



Entomofauna

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**Urban fauna.
Hymenoptera in Madrid households,
with special reference to ants.
(Hymenoptera, Formicidae)**

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Abstract

Key words: Urban fauna, Hymenoptera, Formicidae.

Over a one year period (October 1991-October 1992), 13.438 arthropods were captured from 52 Madrid households. The third most abundant group after the flies (Diptera) and acari (Acarina) were the Hymenoptera with 1.608 individuals, 11.96% of the total. This order, together with the Diptera, were the only orders with maximum prevalence (i.e. present in 100% of households).

The *Formicidae* is the most highly represented hymenopteran family constituting 80.10% of individuals of this order recorded and is present in 82.69% of households. The remaining 19.90% were other Hymenoptera groups that only appeared accidentally.

Zusammenfassung

Es wird eine Studie über das Vorkommen von Ameisen (Hymenoptera, Formicidae) in Madrider (Spanien) Haushalten vorgelegt.

Introduction

This work is one of a series of studies comprising an important research project on Arthropods in Madrid Households funded by Johnson WAX ESPAÑOLA.

Given the close connection between arthropods and man, it is of great interest to know precisely what kind of fauna inhabits our houses, the degree of synanthropism or accidentally these represent and whether they pose a significant health risk. It is also

pertinent to compile species lists of taxa that could migrate from green urban areas where there establishment is severely limited.

The originality of this work lies in its focus on city household fauna, in this case Madrid, compared to previous publications that describe the fauna in areas surrounding buildings or in open spaces such as parks, gardens or green areas in European towns (PISARSKI & TROJAN 1976, LUNIAK & PISARSKI 1982, LUNIAK 1990, MONSERRAT & GAMARRA, 1995).

Urban myrmecofauna are the hymenopterans that have received the most attention in the literature (MALLIS 1969, CZECHOWSKI 1990, CZECHOWSKI et al. 1990, KNIGHT & RUST 1990, OI et al. 1994, ROBINSON 1996), probably due to their characteristic ecological and ethological adaptability. Another new aspect of this work is that it includes the first phenological description of some species.

Methods

Adhesive traps were placed in a total of 52 households throughout the year, from October 1991 to October 1992. They were replaced every 15 days during the whole period. From 52 households sampled in Madrid, 46 of them were in the center of the city, ranging from ground-floors to attics; and 6 households in the outskirts, mostly semidetached houses. In order not to interfere with the results the occupants agreed not to use any type of insecticide. Traps were placed in the following locations: bathroom (B), kitchen (K), and by the living room window (W). This section was described in further detail by MONSERRAT & GAMARRA (1995).

We use the classification adopted for Hymenoptera in GOULET & HUBERT (1993).

All material collected is stored at the Department of Entomology, Universidad Complutense of Madrid.

Results

Of the total 13.438 individuals found belonging to 23 Orders, 1.628 (11.96%) were of the hymenopteran Order which was the third most common in the households sampled. Hymenoptera and Diptera were the only orders to be found in all the households.

A total of 19.90% of the Hymenoptera belonged to families other than the Formicidae: 4.16% to the Braconidae, 3.10% to the Encyrtidae, 3.17% to the other Chalcidoidea do not identified to the Family level and the remaining 9.47% belonged to 23 other Families or Superfamilies (Fig. 1).

The ants were the most represented hymenopteran Family with 1.288 individuals (80.10% of the individuals of this Order) and making 82.69% of the total count (Fig. 1).

There are 4 Subfamilies of myrmecofauna: Dolichoderinae, Formicinae, Myrmicinae and Ponerinae. In our study, 13 species belonging to 10 Genera were identified. However, due to the poor condition in which they were found, three specimens of Ponerinae were only identifiable to the Subfamily level (Fig. 2).

The Formicidae species found in the Madrid households are as follows:

Subfam. Myrmicinae

Gen. *Tetramorium* MAYR, 1855: *T. caespitum* (LINNAEUS, 1758), *T. hispanicum* EMERY, 1909;

Gen. *Aphaenogaster* (MAYR, 1853) Roger emend.: *A. senilis* (MAYR, 1853);

Gen. *Messor* FOREL, 1890: *M. structor* (LATREILLE, 1798);

Gen. *Pheidole* WESTWOOD, 1841: *P. pallidula* (NYLANDER, 1849).

