

## 11. Literatur

ABLE, K. P. 1980. Mechanisms of orientation, navigation, and homing. In: GAUTHREAX Jr, S. A. (Hrsg.), *Animal Migration, Orientation and Navigation*: 284 - 374, Academic Press, New York.

AKRE , R. D., TORGERSON, R. L. 1968. The behavior of *Diploeciton nevermanni*, a staphylinid beetle associated with army ants. *Psyche* 75: 211 - 215.

AKRE, R. D. A., GREENE, J. F., MACDONALD, P. J., DAVIS, H. G. 1980. *The yellowjackets of America North and Mexico*. United States Department of Agriculture, Agric. Handbook no. 552.

ARCHER, M. E. 1980. Numerical characteristics of nests of *Vespa crabro* L. (Hym., Vespidae). *Entomol. Mon. Mag.* 116: 117 - 121.

ATTYGALE, A. B., MORGAN, E. D. 1985. Ant trail pheromones. *Adv. Insect Physiol.* 18: 1 - 30.

BAGNÈRES, A. G., CLÉMENT, J.-L., BLUM, M. S., SEVERSON, R. F., JOULIE, C., LANGE, C. 1990. Cuticular hydrocarbons and defensive compounds of *Reticulitermes flavipes* and *R. santonensis*: polymorphism and chemotaxonomy. *J. Chem. Ecol.* 16: 3213 - 3244.

BAGNÈRES, A. G., MORGAN, E.D. 1991. The postpharyngeal glands and the cuticle contain the same characteristic hydrocarbons. *Experientia* 47: 106 - 111.

BAGNÈRES, A. G., ERRARD, C., MULHEIM, C., JOULIE, C., LANGE, C. 1991. Induced mimicry of colony odours in ants. *J. Chem. Ecol.* 17 (8): 1641 - 1665.

BÄRLOCHER, F. 1999. *Biostatistik*. Georg Thieme Verlag Stuttgart, New York.

BECKER, L. 1958. Untersuchungen zum Himfindevermögen der Bienen. *Z. Vergl. Physiol.* 41: 1 - 25.

BELL, W. J., CARDÈ, R. T. 1984. *Chemical Ecology of Insects*. Chapman and Hall, London.

BEYE, M., NEUMANN, P., MORITZ, R. F. A. 1997. Nestmate recognition and the genetic gestalt in the mound-building ant *Formica polyctena*. *Ins. Soc.* 44: 49 - 58.

BLOMQUIST, G. J., NELSON , D. R., DE RENOBALES, M. 1987. Chemistry, biochemistry and physiology of insect cuticular lipids. *Arch. Insect Biochem. Physiol.* 6: 227 - 265.

BLUM, M. S. 1985. Alarm pheromones. In: KERKUT, G. A., GILBERT, L. I. (Hrsg.), *Comprehensive Insect Physiology Biochemistry and Pharmacology*, 1<sup>st</sup> ed., Vol. 9: 193 - 224, Pergamon Press, Oxford.

BLUM, M. S., MOSER, J. C., CORDERO, A. D. 1964. Chemical releasers of social behaviour. II. Source and specificity of the odour trail substances in four attine genera (Hymenoptera: Formicidae). *Psyche* 71 (1): 1 - 7.

BONAVITA-COUGOURDAN, A., CLÉMENT, J.-L., LANGE, C. 1987. Nestmate recognition: the role of cuticular hydrocarbons in the ant *Camponotus vagus* Scop. *J. Entomol. Sci.* 22: 1 -10.

BONAVITA-COUGOURDAN, A., THERAULAZ, G., BAGNÈRES, A. G., ROUX, M., PRATTE, M., PROVOST, E., CLÉMENT, J. L. 1991. Cuticular hydrocarbons, social organization and ovarian development in a polistine wasp: *Polistes dominulus* Christ. *Comp. Biochem. Physiol.* 100B: 667 - 680.

BORDEN, J. H. 1995. Aggregation pheromones. In: KERKUT, G. A., GILBERT, L. I. (Hrsg.), *Comprehensive Insect Physiology Biochemistry and Pharmacology*, 1<sup>st</sup> ed., Vol. 9: 257 - 285, Pergamon Press, Oxford.

BOULAY, R., HEFETZ, A., SOROKER, V. 2000. *Camponotus fellah* colony integration: Worker individuality necessitates frequent hydrocarbon exchanges. *Anim. Behav.* 59: 1127 - 1133.

BOULAY, R., KATSAV, T., HEFETZ, A. 2001. Nestmate and queen deprivation effects on nestmate recognition in the ant *Camponotus fellah*. *Proceedings of the 2001 Berlin Meeting of the European Session of International Union for the Study of Social Insects*: 171.

BRADSHAW, J. W. S., HOWSE, P. E. 1984. Sociochemicals in Ants. In: BELL, W. J., CARDÉ, R. T. (Hrsg.), *Chemical Ecology of Insects*. Chapman and Hall: 429 - 474, London, New York.

BREED, M. D. 1998. Chemical cues in kin recognition: Criteria for identification, experimental approach, and the honey bee as an example. In: VANDER MEER, R., K., BREED, M. D., ESPELIE, K. E., WINSTON, M. L. (Hrsg.), *Pheromonal Communication in Social Insects (Ants, Wasps, Bees, and Termites)*: 57 - 78, Westview Press, Oxford.

BREED, M. D., BENNETT, B. 1987. Kin recognition in highly eusocial insects. In: FLETCHER, D. J. C., MICHENER, C. D. (Hrsg.), *Kin Recognition in Animals*: 243 - 285, J. Wiley & Sons Ltd.

