SMITHSONIAN MISCELLANEOUS COLLECTIONS VOLUME 152, NO. 3

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SECOND SUPPLEMENT TO THE ANNOTATED, SUBJECT-HEADING BIBLIOGRAPHY OF TERMITES 1961–1965

By

THOMAS E. SNYDER

HONORARY RESEARCH ASSOCIATE SMITHSONIAN INSTITUTION



PUBLICATION 4705

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By THOMAS E. SNYDER Honorary Research Associate Smithsonian Institution

INTRODUCTION

ON DECEMBER 29, 1961, a Supplement 1955-1960 to an "Annotated Subject-Heading Bibliography of Termites 1350 B.C. to A.D. 1954," by Thomas E. Snyder was published as Publication 4463, Smithsonian Miscellaneous Collections, vol. 143, No. 3. The present (second) supplement covers publications from 1961 through 1965; some 1966, as well as some earlier, overlooked papers are included. A total of 1135 references are listed under authors and titles, and 2381 references are listed under subject headings, the greater number being due to cross references to publications covering more than one subject. New subject headings are: Attractants, Communication, Glossary, International Cooperation, and Resistant Plants; some previous ones are not included in this supplement.

ACKNOWLEDGMENTS

The publication of this bibliography was made possible by a grant from the National Science Foundation, Washington, D.C.

Editors of the Smithsonian Institution have been very helpful in the preparation of the manuscript and index.

Mrs. Lucile W. Yates, cataloger of the Entomology Research Division, Agricultural Research Service, U. S. Department of Agriculture, has supplied some references. Miss Emily Bennett (1960 to early 1963), Mr. Armitt J. Spohn (1963 to late October 1965), and Mrs. Gloria Mauney (from October 1965 to date), librarians of the Department of Entomology, Smithsonian Institution, have been especially helpful in checking references and obtaining obscure publications, often difficult to locate.

LIST OF SUBJECT HEADINGS

Anatomy. See Morphology. Attractants. Bacteria. See also Nutrition. Baits. See Soil poisons. Behavior. See also Biology. Bibliography. Biography. Biology, ecology. Building codes. See also Control; Resistant woods; Wood preservation. intermediates, Caste determination, also intercastes. Chemical analysis, Cold. See Temperature. Communication. Control, construction, and termite-proofing. Cytology (cell growth). Damage to buildings, material. See also Biology; Flight. Damage to living vegetation. Detection. See also Experimentation. Digestion. See also Nutrition; Protozoa. Diseases, human, plant, and termite. See also Parasites. Distribution. Dusts, poison. See Soil poisons. Ecology. See Biology. Electricity. See Detection; Experimentation. Embryology. Evolution. Experimentation, See also Detection. Flight, swarm. See also Biology; Damage. Food, termites as. Fossil. Fumigation. Fungi, association with. See also Rearing. Fungus cultivation. Gaseous environment. Genetics. See Biology. Genitalia, reproductive or sex organs. Geologic agents. Glossary. Heat. See Temperature. Hermaphrodites. See Biology. Histology. See Morphology. Humidity. International cooperation.

Introduced, or intercepted. Migration. See Biology. Moisture. See Biology. Molds. See Nutrition, Parasites. Morphology, histology (tissue growth). Neoteinia. See Biology. Nests. Nutrition. Obituary. Parasites. Parthenogenesis. See Biology. Phylogeny. See also Evolution; Taxonomy. Physiology. Poison dusts. See Soil poisons. Population, Predators. Protozoa. See also Digestion; Nutrition. Racket. Radiation. Rearing. Regulation. See Legislation. Repellents. See Soil poisons; Wood preservation. Reproductive organs. See Genitalia. Resistant plants. Resistant woods, fiber, plastics. Respiration. See Gaseous environment. Reviews and abstracts. Secretions. Sense organs. Sex organs. See Genitalia. Shields, metal barriers. Soil poisons, baits, dusts, repellents. Sound. Superorganism, supraorganism, colony as. Swarm. See Flight. Symbiosis. See Biology; Nutrition; Protozoa; Termitophiles. Tax status of loss. See Damage. Taxonomy. Temperature. Termitophiles. Toxicology. Uses in industry, arts, and religion. Wood preservation, poisons for fabrics and fiberboards, insulation, etc. Zoogeographical regions.

SUBJECT HEADINGS

(For complete citations see List of Authors and Titles beginning on page 107.)

ATTRACTANTS

- ALLEN, T. C., SMYTHE, R. V., and COPPEL, H. C., 1964, pp. 1009-1011. (Studies in the United States and in several foreign countries involving termite attractancy tests, similar to those made in the United States in 1061, showed that aqueous extracts from wood invaded by the fungus Lenzites trabea gave similar results, 21 termite species in 14 genera, including 3 dampwood, 8 drywood and 10 subterranean termites were tested. The termites were listed, methods of test given. Every species which was significantly attracted except one was subterranean in habit; no dampwood termites were attracted and no drywood species responded strongly. Tests will be continued.)
- BECKER, G., 1964a, pp. 168-172. (Effect on termites of attractive compounds (aldehydes and acids) formed in wood attacked by Basidiomycetes.)
- ESENTHER, G. R., ALLEN, T. C., CASIDA, J. E., and SHENEFELT, R. D., 1961, p. 50. (U.S. subterranean termites follow concentration gradient of attractive material, culture of brown rot fungus on pine, to find decaying wood. Such a potent termite attractant may be useful in termite surveys and control.)
- ESENTHER, G. R., and COPPEL, H. C., 1964, pp. 34, 36, 38, 42, 44, 46. (Madison, Wisconsin, experiments continued in the laboratory with the response of Reticulitermes flavipes to attractants from extractive and synthetics, especially to extracts from white pine infected with the brown rot fungus Lenzites trabea. Periodically for as long as several weeks the termites would not be attracted to any attractant, the cause remains unexplained. Receptors appear to be terminal antennal segments and hind tarsi. The reproductive caste gave the most positive response. Specific differences are being studied between termite species and specific wood-decaying fungi. Field studies indicate that sterilized L. trabea-infected

wood is the best field attractant. A modified attractant-insecticide unit was used. A sandwich of five corrugated fiberboard pieces in which the center and two outermost pieces were not treated with insecticide. The second and fourth pieces were dipped in either 1% chlordane or dieldrin solutions, or a massive dose of dieldrin was also applied to a sandwich unit by shaking only the central piece in a plastic bag that contained 75% wettable powder. The last method caused the greatest mortality. Decayed wood contains both an orientating and feeding stimulus, synthetics show poorer results in field tests because they may be orientative attractants only.)

- JACOBSON, M., 1965, pp. 32, 38. (U.S., Reticulitermes arenincola and R. flavipes, following flight, females attract males by odor. When male touches female, she lowers her abdomen and is followed in tandem. Males also follow severed tip of female abdomen, or other males if once attracted by female. The odor is detected by males' antennae.)
- GREEN, N., BEROZA, M., and HALL, S. A., 1960, pp. 129-179. (U.S., recent developments in chemical attractants for insects.)
- SMYTHE, R. V., ALLEN, T. C., and COPPELL, H. C., 1965, pp. 420-423. (U.S., effect of various factors on response of Reticulitermes flavipes to pentane extracts of Lenzites trabea-invaded wood measured. Degree response for single termites lower than unit of five; unit of five responded less positively than unit of ten. The most positive response was by secondary reproductives followed in order by workers and soldiers. Increased temperature caused a more rapid and positive response. Level of response decreased under the influence of shorter wavelengths and higher intensities of light.)
- VERRON, H., 1963, pp. 167-335. (France, Calotermes flavicollis reaction stimuli of various castes, interindividual relations

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show same characters as behavior linked with trophallaxy, interaction partly of an alimentary nature. Recognition on olfactive basis possible, attractive scent of metabolic origin. During post-embryonic ontogenesis, sexual differentiation increases as reactivity decreases. If the two phenomena are in any way related, their concomitance would tend to show that the insect is less and less submitted to the effects of sexual inhibition pertaining to the reproducers, owing to a progressive decrease in the frequency of alimentary exchanges. The females are licked by the nymphs; the male-sexed individuals are not. The activity of the reproducers causes them to act as "inciters." The neoteinics are little attractive yet react strongly. The deep modifications observed during the swarming period that are particularly concerned with social interattraction and sex-related behavior are to be added to inversion of the tropisms and sexual maturity. These modifications enable the insect now liberated of its social environment, to engage in a new phylogenetical cycle and to multiply.)

VERRON, H., and BARBIER, M., 1962, pp. 4089-4091. (An attractant fraction hexene301-I has been isolated from nymphs of *Calotermes flavicollis*, as well as from the crushed galleries of the African termite *Microcerotermes edentatus*. The compound when synthesized is an attractant under experimental conditions. The compounds from the two sources have a totally different odor.)

WATANABE, T., and CASIDA, J. E., 1963, pp. 300-307. (U.S., at least six materials attractive to Reticulitermes flavipes found in wood partially decayed by Lenzites trabea. These unidentified attractants were steam-volatile, neutral unsaturated compounds. Steam-volatile attractants were also present in the fungus grown on synthetic media, in the wood alone, and in the termites. Testing of compounds of known structure for attractants indicated that some materials with the propenyl and styryl radical were active, for example cinnamyl alcohol and isosafrole. Other attractive compounds were six ionones and certain camphor analogs. The attractivity of camphor may be due to a minor impurity. Considerable specificity should occur in the response of different species of termites. The potential of these attractants in control is undetermined.)

BACTERIA

- DAS, S. R., MAHESHWARI, K. L., NIGAM, S. S., SHUKLA, R. K., and TANDON, R. N., 1962, pp. 163-165. (India, Odontotermes obesus, bacteria in fungus garden anaerobic sulfate reducing; in guts workers a few sulfate reducing bacteria, but in guts soldiers and nymphs a few bacteria, but not sulfate reducing.)
- LUND, A. E., 1962, pp. 30-34, 36, 60-61. (U.S., Serratia kills termites in laboratory, carried by mites.)
 - 1965, pp. 22, 24. (U.S., spore-forming bacteria, Serratia marcescens, that can be carried by termites back to their colony, gave 100% mortality to laboratory termite cultures within 24 hours, only a few strains are effective. The bacteria produces red pigmented growths and is called red agent. It has been field tested in South Carolina by soil spraying a solution of spores, and the termite activity was reduced. The impregnation of wooden planks with a spore solution led to the discontinuation of termite attack.

The longevity of *S. marcescens* was at least 8 months and it has the ability of spreading. It is a potential means of termite control, but after a certain length of time virulence decreases. The influences of pH and moisture must be examined. Protective respirators or aspirators will be required during application to prevent infection by human beings.)

- MISRA, J. N., 1962, p. 153. (Intestinal cellulose digesting symbionts in higher termites microbial flora, enzymes bacteria in hindgut *Odontotermes obesus*, other enzyme systems present.)
- SEBALD, M., and PREVOT, A. R., 1962, pp. 199-214. (A new species of strict anaerobic bacterium *Micromonospora acetoformici* isolated from the posterior intestine of *Reticulitermes lucifugus* var. santonnensis.)
- SMYTHE, R. V., and COPPEL, H. C., 1965, pp. 423-426. (U.S., Wisconsin, an experimental soluble toxin preparation derived

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from *Bacillus thuringiensis* is toxic to three species of *Reticulitermes* and *Zootermopsis angusticollis*; 75% mortality after 9 days, in combination with spores and inclusion bodies results in greater than 90% mortality.)

BEHAVIOR

- DELIGNE, J., 1965, pp. 179-186. (Africa, different types fighting behavior considered as four different evolutionary grades soldier mandibles acquired poly-phyletically.)
- HOCKING, B., 1963, pp. 280-285. (East Africa, technique developed for studying the behavior of worker termites toward others of the same species, and in relation to their distribution in space is described and illustrated.)
- Howse, P. E., 1965b, pp. 335-345. (Zootermopsis angusticollis oscillatory movements, "longitudinal" response to lowintensity stimulus to antennal sensilla. "Complex" took place after large disturbance; associated with laying down of odor trail, occurs only on contact with an individual of same species, means of exciting other termites to follow odor trail, but not a specific stimulus.)
- HUTCHINS, R. E., 1966, pp. 1-324. (East Africa, queen lays 43,000 eggs per day.)

BIBLIOGRAPHY

ANONYMOUS. 1961, pp. 1-9. (Italy, control, damage, list of publications 1952-1960.)

