INTRODUCTION

When primitive man established his abode in caves, under cliff overhangs or in rudely constructed forest shelters, he came into close contact with wasps of the family Sphecidae. These insects had been making use of such protected places as nest sites for a long time, and there was probably an adverse reaction to the intrusion. The result may have been an uneasy truce and occasional "warfare." When man moved into more sophisticated dwellings, the wasps moved with him and proceeded to build nests under the eaves of his house, in his garden pathways, and in the twigs of his ornamental plants. Today, every farm boy and many city youngsters quickly learn to recognize the blue mud-dauber, the black and yellow mud-dauber, the cicada-killer, and the bembicin sand wasps. The relationship with these insects is generally unfriendly and results from a fear of their greatly overrated stinging powers. Actually, sphecids are mainly beneficial to man and are relatively harmless.

The curious and often elaborate actions of wasps have made them favorite subjects of studies on behavior. Without correct identifications, these studies are of little value. Yet determinations have not always been correct or easy to obtain. In the past century hundreds of scientists have contributed new information on the taxonomy of the several thousand kinds of sphecid wasps. This accumulation is now so large that there is a great need for its consideration from a worldwide standpoint and summarization in the form of revisions, keys, and catalogs.

Since there is no modern, world revision of Sphecidae, no continental revision, and very few comprehensive studies dealing with local faunae, many of the characteristics imputed to the genera and tribes are not reliable except at a regional level. This has resulted in widespread differences of opinion about use and composition of most genera, tribes, and subfamilies. We have taken a broad view and have created or retained categories that seem to convey the most information and that are at the same time morphologically defensible. On the whole this has led to a reduction of subgenera, recognition of more genera than previously, and a narrowing of morphological gaps as large, "catchall" genera have been partitioned in the interests of practicality. We hope that our classification will be viewed impartially and without traditional or conservative bias. Also, since so many genera are imperfectly known, it is to be expected that changes enlarging or decreasing the number will be made in the future as more information becomes available.

Our work then has been directed toward several different goals: (1) providing a worldwide perspective of the family including a reclassification of all categories down to the generic level, diagnoses, keys for all categories down through subgenus, illustrations, and distributional data; (2) the summarization of previously published data including biological information; (3) the notation of problem areas within various taxa; (4) the establishment of a standardized morphological nomenclature for the family; (5) provision of an up-to-date generic catalog; and (6) compilation of species and their synonyms.

We have tried to lay the groundwork for more detailed revisions at the generic or tribal level. Obviously, there is much undetected synonymy presently built into the Sphecidae. Likewise, there are myriads of species yet undiscovered. In a fast-moving science such as taxonomy it is the fate of any revision to be several years out-of-date by the time of its publication. This should in no way diminish its long-term value, however. Incorporation of new species and synonymic findings into a well-ordered revision is a relatively simple matter. It is our hope that with the publishing of this book the state of knowledge in this family will have reached the point where most future generic revisions will not be limited to political areas. This is not to imply that studies of local faunae are not valuable; but what is needed are revisionary studies on a broader geographical basis, e.g., hemispheric or worldwide, if we are to unravel the many remaining problems.

Subjects that we have not studied or have touched upon only briefly in this book are: comparative anatomy of mouthparts; female terminalia; internal organs; eggs, larvae, and pupae; the metasternal area of the thorax; and...
leg details such as setation and coxal morphology. Studies in these areas may help to further clarify the classification of the family.

We have been able to study material of all but 5 of the 226 genera recognized in this book: Anomiopteryx, Odontocrinus, Chimilibates, Leclercqia, and Towada. One additional taxon, Mellinuswesteri, has never been satisfactorily identified, and we have been unable to locate type material. It may not be a sphecid.

Inevitably, our treatment of various sections has been somewhat uneven. The multiple authorship has been partly responsible, but differing extent of published knowledge has contributed, also. There are limitations in the present study, but we feel that we have done the best we can considering the time and material available. In this connection we are reminded of the subtly humorous statement by J. B. Parker (1929) with respect to his revision of the Stizini and Bembicini. He asked his readers for "a full measure of their generous sympathy," and to those who found his work "intolerably bad," he said, "I shall look with expectancy for a speedy publication of something better."

PROCEDURE

The present study was begun in 1964. Implementation of the work followed a series of steps: (1) a thorough search of literature and development of a working library of about 2,000 individual papers by some 400 authors; (2) assembling a collection representing nearly every genus in the Sphecidae with special emphasis on the type species of each genus; and (3) intensive study of wasps thus accumulated, comparison with descriptions in the literature, preparation of several thousand illustrations. Illustrations are often the most useful part of a taxonomic publication. We have tried to provide "habitats" or recognition drawings in lateral and face view as well as detailed figures to supplement the keys and descriptions.

As an important background for the present study, visits to a large number of museums were necessary. R. M. Bohart spent a total of seven months during two trips (1960, 1971) in western Europe, and A. S. Menke visited there for short periods in 1964 and 1965. Bohart, Menke, and F. D. Parker visited museums in the eastern United States at various times from 1960-1970, and Menke traveled to the Canadian National Collection at Ottawa and the Provancher Collection at Quebec in 1966.

We have had the helpful cooperation and support of museum curators and other scientists in all parts of the world, and many individual specialists gave us the benefit of their knowledge on systematic problems in addition to contribution of specimens and personal reprints. Without such help a project of this scope and magnitude would have been impossible.

Of the various collaborators on this book, R. M. Bohart and A. S. Menke have written the sections of general information and have acted as editors for the entire work. Individual authorship of taxonomic sections should be attributed as follows: Nyssoninaceae, Entomosericinae, and Xenosphecinae to Bohart; Sphecinae, Laphyragoginae, Larrinae, and Heliocausini to Menke; Ampulicinae and Philanthinae to Bohart and Menke; Crabroninae to Mrs. H. Court, except Cossocerus to D. Levin, Crabro, Ectennius, and Lestia to Bohart; Pemphredoninae to Bohart and E. E. Grisell; and Astatinae to F. D. Parker.