BREED, M. D., STILLER, T. M. 1992. Honey bee, *Apis mellifera*, nestmate discrimination: Hydrocarbons effects and the evolutionary implications of comb choice.

*Anim. Behav.* 43: 875 - 883.

BROWN, W. V., SPRADBURY, J. P., LACEY, M. J. 1991. Changes in the cuticular hydrocarbon composition during development of the social wasp, *Vespula germanica* F. (Hymenoptera: Vespidae). *Comp. Biochem. Physiol.* 99B (3): 553 - 562.

BURA, E. A., GAMBOA, G. J. 1994. Kin recognition by social wasps: asymmetric tolerance between aunts and nieces. *Anim. Behav.* 47: 977 - 979.

BUTTS, D. P., ESPELIE, K. E., HERMANN, H. R. 1991. Cuticular hydrocarbons of four species of social wasps in the subfamily Vespinae: *Vespa crabro* L., *Dolichovespula maculata* L., *Vespula squamosa* (Drury), and *Vespula maculifrons* (Buysson). *Comp. Biochem. Physiol.* 99B (1): 87 - 91.

BUTTS, D. P., CAMANN, M. A., ESPELIE, K. E. 1993. Discriminant analysis of cuticular hydrocarbons of the baldfaced hornet, *Dolichovespula maculata* (Hymenoptera: Vespidae). *Sociobiology* 21: 193 - 201.

BUTTS, D. P., CAMANN, M. A., ESPELIE, K. E. 1995. Workers and queens of the European hornet *Vespa crabro* L. have colony-specific cuticular hydrocarbon profiles (Hymenoptera: Vespidae). *Ins. Soc.* 42: 45 - 55.

CAMERON, S. A., WHITFIELD, J. B. 1996. Use of walking trails by bees. *Nature* 379: 125.

CAMERON, S. A., WHITFIELD, J. B., COHEN, M., THORP, N. 1999. Novel use walking trails by the amazonian bumble bee, *Bombus transversalis* (Hymenoptera: Apidae). *University of Kansas Natural History Museum Special Publication* 24: 187 - 193.

CAMMAERTS-TRICOT, M. C. 1974. Production and perception of attractive pheromones by differently aged workers of *Myrmica rubra* (Hymenoptera, Formicidae). *Ins. Soc.* 3: 235 - 248.

CAMMAERTS, M. C., MORGAN, E. D., TYKER, R. 1977. Territorial marking in the ant *Myrmica rubra* L. (Formicidae). *Biol. Behav.* 2: 263 - 272.

CAPALDI, E. A., DYER, F. C. 1999. The role of orientation flights on homing performance in honeybees. *J. Exper. Biol.* 202: 1655 - 1666.

CARLIN, N. F. 1988. Species, kin and other forms of recognition in the brood discrimination behaviour of ants. In: TRAGER, J. C. (Hrsg.), *Advances in myrmecology*: 267 - 295. E. Brill, Leiden.

- CARLIN, N. F., HÖLLODOBLER, B. 1983. Nestmate and kin recognition in interspecific mixed colonies of ants. *Science* 222: 1027 - 1029.
- CARLIN, N. F., HÖLLODOBLER, B. 1986. The kin recognition system of carpenter ants (*Camponotus spp.*). I. Hierarchical cues in small colonies. *Behav. Ecol. Sociobiol.* 19: 123 - 134.
- CARLIN, N. F., HÖLLODOBLER, B. 1987. The kin recognition system of carpenter ants (*Camponotus spp.*). II: Larger colonies. *Behav. Ecol. Sociobiol.* 20: 209 - 217.
- CARPENTER, J. M. 1982. The phylogenetic relationship and natural classification of the Vespoidea (Hymenoptera). *Syst. Entomol.* 7: 11 - 38.
- CARPENTER, J. M. 1987: Phylogenetic relationships and classification of the Vespinae (Hymenoptera: Vespidae). *Syst. Entomol.* 12: 140 - 175.
- CEDERBERG, B. 1977. Evidence for trail marking in *Bombus terrestris* workers (Hymenoptera, Apidae). *Zoon* 5: 143 - 146.
- CHAPMAN, R. F. 1982. *The Insects. Structure and Function*. Harvard University Press, Cambridge, Massachusetts.
- CLARKE, S. R., DANI, F. R., JONES, G. R., MORGAN, E. D., TURILLAZZI, S. 1999. Chemical analysis of the swarming trail pheromone of the social wasp *Polybia sericea* (Hymenoptera: Vespidae). *J. Ins. Physiol.* 45: 877 - 883.
- CLÉMENT, J. - L., BAGNÈRES, A. - G. 1998. Nestmate recognition in Termites. In: VANDER MEER, R. K., BREED, M. D., ESPELIE, K. E., WINSTON, M. L. (Hrsg.), *Pheromone Communication in Social Insects (Ants, Wasps, Bees and Termites)*: 126 - 158, Westview Press, Oxford.
- COSENS, D., TOUSSANT, N. 1985. An experimental study of the foraging strategy of the wood ant *Formica aquilonia*. *Anim. Behav.* 33: 541 - 552.

COWAN, D. P. 1991. The solitary and presocial Vespidae. In: Ross, K. G., MATTHEWS, R. W. (Hrsg.), *The Social Biology of Wasps*: 33 - 73. Comstock Publishing Associates, Ithaca and London.

CROZIER, R. H., DIX, M. W. 1979. Analysis of the two genetic models for the innate components of colony odour in social hymenoptera.

*Behav. Ecol. Sociobiol.* 4: 217 - 224.