- COMMONWEALTH BUREAU SOIL SCI., 1960, pp. 352, 3. (Bibliography (annotated) 1959-1957, effect termites on soil, tropics.)
 - 1964, 797., pp. 1-8. (Bibliography (annotated) 1964-1933, termites and soil formation, tropics.)
- HARRIS, W. V., 1965, pp. 40-43 (Bibliography, world.)
- PEMBERTON, C. E., 1964, pp. 689-729. (Hawaii, review of entomology in Hawaii; early
- ANONYMOUS, 1964d, pp. 23-24. (Dr. A. E. Emerson, professor emeritus of zoology, a foremost authority on termites, donated his collection of termites to the American Museum of Natural History. There are 1800 living and fossil termites identified in the world, Dr. Emerson has obtained 1600. The smallest is 3 mm. long, the largest—a queen—4 inches by 1¹/₄ inches. It relates how Emerson became interested in termites and his association with Dr.

BIOGRAPHY

W. Beebe at the New York Zoological Society Tropical Research Center in British Guiana. Dr. Emerson discussed the biology of termites, the caste system, division of labor, mound nests 30 feet high, queens that lay 8,000 eggs per day, etc. The vast majority of termites are sterile. The whole question of teleology and purposiveness is reflected in termites.)

- **TIOR** LINDAUER, M., 1965, pp. 123-186. (Behavior
- and mutual communication.) MACHADO, A. DEB., 1963, pp. 1-3. (The ecological concept of species and its premature application to the systematics of *Apicotermes.*)
- McMAHAN, E. A., 1961, p. 2414. (Cryptotermes brevis, laboratory studies colony development and behavior.)
- PASTEELS, J. M., 1965, pp. 191-205. (Africa, *Nasutitermes lujae* workers different stages; ethological and physiological differences exist between first-stage workers and the other; third-stage workers oldest, venture more readily outside nest.)
- SANDS, W. A., 1961a, pp. 277-288. (West Africa, foraging behavior and feeding habits five species *Trinervitermes*, two groups, those which store grass fragments in mounds, and those which do not; list of grasses used in experiment.)
- SUDD, J., 1965, pp. 489-496. (Behavior termites in building nest cooperative.)

references to Hawaiian insects; important

immigrant insect pests; biological con-

trol; control measures for each pest; bibliography; Isoptera, p. 696 and 710.)

ography of E. O. Essig, 1909 to 1958.)

cations of F. Silvestri on termites and

Sмітн, R. F., 1965, pp. 235-258. (U.S., bibli-

Russo, G., 1963a, pp. 217-222. (List of publi-

termitophiles, 51 papers, 1901-1949.)

SNYDER, T. E., 1961, pp. 1-137. (Supplement to annotated, subject-heading bibliogra-

phy of termites, 1955-1960.)

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NELSON, J. A., 1966, p. 50. (Dr. W. V. Harris, isopterist. British Museum, London, in interview stated that while no live termites occur in England, half of all known species are preserved in the Commonwealth Institute of Entomology collection

BIOLOGY, ECOLOGY

- ARORA, G. L., 1962, pp. 111-113. (India, Hoshiarpur, Punjab, Heterotermes indicola, Coptotermes heimi and Microtermes anandi subterranean termites, galleries of nests differ, number soldiers proportionately small 20%, 31.5%, and 31.5% respectively. Heterotermes and Coptotermes voracious wood eaters. Coptotermes swarms after first heavy showers in late June, early July at sunset, three to four swarms, second largest, Microtermes the second week in July, Heterotermes the middle of August when it is actually raining. Females of both C. heimi and M. anandi raise abdomens and emit sweet odor, attract males in courtship.)
- BECKER, G., 1961a, pp. 78-94. (Observations and experiments upon the beginnings of colony development of Mexican Nasutitermes ephratae, life history in laboratory. Egg laying began 3-4 days after swarming, I to 3 daily up to total of 25-30, then a pause. Incubation averaged 6-11 weeks. Half eggs laid eaten by adults, larvae also gradually eaten and adults died. Survival only by addition number older workers and soldiers, with increasing oviposition by young queens.)

1962, p. 232. (1dem.)

- 1963a, pp. 455-456. (Experiments in laboratory with tropical termites show magnetotaxis or reaction to the points of the compass. Winged adult pairs of *Macrotermes* and *Odontotermes* always assume an east-west resting position. In nature, large queens of *Odontotermes* in India rest in a north-south direction.)
- 1964, pp. 75-88. (Dealated imagos, particularly *Macrotermes* and *Odontotermes* adjust their resting position to the magnetic field of the earth or to artificial magnetic fields. Correlation between intensity of respiration and atmospherics, higher with minimum atmospherics.)
- Bess, H. A., 1963, p. 204. (Ruiru, Kenya, East Africa, Odontotermes badius? large queens from underground termitaria, 2.5 to 4 inches in length and three-eighths

at the museum. A world authority on classification of termites, Dr. Harris also recommends control measures for the Commonwealth, heading the Termite Research Unit. Much attention focuses on termites which destroy crops.)

to 0.75 inches in diameter. This is a nonmound building termite abundant in the Kiambu-Ruiru area at 5000 to 6000 feet.)

- 1964, p. 351. (Honolulu, Hawaii, Coptotermes formosanus queen of subterranean termite found on Dec. 2, 1963, in carton nest; nest of about two cubic feet of material was in false bottom of closet directly on the concrete slab near a bathroom. No tunneling leading to ground. Hundreds of soldiers, small nymphs, and many thousands of workers present, but no eggs.)
- BODOT, P., 1962, pp. 789-790. (Africa, southern Ivory Coast, savannahs, seasonal cycle termites.)
- BORROR, D. J., and DELONG, D. M., 1964, pp. 56, 62, 65, 118-124, Chap. 10, Order Isoptera, p. 489, 657, 665, 720-721. (U.S., key to Order Isoptera, castes, keys to genera, families, habits, termitophiles, damage, as scavengers, rearing methods.)
- BOUILLON, A. (Ed.), 1964, pp. 1-414. (Africa, systematics, physiology, population, and ecology, 11 papers, 3 genera singled out— *Cubitermes, Macrotermes,* and *Apicotermes*, nests of latter described in detail.)
- BUCHLI, H., 1961, pp. 628-632. (*Reticulitermes lucifugus*, relations between the maternal colony and the young winged imagos.)
- CALS-USCIATI, J., and FRESCHEVILLE, J. DE, 1963, p. 54. (France, Paris, perennation of a colony of *Reticulitermes lucifugus*.)
- CHATTERJEE, P. N., and SEN-SARMA, P. K., 1962, pp. 139-142. (India, *Odontotermes obesus*, seasonal incidence of wood destroying subterranean termites tested with wood from *Salmalia malabarica*.)
- CHEN, NING-SEN, 1959, pp. 1-17. (China, Coptotermes formosanus, Reticulitermes chinensis, and R. flaviceps, list of 16 genera.)
- CHHOTANI, O. B., 1962a, pp. 73-75. (India, *Kalotermes beesoni*, all alates emerging from colony in laboratory were females, as were those infesting banyan trees in the field, showing reproduction by

parthenogenesis to be regular and normal.)

- CHIN, CHUN-TEH, and MA, SHIH-CHUN, 1959, p. 240. (China, Odontotermes formosanus, Coptotermes formosanus soil insects.)
- CLOUDSLEY-THOMPSON, J. L., 1964, pp. 1-11. (Africa, Sudan, Khartoum Prov., desert, Subulitermes sp., Macrotermes bellicosus, Trinervitermes geminatus.)
- COLLINS, M. S., and RICHARDS, A. G., 1963, pp. 600-604. (U.S. studies on water relations eastern species Reticulitermes: R. tibialis is rather desiccation-tolerant and loses water at a consistently low rate, three species that lose water relatively slowly but show great variability under experimental conditions, R. flavipes shows a variable but relatively high rate of water loss. The desiccation tolerance of tibialis due to relatively effective waterproofing mechanism, a well-developed cement layer, and moderate-size flavipes seems to have least efficient transpirationretarding mechanism, large size permits it to outlive species having lower loss rates during drying possibility. Transpiration resistance increases with age, as does resistance of waterproofing to damage, the rate of transpiration in imagoes falling to about one-third the rate of teneral individuals. Size appears to have no influence on rate of loss though it can influence length of survival under dry conditions. When treated to demonstrate the cement layer, species of Reticulitermes other than tibialis were found to have very small argentaffin granules in depressed areas, instead of the heavy scaly layer found in *tibialis*.)
- COUPIN, H., 1905, pp. 8-10. (General, nests, and as food.)
- DAVENPORT, D., 1966, p. 8. (U.S., futile? termite tubing, Ashland, Nebraska, down from floor joists 37 inches for moisture, still 5 feet from soil in basement, no heat, soil dry, house 24 years old, no serious damage.)
- DELIGNE, J., 1962, pp. 7-21. (Bellicositermes natalensis by two successive moultings the minor worker develops into a major soldier. Its mandibles and head exhibit important allometric growths. The labrum, maxillae, the hypopharynx, and the prementum are reduced and lose cuticular formations which probably have mechanical and sensorial functions. Prob-

lems raised by these transformations are mentioned.)

- Deligne, J., and Pasteels, J. M., 1963a, pp. 462-472. (Biology.)
- DRIFT, J. W. P. T., VAN DER, 1962, pp. 24-28. (Europe, Kalotermes flavicollis, Reticulitermes lucifugus habits, damage, control.)
- DURANT, J. A., and Fox, R. C., 1960, pp. 202-207. (U.S., South Carolina, Piedmont region *Reticulitermes* spp. in soil and litter of pine and hardwood stands May-September 1962 pine: loblolly and shortleaf; hardwood: oak, beech, yellow poplar. Of all the arthropods, termites were 0.64, 0.07, and 0.00 in relative abundance in the pine stands, and 0.60, 0.82, and 0.22 in the hardwood stands. Soil moisture was an influence, and it was lower in the pine stands.)
- ESENTHER, G. R., 1961, pp. 945-946. (U.S., Wisconsin, *Reticulitermes flavipes* and related experiments with other species.)
- FARB, P., and the Editors of Life, 1962, pp. 82-86. (General, summary of the life of termites.)
- Fox, R. M., and Fox, J. W., 1964, pp. 5, 19, 20, 338, 350-354, 357. (Damage, scavengers in forest, as food for humans, classification, biology, general, in Africa and Australia termite mounds are characteristic of the landscape in vast areas. These hills may be up to 40 feet high. A *Macrotermes* queen in Liberia weighed 35.5 grams, capable of laying 34,000 eggs a day. More than 500 species of other invertebrates share their nests as termitophiles.)
- Gösswald, K., 1961, pp. 146-151. (Comparison societies termites and man, termites more social, not independent, colony an entity or single biological unit. Basis for man's society is the family. Each family is an independent biological unit. Each single individual is biologically selfsufficient.)
- GRASSÉ, P. P., and NOIROT, C., 1960, pp. 109-123. (France, *Calotermes flavicollis*, formation neoteinics easier and quicker in female, sex differences in female, sex differences in inhibition, numbers; have different role.)
- GREAVES, T., 1962, pp. 1-17. (Australia, Coptotermes acinaciformis, vibration causes temperature in colony in tree to drop 11° C.; colonies can attack living trees from nearby colonies.)

1962a, p. 65. (Australia, Porotermes adam-

soni of the 101 pairs maintained at 60° F. since January 1961, 81 survived the first year but only 8 pairs produced eggs and larvae, only 66 of the 100 pairs survived at 78° F. and only 2 pairs produced larvae.)