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We have been fortunate to have the services of four fine artists: Judy Jay (Mrs. J. Skovlin), who drew the full figure profiles; Mrs. Karen Fulk, who rendered the many facial portraits; Mrs. Ellen Parker, who contributed several detailed drawings, and Mrs. Mary Benson, who painted the watercolor frontispiece. Most of the line drawings were made by the coeditors.

J. van der Vecht, Putten, Netherlands; W. J. Pulawski, Zoological Institute, Breslau (Wroclaw), Poland, and J. de Beaumont, Lausanne, Switzerland deserve special mention for taking the time to review certain sections of the book. Not only did they offer many useful criticisms, but they also freely gave us much new species synonymy and clarified the status of various names. In the checklists we have credited them in each specific case. Several people examined types, providing helpful notes on each, and assisted with the identification of various species: K. V. Krombein, D. Vincent, E. Riek, I. H. H. Yarrow, E. Rubio, J. Leclercq, K. Tsuneki, D. Levin, and M. Fritz. H. E. Evans and K. V. Krombein reviewed some of the biology sections. W. J. Pulawski was especially helpful in bringing to our attention obscure or unobtainable literature published in eastern Europe. R. Brumley performed extensive library research on wasp biology and contributed significantly to the section on Pemphredoninae. L. A. Stange established a background for our subsequent studies in the taxonomy and phylogeny of the same subfamily. G. S. Steyskal and R. Gagne translated a number of important foreign papers for us, and A. Gurney verified the use of many Orthoptera names. R. W. Matthews, J. Davidson, J. P. van Lith, O. W. Richards, and C. Sabrosky also assisted in various ways. To all of these people we are most grateful for their help.

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New York City (J. Rozen); Bishop Museum, Honolulu, Hawaii (C. Yoshimoto, L. Gressitt); California Academy of Sciences, San Francisco (C. MacNeill, P. Arnaud); California Insect Survey, University of California, Berkeley (J. Powell); Carnegie Museum, Pittsburgh, Pennsylvania (G. Wallace); Los Angeles County Museum of Natural History, California (C. Hogue, R. Snelling); Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts (H. Evans); U. S. National Museum, Washington, D. C. (K. Krombein, A. Menke); University of California, Davis (R. Schuster); University of California, Riverside (P. Timberlake, S. Frommer); University of Kansas, Lawrence (G. Byers); Utah State University, Logan (G. Bohart, W. Hanson).

Foreign institutions: Academia de Ciencias de Cuba, Havana (P. Alayo); Academy of Sciences, Moscow, USSR (Y. Popov); British Museum (Natural History), London (I. H. H. Yarrow, C. Vardy, R. W. Crosskey); Canadian National Collection, Ottawa (W. R. M. Mason); Commonwealth Scientific and Industrial Research Organization, Canberra, Australia (E. Riek); Department of Scientific and Industrial Research, Nelson, New Zealand (G. Kuschel); Fukui University Biological Laboratory, Japan (K. Tsuneki); Institut für Pflanzenschutzforschung Kleinmachnow (formerly Deutsches Entomologisches Institut), Eberswalde, German Democratic Republic (J. Oehlke); Institut Agronomique de l’État, Gembloux, Belgium (J. Leclercq); Instituto Miguel Lillo, Tucumán, Argentina (A. Willink, L. Stange); Kyushu University Entomological Laboratory, Fukuoka, Japan (K. Yasumatsu); Lunds Universitetets Zoologiska Institution, Lund Sweden (H. Andersson); Musée Zoologique, Lausanne, Switzerland (J. de Beaumont, J. Aubert); Museo Argentino de Ciencias Naturales, Buenos Aires (M. Viana); Museo Civico di Storia Naturale, Genoa, Italy (D. Guiglia, E. Tortone); Museo Civico di Storia Naturale, Venice, Italy (A. Giordano Soika); Museo ed Istituto di Zoologia Sistematica, Università di Torino, Italy (M. Zunino, U. Parenti, G. Bacci); Museo de Zoología, Instituto Municipal de Ciencias Naturales, Barcelona, Spain (F. Español); Museu e Laboratorio Zoologico, Universidade de Coimbra, Portugal (M. de A. Diniz); Muséum d’Histoire Naturelle, Geneva, Switzerland (C. Besuchet); Muséum National d’Histoire Naturelle, Paris, France (S. Kelner-Pillault); Muzeul de Istorie Naturală “Grigore Antipa,” Bucharest, Romania (X. Scobbi-Palade); National Museums of Rhodesia, Bulawayo (E. Pinhey); Naturhistorisches Museum, Vienna, Austria (M. Fischer); Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands (J. van der Vecht); South Australian Museum, Adelaide (G. Gross, N. McFarland); Természettudományi Múzeum Allattára, Budapest, Hungary (L. Móczár, J. Papp); Transvaal Museum, Pretoria, South Africa (S. de Kock, the late G. van Son); University of Stellenbosch, South Africa (J. Theron); University Museum, Oxford, England (C. O’Toole, I. Lansbury); Zoological Institute, Leningrad, USSR (V. Tobias); Zoological Institute, Breslau (Wroclaw), Poland (W. Pulawska); Zoologische Sammlung des Bayerischen Staates, Munich, Federal Republic of Germany (F. Bachmaier); Zoologische Institut, Martin Luther Universität, Halle, German Democratic Republic (J. Hüsinger); Zoologischen Museum der Humboldt Universität, Berlin, German Democratic Republic (E. Königsmann).

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