DANI, F. R., MORGAN, E. D., TURILLAZZI, S. 1996. Dufour gland secretions of *Polistes* wasp: chemical composition and possible involvement in nestmate recognition (Hymenoptera: Vespidae). *J. Insect Physiol.* 42: 541 - 548.

DANI, F. R., MORGAN, E. D., JONES, G. R., FRANCESCATO, E., TURILLAZZI, S., DEJEAN, A. 1997. Search for a trail pheromone in a social swarming wasp of the old world (*Polybioides tabidus* Hymenoptera: Vespidae). *Proceedings of the C.N.R.S.. Jaques Monod Conference Chemical Communication in vertebrates and invertebrates: evolution, function and perception of communication substances and evoked responses* : 41. La Londe-les-Maures, France.

DANI, F.R., JONES, G.R., DESTRI, S., SPENCER, S.H., TURRILAZZI, S. 2001. Deciphering the recognition signature within cuticular chemical profile of paper wasps. *Anim. Behav.* 62: 165 - 171.

DEROE, C, PASTEELS, J. M. 1982. Distribution of adult defense glands in Chrysomelids (Coleoptera: Chrysomelidae) and its significance in the evolution of defense mechanisms within the family. *J. Chem. Ecol.* 8 (1): 67 - 82.

DETTNER, K., LIEPERT, C. 1994. Chemical mimicry and Camouflage.  
*Annu. Rev. Entomol.* 39: 129 - 154.

DHABI, A., CERDA, X., , LENOIR, A. 1998. Ontogeny of colonial hydrocarbon label in callow workers of the ant *Cataglyphis iberica*. *Comptes Rendus de l' Academie des Sciences, serie III, Sciences de la Vie*: 321: 395 - 402.

- DHABI, A., LENOIR, A. 1998. Nest separation and the dynamics of the Gestalt odour in the polydomous ant *Cataglyphis iberica* (Hymenoptera, Formicidae).  
*Behav. Ecol. Sociobiol.* 42: 349 - 355.
- DHABI, A., HEFETZ, A., CERDA, X., LENOIR, A. 1999. Trophallaxis mediates uniformity of colony odour in *Cataglyphis iberica* ants (Hymenoptera, Formicidae).  
*J. Ins. Behav.* 12: 559 - 567.
- DORNFELDT, K. 1975. Eine Elementaranalyse des Wirkungsgefüges des Heimfindevermögens der Trichterspinne *Agelena labyrinthica* (Cl.).  
*Z. Tierpsychol.* 38: 267 - 293.
- DOWNING, H. S. 1991. The function and evolution of exocrine glands. In: Ross, K. G., MATTHEWS, R. W. (Hrsg.), *The Social Biology of Wasps*: 540 - 569. Comstock Publishing Associates, Ithaca and London.
- EDWARDS, R. 1980a. Life history I: Nest initiation. In: EDWARDS, R. (Hrsg.), *Social Wasps*: 25 - 61. Rentokil Ltd., Felcourt.
- EDWARDS, R. 1980b. Organisms associated with wasps and hornets. In: EDWARDS, R. (Hrsg.), *Social Wasps*: 146 - 171. Rentokil Ltd., Felcourt.
- EMMERICH, G. 1994. Vergleichende Untersuchung der chemischen Alarmkommunikation bei einheimischen Vespiane, sowie Ultrastruktur und Funktion der Giftdrüse von *Vespa crabro*. Dissertation am Fachbereich Biologie der Johann-Wolfgang-Goethe Universität Frankfurt a. M.
- ERRARD, C., JAISSON, P. 1991. Les premières étapes de la reconnaissance interspécifique chez les fourmis *Manica rubida* et *Formica selysi* (Hymenoptera, Formicidae) élevées en colonies mixtes.  
*C. R. Acad. Sci. Paris, Series III*, 313: 73 - 80.

ESPELIE, K. E., Hermann, H. R. 1988. Congruent cuticular hydrocarbons: Biochemical convergence of a social wasp, an ant and a host plant.  
*Biochem. Syst. Ecol.* 16: 505 - 508.

ESPELIE, K. E., HERMANN, H. R. 1990. Surface lipids of the social wasp *Polistes annularis* (L.) and its nest and nest pedicel. *J. Chem. Ecol.* 16: 1841 - 1852.

ESPELIE, K. E., WENZEL, J. W., CHANG W. 1990. Surface lipids of social wasp *Polistes metricus* Say and its nest and nest and nest pedicel and their relation to nestmate recognition. *J. Chem. Ecol.* 16: 2229 - 2241.

ESPELIE, K. E., GAMBOA, G. J., GRUDZIEN, T. A., BURA, E. A. 1994. Cuticular hydrocarbons of the paper wasp, *Polistes fuscatus*: A search for recognition pheromones. *J. Chem. Ecol.* 20: 1677 - 1687.

FOSTER, R. L., GAMBOA, G. J. 1989. Nest entrance marking with colony specific odours by the bumblebee *Bombus occidentalis* (Hymenoptera: Apidae). *Ethology* 81: 273 - 278.

FRANCESCATO, E. TURILLAZZI, S., DEJEAN, A. 1993. Swarming behaviour in *Polybioides tabida* (Hymenoptera: Vespidae). *Actes Colloques Insectes Sociaux* 8: 121 - 126.

FRANCIS G. W., VELAND, K. 1981. Alkylthiolation for the determination of double-bond position in linear alkenes. *J. Chromatogr.* 219: 379 - 384.

FRANKS, N., BLUM, M. S., SMITH, R. K., ALLIES, A. B. 1990. Behavior and chemical disguise of cuckoo ant *Leptothorax kutteri* in relation to its host *Leptothorax acervorum*. *J. Chem. Ecol.* 16: 1431 - 1444.