- 1962b, pp. 238-240. (Australia, termites living in forest trees, species, competition, population, effect colonies on temperature trees, reaction to vibration.)
- GRIFFIN, F. J., 1961, pp. 1524-1526. (General.)
- HARRIS, W. V., 1961, pp. 1-187. (Tropical Africa, mounds of *Macrotermes* in East Africa 30 feet high; queens 5 inches in length; flight, colony foundation, nests.)
 - 1962b, p. 99. (In termites there is a dual nature to biology, involving both the individual and the colony; there are differences in food, shelter, and reproduction according to the family.)
- HARRIS, W. V., and SANDS, W. A., 1965, pp. 113-131. (Social organization of termite colonies, summary recent research on all phases of termite biology under diverse world conditions. Extensive list of pertinent references included.)
- HEATON, S. S., 1966, pp. 28a, 28b, 29-30. (U.S., California, life of Zootermopsis angusticollis illustrated, egg to adult, castes, anatomy, protozoa photographed.)
- HOCKING, B., 1965, pp. 83-87. (East and South Africa, mass exodus of all stages workers and soldiers *Macrotermes bellicosus* from nest described. Observations on alarm reactions and on weights and load weights of foraging individuals of *Hodotermes mossambicus* given. Some peculiar nest structures are illustrated.)
- Howse, P. E., 1964, pp. 90-97. (The nature of the insect colony, entire termite colony considered as a single organism, the superorganism. Dr. A. E. Emerson believes features of the nest can be considered as equally important in classification. Emerson also believes in this conception: it is possible to appreciate evolutionary trends more clearly such as increased social homeostasis. An example M. Lüscher has shown that an "airconditioning" system is present in the mounds of the African Macrotermes natalensis, whereby hot air arises from the center of the nest and is cooled in large canals near the surface. The air is in constant circulation and some gas exchange takes place near the surface of the mound; an effective "respiratory system.")

- HRDÝ, I., (Ed.), 1960, pp. 1-406. (Czechoslovakia, ontogeny of insects.)
- HUTCHINS, R. E., 1966, pp. 1-324. (Habits, number species, nests, protozoa, sounds.)
- JEANNEL, R. G., 1960, pp. 92, 93, 212-226, 274. (General, social life, nests, fossils, 500 termitophiles known, enemies.)
- JOSEPH, K. J., 1964, pp. 54-55. (India, supplementary reproductives (neoteinics) from a colony of *Microcerotermes fletcheri*, 256 forms collected from nest in Mysore State at Yellapur, males and females, function.)
- Jucci, C., 1957, pp. 109-129. (General, genetics, experimental biology, systematics.)
 - 1960, pp. 107-127. (General, genetics, evolution and systematics. Bacteriocytes Mastotermes darwiniensis: symbiosis, inherited in ontogenesis (transmitted from body mother to eggs) and in phylogenesis (from Protoblattoids, since paleozoic). In every other family Isoptera (except Termitidae) symbiosis with intestinal flora and fauna. Specificity symbiosis between Hypermastigina and Hodotermitidae, Calotermitidae and Rhinotermitidae; relation of symbionts with host organism and their transmission. Losing of intestinal fauna and exteriorisation of the symbiosis in Termitidae: cultivation fungus gardens (sometimes gardens without fungi).)
 - 1960a, pp. 1-24. (General, the society among insects.)
- KENDEIGH, S. C., 1961, figs. 12-1, 27-7, pp. 109, 164, table 9-8, pp. 174-177, 179, 251, 311-312, 338-339, 344, 347, 349. (Ecology, social life, mutualism, symbiosis, inheritance behavior patterns, woodland biociation, adjustments to desert, nests in savanna, abundance in American tropics, nests in trees, meridian nests.)
- KETKAR, S. M., 1962, pp. 115-116. (India, Poona, Odontotermes redemanni, swarming occurs twice a year, April to June, September to October, the first period at dusk during the day rain occurred, during the second period the swarming also at dusk was less frequent. Alates attracted to lights for distance 2-3 miles.)
- KEVAN, D. K. McE., 1962, pp. 2, 10, 35, 52-55, fig. 76, 79, 89, 90, 92, 98, 99, 133, 135, 140, 141, 177-179, 184, 189 et seq. (General, mostly tropical species.)
- KLOTS, A. B., and KLOTS, E. B., 1959, pp. 23-30. (Living insects of the world.)
- KRUTCH, J. W., 1963, pp. 22-25. (Comparison society man and that of termites. Anthro-

pologist Ralph Linton states man is an anthropoid ape trying to live like termites and not doing too well at it. Survival alone is termites only success, have become mechanical guided by instinct. Man can reason, has power to choose.)

- KURIR, A., 1962, pp. 1-8. (Europe, *Reticuli*termes flavipes manner of living in wood of this subterranean termite illustrated.)
- LANHAM, U., 1964, pp. 35, 145, 154-158. (General, description, relations, habits.)
- LUND, A. E., 1962, pp. 30-34, 36, 60-61. (U.S., ecology, termite fungi relations, termites able to attack wood uninfected by fungi; some wood-destroying fungi produce end products (metabolites) that are repellent, or toxic, others attractants. Some molds reduce longevity termites. Mites usually scavengers, but are disease vectors of a bacterium *Serratia*. Termites fluoresce when exposed to ultraviolet light, cuticle involved. Temperature lower lethal average—11° C., winged—17.5° C., upper lethal—48.5° C.)
- LUPPOVA, A. N., 1963, pp. 17-27. (Central Asia, Transcaspia, corrections on faunal data and information on biology of Anacanthotermes turkestanicus and the major Transcaspian termites are given. Kalotermes flavicollis, Anacanthotermes ahngerianus, Reticulitermes lucifugus, Amitermes vilis, Microcerotermes sp.)
- McMAHAN, E. A., 1961, p. 2414. (Hawaii, *Cryptotermes brevis*, laboratory studies colony development and behavior.)
 - 1962, pp. 145-153. (Hawaii, Cryptotermes brevis, laboratory studies in termitaries of birch tongue blades, colony growth slow, no soldiers produced first year, survival of primary reproductives paired for different intervals up to 12 months varied from 50% to 85%. Supplementary reproductives superior to primaries in egg production. Mixed pairs of primary and supplementary reproductives produced young. Primary females differ from supplementary in tendency to suspend egg production following an initial egg laying period.)
- MARTINEZ, J. B., 1963, pp. 1-30. (Spain, Peninsula, Balearic, and Canary Isles, habits *Reticulitermes lucifugus*, Peninsula, Balearic Isles; *Cryptotermes brevis*, Canary Islands.)
- MATHUR, R. N., and SEN-SARMA, P. K., 1962, pp. 1-18. (India, Dehra Dun, notes on habits and biology termites.)
- MILLER, E. M., 1964, pp. 1-36. (General summary biology, with special reference to

Florida termites, kinds, behavior, nests, communication, regulation castes, colony as superorganism, control, nutrition, evolution, Data on "swarming" months and resistance to drying of Florida species given.)

- NAKAJIMA, S., SHIMIZU, K., and NAKAJIMA, Y., 1964, pp. 222-227. (Coptotermes formosanus, studies vitality colonies. Seasonal fluctuations on external characters workers, the ratio of caste-member and carbon dioxide in the nest of a colony.)
- FUDALEWICZ-NIEMCZYK, W., 1962, pp. 137-155. (Polymorphism, determination of castes and establishment of new communities, by several methods.)
- Noirot, C., (1960) 1962, pp. 583-585. (General, seasonal cycle of termites, essentially regulated by temperature, in Tropics rain factor in flight.)
 - (1960) 1962a., pp. 658-659. (Africa, Ivory Coast, the evolution of the termite fauna of the savanna region, the regression of *Bellicositermes natalensis* and the expansion of *Amitermes evuncifer*. Dead nests of former evidence, two species have different action on soil, former more favorable.)
 - 1963, pp. 636-662. (Africa, Bellicositermes natalensis description, figure and evolution nest; population, fungus gardens. Globitermes annamensis description and figure nest, biology. Polymorphism, castes, alimentation, nutrition. Nest construction, primitive to specialized. Apicotermes arquieri nest, description, figure. Social regulation, superorganism.)
- NUTTING, W. L., 1965, pp. 113-125. (Arizona, Zootermopsis laticeps, habits, distribution flights June to early August, nests in trees, enters through wounds, cockroach and syrphid larvae in nests.)
 - 1965a, pp. 1-5. (U.S., Southwest, and northern Mexico, 28 species three-fourths of total native termites occur, generally no more than 6 economically important, in any area, but 13 for whole region; discusses types; habits of 7 species, including flights, size colonies.)
- PICKENS, A. L., 1962, p. 101. (Caste in ants, bees, and termites, abstr.)
- PLATEAUX-QUÉNU, C., 1961, pp. 178-185. (Replacement sexuals in the social insects, imaginal in primitive and specialized termites, neoteinic derived from nymphs, from workers, number of neoteinics, importance.)
- RITTER, H., 1964, pp. 1459-1460. (Defense of

mate and mating chamber in a wood roach [Cryptocercus punctulatus].)

- ROONWAL, M. L., and CHHOTANI, O. B., 1963, pp. 975-976. (India, Odontotermes obesus royal chamber with four queens and two kings, dealated, queens laying in pairs one pair lying north-south the other westsoutheast, with the heads facing in opposite directions, small mounds, 52-62 mm. in length queens, record of more than one king and queen in colony listed.)
- Rozanov, B. C., 1963, pp. 63-67. (Burma, tropical, habits and behavior termites.)
- SANDS, W. A., 1961a, pp. 277-288. (West Africa, foraging behavior and feeding habits five species *Trinervitermes*, two groups, those which store grass fragments in mounds, and those which do not, list of grasses used in experiment.)
 - 1965a, pp. 117-129. (Nigeria, West Africa, the development and dispersal of alates, and subsequent development new colonies of five species *Trinervitermes* in laboratory cultures show differences between species that can be related to their distribution and environmental requirements.)
- Scott, K., 1964, p. 23. (U.S., California, Atwater District, Los Angeles, infestation attic by *Kalotermes* in several places spacing gap bridged by pellets attached to one another by an adhesive forming a ball about the size of an elliptical baseball. Through these masses the termites traveled from timber to timber, through voids, an uncommon occurrence.)
- SEMEDO, C. M. B., 1961, p. 105. (Portugal, Leucotermes (Reticulitermes) lucifugus, morphology adult worker, habits, habitats.)
- SEN-SARMA, P. K., 1962, pp. 292-297. (India, Dehra Dun, Odontotermes assmuthi, colony foundation in the laboratory in glass jars with semul sawdust with 85% relative humidity and temperature of 28°C. Nesting site selected by females. Eggs laid after 6-9 days of swarming, number of first batch 100-300. Second batch laid on 4th day after hatching first batch, laying thereafter continuous. Incubation period 40-42 days. In hatching parental care of eggs essential. Parthenogenesis not observed.)
- SEN-SARMA, P. K., and CHATTERJEE, P. N., 1965, pp. 9-11. (India, *Heterotermes indicola* founding new colonies in laboratory through substitute reproductives de-

veloped from workers after a period of 3 months.)

- SHELL CHEMICAL Co., 1962, p. 62. (U.S., photograph of a shelter tube 15½ inches from ground to floor joists.)
- SHIMIZU, K., 1962, pp. 105-110. (Japan, Coptotermes formosanus, vitality of colonies vary in field, factors: body weight workers; greater the ratio of the younger individuals to workers with 14 antennal segments, the more vigorous the colony; ratio of larvae.)
- SIMON, H., 1962, pp. 7-119. (Habits, nests, damage, illustrated.)
- SMITH, M. V., 1963, pp. 7-11. (Complex behavior ants, bees, wasps, and termites, social insects and caste system.)
- SMYTHE, R. V., and COPPEL, H. C., 1964, pp. 133-135. (Laboratory studies on relationships *Reticulitermes flavipes* and ants in Wisconsin.)
- SNODGRASS, R. E., 1961, pp. 425-445. (Termites, pp. 430-432, general, ectohormone as regulatory agent for colony.)
- SNYDER, T. E., 1963b, pp. 175-179. (U.S., eastern states, *Reticulitermes* spp., manner founding new colonies by supplementary reproductives not known. In spring large numbers are present before the annual colonizing flight or swarm of the winged adults. These disappear just before or at the time of the flight from the colony. Are they killed by the workers as being unnecessary in the parent colony where reproductives are already present? Or, impelled by the same stimuli as the winged, do they migrate—with or without workers—by subterranean galleries to form new colonies?)
- 1965, pp. 497-506. (Recent research, mostly in the United States, summarized.)
- SNYDER, T. E., and FRANCIA, F. C., 1962, pp. 63-77. (Philippines, habits, and habitats, emergence dates termites.)
- SWAN, L. A., 1964, pp. 4, 97, 240. (Population colonies South American termite three million. Queen fungus-feeding tropical termites may live as long as 50 years. Queen some Australian termites lay 360 eggs an hour, or 3 million in course of a year—for 25 to 50 years. Ants important check on termites in tropics. In Madras, myrmicine ants used to protect structural timbers in warehouses. Species of dolichoderine ant occupy 80% of nests of common species of termites in South Queensland, Australia. Termites important scavengers in tropics.

