

New agenda for social-insect research

Success and Dominance in Ecosystems: The Case of the Social Insects. Edward O. Wilson. Ecology Institute, Nordbunte 23, D-2124 Oldendorf/Luhe, Germany, 1990. 104 pp.

All termites and ants and some bees and wasps live in societies of varying degrees of complexity ranging from an association of two or three individuals in a small cavity to a highly organized, elaborately architected nest with tens of thousands or even millions of individuals. Most modern social-insect researchers are engrossed in unravelling either the mechanisms of social organization and integration leading to the 'superorganisms' that social-insect colonies are thought to represent or the genetic and other mechanisms responsible for the origin and evolution of social life itself. Few, if any, have been more deeply engrossed in these problems than E. O. Wilson of Harvard University, who wrote not only the influential *The Insect Societies*¹ and *Caste and Ecology in the Social Insects*² but also the monumental 732-page *The Ants*³. Yet it is none other than Wilson who has been able to rise above these preoccupying concerns of social-insect researchers and give us a delightful little book with a new agenda for research—success and dominance in ecosystems.

The book is the result of the Ecology Institute prize awarded to Wilson for terrestrial ecology in 1987. The Ecology Institute is a unique organization, directed by the noted marine ecologist Otto Kinne and run entirely by honorary faculty, including, incidentally, four of India's leading ecologists. Among the activities of the Ecology Institute is the award of the Ecology Institute prize every year, in a rotating pattern, to marine, terrestrial and limnetic ecologists. Each recipient is expected to write a book, which is made available worldwide at cost price. A number of copies are also donated to libraries in Third World countries.

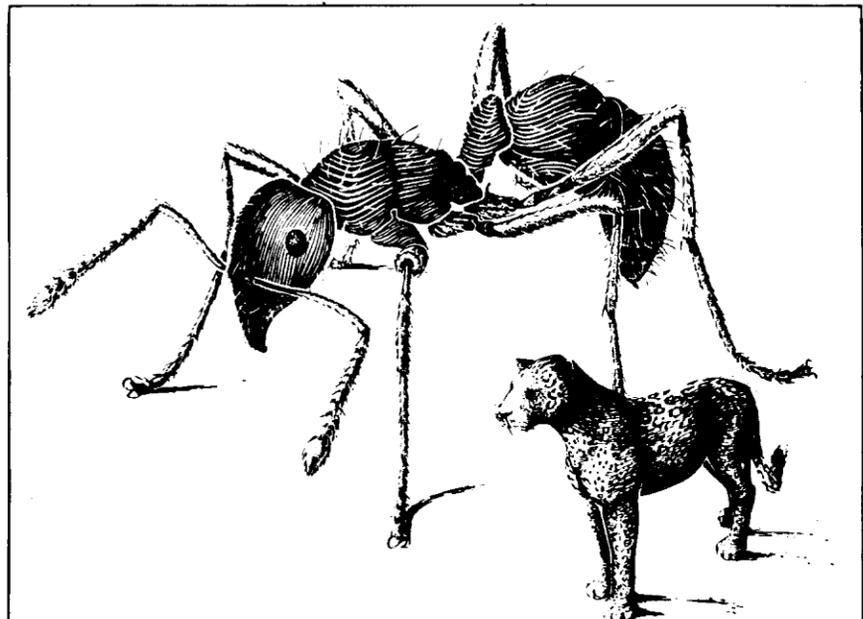
The award of the 1987 prize to Wilson and the requirement that recipients produce a book have resulted in a most delightful consequence for all of us. Wilson has outlined a new agenda for social-insect research in the form of

the hypothesis that social insects are particularly successful and spectacularly dominant in their ecosystems. To start with, Wilson has produced working definitions of success and dominance—success as the longevity of a clade in evolutionary time and dominance as the relative abundance of a clade in comparison with related clades over its entire history and its ecological and evolutionary impact on coexisting flora and fauna. The 104-page book is organized into eight chapters—'The dominance of the social insects', 'The social insects: a primer', 'The meaning of success and dominance', 'Why are social insects ecologically dominant?', 'The superorganism', 'Social optimization', 'Competition and community organization', and 'Hawaii: a world without social insects'—and concludes with a two-page summary. It is tempting to mention a printer's devil (or a Freudian slip?!): while there is no error in the chapter titles in the body of the book, the title of chapter eight in the table of contents reads 'Hawaii: a world without insects' instead of 'Hawaii: a world without social insects'. If Hawaii were indeed without insects altogether, that would of course have

been truly remarkable. As it happens, there is virtually no terrestrial or freshwater habitat, from the Antarctic to hot springs and from deep underground caves to the top of the Himalayas, that has not been colonized by insects of one kind or another. It must be mentioned though that very few insects have learnt to live in the ocean⁴.

Even a cursory glance at the known facts about social insects shows, as Wilson points out, that social insects are ecologically dominant. Social insects may constitute as much as 30% of the entire animal biomass and 80% of the entire insect biomass in tropical forests. And yet, they account for only about 2% of the described insect species. The biomass of ants alone in the Brazilian tropical forest has been estimated to be at least four times the total biomass of all vertebrates put together!

The question of the success of social insects is not so obvious. Wilson reviews what little is known about evolutionary longevity of different insect and other animal clades and has some obvious difficulty in arriving at a conclusion. He states variously that 'social insects are relatively successful', '[the evidence] is



In the Brazilian tropical forest, the biomass of ants is approximately four times greater than the biomass of all of the vertebrates (mammals, birds, reptiles and amphibians) combined. The difference is represented here by the relative sizes of an ant, *Gnamptogenys pleurodon*, and a jaguar. (Original drawing by Katherine Brown-Wing. Reproduced from the book with permission from Ecology Institute and E. O. Wilson)

consistent with the view that eusociality conveys evolutionary long life in the insects', 'social insects can be judged as at least moderately successful', and 'their tenacity is further indicated by the fact that so far as known no major eusocial clade, at the rank of family or above, has ever gone extinct'. It is clear, however, that too little is known about the fossil history of insects to draw a more accurate conclusion about the success or otherwise of social insects. But Wilson's account of what little is known and his focus on success should stimulate more research on this question. On the final outcome of such research will rest the important question of the relationship between success and dominance — an almost completely unexplored domain. Next comes the question of why social insects are so ecologically dominant. Wilson cites their series-parallel operations, the presence of sterile 'dispensable' workers, resource inheritance, and social homeostasis as possible factors.

The many provocative hypotheses and predictions made by Wilson, such as that 'social insects are at the ecological centre' and 'solitary insects [are] at the periphery' and that all insects are not social because someone can thrive in the 'ecological cracks left by the social insects', should open up whole new programmes of research. Even in the incipient stage of this new research programme, Wilson has already pointed out ways of capitalizing on a natural experiment. There were no social insects in Hawaii before colonization by man. How different was the evolution of the fauna and flora of Hawaii because of the absence of termites, ants, and eusocial bees and wasps? Wilson makes a number of predictions: Scale insects and other honeydew-providing insects protected by ants elsewhere will be scarce in Hawaii relative to related groups; herbivores and predaceous insects will occur in denser, less protected populations; non-formicid predators such as carabid

beetle and spiders should be more diverse and abundant; and so on. Wilson then goes on to outline what little evidence already exists for and against such predictions. Surely the best is yet to come — when social-insect researchers embark on the new agenda provided by Wilson?

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