GADAGKAR, R. 1991. *Belonogaster*, *Mischocyttarus*, *Parapolybia*, and independent-founding Ropalidia. In: Ross, K. G., Matthews, R. W. (Hrsg.), *The Social Biology of Wasps*: 149 - 190. Comstock Publishing Associates, Ithaca and London.

- GAMBOA, G. J. 1996. Kin recognition in social wasps. In: TURILLAZZI, S., WEST-EBERHARDT, M. J. (Hrsg.), *Natural History and evolution of Paper Wasps*: 161 - 177. Oxford University Press, Oxford, UK.
- GAMBOA, G. J., REEVE, H. K., FERGUSON, I. D., WACKER, T. L. 1986 a. Nestmate recognition in social wasps: the origin and acquisition of recognition odours. *Anim. Behav.* 34: 685 - 695.
- GAMBOA, G. J., REEVE, H. K., PFENNIG, D. W. 1986 b. The evolution and ontogeny of nestmate recognition in social wasps. *Annu. Rev. Entomol.* 31: 431 - 454.
- GÖRNER, P. 1958. Die optische und kinästhetische Orientierung der Trichterspinne *Agelena labyrinthica*. *Z. Vergl. Physiol.* 53: 253 - 276.
- GRACE, J.K., WOOD, D.L., KUBO, I., KIM, M. 1995. Behavioural and chemical investigation of trail pheromone from the termite *Reticulitermes hesperus* Banks (Isoptera, Rhinotermitidae). *J. Appl. Entomol.* 119: 501 - 505.
- GREENE, A., 1991. *Dolichovespula* and *Vespa*. In: Ross, K.G. und MATTHEWS, R. W. (Hrsg.), *The Social Biology of Wasps*: 263 - 305. Comstock Publishing Associates, Ithaca and London.
- HANGARTNER, W., REICHSON, J. M., WILSON, E. O. 1970. Orientation to nest material by the ant, *Pogonomyrmex badius*. *Anim. Behav.* 18: 331 - 334.
- HARBORNE, J.B. 1995. Ökologische Biochemie. Spektrum Verlag.
- HARRISON, J. F., FEWELL, J. H., STILLER, T. M., BREED, M. D. 1988. Effects of experience on use of orientation cues in the Giant Tropical Ant. *Anim. Behav.* 37: 869 - 871.

HAYNES, K. F., BIRCH, M. C. 1985. The role of other pheromones, allomones and kairomones in the behavioural response of insects. In: KERKUT, G. A., GILBERT, L. I. (Hrsg.), *Comprehensive Insect Physiology Biochemistry and Pharmacology*, 1<sup>st</sup> ed., Vol. 9: 225 - 255. Pergamon Press, Oxford.

HEFETZ, A. 1990. Individual badges and specific messages in multicomponent pheromones of bees (Hymenoptera: Apidae). *Entomol. Gener.* 15: 103 - 113.

HEITMANS, W. R. B., PEETERS, T. M. J. 1996: *Metoecus paradoxus* in The Netherlands (Coleoptera: Rhipiphoridae). *Ent. Ber. Amst.* 56 (7): 109 - 117.

HÖLLOBLER, B. 1971. Homing in the harvester ant *Pogonomyrmex badius*. *Science* 171: 1149 - 1151.

HÖLLOBLER, B. 1991a. Soziobiologische Klammern und Barrieren im Superorganismus Ameisenstaat. *Verh. Dtsch. Zool. Ges.* 84: 61 - 78.

HÖLLOBLER, B. 1991b. Soziale Verständigung und territorialer Konflikt in Ameisenpopulationen. *Naturwissenschaftliche Rundschau* 2: 43 - 52.

HÖLLOBLER, B., MICHERNER, C. D. 1980. Mechanisms of identification and discrimination in social hymenoptera. In: MARKL, H. (Hrsg.), *Evolution of social behaviour: Hypothesis and empirical tests*: 35 - 58. Dahlem Konferenzen 1980, Weinheim: Verlag Chemie GmbH.

HÖLLOBLER, B., CARLIN, F. 1987. Anonymity and specificity in the chemical communication signals of social insects. *J. Comp. Physiol.* 161: 567 - 581.

HÖLLOBLER, B., WILSON, E. O. 1990. *The ants*. Springer Verlag Berlin, Heidelberg, London.

HOWARD, R. W., BLOMQUIST, G. J. 1982. Chemical ecology and biochemistry of insect hydrocarbons. *A. Rev. Entomol.* 27: 149 - 172.

HOWARD, R. W., McDANIEL, C. A., BLOMQUIST, G. J. 1978. Cuticular hydrocarbons of the eastern subterranean termite, *Reticulitermes flavipes* (Kollar) (Isoptera: Rhinotermitidae). *J. Chem. Ecol.* 4: 233 - 245.

HOWARD, R. W., McDANIEL, C. A., BLOMQUIST, G. J. 1980. Chemical mimicry as an integration mechanism: Cuticular hydrocarbons of a termitophile and its host. *Science* 210: 431 - 432.

HOWARD, R. W., McDANIEL, C. A., BLOMQUIST, G. J. 1982. Chemical mimicry as an integration mechanism for three termitophiles associated with *Reticulitermes virginicus* (Banks). *Psyche* 89: 157 - 167.

HOWARD, R. W., AKRE, R. D., GARNETT, W. B. 1990: Chemical Mimicry in an obligate predator of Carpenter Ants (Hymenoptera: Formicidae). *Annals of the Entomological Society of America* 83 (3): 607 - 616.