In South Africa termites function like temperate earthworms.)

- TANG, C., and LI, S., 1960, pp. 302-306. (Coptotermes formosanus and Reticulitermes flaviceps, types of reproductive forms in these subterranean termites in Hangchow, China, macropterous, brachypterous, and apterous, latter two polygamous, as many as 50 brachypterous queens in one colony.)
- URQUHART, F. A., 1965, pp. 69-72. (Habits, damage, castes, nests, rate egg laying, detection, spread, transportation.)
- U.S. DEPT. AGRICULTURE, PLANT PEST CON-TROL DIV., 1963n, p. 1416. (Hawaii, *Coptotermes formosanus* subterranean termite queen found Dec. 2 by D. Yara. Carton nest of 2 cubic feet material in false bottom of closet on concrete slab near bathroom, no tunneling to ground. Hundreds of soldiers and small nymphs present, no eggs, thousands of workers. H. B. Bess.)
- UTHAISILP, C., 1962, pp. 417-422. (Thailand, life history termites that live in ground, make mounds, queen could produce 6,000-7,000 eggs a day. Colony built by a couple of termite workers after leaving old colony. One becomes queen and reproduces rapidly, mating with a group of nonworking males, other groups remain sterile and become workers and soldiers.)
- WEESNER, F. M., 1965, pp. 1-71. (U.S., a handbook, all Nearctic termites, classification, structure, behavior, biology, flight dates regionally *Reticulitermes* spp. indoors, introduction, keys for identifications, illustr.)
 - 1966, pp. 19-20, 53-56. (Western U.S., excerpts from 1965 handbook and answers
- ANONYMOUS, 1962h, pp. 16-17. (U.S., Southern Building Code Congress and Building Officials Conference of America have approved Bruce-Terminix \$5000 Protection Contract, renewable annually, annual reinspection, necessary free treating and repair all new termite damage to structure or contents up to \$500. Such pretreatment an equivalent to metal shields or pressure-treated lumber. More than 1500 cities and towns adhere to these two building codes.)

SUNDLOL, W. A., 1964, pp. 11-15, 17-18. (U.S.,

to questions when addressing 13th Ann. Cal. Poly. Pest Control Conference, Pomona, Calif., Dec. 3-4, 1965.)

- WENDT, H., 1965, pp. 185-192. (Summary studies of authors, flight not nuptial, rate of egg laying.)
- WIGGLESWORTH, V. B., 1964, pp. 71, 86, 87, 100, 117, 120, 135, 156, 239-240, 244, 245, 247, 309, 310. (Symbiont protozoa, p. 71; growth and metamorphosis, pp. 86-87; polymorphism, p. 100; egg-laying capacity, p. 117; termitophiles, p. 120; color, p. 135; defense: mandibular, ejection secretions, p. 150; relation to cockroaches, pp. 239-240; control of castes by pheromones, pp. 244-246; nests, population, p. 247; castes, biology, p. 309; longevity, p. 310.)
- WILKINSON, W., 1962, pp. 265-286. (West Africa, Nigeria, *Cryptotermes havilandi*, establishment new colonies, dealates seek hole or crack which is sealed with material from gut, holes between 1.5 and 3 mm. in diameter; rate egg production, incubation period, and duration first three instars recorded. Egg production by physogastric queen could maintain populations in excess of 3000, neoteinics in first year have much greater fecundity than primary queens.)
 - 1963, pp. 269-275. (Port Harcourt, Nigeria, *Cryptotermes havilandi*, causes serious damage to buildings on West Coast tropical Africa. Daily observations of number alates flying, seasonal variation and diurnal pattern flight made over period 13 months. Method colony foundation, rate egg laying, incubation period, progress early instars described. Methods by which infestations are spread discussed.)

BUILDING CODES

in 1960 building code bodies began to accept fire retardant pressure-treated wood (FRTW) as a safe and desirable material in construction. The annual production has increased from 12,600,000 to 22,120,000 feet board measure. It will not allow fire to spread, it is identified by label, quality controls maintained. Been successfully used for 50 years, beginning in New York. Preferential rates granted for FRTW by insurance companies. Baxco-Pyresote a well-tested product.)

CASTE DETERMINATION

- GAY, F. J., 1961, Laboratory studies, p. 38. In Commonwealth Sci. and Indus. Res. Org., Div. Ent. 1960-1961 Ann. Rept. (Australia, small-scale laboratory colonies of Nasutitermes exitiosus with an initial population of 4 g. are being used in an attempt to develop a bioassay method for use in assessing the activity of "soldierinhibitor" materials in connection with caste-determination studies.)
- Jucci, C., 1963, pp. 73-97. (Caste differentiation effected through the mediation of an endocrine system. The adoption of a system of ectohormones or pheromones could represent a kind of pharmaceutics of endocrine organs, elaborated in the course of evolution of social insects in order to achieve a better regulation of social equilibrium. The ectohormones could, at least in part, derive in metabolism from endohormones. These metabolic products, being excreted by various parts of the organism of royal individuals (and others) would be utilized as social hormones, for the homeostatic regulation of social behavior and organization.)
- LEBRUN, D., 1964, pp. 4152-4155. (France, *Calotermes flavicollis*, the role of the corpora allata in caste formation.)
- LÜSCHER, M., 1963, pp. 244-250. (Europe, Kalotermes flavicollis, function of corpora allata crucial in caste determination, different hormones secreted by different castes. Corpora allata hormones are true differentiation hormones, rather than

ecdyson, the hormone of the prothoracic glands.)

- 1963a, pp. 1-11. (Europe, Kalotermes flavicollis, production replacement reproductives regulated by two sex-specific inhibitory pheromones given off by the sexual pair and in part by a stimulating pheromone given off by male reproductives. There are probably three pheromones, endohormones may act directly or in modified form as pheromones.)
- RUPPLI, E., and LÜSCHER, M., 1964, pp. 626-632. (Europe, Kalotermes flavicollis, the elimination of supernumerary replacement reproductive is initiated by fighting. When one reproductive is injured it is abandoned by its aggressor and becomes a victim of cannibalism by larvae and nymphs.)
- SHIMIZU, К., 1963, pp. 207-213. (Japan, emergence of soldiers and supplementary reproductives of the Japanese termite Leucotermes (Reticulitermes) speratus (Kolbe), the emergence ratio of soldiers increases with the number of larvae plus workers in colonies and a certain number of larvae plus workers is needed for the initiation of soldier differentiation. Supplementary reproductives can develop either from larvae-workers or nymphs but most frequently from nymphs combined with considerable numbers of workers. Caste differentiation is easily influenced by the composition of members in the colonies.)

CHEMICAL ANALYSIS

BECKER, G., and SEIFERT, K., 1962, pp. 273-289. (Materials used by 21 termite species for nests and galleries, and dry fungus combs of 3 further species were analytically examined as to their contents of ash, lignin, and carbohydrates. Carton nests of Nasutitermes, Microcerotermes, and Termes species had an ash content of between 3% and 25% which varied with the distance between nest and soil. With Kalotermitidae and Termopsidae the gallery material consists almost exclusively of faeces. Heterotermes builds galleries with a mineral content of only 4% to 17% (like an ash content of 8% in the deposits in their tunnels) as well as others containing about 85% of ash. Galleries of Reticulitermes species showed

an average ash content of 80%. The relation between lignin and carbohydrates in gallery material is connected with ash content. Coptotermes species produces deposits in wood, the mineral portion of which is below 10%; also the galleries may contain about 20% of ash only. Galleries of Nasutitermes species partly have an ash content less than 10%, partly a considerably higher one. The lignin portion in faeces and ash-free material of nests and galleries of Kalotermitidae and Rhinotermitidae is 65% to 69% or less, if pine is food, slightly lower if hardwood, the lowest about 40%. With Kalotermes flavicollis the lignin content after consumption of different hardwood species varied between 57% and 44%,

the relation of lignin content in pellets and consumed wood between 2.4:1 and 1.6:1. The preferred wood species had the highest coefficient. Apparently representatives of different termite families effect equal degrees of decay in wood.)

- BANO, Z., AHMED, R., and SHRIVASTAVA, H. C., 1964, pp. 380-381. (Seventeen amino acids have been identified in the proteins of the edible mushrooms *Lepiota* sp. and *Termitomyces* sp. The protein from the former contains a high percentage of leucine (8.9) and isoleucine (9.2), whereas that from *Termitomyces* sp. contains a high percentage of histidine (6.5) and arginine (8.5).)
- DUPERON, P., HÜGEL, M. F., SIPAL, Z., and BARBIER, M., 1964, pp. 257-262. (France, *Calotermes flavicollis*, cholesterol is the principal sterol of this termite as determined by a mass spectrometer.)
- FUJII, N., 1964, pp. 213-216. (Free amino acids in *Coptotermes formosanus*.)
- FUJII, N., SEGAWA, M., OCHIAI, N., and SHIMIZU, K., 1962, pp. 7-11. (Free amino acids in Coptotermes formosanus.)
- NAKAJIMA, S., SHIMIZU, K., and NAKAJIMA, Y., 1962, pp. 59-74. (Japan, *Coptotermes formosanus*, analyses of termite earth and runways, in runways on concrete

bases the organic matter in the upper part was much greater than in the lower part (50.5% to 36.9% and 40.5%to 28.5%) and much greater than in the soil nearby; the nest contained the most organic matter. It is evident that the termites use the materials near by to construct the termite earth.)

SEIFERT, K., and BECKER, G., 1965, pp. 105-111. (Chemical decomposition of broadleaved and coniferous wood species by different termites. The relative loss of cellulose amounted to an average of 85% with Kalotermes species; average 86% with Heterotermes; average 97% with Reticulitermes; average 94% with Nasutitermes. Relative loss lignin with Kalotermes flavicollis average 19%; with Heterotermes indicola 29%; with Reticulitermes santonensis 77%; with Nasutitermes ephratae 46%. Relatively largest decomposition cellulose and smallest lignin found in pine. With elm loss cellulose lowest; with poplar loss lignin highest; with beech in case of K. flavicollis decomposition of lignin extraordinarily poor. The utilization of food, with the aid of microorganisms, is by far more intensive with termites than with other wood-destroying insects.)

COMMUNICATION

- FRINGS, H., and FRINGS, M., 1964, pp. 1-211. (Animal communication, in termites alarm scents, rasping sounds, or sounds by tapping body against nest, or by stridulatory ridges on body.)
- Howse, P. E., 1963, pp. 258-267. (Zootermopsis angusticollis, evolution of the production of vibrations as a communication means among termites.)
 - 1963a, pp. 256-268. (Zootermopsis angusticollis, several types of vibration movement or jerking behavior by individual termites recognized each occurring under different conditions of stimulation. Main behavior pattern giving rise to substratum vibration and usually audible sound which has been recorded.)
 - 1965, pp. 314-315. (Zootermopsis angusticollis, subgenual organ registers particular pattern of sounds, associated jerking movement, "vertical oscillatory movement," V.O.M. In "complex oscillatory movement," C.O.M. body movement with no sounds, after laying of an odor

trail. C.O.M. solely means arousing other termites. "Longitudinal oscillatory movement" a simple reflex response to a relatively low-level stimulus to antennal sensilla.)