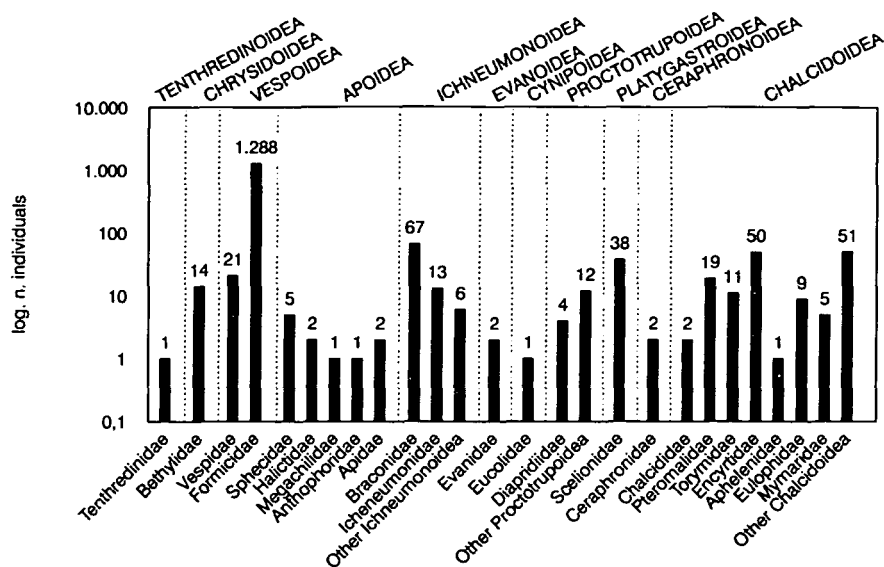


Fig. 1: Abundance of the hymenopteran families and superfamilies collected (at the top of each column the number of individuals is recorded).

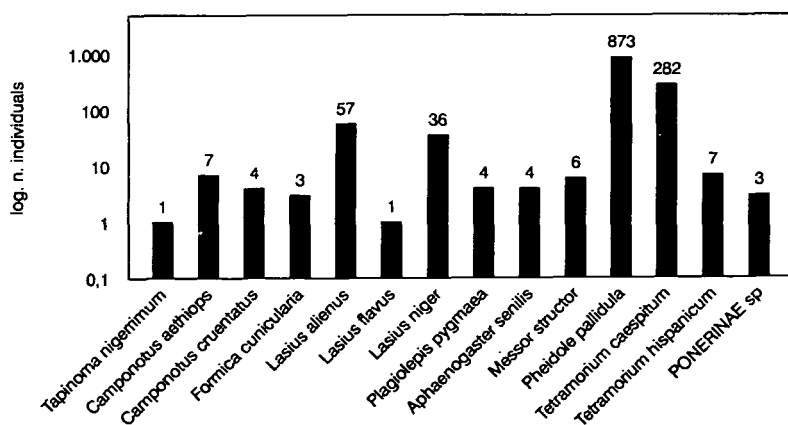


Fig. 2: Species abundance of the Formicidae family (at the top of each column the number of individuals is recorded).

Subfam. Formicinae

Gen. *Lasius* FABRICIUS, 1804: *L. niger* (LINNAEUS, 1758), *L. alienus* (FÖRSTER, 1781), *L. flavus* (FABRICIUS, 1781);

Gen. *Camponotus* MAYR, 1861: *C. cruentatus* LATREILLE, 1802, *C. aethiops* (LATREILLE, 1798);

Gen. *Plagiolepis* MAYR, 1861: *P. pygmaea* (LATREILLE, 1798);

Gen. *Formica* LINNAEUS, 1758: *F. cunicularia* LATREILLE, 1798.

Subfam. Dolichoderinae

Gen. *Tapinoma* FÖRSTER, 1850: *T. nigerrimum* NYLANDER, 1856.

Subfam. Ponerinae

Ponerinae sp.

The most abundant were: *Pheidole pallidula*, (67.78 % of Formicidae), *Tetramorium caespitum*, (21.89 %), *Lasius alienus*, (4.42%) and *Lasius niger*, (2.79 %). The 3.12% remaining to other species of ants.

Regarding sex and caste distribution, the females were the least frequent (0.46%), followed by the males (2.32%). The most numerous caste were the workers (97.22%), as could be expected since these are foragers.