HOWARD, R. W. 1993. Cuticular hydrocarbons and chemical communication. In: Stanley-Samuelson, D. W., Nelson, D. R. (Hrsg.), *Insect Lipids*: 179-226. University of Nebraska Press, Nebraska.

HOWARD, R. W., McDANIEL, C. A., NELSON, D. R., BLOMQUIST, G. J., GELBAUM, L. T., ZALKOW, L. H. 1982. Cuticular hydrocarbons of *Reticulitermes virginicus* (Banks) and their role as potential species- and caste-recognition cues. *J. Chem. Ecol.* 8 (9): 1227 - 1239.

JACKSON, B. D., MORGAN, E. D. 1993. Insect chemical communication: pheromones and exocrine glands of ants. *Chemoecology* 4: 125 - 144.

JANDER, R. 1970. Ein Ansatz zur modernen Elementarbeschreibung der Orientierungshandlung. *Z. für Tierpsychol.* 27: 771 - 788.

JEANNE, R.L. 1975. The adaptivness of social wasp nest architecture. *The Quarterly Review of Biology* 50: 267 - 287.

JEANNE, R. L. 1981. Chemical communication during swarm emigration in the social wasp *Polybia sericea* (Olivier). *Anim. Behav.* 29: 102 - 113.

JEANNE, R. L., Downing, H. A., Post, D. C. 1983. Morphology and function of sternal glands in polistine wasps (Hymenoptera: Vespidae). *Zoomorphology* 103: 149 - 164.

JEANNE, R. 1991. The swarm-founding Polistinae. In: Ross, K. G., Matthews, R. W. (Hrsg.), *The Social Biology of Wasps*: 191-231. Comstock Publishing Associates, Ithaca and London.

JONES, D. T., Gathorne-Hardy, F. 1995. Foraging activity of the processional termite *Hospitalitermes hospitalis* (Termitidae: Nasutitermitinae) in the rain forest of Brunei, north-west Borneo. *Ins. Soc.* 42: 359 - 369.

JUTSUM, A. R., SAUNDERS, T. S., CHERRETT, J. M. 1979. Intraspecific aggression in the leaf-cutting ant *Acromyrmex octospinosus*. *Anim. Behav.* 27: 839 - 844.

KALMUS, H., RIBBANDS, C. R. 1952. The origin of the odours by which honeybees distinguish their companions. *Proc. Royal Society (B)* 140: 50 - 59.

KLAHN, J. E. 1979. Philopatric and nonphilopatric foundress associations in the social wasp *Polistes fuscatus*. *Behav. Ecol. Syst.* 5: 417 - 424.

KLOTZ, J. H., REID, B. L. 1993. Nocturnal orientation in the black carpenter ant *Camponotus pennsylvanicus* (DeGeer) (Hymenoptera: Formicidae). *Ins. Soc.* 40: 95 - 106.

LAHAV, S., SOROKER, V., HEFETZ, A. 1999. Direct behavioural evidence for hydrocarbons as ant recognition discriminators. *Naturwissenschaften* 86: 246 - 249.

LAHAV, S., SOROKER, V., VANDER MEER, R. K., HEFETZ, A. 2001. Segregation of colony odour in the desert ant *Cataglyphis niger*. *J. Chem. Ecol.* 27: 927 - 943.

LANGER, N. 1995. Dämmerungsflugverhalten bei der Hornisse (*Vespa crabro* L.).  
Diplomarbeit am Fachbereich Biologie der Freien Universität Berlin.

LAYTON, J. M., CAMANN, M. A., ESPELIE, K. E. 1994. Cuticular lipid profiles of queens,  
workers, and males of social wasp *Polistes metricus* Say are colony specific.  
*J. Chem. Ecol.* 20: 2307 - 2321.

LAYTON, J. M., ESPELIE, K. E. 1995. Effects of nest paper hydrocarbons on nest and  
nestmate recognition in colonies of *Polistes metricus* Say.  
*J. Ins. Behav.* 8 (1): 103 - 113.

LENOIR, A., MALOSSE, C., YAMAOKA, R. 1997. Chemical mimicry between parasitic  
ants of the genus *Formicoxenus* and their host *Myrmica* (Hymenoptera, Formicidae).  
*Biochem. Syst. Ecol.* 25 (5) : 379 - 389.

LENOIR, A., HEFETZ, A., SIMON, T., SOROKER, V. 2001a. Comparative dynamics of  
gestalt odour formation in two ant species *Camponotus fellah* and *Aphaenogaster*  
*senilis* (Hymenoptera: Formicidae). *Physiol. Entomol.* 26: 275 - 283.

LENOIR, A., CIUSSET, D., HEFETZ, A. 2001b. Effects of social isolation on hydrocarbon  
pattern and nestmate recognition in the ant *Aphaenogaster senilis* (Hymenoptera:  
Formicidae). *Ins. Soc.* 48: 101 - 109.

LEUTHOLD, R. H., BRUINSMA, O., VAN HUIS, A. 1976. Optical and pheromonal  
orientation and memory for homing distance in the harvester termite *Hodotermes*  
*mossambicus* (Hagen). *Behav. Ecol. Sociobiol.* 1: 127 - 139.

LINDAUER, M. 1956. Über die Verständigung bei Indischen Bienen.  
*Z. vergl. Physiol.* 38: 521 - 557.

LOCKEY, K. H. 1988. Lipids of the insect cuticle: origin, composition and function.  
*Comp. Biochem. Physiol.* 89B: 595 - 645.

LORENZI, M. C. 1992. Epicuticular hydrocarbons of *Polistes biglumis bimaculatus* (Hymenoptera Vespidae): preliminary results. *Ethol. Ecol. Evol.* 2: 61 - 63.