- STUART, A. M., 1963a, pp. 85-96. (Communication of alarm in Zootermopsis nevadensis, sound plays no primary role, nor does glandular secretion, rather mechanical contact, directional vector by trail laid from point of disturbance to main area nest.)
- WILSON, E. O., 1965, pp. 1064-1071. (Summary: pheromone systems have reached their highest evolutionary development in the social insects, most communication is chemical, a chemical signal is a pheromone, which may be olfactory or oral according to the site of reception. Pheromones have the central role in the organization of insect societies. There are nine categories of responses: alarm, attraction, recruitment, grooming (including assistance at moulting), exchange

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of oral and anal liquid, exchange of solid food particles, facilitation, recognition (of both nest mates and members of various castes), and caste determination either by inhibition or stimulation. Alarm is often synonymous with recruitment. In lower termites odor trails laid to breaks in nest wall, recruited workers assist in repelling invaders and repairing breaks. In higher termites which forage trails used to recruit workers to new food sources. Number alarm substances greater than all other pheromones, many are volatile, chemical identity discussed. In termites there is a remarkably complex and precise pheromonal caste control. In Kalotermes flavicollis (Fab.) the key caste is the pseudergate, which is capable, when the inhibitory pheromones are removed of transforming into a soldier or one of the two reproductive castes. The pheromones act by interfering with

CONTROL

- ALLEN, T. C., ESENTHER, G. R., and SHENE-FELT, R. D., 1961, pp. 1055-1056. (U.S., Sheboygan, Wisconsin, dieldrin incorporated into concrete mixtures, a wettable powder containing 75% was added leading to a concentration of 0.1 to 1.6%. One week after fabrication the block surfaces caused 100% mortality to R. *flavipes* workers exposed for only I minute. Exposures of nasutes and workers of Nasutitermes columbicus for 10 minutes killed 100% of the termites. Following a storage period of 4 months at 80° F. and 97% relative humidity blocks containing 1.6% dieldrin were still toxic to all termites, whereas blocks with 1.0% did not kill the termites after 30 minutes exposure.)
- AMANTE, E., 1962, pp. 133-138. (Brazil, Cornitermes cumulans, insecticides as emulsions or dusts applied through hole in top nest by iron bar to reach center. After 95 days the best results were with Telodrin EC 15%; Aldrex 4 EC, 40%; Endrex 20 EC, 20%; Shell DD.)
- ANONYMOUS, 1960, p. 109. (Malaya, Rubber Research Inst.)
 - 1960a, pp. 37-38. (Australia, Canberra, wood preservation by dip diffusion.)
 - 1961, pp. 1-9. (Italy, damage and control, 1952-1960, list publications.)
 - 1961a, pp. 46, 48. (U.S., down and horizontal drilling compared, down drilling, low pressure favored, table pressures.)

the endocrine system. The proportion of orphaned pseudergates that change into replacement reproductives shows a negative correlation with the volume of the corpora allata, while soldiers can be produced experimentally from pseudergates by implantation of the corpora allata of reproductives. It is likely that patterns of caste control vary greatly within the termites. Pheromones have been demonstrated in primitive genera. In the higher Termitidae, reproductives can be derived only from nymphs. A true worker caste exists which lacks the potential for caste alteration. Pheromones studied are those ingested to influence caste and those that are transmitted in volatile form through the air to attract or alarm. "Surface pheromones" such as colony odors are of fundamental importance but extremely difficult to study, they need further research.)

- 1961c, p. 40. (U.S., consistent, realistic certification form important for termite clearance report, chart with areas inspected and those not, helpful, charge should be made.)
- 1962, pp. 24, 26. (U.S. Veterans Administration require professional termite inspection before approving loans. There is indication that regional offices must determine information that must be included in the report. The extent of the liability of the operator is not clear.)
- 1962b, pp. 142-147. (U.S., infestation buildings by three basic routes: wood in contact with the ground, cracks in concrete slabs or foundations, shelter-tubes; reasons for increase in damage due to milder winters in north, more land is cleared, less food, more slab or low foundation construction, attached patios, decks, breezeways and garages, sapwood now used more susceptible than heartwood, better central heating plants. Protection by: sound construction, shields (now in disrepute), soil poisoning, pressure treated or naturally toxic, resistant woods.)
- 1962c, pp. 68-74. (U.S., discussions at Purdue's P.C.O. conference: Dr. A. E. Emerson (Univ. Chicago): termites ability to regulate temperature and humidity complicate control, parthenogenesis not important. D. H. Percival (Univ. Illinois): builders not preparing for future termite

attack, leaving access and wood debris. L. J. Berzai, an Indiana operator, drills rock foundations at a mortar joint, using gravity flow; for brick veneer where the sill plate is on the foundation, the plate is drilled allowing the chemical to flow down between the bricks; if there is a central hollow brick supporting pier drill and treat inside voids; if three horizontal layers of brick, drill from both sides, drill holes spaced every 18 inches. I. Hatfield, (wood Treating Chemicals Co.) described how to formulate desired concentration of insecticide; to determine dilution ratio subtract the percent of active ingredient desired from the percent of active ingredient in the concentrate and divide by percent of active ingredient desired. Then multiply by the number which results when the weight of the concentrate per gallon is divided by the weight of solvent per gallon, the final figure is the number of gallons of solvent required. N. R. Ehmann (N. A. Maclean Co.) discussed fumigation to control termites with methyl bromide, use of Halide lamp, remove all live objects, protect plants with water barrier, extinguish all open flames, turn off gas at meter, pipes should be bled of any remaining gas, objects with free sulfur molecules, such as foam rubber, should be removed, post warning signs, use Fumiscope to measure concentration at three levels, use proper tarps, wet down porous sand under area, temperature should be above 65° F. J. Kahn (Vogel-Ritt) discussed control of subterranean termites by fumigation with ethylene dibromide, EDB 15% solution in base oil applied at 1 quart per 25 square foot of slab area, effect of soil moisture on EDB movement most important factor in dispersion gas. G. Klepser (Dow Chemical Co.) stated sulfuryl fluoride, Vikane been successful in fumigation drywood termites in Florida and California successful, no odor problem, penetration superior to methyl bromide, ovicidal action poor, food clearances not yet granted, may be used later under slabs, special detector necessary for Vikane.)

- 1962f, pp. 64-70. (U.S., P.C.O. equipment directory for termite control 1962.)
- 19620, pp. 80, 82. (U.S., (based on unpublished information from the late A. Zimmern) no uniform treatment of fill can be accomplished by drilling concrete

slabs, chemical run off; sources of infestation cellulose waste, tree stumps, faulty drainage. Trench 3 feet deep around perimeter foundation, drill and inject chemical through side foundation about 2 inches below bottom gravel fill, apply chemical under low pressure, slow percolation. Infestation in fill-porches treated in same manner.)

- 1962q, pp. 40. 42. (U.S., National Pest Control Assocn, suggested a certification statement which might be a standard inspection form for the VA and FHA: "We have inspected the designated structure on the property at (address) and have found no visible evidence of termite damage and no visible structural damage from termite attack. This certification is warranted for — days.")
- 1962r, pp. 42, 44. (U.S., NPCA recommends commercial warranties for commercial establishments and suggests insurance companies be approached.)
- 1963a, pp. 9-10, 12, 16. (U.S., Pest Control's survey in 50 states showed that there was no standard acceptable statement accredited by every VA and FHA office across the country. Guarantees, inspection forms, and warranties are still open to industry discussion before a nationwide agreement on the use of warranties can be reached.)
- 1963c, pp. 72, 74, 76, 78. (U.S., cost inspection \$7.77, operator should charge. Three types inspection: (1) "estimate," where infestation known, (2) "routine," to determine no wood-destroying insects present, (3) "certificate," change of ownership, condition of sale, liability justifies charge for inspection. Fixed water vapor and termite barriers installed at construction time prior to pouring concrete slabs, three kinds: asphalt emulsion with toxicant, sprayed on soil surface; film of plastic coated on one side with watersoluble paste containing a toxicant, which moves into soil when water table rises; polyethylene-backed, paper felt with a toxicant, fungicide, and oil impregnated in the material.)
- 1963f, pp. 74-80, 80-82, 87-89. (U.S., pest control equipment directory 1963, termite control, pp. 74-80; fumigation, pp. 80-82; safety pp. 87-89.)
- 1963g, pp. 92, 94-96. (U.S., flower box retaining walls have no bottoms, soil piled high in them source of infestation,

earth kept moist, difficult to drill, watering soil leaches chemical.)

- 1963k, pp. 50, 52, 54-55. (U.S., wood embedded in concrete can introduce termites into a dwelling, it must be located, removed, or treated, have hidden contact with soil. Cases cited, where hidden wood disguised, remedies detailed, more difficult in slab house.)
- 1963m, pp. 40, 42-43. (U.S., hazards of control in crawl spaces, TOs should proceed with caution. Low clearance, nails, broken glass, creeping eruption in south, steam pipes, electricity, faulty grounds, dust. Protect by wearing helmet, heavy gloves, spray, where dog waste, to kill hookworm nematodes, with 1 ounce salicylic acid in 5 ounce alcohol, insulate against damp soil, wear protective mask.)
- 1963n, pp. 68, 70, 72 and 74. (U.S., ventilation and decay control may help prevent termite infestation, control moisture by use of ventilators and vapor barriers, use wood preservatives.)
- 19630, pp. 42, 46. (U.S., special skills and equipment needed, knowledge of type of construction, special control techniques, experience.)
- 1963q, pp. 35-44k. (U.S., chemicals in subterranean termite control revised, for approved reference procedures for subterranean termite control, Nat. Pest Control Assoc., 1951. A number of chemicals formerly recommended as soil poisons replaced by those more effective, described in detail, pp. 35-44, certain other chemicals for special uses described. List of chemical wood preservatives and their proper uses, p. 44. Precautions, toxicity, fire hazard, odors, property damage, application equipment, termite control chemicals, pp. 44-44k.)
- 1964e, pp. 13-14, 16, 18. (U.S., termite truck inventory of equipment for control listed. Job preparation, chemical treatment, structural repair, job cleanup, worker protection, equipment repair all need special equipment.)
- 1964f, pp. 48, 50, 54. (U.S., tips on more aggressive selling of termite pretreat contracts, advertising, personal contacts with builders, well-equipped truck, neat servicemen, color added to chemical.)
- 1964i, pp. 59-60, 62, 64, 66, 68, 70, 72, 75-76, 78. (U.S., directory of pesticides; pp. 78, 80, 82, list and address suppliers.)
- 1964m, pp. 36, 38, 40, 42, 44, 46, 48, 50-51, 54-55, 58, 60-62, 64, 66-68, 70, 72, 74, 76-

80. U.S., equipment directory pest control 1964, itemized list products, suppliers and addresses.)

- 1964n, pp. 108-109. (U.S., modern methods of control, detection, ways of infestation, annual inspection, retreatment, replacement damage up to \$5,000 excellent protection, racketeers.)
- 1964q, p. 70. (U.S., new inspection requirements for VA termite report broadens statement to include all wooddestroying infestations, and that damage has been corrected.)
- 1964u, p. 11. (U.S., California, the average number of complaints filed with the Structural Pest Control Board against each licensee in the fiscal year 1961/1962 was 0.91; for 1962/1963, 1.15; and for 1963/1964, 1.05. 5.6% of our licensees had five or more complaints filed against them, 2.4% had four, 3.5% had three, 9.2% had two, 24.4% had one, 54.9% had none. 88.5% of the licensees had fewer than three complaints filed against them. This 88.5% account for only 31% of the total number of complaints filed. Therefore 11.5% of the licensees account for 69% of the total complaints filed. A larger company does not have more complaints or a small company fewer.)
- 1964x, pp. 28, 30, 32. (Worldwide picture termite control, G. Hutton, U.S. Navy, stated drywood termites more formidable in tropical areas, pretreatment is most economical for subterranean termites. Control work where possible done by P.C.O.s. Phil Hadlington, Forest Entomologist of New South Wales, stated prevention is by use of soil poisons, eradication by blowing arsenical dusts into their tubes and galleries. V. Smith, U.S. Forest Service, stated so far tests of granular termiticides show the same results as emulsions.)
- 1965, pp. 5, 7, 9, 11, 15, 17, 19, 21, 22-23. (U.S., 1965, National buyers guide for pressure preserved wood products, list companies and addresses.)
- 1965a, pp. 18-19, 22, 25, 50. (U.S., Pest Control survey, industry successful, free inspections, price cutting bad, service only product for sale, public must realize, business methods improving. Shields are no longer recommended, use soil-testing kits, greater acceptance by public of industry, pretreatment will increase. National Pest Control Association help to industry, chlorinated hydrocarbons per-

sistent soil poisons, equipment will be streamlined.)