Regarding their presence throughout the year, the number of individuals increases from spring to reach a maximum in August (Fig. 3). With respect to the distribution of the individuals within the houses these showed a slight preference for the kitchen (55.66%) followed closely by the bathroom (39.98%), and very few found at the window (4.36%).

Although ants were found in the majority of households, more than 100 specimens were found in three houses Nos. 43, 11 and 27, with 147, 166 and 270 individuals respectively. In the first two of these, high numbers of individuals were recorded throughout the year implying that there were well established colonies. These were all flats reasonably near ground level, the first on the ground floor and the second on the first floor, thus facilitating access from outside. In household No. 27 however, the ants appeared suddenly and at the same time as a prey (cockroach). Once this event was over they did not appear again.

Discussion

With the exception of the ants, the appearance of the other hymenopteran families was accidental (Fig. 1), this was also the case in the families such as the braconids and encyrtids with a slightly greater number of individuals. This could be explained by the parasitic behavior of the latter on juvenile stages or adults of other insect groups commonly inhabiting human dwellings (flies, butterflies) (GAULD & BOLTON 1988) or their introduction with items of daily household use (fruit, plants, etc.).

Regarding ants, a lot of species could be expected to nest and feed in houses, since there is permanent access to food, absence of natural predators and stable environmental conditions (only small changes in temperature and humidity, VEPSALAINEN & PISARSKI 1982). They would be given pest status for foraging indoors (ROBINSON 1996). Moreover, we could expect to find a predominance of xerophilic or thermophilic species, but there could be a greater range and include species with other preferences.

At first glance, the number of species found could seem very low considering the great number of ant species in Spain (more than 220). This, however, coincides with the results from other studies and is a characteristic mentioned in articles published on urban fauna. Similar results are given by studies on green areas in Poland: a study on park trees in Varsovia (CZECZOWSKI et al. 1990) recorded only 8 species, or one on parks and other green zones of built-up areas in Varsovia revealing the presence of 11 ant species

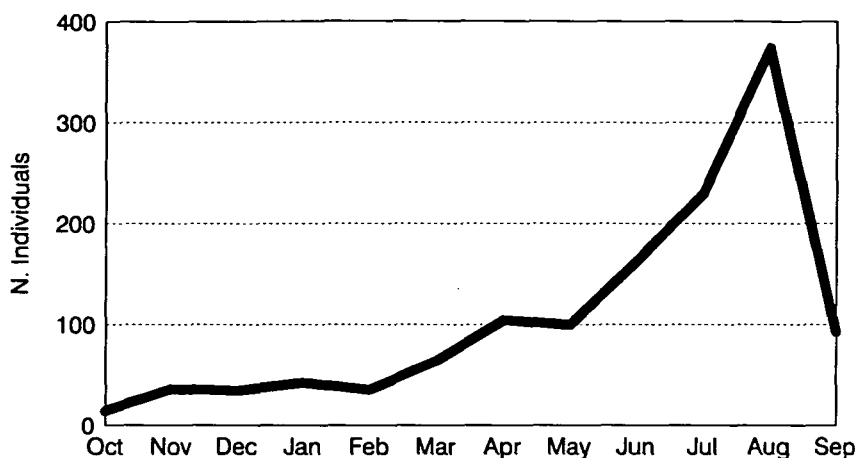


Fig. 3: Phenology of the Formicidae family.

(PISARSKI & CZECHOWSKI 1978) and the 4 year study of urban myrmecofauna on lawns in the same city that only identified 23 species (CZECHOWSKI 1990).

In general, there are only one or two dominant species of urban myrmecofauna. If conditions in the houses fulfill certain necessities, these species will migrate from the green areas and establish their colonies indoors.

Regarding their effect on human health, the release of formic acid, poisonous stings of the Myrmicinae or irritant substances from the anal gland of the Dolichoderinae do not pose any major health risk. It is noteworthy, however, that some genera such as *Pheidole* and *Tetramorium* can be intermediate hosts of Cestodes (BEAVER et al. 1986, PASSERA 1975).

Some reflections on certain species

Pheidole pallidula (NYLANDER, 1849)

This is one of the most characteristic ant species of both natural and urban environments. Its great ecological success can be attributed to its nocturnal and diurnal foraging, as well as its individual and collective foraging techniques (mass recruitment) (DETRAIN 1990).