LORENZI, M. C., BAGNÈRES, A. G., CLÉMENT, J.-L., TURILLAZZI, S. 1997. *Polistes biglumis bimaculatus* epicuticular hydrocarbons and nestmate recognition (Hymenoptera, Vespidae). *Ins. Soc.* 44: 123 - 138.

LÜSCHER, M. 1960. Sozialwirkstoffe bei Termiten. *Verh. XI. Intern. Kongr. Entomol. Wien, Bd. I:* 579 - 582.

LÜSCHER, M. 1961. Demonstration of a trail pheromone in termites. *Symp. Gen. et Biol. Ital.* 11: 189 - 190.

LÜSCHER, M., MÜLLER, B. 1960. Ein spurbildendes Sekret bei Termiten. *Naturwissenschaften* 47: 503.

MALHAM, J.P., REES, J.S., ALSPACH, P.A., BEGGS, J.R., MOLLER, H. 1991. Traffic rates as an index of colony size in *Vespula* wasps.

*New Zealand Journal of Zoology* 18: 105 - 109.

MARTIN H. 1965. Leistungen des topochemischen Sinnes bei der Honigbiene. *Z. Vergl. Physiol.* 50: 254 - 292.

MASCHWITZ, U. 1964. Gefahrenstoffe und Gefahrenalarmierung bei sozialen Hymenopteren. *Z. Vergl. Physiol.* 47: 596 - 655.

MATSUURA, M., 1991. *Vespa* and *Provespa*.

In: Ross, K. G., MATTHEWS, R. W. (Hrsg.), *The Social Biology of Wasps*: 232-262.  
Comstock Publishing Associates, Ithaca and London.

MERKEL, F. W. 1980. *Grundbegriffe der modernen Biologie Bd. 15: Orientierung im Tierreich*. Gustav Fischer Verlag Stuttgart, New York.

- MESKALI, M., PROVOST, E., BONAVITA-COUGOURDAN, A., CLÉMENT 1995. Behavioural effects of an experimental change in the chemical signature of the ant *Camponotus vagus* (Scop.). *Ins. Soc.* 42: 347 - 357.
- MINTZER, A., VINSON, S. B. 1985. Kinship and incompatibility between colonies of the acacia ant *Pseudomyrmex ferruginea*. *Behav. Ecol. Sociobiol.* 17: 75 - 78.
- MITTELSTAEDT, H., MITTELSTAEDT, M.-L. 1973. Mechanismen der Orientierung ohne richtende Außenreize. *Fortschritte der Zoologie* 21: 45 - 58.
- MOORE, B. P. 1966. Isolation of the scent-trail pheromone of an Australian termite. *Nature* 211: 746 - 747.
- MOREL, L., VANDER MEER, R., K., LAVINE, B. K. 1988. Ontogeny of nestmate recognition cues in the red carpenter ant (*Camponotus floridanus*): Behavioural and chemical evidence for the role of age and social experience. *Behav. Ecol. Sociobiol.* 22: 175 - 183.
- MORITZ, R. F. A., KIRCHNER, W. H., CREWE, R. M. 1991. Chemical Camouflage of the death's head hawkmoth (*Acherontia atropos* L.) in honeybee colonies. *Naturwissenschaften* 78: 179 - 182.
- MOSER, J. C., BLUM, M. S. 1963. Trail marking substance of the Texas Leaf-Cutting Ant: Source and potency. *Science* 140: 1228.
- NAUMANN, M. G. 1975. Swarming behaviour: evidence for communication in social wasps. *Science*: 642 - 644.
- NELSON, D. R. 1993. Methyl-branched lipids in insects. In: STANLEY-SAMUELSON, D. W., NELSON, D. R. (Hrsg.), *Insect Lipids. Chemistry, Biochemistry & Biology*: 271 - 315. University of Nebraska Press, Lincoln.
- NORDLUND, D. A. 1981. Semiochemicals: A review of the terminology. In: NORDLUND, D. A., JONES, R. L., LEWIS, W. J. (Hrsg.), *Semiochemicals*: 13 - 27.

OBIN, M. S., VANDER MEER, R. K. 1988. Sources of nestmate recognition cues in the imported fire ant *Solenopsis invicta* Buren (Hymenoptera: Formicidae).  
*Anim. Behav.* 36: 1361 - 1370.

OLDHAM, N. J., BILLEN, J., MORGAN, E. D. 1994. On the similarity of the Dufour gland secretion and the cuticular hydrocarbons of some bumblebees.  
*Physiol. Entomol.* 19: 115 - 123.

PAGE, R. E., METCALF, R. A., METCALF, R. L., ERICKSON, E. H., LAMPMAN, R. L. 1991. Extractable hydrocarbons and kin recognition in honeybee (*Apis mellifera* L.).  
*J. Chem. Ecol.* 17: 745 - 756.

PFENNIG, D. W., GAMBOA, G. J., REEVE, H. K., FERGUSON, I. D. 1983a. The mechanism of nestmate discrimination in social wasps (*Polistes*, Hymenoptera: Vespidae). *Behav. Ecol. Sociobiol.* 13: 299 - 305.

PFENNIG, D. W., REEVE, H. K., SHELLMAN, J. S. 1983b. Learnt component of nestmate discrimination in workers of a social wasp, *Polistes fuscatus* (Hymenoptera: Vespidae). *Anim. Behav.* 31: 412 - 416.

PROVOST, E, RIVIÈRE, G., ROUX, M., MORGAN, E. D., BAGNÈRES, A. G. 1993. Change in the chemical signature of the ant *Leptothorax lichtensteini* Bondroit with time.  
*Insect Biochem. Mol. Biol.* 2: 945 - 957.

