

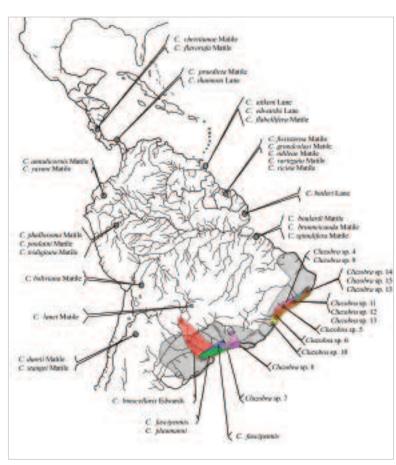
GEOGRAPHIC LIMITS AND CAUSAL AGENTS OF DIPTERA ENDEMISM IN THE ATLANTIC FOREST

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Biological diversity is heterogeneously distributed in space, so biodiversity knowledge cannot properly be reduced to a list of names. Even though attention given to biodiversity has grown in the last decades, quite few is still known about the geographic patterns of distribution of species and the historical causes of these patterns. It is still not possible to map the distribution of Brazilian species of most groups of animals and plants - not even in the most well studied areas - and it is neither possible to determine the sequence of events in the geological history of the continent that resulted in these patterns of distribution. This deficiency has implications for conservation policies and for the understanding of the evolutionary processes in the tropics. Conservation decisions are largely dependent on precise

knowledge of the geographic distribution of species. The understanding of the rate of biological evolution deeply depends of a correct association between the geographic range of species and the age of the events that may have caused these speciation processes in the past. This project uses more than 200,000 specimens of Diptera - one of the four megadiverse insect orders - collected with standardized methods along the Atlantic Forest, with emphasis in the State of São Paulo, to delimit areas of endemism of Diptera groups and to connect these areas in a hierarchy that reflects the history of geological events that resulted in the



Example of a distribution map of a single genus, Cluzobra (Mycetophilidae), for the Neotropical Region and with the new species collected in the study. In gray, are the hypothesized general areas of endemisms for Diptera along the Atlantic Forest. The grey areas represent the general hypothesis of areas of endemism along the Atlantic Forest for Diptera group. Differently from most species described, known only from the type-locality, the species studied in the project have species ranges known (color). Ther e is still material from the project from central and northern states along the Atlantic Forest with material to be analysed

present biodiversity in this area. As a byproduct of the project, a Home Page is being developed with identification keys, atalogs of Neotropical families of dipterans, photographs, and information on biology and distribution maps, to be used by the general public and by researchers with different degree of expertise on Diptera systematics or conservation.

SUMMARY OF RESULTS TO DATE AND PERSPECTIVES

The project is dealing with a collection with over 200,000 specimens belonging to more than 60 families of Diptera. The groups that have been reared below the family level resulted in the identification of species of almost 200 genera. The genera worked out resulted in the identification of almost 400 species, of which about 200 are new. The number of actual new species, however, will be far greater than this, since many families have still not been identified at the species level. General numbers, hence, point that the size of the overall Diptera diversity in the entire Neotropical region may be five times the number of species now identified in the group, of about 31,000 species. Being the most important study on Diptera diversity in the Atlantic Forest ever, the large sample along the study area covered in the project resulted in the correction of the number of areas of endemism identified for diptera groups: the seven areas proposed before were reduced to four main areas – even though subdivisions at the population level may exist. Also, the distribution of the species of many groups showed to be much more dynamic than expected, with at least marginal overlap in the distribution of species in different areas. The overlap in the Atlantic Forest, between species belonging to taxa of tropical distribution and taxa also present in Chile, Australia, and New Zealand showed the co-existence of species belonging to different temporal "layers" in the same areas. The secondary occupation of tropical terrains by species originated in temperate areas implicates in a modified understanding of the evolution of the Atlantic Forest and in new recommendation to the construction of analytical methods of biogeography. Possibly the cycles of glaciations and interglaciation occurring in South America, since the late Cenozoic, have been much more responsible for the alteration of the limits of species distribution than for speciation processes.

Very few biogeographical studies have been made with the amount of detailed original data on species distribution in the Atlantic Forest used in this project. The results generated allowed modifying different aspects of numerical methods of biogeography analyses. This includes the use of information on marginal overlap between species distribution, the subdivision of grids with geographical coordinates based on topographical accidents, the identification and separate use of allochronic taxa in biogeographic matrices, and the establishment of adequate protocols for different steps of the biogeographical study. The results of the project allow that new studies address biogeographic problems for which there is insufficient knowledge on its dipteran composition and connections. Certain areas with rather isolated spots of Atlantic Forest in eastern Mato Grosso do Sul, Goiás, central and west Bahia and Minas Gerais, and the state of Ceará have been so scarcely studied that cannot, with the information at hands, be included in general maps of species distribution. New studies can address precisely these areas, resulting in precious information for conservation purposes.

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