This species has a Mediterranean distribution but has been introduced into other territories through fruit and vegetables. Their colonies can have up to 6000 individuals (DETRAIN et al. 1988). The worker caste are strongly dimorphic and the soldiers comprise from 2 to 15% of the total population (PASSERA 1977). Members of this species have lost the ability to sting, but have an effective defense system based on the soldiers' bites.

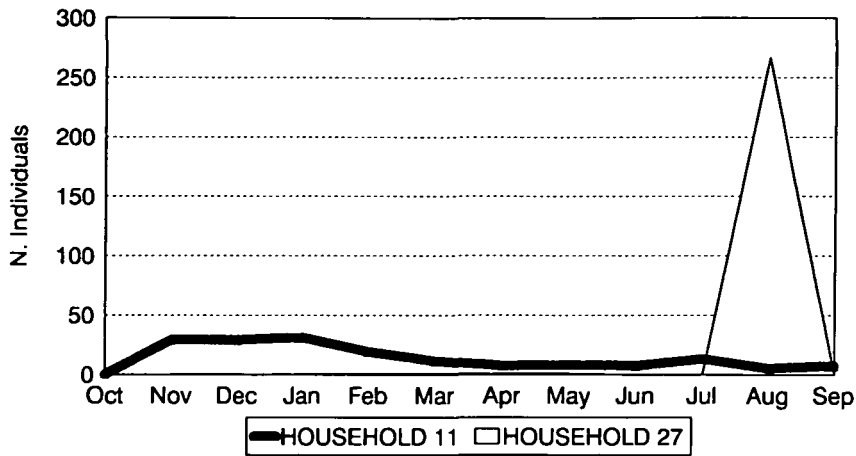


Fig. 4: Phenology of *Pheidole pallidula* in the two households with greatest abundance.

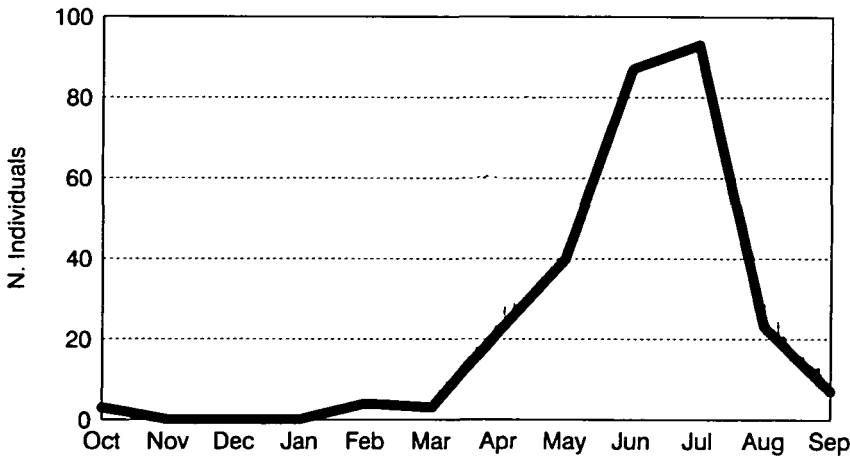


Fig. 5: Phenology of *Tetramorium caespitum*.

It is however a highly synanthropic species common in houses and is the most represented species in households of this study (57.7%). It is also the most abundant with 67.78% of the total, but only exceeding 100 individuals in 2 households. As mentioned above, in some households this species appears to be well established (No. 11) but in others, a large number of individuals appear temporarily (household No. 27) (Fig. 4) possibly due to a mass recruitment followed by their fall in the trap. With respect to their preferred location, it is interesting to note the high numbers found in the bathroom (60.48%), although this was mainly due to an isolated mass appearance. The most favored location for this species is probably the kitchen, where they are regularly found in households with established populations.

Likewise, the appearance of two isolated females can be interpreted as accidental, since this occurs in two separate events in different households.

It is worth pointing out that there are always some active individuals throughout the year. This is probably explained by the different annual cycle in the households compared to natural environment, with no period of hibernation in the former. This also indicates that the conditions present in the households are probably optimum for this species.

P. pallidula is a species with important health implications for man since it is an intermediate host of the cestode *Raillietina* Fuhrmann, 1920. This does not have great implications, since it is easily eliminated (BEAVER et al. 1986).