REEVE, H. K. 1991. *Polistes*. In: Ross, K. G., MATTHEWS, R. W. (Hrsg.), *The Social Biology of Wasps*: 99 - 148. Comstock Publishing Associates, Ithaca and London.

REINHARD, J., HERTEL, H., KAIB, M. 1997. Systematic search for food in the subterranean termite *Reticulitermes santonensis* De Feytaud (Isoptera, Rhinotermitidae). *Ins. Soc.* 44: 147 - 158.

- ROSENGREN, R. 1971. Route fidelity, visual memory and recruitment behaviour in foraging wood ants of the genus *Formica* (Hymenoptera, Formicidae). *Acta Zool. Fenn.* 133: 1 - 106.
- ROSENGREN, R., FORTELIUS, W. 1986. Ortstreue in foraging ants of the *Formica rufa* group - hierarchy of orienting cues and long term memory. *Ins. Soc.* 33: 306 - 337.
- Ross, N. M., GAMBOA, G. J. 1981. Nestmate discrimination in social wasps (*Polistes metricus*, Hymenoptera: Vespidae). *Behav. Ecol. Sociobiol.* 9: 163 - 165.
- RUTHER, J., SIEBEN, S., SCHRICKER, B. 1997. Role of cuticular lipids in nestmate recognition of the European hornet *Vespa crabro* L. (Hymenoptera, Vespidae). *Ins. Soc.* 45: 169 - 179.
- RUTHER, J., SIEBEN, S., SCHRICKER, B. 2002. Nestmate recognition in social wasps: manipulation of hydrocarbon profiles induces aggression in the European hornet. *Naturwissenschaften* 89: 111 - 114.
- RYAN, R. E., CORNELL, T. J., GAMBOA, G. J. 1985. Nestmate recognition in the baldfaced hornet, *Dolichovespula maculata* (Hymenoptera: Vespidae). *Z. Tierpsychol.* 69: 19 - 26.
- SCHMID-HEMPPEL, P. 1998. Parasites in social insects. Princeton University Press, Princeton, New Jersey.
- SCHMITZ, J. 1997. Molekulare Phylogenie und Evolution sozialer Wespen. Dissertation an der Technischen Universität Berlin.
- SCHÖNE, H. 1983. *Orientierung im Raum: Formen und Mechanismen der Lenkung des Verhaltens im Raum bei Tier und Mensch*. Wiss. Verlagsgesellschaft Stuttgart.
- SEYFARTH, E.-A., HERGENRÖDER, R., EBBES, H., BARTH, F. G. 1982. Idiothetic orientation of a wandering spider: compensation of detours and estimates of goal distance. *Behav. Ecol. Sociobiol.* 11: 139 - 148.

SHELLMAN, J. S., GAMBOA, G. J. 1982. Nestmate discrimination in social wasps: the role of exposure to nest and nestmates (*Polistes fuscatus*, Hymenoptera: Vespidae). *Behav. Ecol. Sociobiol.* 11: 51 - 53.

SHIMRON, O., HEFETZ, A., TENGÖ, J. 1985. Structural and communicative functions of Dufour's gland secretion in *Eucera palestinae* (Hymenoptera: Anthophoridae). *Insect Biochem.* 15: 635 - 638.

SIEBEN, S. 1999. Zur chemischen Ökologie von *Vespa crabro* L.: Chemische Orientierung, chemische Kolonieabgrenzung und Erkennung von Nestgenossinnen. Dissertation an der Freien Universität Berlin.

SINGER, T. L., CAMANN, M. A., ESPELIE, K. E. 1992. Discriminant analysis of cuticular hydrocarbons of social wasp *Polistes exclamans* Viereck and nest surface hydrocarbons of its nest paper and pedicel. *J. Chem. Ecol.* 18: 785 - 797.

SINGER, T. L., ESPELIE, K. E. 1992. Social wasps use nest paper hydrocarbons for nestmate recognition. *Anim. Behav.* 44: 63 - 68.

SINGER, T. L., ESPELIE, K. E. 1996. Nest surface hydrocarbons facilitate nestmate recognition for *Polistes metricus* Say. *J. Insect Behav.* 9 (6): 857 - 870.

SINGER, T. L., ESPELIE, K. E. 1997. Exposure to nest paper hydrocarbons is important for nestmate recognition by a social wasp, *Polistes metricus* Say (Hymenoptera: Vespidae). *Ins. Soc.* 44: 245 - 254.

SINGER, T. L., ESPELIE, K. E., GAMBOA, G. J. 1998. Nest and nestmate discrimination in independent-founding paper wasps. In: VANDER MEER, R. K., BREED, M. D., ESPELIE, K. E., WINSTON, M. L. (Hrsg.), *Pheromonal Communication in insects: ants, wasps, bees and termites*: 105-125. Westview Press, Oxford.