- 1965c, pp. 42, 44, 46, 48, 50, 52, 54, 99-100, 102. (U.S., Purdue Univ. 1965 conference gave P.C.O.s technical information on bird, rodent, and carpenter ant control, flies, and dermestids. Roach resistance and new chemicals for control were discussed. Better training, improvement of business methods were important subjects. On termites, Dr. F. M. Weesner is studying swarming habits of termites in connection with control. She gave some biological notes. A symposium was held on rodding to replace trenching in using soil poisons. Use of rods on slabon-grade houses was described in detail.)
- 1965d, pp. 60-62, 65, 68, 70, 72-76, 78, 80-82, 84, 85-87. (U.S., directory of pesticides, insecticides, fumigants, rodenticides, miticides, insect repellents, bird control products, bird repellents, animal repellents, suppliers and addresses.)
- 1965e, pp. 32, 36, 38, 40, 42-44, 46, 48, 51-52, 54, 56, 58, 60, 62, 64-65, 66, 68, 70, 72. (U.S., 1965 equipment directory, alphabetically listed for all types of control, with a list of suppliers and addresses.)
- 1965g, pp. 60A and 60B. (U.S., revision Natl. Pest Control Assoc's. approved reference procedures for termite control, reference standards for preconstruction soil treatment. Toxicants and concentrations, for slab-on-ground construction, crawl space and basement construction.)
- 1965h, pp. 8-1 to 8-19. (U.S., Army, Navy, and Air Force Military Entomology Operational Handbook, Chapter 8, Termites, revision Army Technical Manual, TM5-632 Feb. 1956. Description of types castes, habits, damage, inspection form, construction faults, prevention of infestation by subterranean termites by mechanical and chemical methods, revision list soil poisons: chlordane 1%, dieldrin 0.5%, aldrin 0.5%, heptachlor 0.5%, water emulsions, dosages for various types buildings; control drywood termites by screening, sanitation, injection chemicals, wood preservation, fumigation.)
- 1966, pp. 13-15. (U.S., masking agents and perfumes are most often oil soluble; 54% of P.C.O.s who returned survey forms sent by Pest Control used masking agents in indoor insecticide sprays; familiar aromas preferred by 27% of customers. Lemon or citrus choice of

industry. Scents preferred are quality fragrances.)

- 1966c, pp. 53-74. (U.S., Pest Control's 1966 directory of pesticides: pp. 53-65, insecticides; pp. 65-68, fumigants; pp. 68-69, rodenticides; pp. 69-70, miticides; p. 70, avicides, pp. 70-72, repellents; pp. 72-74, masking agents.)
- 1966d, pp. 86-92. (U.S., Nat. Acad. Sci. public symposium on scientific aspects of pest control, participants Government officials, prominent scientists. Academy's neutral approach shows expert opinion no longer weighted against use of chemical pest controls if applied carefully. E. P. Lichtenstein listed 10 most important factors that influence persistence insecticides in soil: soil type, moisture, temperature; wind or air movement; cover crops; soil cultivation; mode application insecticide to soil; formulation; and soil microorganisms. Chlorinated hydrocarbon group more persistent than organophosphorous.)
- 1966g, pp. 48, 50, 52. (U.S., FHA revised standards for use of soil poisons near independent water systems, paragraphs 815-2.5, a to e, 1102-3.5. Treatment, application, guarantee, minimum distance between wells and sources of pollution, exceptions.)
- 1966i, pp. 20, 22, 24, 28, 30, 32, 34, 36, 38, 40, 42, 45-46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66. (U.S., Pest Control's 1966 equipment directory, materials, equipment for control various insects and rodents, listing suppliers with addresses.)
- ARMED FORCES PEST CONTROL BOARD, 1963, pp. 1-14. (U.S., shields obsolete, soil poisons, impregnated wood recommended. Soil poisons BHC and chlorinated hydrocarbons, including heptachlor. Dosages given water emulsions preferable.)
- BEUERLE, O. K., 1961, pp. 150, 152. (Austria, contact insecticides in soil, mixing with earth removed to depth $4\frac{1}{2}$ feet, then replaced, drilling wood.)
- BHATNAGAR, S. P., 1962, p. 223. (India, Rajasthan, during 1958-1959 termites caused considerable losses through attacks on germinating cotton seeds and young crops under unirrigated conditions. Sevin at 10 or 15 pounds per acre applied before sowing gave higher yields and less damage.)
- BINDRA, O. S., 1961, pp. 277-282. (India, North West Madhya Pradesh, DDT and

BHC 50% wettable powder, chlordane 75% emulsifiable concentrate, toxaphene 25% E. C., dieldrin 18% E. C. each at 2 ounce and aldrin 40% E. C. at 1 ounce per nest dissolved in 10 gallons water and poured into nests destroyed colonies at a cost cheaper than digging out nests. Mixing 5% aldrin dust with wheat seed just before sowing at the rate of 20-40 pounds gives protection crops and higher yield.)

- BONAVENTURA, G., 1961, pp. 237-254. (Italy, Inst. Pathology of Books and Termite Control in Italy (Rome), government act since 1952 permits government to conduct scientific research, antitermite protection and disinfestation. The chief control measures and expenses on the premises of State and Notarial Archives, Libraries and National Monuments are listed.)
 - 1963, pp. 9-19. (Government act since 1952 made it possible to fight termites in Italy officially; description criteria followed by "Commissione Interministeriale per la lotta Antitermitica"; scientific and field research.)
- BROWN, K. W., 1962, pp. 1-18. (Uganda, termite control in Eucalyptus plantations.)
- BROWNSTEIN, P. N., 1962, pp. 9, 11, 12. (U.S., acceptable statement for a termite report to the Veterans Administration is: "On this date I have made a thorough inspection of these premises, and there was no visible evidence of termite infestation or damage." A simple, practical inspection form should be provided. Inspections should be made by professional P.C.O. Accuracy will determine continued employment.)
- BRUCE, E. L. Co., INC., 1963, pp. 1-2. (U.S., in remodeling plans include termite control, pretreatment far less costly, methods infestation described and illustrated; through wood in direct contact with ground; through cracks in slab foundations and piers; through shelter tubes over materials they cannot penetrate. Control; sanitation, drainage, pretreatment by licensed termite control operator by soil poisoning. Cross ventilation and the use of a polyethylene waterproof membrane are recommended.)
- CALIFORNIA STRUCTURAL PEST CONTROL BOARD, 1962, pp. 12-13. (U.S., California, complete report from governor June 1961, 1962, total to end month fiscal year 1960-1961, 1961-1962, applications, li-

censes, renewals, inspection reports, complaints, investigations, actions.)

- 1962a, pp. 12-13. (U.S., California, complete report from governor July 1961, 1962, total to end month fiscal year 1961-1962, 1962-1963 as for June.)
- 1963, pp. 12-13. (U.S., California, report from governor November 1961, 1962, total to end month fiscal year 1961-1962, 1962-1963.)
- 1963a, pp. 12-13. (U.S., California, report from governor April 1962, 1963, total to end month fiscal year 1961-1962, 1962-1963.)
- 1963b, pp. 12-13. (U.S., California, report from governor July 1962, 1963, total to end month fiscal year 1962-1963, 1963-1964.)
- 1964, pp. 12-13. (U.S., California, report from governor November 1962, 1963, total to end month fiscal year 1962-1963, 1963-1964.)
- 1964a, pp. 12-13. (U.S., California, report from governor January 1963-1964, total to end month fiscal year 1962-1963, 1963-1964.)
- 1964b, pp. 16-17. (U.S., California, report from governor April 1963-1964, total to end month fiscal year 1962-1963, 1963-1964.)
- 1964c, pp. 18-19. (U.S., California, report from governor September 1963-1964, total to end month fiscal year 1963-1964, 1964-1965.)
- 1965, pp. 12-13. (U.S., California, report from governor November 1963-1964, total to end month fiscal year 1963-1964, 1964-1965.)
- 1965a, pp. 12-13. (U.S., California, report from governor January 1964-1965, total to end month fiscal year 1963-1964, 1964-1965.)
- 1965b, pp. 12-13. (U.S., California, report from governor March 1964-1965, total to end month fiscal year 1963-1964, 1964-1965.)
- 1965c, pp. 10, 12-13. (U.S., California report from governor July 1964-1965, total to end month fiscal year 1964-1965, 1965-1966.)
- 1965d, p. 10. (U.S., California, informational letter, September 2 from January 1 through June 30, 1965, there were filed with the Structural Pest Control Bd., 82,140 notices of work completed at a total cost of \$14,453,048, average cost per job \$172.00. The lowest price was \$25, highest \$2,350.)

- 1965e, pp. 20-21. (U.S., California, report from governor September 1964-1965, total to end month fiscal year 1964-1965, 1965-1966.)
- 1966, p. 65. (U.S. California report from governor December 1964-1965, total to end month fiscal year 1964-1965, 1965-1966.)
- CANCIENNE, E. A., 1961, pp. 1-8. (U.S., Louisiana, guard your home against termites.)
- CHATTERJI, S., and SARUP, P., 1962, pp. 5-12. (India, cotton.)
- CHATTERJI, S., SARUP, P., and CHOPRA, S. C., 1960, pp. 356-357. (India, cotton crop.) CHAWALA, D. R., 1965, pp. 11-12. (Termite
- CHAWALA, D. R., 1965, pp. 11-12. (Termite damage leading to poor crop solved by use superphosphate and aldrin.)
- CHHOTANI, O. B., 1962, pp. 476-478. (India, Kalotermes beesoni (now in Bifiditermes) has been recorded infesting apple and other trees in Pakistan, and is a serious pest of Ficus bengalensis in Panjab, India. 38% of alates emerged on night of July 11/12, 1959, all were females. (Fecal pellets are ovoid.))
- CHOUDHURI, J. C. B., 1961, p. 125. (India, Allahabad, new approaches to applied termitological researches.)
 - 1963, pp. 189-192. (India, understanding of termites with special references to agriculture, forestry, etc., essential.)
- CLARK, B., 1963, pp. 18, 20, 22, 24. (U.S., Cleveland, Ohio, do-it-yourself owner injured himself unaware of termite damage to home. Home treated by Terminix of Cleveland, Ohio, illustrated account of damage and method of treatment.)
- CLEMENTS, W. B., 1963, pp. 54, 56. (U.S., NPCA Termite Committee urges program of minimum standards for corrective termite work to secure uniformity and regulations approved by the industry.)
- COATON, W. G. H., 1962c, pp. 318-327. (Karoo, South Africa, Microhodotermes viator due to unavailability of local supplies veld hay baiting uneconomic. Where mounding over nest sites occurs, applying 24% aldrin emulsifiable concentrate to the nest by injection at a cost of 2.08 per nest. Where mounding does not occur, sprays of 18.5% dieldrin emulsifiable concentrate sprays applied directly to standing vegetation offers promise from the ground. Probably the only practical method would be the use of aircraft.)

- CONNER, F. B., 1965, pp. 28, 32, 34. (District of Columbia, Marumsco, successful pretreatment 9000 homes of three types with chlordane soil poison described and illustrated, 5-year guarantee to protect buyer.)
- CRUZ, B. P. B., FIGUEIREDO, M. B., and ALMEIDA, E., 1962, pp. 189-195. (Brazil, State of São Paulo, *Syntermes* sp. pest of peanuts controlled by 2.5% heptachlor or 2.5% aldrin dusts at from 13-17 kg/ha.)
- DAS, G. M., 1962, pp. 229-231. (North-East India, Assam, tea gardens in Darrang and Cachar districts control of live-woodeating termites Microcerotermes spp. and Odontotermes assamensis, O. parvidens and O. spp. scavenging termites damage to trunks tea bushes. Latter controlled by introducing DDT, BHC, aldrin and dieldrin into mounds through holes, followed by pouring down sufficient water, elimination dead and diseased wood and covering exposed wood with protective paint. Live-wood-eating termites were controlled by applying aldrin and dieldrin at the rate of 2 pounds active material per acre, latter slightly more effective, as spray or dust to soil. Pretreatment by sanitation and use protective paint "indopaste." Treatment effective for 5 years.)
- DAVLETSHINA, A. G., 1963, pp. 74-83. (U.S.S.R., Golodnaya steppe, Anacanthotermes turkestanicus control deep plowing and application of DDT or BHC dust, at rate 100 kg/ha, during subsequent tramping and rolling land before construction. Soil fumigation with ethylene dibromide at rate of 100 g/m^a, is proposed to exterminate isolated nests.)
- DEORAS, P. J., 1962, pp. 101-103. (India, Bombay, many mounds *Odontotermes* necessary to locate primary colony for control by dusts, suspensions and emulsion insecticides, treating secondary mounds not effective. Queen cell located by magnetic compass, parallel to magnetic meridian. *Heterotermes indicola* was controlled by spraying building with 2% suspension DDT or BHC.)
- Dresner, E., 1960, pp. 24-25. (South America.)
- DUTT, N., 1962, pp. 217-218. (India, control Microtermes obesi attacking jute stem, 0.4 aldrin surface soil and 1½ inches below gave 100% mortality 24 hours after treatment.)

