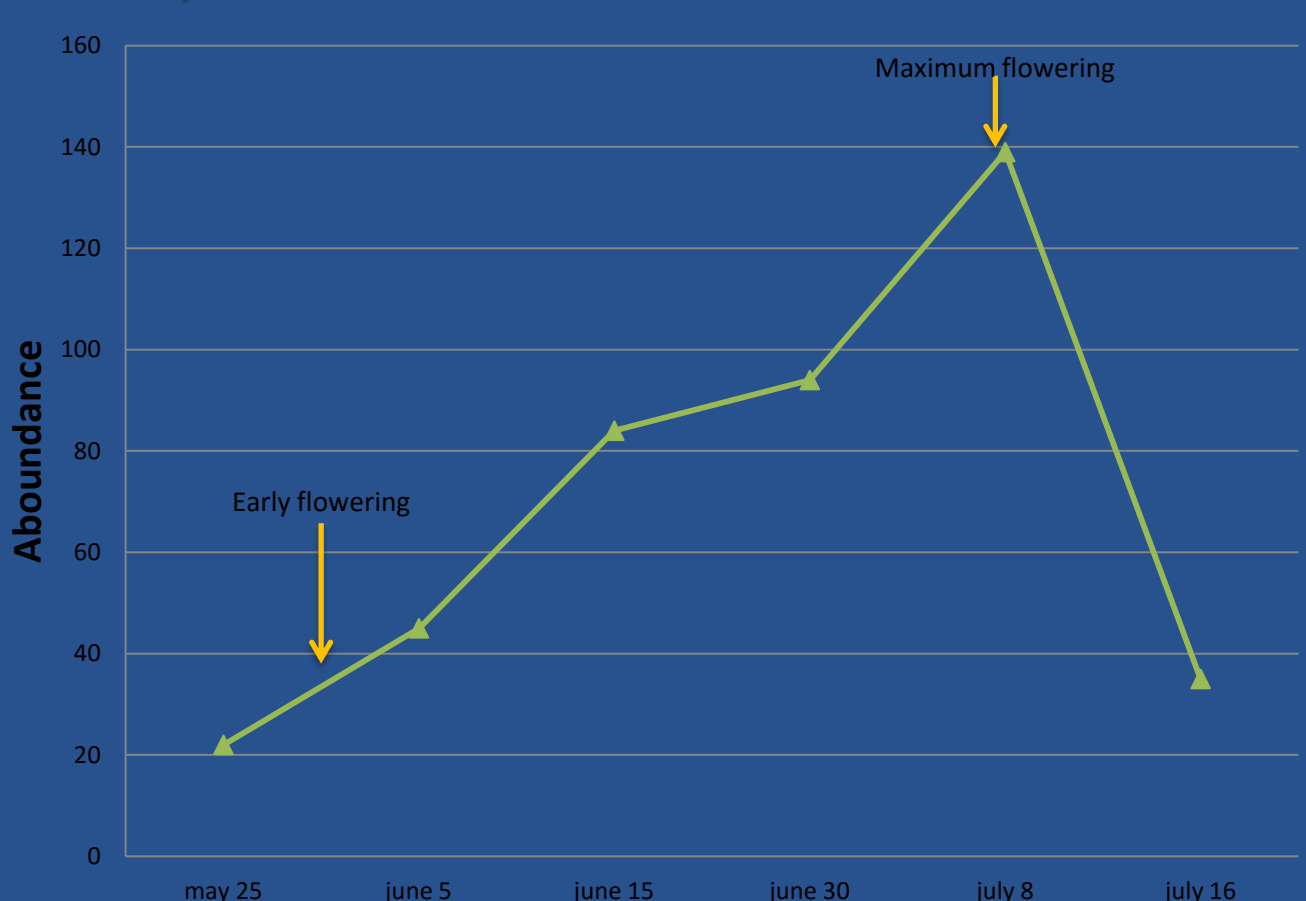
A case study: effects of landscape on biodiversity in vineyards and evaluation of service to crops by flowered strips