- SMITH, B. H., BREED, M. D. 1995. The chemical basis for nestmate recognition and mate discrimination in social insects. In: CARDÉ, R. T., BELL, W. J. (Hrsg.), *Chemical Ecology of insects II*. Chapman and Hall, New York.
- SOROKER, V., HEFETZ, A. 1994. The postpharyngeal gland as a „Gestalt“ organ for nestmate recognition in the ant *Cataglyphis niger*.  
*Naturwissenschaften* 81 (11): 510 - 513.
- SOROKER, V., FRESNEAU, D., HEFETZ, A. 1998. Formation of colony odour in ponerine ant *Pachycondyla apicalis*. *J. Chem. Ecol.* 24: 1077 - 1090.
- SOROKER, V., HEFETZ, A. 2000. Hydrocarbons site of synthesis and circulation in the desert ant *Cataglyphis niger*. *J. Ins. Physiol.* 46: 1097 - 1102.
- SPRADBERY, J. P. 1973. *Wasps: An account of the biology and natural history of solitary and social wasps*. University of Washington Press, Seattle.
- STEINMETZ, I. 2000. Orientierungsmechanismen im Nestbereich bei der Höhlenbrütenden sozialen Faltenwespe *Vespula vulgaris* L. Diplomarbeit an der Freien Universität Berlin.
- STUART, A., M. 1961. Mechanism of trail laying in two species of termites.  
*Nature* 189: 419.
- STUART, A., M. 1963. Origin of the trail in the termites *Nasutitermes corniger* (Motschulsky) and *Zootermopsis nevadensis* (Hagen), Isoptera.  
*Physiol. Zoöl.* 36: 69 - 84.
- STUART, R. J. 1987. Individual worker produce colony-specific nestmate recognition cues in the ant, *Leptothorax curvispinosus*. *Anim. Behav.* 35: 1062 - 1069.
- TAMAKI, Y. 1985. Sex pheromones. In: KERKUT, G. A., GILBERT, L. I. (Hrsg.), *Comprehensive Insect Physiology Biochemistry and Pharmacology*, 1<sup>st</sup> ed., Vol. 9: 145 - 191. Pergamon Press, Oxford.

TRANIELLO, J. F. A. 1980. Colony specificity in the trail pheromone of an ant. *Naturwissenschaften* 67: 361 - 362.

TSUJI, K. 1990. Kin recognition in *Pristomyrmex pugens* (Hymenoptera: Formicidae): asymmetrical change in acceptance and rejection due to odour transfer. *Anim. Behav.* 40: 306 - 312.

TURILLAZZI, S. 1991. The Stenogastrinae. In: ROSS, K. G., MATTHEWS, R. W. (Hrsg.), *The Social Biology of Wasps*: 74 - 98. Comstock Publishing Associates, Ithaca and London.

TURILLAZZI, S., SLEDGE, M. F., DANI, F. R., CERVO, R., MASSOLO, a., FONDELLI, L. 2000. Social hackers: Integration in the host chemical recognition system by a paper wasp social parasite. *Naturwissenschaften* 87 (4): 172 - 176.

VANDER MEER, R. K., WOJCIK, D. P. 1982. Chemical mimicry of the myrmecophilous beetle *Myrmecaphadus excavaticollis*. *Science* 218: 806 - 808.

VANDER MEER, R. K. 1988. Behavioural and biochemical variation in the fire ant, *Solenopsis invicta*. In: JEANNE, R. L. (Hrsg.), *Interindividual Behavioural Variability in Social Insects*: 223 - 255. Boulder, CO, Westview press.

VANDER MEER, R. K., JOUVENAZ, D. P., WOJCIK, D. P. 1988. Chemical mimicry in a parasitoid (Hymenoptera: Eucharitidae) of fire ants (Hymenoptera: Formicidae). *J. Chem. Ecol.* 15: 2247 - 2261.

VANDER MEER, R. K., SALIWANCHIK, D., LAVINE, B. 1989. Temporal changes in colony cuticular hydrocarbon patterns of *Solenopsis invicta*: Implications for nestmate recognition. *J. Chem. Ecol.* 15: 2115 - 2125.

- VANDER MEER, R. K., MOREL, L. 1998. Nestmate recognition in ants. In: VANDER MEER, R. K., BREED, M. D., ESPELIE, K. E., WINSTON, M. L. (Hrsg.), *Pheromonal Communication in Social Insects: Ants, Wasps, Bees, and Termites*: 79 - 103, Westview Press, Oxford.
- VANDER MEER, R. K., ALONSO, L. E. 1998. Pheromones directed behaviour in ants. In: VANDER MEER, R. K., BREED, M. D., ESPELIE, K. E., WINSTON, M. L. (Hrsg.), *Pheromone Communication in Social Insects (Ants, Wasps, Bees and Termites)*: 159-192. Westview Press, Oxford.
- VANE-WRIGHT, R. I. 1976. A unified classification of mimetic resemblances. *Biol. J. Linn. Soc.* 8: 25 - 26.
- VENTAKATAMARAN, A. B., SWARNALATHA, V. B., NAIR, P., VINUTHA, C., GADAGKAR, R. 1988. The mechanism of nestmate discrimination in the tropical social wasp *Ropalidia marginata* and its implications for the evolution of sociality. *Behav. Ecol. Sociobiol.* 23: 271 - 279.
- VIENNE, C., SOROKER, V., HEFETZ, A. 1995. Congruency of hydrocarbon patterns in heterospecific groups of ants: Transfer and/or biosynthesis? *Ins. Soc.* 42: 267 - 277.
- VON FRISCH, K. 1967. *The Dance Language and Orientation of Honeybees*. Cambridge, Massachusetts: Belknap Press of Harvard University Press.
- WALLIS, D. I. 1962. Aggressive behaviour in the ant, *Formica fusca*. *Anim. Behav.* 10: 267 - 274.
- WEHNER, R., Menzel, R. 1969. Homing in the ant *Cataglyphis bicolor*. *Science* 164: 192 - 194.
- WILSON, E. O. 1959. Source and possible nature of the odour trail of Fire Ants. *Science* 129: 643 - 644.

WILSON, E. O. 1971 *The Insect Societies*. Harvard University Press, Camebridge, Mass.

ZAR J. H. 1984. *Biostatistical Analysis*, 2<sup>nd</sup> ed., Prentice-Hall, Englewood Cliffs, New Jersey.