- DYER, T. A., 1966, p. 61. (U.S., Tampa, Florida, applicants for FHA housing in West Tampa advised no furniture or household furnishings can be moved if it contains drywood termites. Infested furniture should be destroyed and replaced or fumigated by a P.C.O. Evidence required that furniture is termitefree before occupancy.)
- EBELING, W., 1962, 451-454. (U.S., relation of lipid adsorptivity of powders to their suitability as insecticide diluents, tests against insects.)
- EBELING, W., and PENCE, R. J., 1965, pp. 1-16. (U.S., California control western subterranean termite; dark, western drywood termite, revision of 1958 edition.)
- EBELING, W., and WAGNER, R. E., 1963, pp. 14-17. (U.S., California, Dri-Die 67 fluoridated silica aerogel, of Davison Chemical Co., Baltimore, Md., applied at rate 1 pound per 1000 square feet in attic, prevented reinfestation by drywood termites; applied with electric duster. Dust also recirculated through the walls by gun. Wall voids treated at time of construction practical.)
 - 1964, pp. 20-22, 24, 26, 28, 31-32. (U.S., California, built-in termite control, pretreatment with soil poisons to prevent attack by subterranean termites and dusting attics with Dri-Die 67, a fluoridated silica aerogel to prevent attack by drywood termites outlined.)
- FEDERAL HOUSING ADMINISTRATION, 1963, pp. 1-500. (U.S., multifamily housing, under these standards, soil treatment gets somewhat greater recognition than under standards for one and two living units. Of the two chemical barriers recognized it is more economical than the rather extensive use of pressure-treated wood. In region 1, very heavy termite infestation, a chemical barrier is required for all slab-on-ground construction. In areas of moderate to heavy infestation, where termite protection is not specifically exempted by the FHA field office, slab-onground construction must be protected by the use of a chemical barrier or monolithic concrete slab design. Shields are not included as acceptable protection for slab-on-ground construction. Where soil treatment is required, individual water-supply systems are not acceptable. Heptachlor has been added to the accepted chemicals, trichlorobenzene dropped.)

- 1966, pp. 1-4. (U.S., Minimum Property Standards for One and Two Living Units, revision, paragraphs 815-2.5, 815-3.6, 1102-3.4, and 1102-3.5; included are provisions for use of individual water supply systems in conjunction with soiltreatment method, exceptions; and an alternate method of application of soil treatment, rodding; minimum distance 100 feet from well to soil treatment. Lindane is dropped as a soil poison. The soil treatment firm furnishes the home owner a guarantee of the effectiveness of the treatment if infestation found within period.)
- FERNANDO, H. E., 1962, pp. 205-210. (Ceylon, Kalotermitidae damage tea and rubber; control by injecting paris green in infested trees.)
- FLOYD, J., 1965, pp. 46, 49, 50. (U.S., Decatur, Ill., library treated for termites by soil drill treatments, then retreat necessitated by discovery of wood construction on earth, instead of concrete, hidden behind a built-in bookcase.)
- GALLO, P., 1961, pp. 214-220. (Italy, "Centro di studi per la lotta antitermitica" studied toxicity insecticides for 8 years, also alterations brought about in tissues mammals. New method localizing adenosinetriphosphate (ATP) in muscular tissue developed, applicable in investigations concerning insecticides which interfere with oxidative phosphorylation but also pathology and biochemistry.)
 - 1963, pp. 120-126. (Italy, research work of above organization. List of various archives and libraries where work on protection of books has been carried on.)
- GAY, F. J., 1963b, pp. 47-60. (Australia, 150 species termites known five cause 95% of the damage: Mastotermes darwiniensis, Coptotermes acinaciformis, C. frenchi, C. michaelseni and Nasutitermes exitiosus. In 1956 the annual loss to poles, cross-arms and cables was 325,000 Australian pounds. In 1961 there were more than 150 pest control firms operating in the five main capital cities, more than half dealing with termites. Annual expenditures due to termite damage: $Af_{,2,000,000}$.

Subterranean termites main problem. Housing authorities require termite-proof construction, including termite shields over foundations, not completely effective, inadequacies in installation. Also low subfloor clearance in Perth and Adelaide allows *Coptotermes* to build stalagmite tubes up to subfloor timbers.

Shortage limits use naturally resistant timbers, eucalypts available locally; jarrah, red gum, ironbarks, etc., and noneucalypts: turpentine, brush-box and cypress pine.

Australian preservative plants provide treatments of sawn timbers of a "dipdiffusion" with water soluble mixtures of boric acid and sodium fluoride, with or without the addition of sodium arsenate and dichromate applied to green sawn timber, followed by block stacking for several weeks to allow the preservative to diffuse into the wood. This was a successful and inexpensive method.

A termite-proof veneer of karri for plywood flooring was similarly dipdiffused. Dry salt retention was just under 0.3 pounds per cubic foot. A 3.2 mixture of zinc chloride and arsenic pentoxide was effective against *Coptotermes* and *Nasutitermes*. Sodium pentaborate was effective against *Coptotermes* but not against *Nasutitermes*.

By incorporating 0.75% pentachlorophenol, or a fractional percentage of arsenicals, or aldrin or dieldrin, building boards, either particle or fiber, can be made resistant to termites.

Treatment with soil poisons—chlorinated hydrocarbons at a dosage 0.5 gallons per cubic feet were effective after 6-7 years. Pest control operators offer pretreatment up to 10 years guarantee.

Termite-proof concrete, "no-fines," a mixture of aggregate with the substitution of a 0.5% emulsion of either dieldrin or aldrin for water was produced.

Existing infestations in buildings by Nasutitermes is from a nearby mound which can be destroyed. Coptotermes and Mastotermes central nests are difficult to locate and occupied runways in the building must be treated. Arsenic trioxide, white arsenic most effective dust, quantities as low as 1.75 g. will kill a colony of 1.5 million Nasutitermes exitiosus within 2 weeks, is the most widely used poison by P.C.O.s. No evidence that arsine gas is produced. Cost of liquid chlorinated hydrocarbons too high to compete with white arsenic except in infested trees where an emulsion will be harmless.

Gases are not effective in Australian

termite nests due to their complex structure.

Poison baits have not proven to be effective.)

- GHILAROV, M. S., 1962, pp. 131-135. (U.S.S.R., Turkmenia, Anacanthotermes turkestanicus damages buildings in settlements. Sleepers in contact with soil are replaced by ferroconcrete permanent way. Adults may be controlled during swarming by aerosols. Antitermite methods of construction, as practiced in other countries, where termites are injurious are adaptable.)
- GHOSE, S. K., 1964, pp. 87-91. (India, insecticidal control of *Microtermes* sp. damaging wheat crop.)
- GOULDING, R. L., and EVERY, R. W., 1965, pp. 376-383. (U.S., Oregon, chemical control termites.)
- GREAVES, T., 1962, pp. 1-17. (Australia, colonies in trees: *Porotermes adamsoni* can be greatly reduced by forest management; *Coptotermes* and *Trinervitermes* by dusts of chlorinated hydrocarbons blown into galleries.)
 - 1962a, p. 64. (Australia, *Coptotermes* acinaciformis, 2 ounces of 2% dieldrin effective when blown into aeration galleries leading from the bark of trees to termite nurseries.)
 - 1963, pp. 74-76. (Australia, *Coptotermes* acinaciformis, 0.25 Telodrin when applied as a dust to aeration galleries was just as effective as when applied in auger holes to the nursery in trees.)
 - 1964, pp. 1-4. (Australia, aldrin, dieldrin, telodrin are very effective against *Coptotermes acinaciformis* when applied as dusts to colonies or as emulsions to soils.)
 - 1965, pp. 46. (Australia, N.S.W., hand duster applied 2 ounces per colony aldrin, dieldrin and telodrin, and $\frac{1}{2}$ ounce white arsenic into nursery or through aeration galleries effective.)
- GUNN, W. C., 1964, pp. 50, 52, 54, 56. (U.S., California, polyethylene damp proofing membrane, improperly installed, led to infestation, had to be corrected in control operations.)
- GUPTA, B. D., 1960, pp. 961-977. (India, studies control termites in sugarcane.)
- HADLINGTON, P., 1965, pp. 36, 38. (Australia, N.S.W., subterranean termites Coptotermes acinaciformis and Schedorhinotermes intermedius cause about 90% of damage. Control is by eradication, using

finely divided arsenic trioxide and ferric hydroxide blown directly into the nest or gallery system, and prevention, using soil treatment with chlorinated hydrocarbons.)

- HARRIS, W. V., 1961, pp. 1-187. (Tropics, Africa, queen removal, chemical and physical barriers, fumigation, nest fragmentation.)
 - 1962c, pp. 179-181. (Prevention of termite damage to buildings with special reference to low-cost housing in humid tropics, damage considerable, 100 species termites recorded from buildings in world, 47 serious, drywood termites 6, Mastotermes 1, subterranean termites 25, ground or tree nesting 15. Cryptotermes particularly important drywood termite, Coptotermes, subterranean, mound building Macrotermes and Odontotermes in Africa, India, and Southeast Asia, Microtermes also important. In Cevlon. Mauritius, and Central America, Nasutitermes is responsible for much damage. Design, drainage, ventilation, pier foundations, inspection and mechanical barriers; sanitation, soil poisoning, use of resistant or chemically impregnated timbers, careful supervision. Selection of proper sites and soil poisoning, 0.3% dieldrin, and a concrete apron 6 inches around the slab, termite-proof concrete mix with dieldrin are most practical for low-cost housing.)
 - 1965, pp. 33-34. (World, review of work on termite control, cost in various countries, protection of buildings, soil poisons, mineral dusts, structural modifications, resistant and treated wood. Damage to plastics, trees, and crops are also discussed. Bibliography.)
- HERES, A., 1963, pp. 92-100. (Summarizes papers on damage and control termites in Tropics, by W. V. Harris 1960 Termite Res. Unit reprint 42, 48, 1962. W. A. Sands repr. 43, 1960, 47, 1961. W. G. H. Coaton Sci. Bull. No. 375 1958. L. G. E. Kalshoven 1962 observations on *Coptotermes.*)
- Hoon, R. C., 1962, pp. 141-143. (India, Hirakud Dam project, Orissa, longest earth dam in world, in site area termites penetrate top soil, few in moorum zone 32-38 inches deep, decrease with increasing depth below ground, but to depth to feet where top soil overlies moorum. Remove mound nests, strip soil 6-8 inches of top.)

- INDIAN COUNCIL OF AGRICULTURAL RESEARCH, 1957-1958. (India, annual report, Cyclotermes spp. in wheat, sugarcane, and cotton and Odontotermes sp. on wooden poles are serious pests. Aldrin, chlordane and dieldrin gave significant control in cotton. In Gujarat dieldrin, aldrin, or endrin applied as a dust in the furrows before cane sets were planted, or else applied as a paste at the two ends of each cane set gave better control than applying BHC at 50 pounds per acre along the furrow. Dusts arranged in percentage of decreasing germination of sugarcane were: 2.5% dieldrin, 2% aldrin, 1% endrin, 5% chlordane and 1% aldrin.)
- ISHERWOOD, H., 1963, pp. 8-10. (U.S., vice president The Antimite Co., St. Louis, Missouri advocates 17 points in detail for efficient control subterranean termites. Comments on most of these points by Ken Scott, editor P.C.O. News, Los Angeles, Calif.)
 - 1965, pp. 78, 80. (U.S., St. Louis, Missouri, termite control job can be justified by sketch of foundation, list of infestation points and detailed eradication plans to explain necessary work and cost.)
- JACQUIOT, C., 1961, pp. 151-164. (France, *Reticulitermes santonensis* by use preserved wood.)
- JAMES, F. R., 1962, pp. 29-33. (U.S., how to discover and destroy termites in homes of different types, soil poisons, trenching, drilling; prevention with concrete caps or shields on foundations.)
- JEN, DA-FONG, 1964, pp. 49-60. (China, termites are important pests of sugarcane, particularly in arid upland regions. In Hainan Island six species are injurious, species of Odontotermes being the most important. Damage is greatest during periods of low rainfall. Good control obtained in field tests by dusting cut ends of seed pieces with 5% aldrin, 10% chlordane, 1% endrin, 5% DDT or 0.5% BHC. Or dipping them in a mud slurry containing 0.5% aldrin or dieldrin, 0.35 chlordane or 0.25-0.35% toxaphene.)
- JOHNSTON, H. R., 1965, pp. 34-37. (U.S., summary of preventive and remedial control methods of the U.S. Dept. of Agriculture for subterranean and drywood termites.)
- KENAGA, E. E., 1963, pp. 67-103. (Commercial and experimental organic insecticides (1963 revision). Indexed as to their scientific, common and trade names,

code designations, uses and manufacturers.)