A. Evolution of natural enemies Morpho-species distribution in a flowered strip



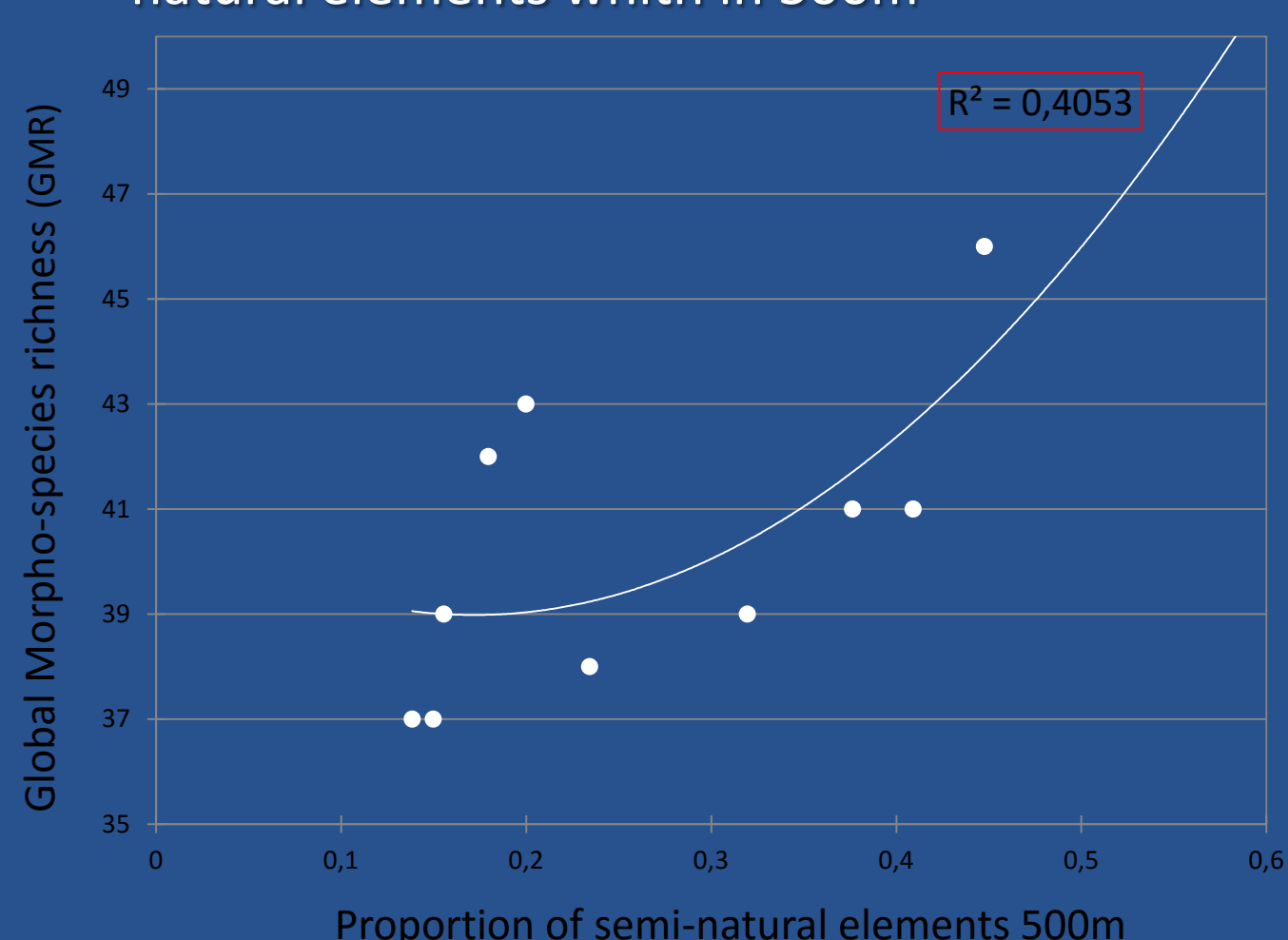
Flowered strips offer habitat to useful parasitoids and natural enemies arthropods

B. Evolution of Morpho-parasitoid wasps abundance during summer in a flowered strip in Tours



Flowered strips offer habitat to pollinators in spring and summer

C. Correlation between Global Morpho-species Richness (GMR) and proportion of semi-natural elements within in 500m



Semi-natural elements bring an important Morpho-species richness

The morphospecies (MS) approach

Identification of arthropods at the species level is often unreachable to non-specialists whose professional activities depend on the quality of local ecosystem services. To meet this demand, decision trees were constructed to classify Arthropods into 54 morphospecies (MS) according to evident morphological differences. Each of these parataxonomic units belonged to a predominant functional guild including pollinators, predators, parasitoids, herbivores and decomposers. For example Morpho-hoverfly pollinators, Morpho-spider carnivorous, Morpho-ladybug carnivorous, Morpho-lacewing carnivorous, Morpho-bug carnivorous... Our classification scheme for MS determination was then integrated into an Android tablet application InsectFinder© and the resulting identification tool was tested in field conditions.



Morpho-spider



Morpho-parasitoid



Morpho-hoverfly

Applications

Our new identification tool based on the MS approach was tested with horticulture professionals in different production conditions and to reach different objectives of applied research :

- evaluation of ecosystem services (pollination and regulation of pests) in asparagus crop production,
- assessment of the status of useful biodiversity in conventional versus organic farms,
- impact of landscape on functional guilds of arthropods in a vineyard...

Results obtained thank to this new tool for biodiversity assessment are **in line with results obtained with classic pre-existing methods** (species identification either by taxonomic determination or DNA barcoding). **The MS approach allows measuring relevant biodiversity indicators** such as average local species richness and relative abundance of major functional guilds of arthropods.

With the exception of some hemipteran and hymenopteran specimens whose correct classification into morphospecies and functional guilds may be difficult for non-specialists, **the method revealed convenient and rapid for exploitation of large sets of specimens** and for calculation of reliable indicators.

Integration of decision trees into the **Android tablet application InsectFinder©** allowed **very fast identification** (about 1 min for each MS) and preliminary feedbacks by professional users are very positive and supportive.

Our work opens the **possibility of an adaption of the tool to a wider typology of agrosystems.**