***Tetramorium caespitum* (LINNAEUS, 1758)**

This is the second most abundant species comprising 21.89% of the individuals (Fig. 2). It appears in 13.5% of the households, a relatively high incidence compared to data reported in the literature.

It is considered harmful and was introduced into the USA long before other species and is an important pest in some crops (SMITH 1943). PISARSKI & CZECHOWSKI (1978) consider it to be an uncommon species in urban environments due to the lack of an adequate food supply. However, other published data concerning this aspect refers to areas surrounding buildings which, compared to the interior of dwelling places, have more predators and less food resources. Recently, ROBINSON (1996) considers this species as one of the major household pests in many urban areas around the world.

T. caespitum is probably the ant species considered to have the greatest health risk since it can act as intermediate host of up to six cestode species (PASSERA 1975).

Very large colonies of *Tetramorium caespitum* are found in natural environments. The sexed individuals develop in early summer and fly in June and July. This coincides with data from our study (Fig. 5).

Like *Lasius alienus*, their favorite location is the kitchen (78.01%) followed by the bathroom (20.92%).

It is worth noting that this species is mostly inactive for three months of the year: November through January, appearing again in March.

***Lasius alienus* (FÖRSTER, 1781)**

This species appears in 9.6% of the households with an abundance of 4.42%. It is interesting to note the large number of males that enter the houses in June. This implies that the emergence of the sexed individuals occurs earlier than in other European cities in which it takes place in August (COLLINGWOOD 1979). All the males studied appeared only in window traps of two houses, probably accidental due to appearances coinciding with the nuptial flight -the households were ground-floors in a garden area.

Considering worker locations, this species is preferentially located in the kitchen. September through December are usually its inactive months.

Lasius niger (LINNAEUS, 1758)

This appears with a frequency and abundance of 15.38% and 2.79% respectively and its presence in households is mostly accidental. Although this was the most prevalent species in other European studies (COLLINGWOOD 1979), our work shows that it was more abundant in the sites furthest away from the city center.

Its favorite location is the kitchen (75%) followed by the bathroom (13.89%) and in our study it is inactive in November and December.

L. alienus and *L. niger* are both considered to use the households in Madrid for foraging.

Conclusions

With the exception of the ants, the hymenopteran species present in Madrid's households appeared accidentally in all cases, either by direct access through windows and doors, or indirectly by being introduced along with other insects, fruit, vegetables or ornamental plants.

The 13 ant species studied show a preference for the different household rooms such as the kitchen and bathroom. In the other rooms (e.g. the living room) they only appear accidentally, coinciding with the emergence of the sexed individuals. Most of the specimens belong to the worker caste.

With regard to their phenology, it is worth noting that in most of the colonies instead of the natural seasonal pattern, they are active throughout the year with perhaps a short inactive period during the coldest months. Sexed individuals, however, appear when expected with slight variations resulting from an early arrival of this period.

In this study, the species best adapted for cohabitation with man, shown by its presence in over half the households and its appearance throughout the year, was *Pheidole pallidula*. This species can enter the households first for foraging, and later to establish themselves there.

Tetramorium caespitum is here considered as a species that goes into the households for foraging, as indicated by the number of individuals indoors compared with the ones outdoors.

However, some species such as *Tapinoma nigerrimum* considered as urban pests in other studies, was not as common in our study as to deserve this label.

It also seems clear that the household myrmecofauna in Madrid, like the surrounding urban fauna, are represented by species highly resistant to soil and air pollution, as well as resistant to the harmful emissions from most common cleaning products.

Finally, the high number of species found seems to indicate their affinity for households, since the mild climatic conditions of our country do not cause synanthropic tendencies as happens in Central and Northern European countries.

Acknowledgements

We should like to thank Dr. W. CZECHOWSKI for helpful comments on the manuscript and D. GARCÍA-BELLIDO for linguistic revision.

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Literaturbesprechung

LODISH, H. et al. 1996: Molekulare Zellbiologie. - Walter de Gruyter, Berlin. 1448 S.
Im Zentrum dieses Mammutwerkes (über 1140 größtenteils vierfarbige Abbildungen, 96 Tabellen) stehen drei Fragen, die dieses Buch zu beantworten versucht:

Wie wird die Genexpression gesteuert? - Welche Struktur und Funktion haben Proteine? - Welcher Zusammenhang besteht zwischen den Aktivitäten der Zellen, Gewebe oder Organismen und den Eigenschaften der Proteine sowie weiterer Moleküle in den Zellen?

Zur Beantwortung dieser Fragestellungen ist dieses Buch in vier Teile gegliedert: 1) Das Fundament, 2) Regulation der Zellaktivitäten durch den Zellkern, 3) Aufbau und Energieversorgung der Zelle, 4) Integrative und spezielle Zellaktivitäten. In dieser 2. Auflage wurden zahlreiche Kapitel umgestellt, erweitert und aktualisiert, neue Techniken werden besprochen und am Ende aller Kapitel sind Verständnisfragen hinzugefügt worden. Ebenso wurde das Glossar gründlich überarbeitet und ein ausführliches Sachregister erleichtert den Zugang zu der Fülle an Informationen.

Eine überaus empfehlenswerte Darstellung einer modernen, molekular orientierten Zellbiologie.
Roland GERSTMEIER

EVANS, A.V., BELLAMY, C.L. & WATSON, L.C. 1996: An inordinate fondness for beetles. - Henry Holt & Co., New York. 208 S.

Berücksichtigt man allein die Artenzahl der Käfer als Kriterium für ihren Erfolg, so kann man diese Insektenordnung zweifellos als erfolgreichste Tiergruppe der Erde bezeichnen. Seit dem Zeitalter der "binominalen Nomenklatur" sind pro Tag durchschnittlich mehr als vier Käferarten beschrieben worden. Heutige Schätzungen über die möglichen Artenzahlen der Käfer gehen in Millionenhöhe. Keine andere Tiergruppe zeigt eine solche Vielfalt an Größe, Form und Farbe, und so ist es nicht verwunderlich, daß ihnen ein solch fantastischer Bildband gewidmet wurde. In sehr ansprechender Weise informieren die beiden anerkannten Wissenschaftler über die grundlegenden Erkenntnisse aus dem Leben der Käfer, wo und wie sie leben, wie sie entstanden sind, und in welcher Weise wir Menschen mit ihnen "konfrontiert" sind. In der Tat kann daraus nur eine "ungeheure Begeisterung für Käfer" resultieren.

Ein aufwendig illustrierter, bibliophiler Band, der hoffentlich bald in einer deutschen Übersetzung vorliegt.
Roland GERSTMEIER

FRANCK, D. 1997: Verhaltensbiologie. - Georg Thieme Verlag, Stuttgart.

In "neuem Gewand" liegt die dritte, völlig neu bearbeitete Auflage dieses einführenden Standard-Lehrbuches über tierisches und menschliches Verhalten vor. Ohne umfassende biologische Grundkenntnisse kann sich der Leser in kurzer Zeit einen aktuellen Überblick über den heutigen Stand der Verhaltensbiologie verschaffen. Die drei Hauptkapitel "Verhaltensphysiologie", "Verhaltensontogenie" und "Verhaltensökologie" wurden beibehalten; auf ca. 50 Seiten werden aktuelle Forschungsbeispiele vorgestellt.

Mit seiner klaren Sprache, dem logischen Aufbau, den prägnanten Beispielen aus dem gesamten Tierreich und den informativen Abbildungen kann dieses bewährte Lehrbuch jedem an Biologie interessierten Leser nur wärmstens empfohlen werden.

Roland GERSTMEIER

KEAST, A. & MILLER, S.E. (eds) 1996: The origin and evolution of Pacific island biotas, New Guinea to eastern Polynesia: Patterns and processes. - SPB Academic Publishing/Backhuys Publishers, Amsterdam/Leiden. 531 S.

Über 25 hochkarätige Beiträge dokumentieren in diesem Buch die aktuellen Forschungsergebnisse über Ursprung und Entwicklung sowie Flora und Fauna der pazifischen Inseln; ein Gebiet, das sich von der Wallace-Linie ostwärts bis an die Küsten Amerikas erstreckt. Grundlage zum Verständnis über die evolutive Entwicklung dieser Region bilden die Kapitel von KROENKE ("Plate tectonic development of the western and southwestern Pacific: mesozoic to the present"), CLAGUE ("The growth and subsidence of the Hawaiian-Emperor volcanic chain"), POLHEMUS ("Island arcs, and their influence on Indo-Pacific biogeography") und THORNTON ("The origins and development of island biotas as illustrated by Krakatau").

Für den Entomologen besonders interessante Artikel beschreiben die Insektenfauna der Galapagos Inseln (PECK), die Lepidopteren der Norfolk Insel (HOLLOWAY), Verteilungsmuster von Schmetterlingen auf den pazifischen Inseln (Munroe), Zikaden östlich der Wallace-Linie (DE BOER/DUFFELS), biogeographische Prozesse innerhalb der Dolichopodidae (BICKEL) und als "Statusreport" die Biogeographie der pazifischen Insekten (MILLER). Beiträge über die Avifauna, Säugetiere sowie Amphibien und Reptilien beschränken sich auf Neuguinea; auch sollen die interessanten botanischen Beiträge keineswegs verschwiegen werden. Neun Farbtafeln und ein ausführliches Stichwortregister beschließen dieses fantastische Werk, das in beeindruckender Weise informativ und illustrativ über die pazifische Inselwelt berichtet.

Roland GERSTMEIER

HÜRKA, K. 1996: Carabidae of the Czech and Slovak Republics. - Kabourek, Zlín. 565 S.

Die "Carabidae der Tschechischen und Slowakischen Republik" stellt ein Standardwerk der ost-mitteleuropäischen Käferliteratur dar; es ist zweisprachig (englisch und tschechisch) aufgebaut und mit über 700 Strichzeichnungen gut illustriert. Diese Abbildungen hätten allerdings vielfach in größerem Format gedruckt werden können, zumal viele Seiten problemlos diesen Druckraum gehabt hätten. Diese Monographie ist also im wesentlichen als illustriertes Bestimmungswerk zu sehen und stellt für die behandelte Region eine deutliche Verbesserung gegenüber dem Standardwerk der mitteleuropäischen Käfer (FREUDE, HARDE & LOHSE) dar. Die taxonomische Bearbeitung ist up-to-date, enthält ausführliche Artbeschreibungen (inkl. Angaben zur aktuellen Verbreitung und Biologie) und genaue Abbildungen; 16 hervorragend colorierte Farbtafeln erhöhen die Bibliophilie dieses Werkes. Der entscheidende und damit bemerkenswerteste Vorteil dieses großartigen Bestimmungswerkes liegt in der Stabilität der Nomenklatur der 672 Arten und Unterarten (zusammengefaßt in 104 Gattungen und 33 Triben).

Eine besonders lobenswerte und gewissenhaft bearbeitete, und daher auch sehr empfehlenswerte Publikation.

Roland GERSTMEIER

EBERT, G. (Hrsg.) 1997: Die Schmetterlinge Baden-Württembergs. Band 5 und 6, Nachtfalter III und IV. - Verlag Eugen Ulmer, Stuttgart. 575 S. und 622 S.

In bewährter luxuriöser Ausstattung sind zwei weitere Bände der erfolgreichen Reihe "Die Schmetterlinge Baden-Württembergs" erschienen, welche weitere Nachtfalterfamilien beinhalten: Band 5 (Nachtfalter III) beschreibt die Sesiidae, Arctiidae und einen Teil der Noctuidae (U.fam. Herminiinae bis Acontiinae); Band 6 (Nachtfalter IV) enthält den zweiten Teil der Noctuiden, mit den Unterfamilien Acronictinae bis Ipimorphinae. Alle in Baden-Württemberg vorkommenden Arten werden in gewohnter Weise ausführlich dargestellt, d.h. Imagines, Raupen und Lebensräume sind in brillanten Farbfotos dokumentiert, exakte Verbreitungangaben werden durch genaue Rasterkarten illustriert

und phänologische Diagramme zeigen auf einen Blick den jahreszeitlichen Verbreitungsschwerpunkt. Unter dem Stichwort "Ökologie" werden Lebensraum, Nahrung von Raupe und Falter, Verhalten sowie Gefährdung und Schutz erschöpfend aufgezeigt und dokumentiert. Sollte der Leser die bisher gewohnten Teile "Deutsche Namen", "Gliederung Lebensraum" und "Blütenbiologie" vermissen, so muß er auf den Abschlußband vertröstet werden, in dem diese Kapitel zusammengefaßt werden sollen (das gleiche gilt für das Literaturverzeichnis).

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