KENJO, Y., 1963, pp. 132-134. (Studies on termite control method in U.S.A.)

KERR, E., 1962, pp. 8-13. (U.S., control.)

- KIRTHISINGHE, F., 1961, pp. 8-15. (Ceylon, coconut trees.)
- KocH, C. D., 1965, pp. 19, 21-22. (South Africa, tackle an extensive program to eradicate *Hodotermes mossambicus* destroying the grass veld.)
- KRAUSE, E., 1962, pp. 162-163. (Germany, consideration of the voices of the press on the theme of protection of wood for insect control, including termites, a termite attractant that might be practical in termite control.)
- KRISHNAMOORTHY, C., and RAMASUBBIAH, K., 1962, pp. 243-245. (India, Andhra Pradesh, control of *Microtermes obesi* attacking wheat and *Odontotermes obesus* attacking sugarcane, fruit plants and coconut, aldrin 5% dust applied to the soil at 20 pounds per acre is better than 5% BHC.)
- KRUPNICK, E., 1961, pp. 42, 44. (U.S., portable plumber's heater used when drilling asphalt tile, 500° at nozzle.)
- KURIR, A., 1963, pp. 67-70. (Austria, Reticulitermes flavipes possibility using atomic wastes in open country, radioactive cobalt (60 Co) in soil, or strontium (90 Sr.) affect gonads termites, precautions outlined.)
- Lowe, R. G., 1961, pp. 73-78. (Nigeria, termite attack on *Eucalyptus citridora*, with Dieldrin and BHC.)
- LUPPOVA, A. N., 1962, pp. 103-109. (S.S.R., methods of planning and improvement of house construction towards termiteproofing.)
- LYON, S. R., 1963, pp. 46, 48, 50. (U.S., Arizona, rebuttal of A. Zimmern Pest Control, Oct. 1962, p. 80, faulty fills create gaps pumping toxicant through floor would result in "washing" fill into voids, cellulose debris under building offers sources infestation, suggest treatment through foundation walls below level top finish fill at very low pressure. Junk fills are unusual, wall treatment will not affect cellulose debris. Overall treatment under slab only answer. Colonies may skirt foundation barrier. Poison all subslab soil, drill floors as well as foundations wall in Arizona.)
- Lyons, F. H., 1964, p. 52. (U.S., more than four million homes treated for termites

since 1936, about two million newly infested houses each year, of which only one-fifth are reported and treated, according to the Terminix division, E. L. Bruce Co., Memphis, Tenn. Three commonly accepted reasons for termites' widespread proliferation and slow but steady march to the north: I. Milder northern winters, wider use of central heating. 2. More homes being built, termite's natural breeding grounds in woodlands being cleared away, turn to manmade structures. 3. The buildings of homes on a low slab. Control: Annual inspection all buildings in termite belt, build out termites. The termite belt practically all the United States. Termites also on the increase in Canadian provinces of Nova Scotia, New Brunswick, Quebec, Ontario, and British Columbia reported.)

- MALLIS, A., 1964, pp. 219-324. (U.S., three types termites, dampwood, drywood, subterranean.)
- MANUEL, W. W., 1964, pp. 20-22. (U.S., California, legal requirements of a "termite report," careful inspection, no misrepresentation, failure may result in disciplinary and civil actions for fraud or negligence, diagram should show location of infested areas, refer to inaccessible areas not inspected, make corrective recommendations, important to state scope of report.)
- Макеснек, G. I., 1963, pp. 49-73. (U.S.S.R., Anacanthotermes turkestanicus control in residential and industrial structures, inclusion of DDT into the composition of wall bonding mixtures (0.15% of dry weight of the cement composition) kills termites on contact with the dry mixture; toxic for over 2 years. In laboratory termites dusted with DDT and planted in an isolated colony transmitted the toxic agent on contact resulting in total mortality of the colony within 7-9 days. Saturation of wood blocks with a DDT emulsion in concentrations of 0.1 to 0.05% of active ingredient killed on contact. DDT 0.01% and BHC 0.02% dusts mixed with soil in trenches 0.8 m. deep around infested houses remained toxic longer than 2 years.)
- MATHIEU, H., 1962, pp. 97-103. (Europe, lists termites, describes habits, distribution, damage to wood in buildings, control: soil poison in trench at wall, drilling floor

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and walls and injecting chemical under pressure, pointing up (sealing) holes with cement, coating or injecting chemical on or in wood.)

- MATHUR, R. N., 1962a, p. 281. (India, control of termites attacking forests, crops and products and prevention of attack very important, more than 100 species of termites involved, wide range of habits, taxonomy and biology must be studied before effective control can be prescribed.)
- MATHUR, R. N., CHATTERJEE, P. N., and THAPA, R. S., 1965, pp. 1-23. (India, Dehra Dun, protection freshly felled stored timber, *Shorea robusta* and *Terminalia belerica*, by various insecticides, relative prophylactic efficacy.)
- METCALF, R. L. (Ed.), 1965, pp. 1-6289. (Advances in pest control research, chemical control, insecticides, fate chemicals in soil, microorganisms, toxicological, resistance, etc.)
- MOORE, H. B., 1963, p. 103. (U.S., North Carolina, U.S. Dept. Agriculture recommendations.)
- NEWSAM, A., and RAO, B. S., 1963, p. 99. (Control *Coptotermes curvignathus* with chlorinated hydrocarbons.)
- New South Wales, DEPT. OF AGRICULTURE, ENTOMOLOGY BR., 1964, pp. 1121-1122. (Australia, chemical control in buildings, arsenical dusts, soil poisons (chlordane, dieldrin), chemically treated timbers.)
- OREGON, STATE UNIV., FEDERAL COOP. EXT. SERV., 1962, pp. 1-6. (U.S., Oregon, control dampwood termite [Zootermopsis angusticollis] primarily problem moisture control. Improve ventilation, drainage. Replace damaged timbers with pressuretreated wood. Remove cellulose-containing debris. Use soil poisons to destroy colonies.)
- PATEL, R. M., 1962, pp. 219-221. (India, Gujarat, Odontotermes obesus and Trinervitermes rubidus attacking field crops, control by use of 5% BHC in drill with seed (56 pounds per acre) had been over 80% with increased yield of 33.3% to 43.4%; treatment of wheat seed 2 pounds of 50% BHC per 112 pounds seed reduced attack by 86% and increased yield by 55.9%; 95% of mango trees were protected by painting bases of trunks with crude oil emulsion containing 5% of 99% BHC (13.5% gamma).)
- PAUL, C. F., AGARWAL, P. N., and AUSAT, A., 1965, pp. 114-117. (India, toxicity Acorus

calamus, sweetflag, to *Heterotermes indicola* in higher concentrations petroleum ether extract less than DDT.)

- PAWAR, J. G., and SOOD, N. K., 1964, pp. 17-19. (India, when forearmed against them, termites need hold no terror for the farmer.)
- PRUTHI, H. S., and BATRA, H. N., 1960, p. 96. (North West India, Microtermes mycophagus attacking young peach and other fruit trees especially in nurseries, infestations checked: 2% chlordane emulsion stirred well in soil about trunk; spraying bark, about 25 pounds of 5% DDT or BHC dust in soil about trees.)
- RAMAGE, A., 1964, pp. 26-27. (Australia, N.S.W., use ethylene dibromide to control *Coptotermes* and *Nasutitermes* colonies, 15% weight/volume in power kerosene, I pint injected into nest.)
- RAMSDEN, C. B., 1962, pp. 48, 50. (Mexicali, Mexico, *Reticulitermes hesperus*, waterlogged soil created pressure problems under slab of office vault, oil solutions used would not penetrate wet soil until pressure relieved.)
- RATNER, H., 1963, pp. 38, 40, 42. (U.S., South Jersey, leaks due to improper flashing lead to second-story infestations by subterranean termites, treat joists with Woodtreat T/C, after removing source moisture, after all windows opened, minute amounts EDB injected into wall voids, attic also dusted with Dri-Die silica gel powder. DDVP fumigant has replaced EDB in later cases as safer. It is used in concentrated form in minute quantities, being injected into wall cavities with a syringe.)
- REDDY, D. B., 1962, pp. 225-227. (India, the chlorinated hydrocarbons have been effective in controlling termites injuring agricultural crops, BHC is most widely used, the dosages vary from ¼ to 3 pounds per acre. Care must be taken especially with BHC in adverse effect on crops, where aldrin and dieldrin can be used. Termites are most active in June-July to February-March. Control must be applied at a time best suited to the various crops.)
- RENO, J., 1962, pp. 26, 28. (U.S., basement house, methods of entrance by termites, proper clearance, basement windows, door framing, sill and frames basement windows pressure-treated with oil preservative, use heartwood of resistant wood, or concrete. Steps with bottom

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step concrete or pressure-treated wood. Shield between top step and house, between porch and house. Two inches should separate supports for porch and steps and the house; have soil cover over enclosed earth. Inspect regularly, destroy tubes, poison soil. All wood should rest on concrete, wood inset in walls should rest on metal and have an air space around sides and ends. Masonry walls should be capped with 4 inches of reinforced concrete.)

- 1962a, p. 30. (U.S., crawl space house, methods of entrance by termites, clearance of 18 inches, solid poured concrete foundations, or 4-inch reinforced cap on top masonry foundations, shields, inspection, destruction tubes, soil poison, no wood in contact with soil, soil cover, no outside attachment to house.)
- 1962b, pp. 32, 33. (U.S., slab on grade house, houses with slab floors should have good drainage, no wood debris left in soil, no tree stumps or roots. A rotand termite-proof vapor barrier soil cover with a vapor transmission rate of onehalf perm, ground or soil poisons, and a well-constructed slab are the most important protective methods.)

1962c, pp. 1-4. (U.S., a combination of the three above papers with illustrations.)

- RESCIA, G., 1963, pp. 123-133. (Conservative treatment of relics in the Garibaldi House with xylamon, wood preservative.)
- ROONWAL, M. L., and CHATTERJEE, P. N., 1961, pp. 67-78. (India, Dehra Dun, Odontotermes obesus, destruction of mounds with chlorinated hydrocarbons, the concentration of the insecticide and total quantity of the liquid are important factors. Minimums giving complete destruction of the colony within a week are:

0.005% gamma BHC (9000 cc. liquid) per 10 cu. ft, vol. of mound cost 18 nP. (naye paise)

0.04% DDT (9000 cc. liquid) per 10 cu. ft. vol. of mound 20 nP.

- 0.025% dieldrin (9000 cc. liquid) per 10 cu. ft. vol. of mound cost 26 nP. 0.025% aldrin (9000 cc. liquid) per 10 cu. ft. vol. of mound cost 21 nP.)
- 1962, pp. 211-212. (India, Dehra Dun, destruction mounds *Odontotermes obesus* with chlorinated hydrocarbons with the same results as above.)

ROONWAL, M. L., CHATTERJEE, P. N., and

THAPA, R. S., 1961, pp. 76-116. (India, field experiments with one to three coat brushings of timber with BHC, DDT, coal tar creosote, etc. in 1950-1955, soil poisoning and mud-wall poisoning with various dilutions of the insecticides. Storing timber over poisoned soil most effective method, surface-treated timber must be stored under covering to prevent chemical washing out. Selective use of chemicals necessary. Data on concentrations and period of protection given.)

- 1962, pp. 183-184. (India, Dehra Dun, field experiments with surface treatments of timber, soil poisoning, and mud-wall poisoning from 1950-1955 for protection against species of *Odontotermes*. Several chemicals used as surface treatments gave protection for 29 months, the cheapest a three-coat brushing with 0.5 gamma BHC in water suspensional; 10% BHC dust and 1% chlordane gave protection as soil poisons for 26-29 months; in mudwall poisoning, mixing the chemical with the mud, BHC dust 5% was successful for 28 months, cheap, the huts are reconstructed every year.)
- ROORKEE, CENTRAL BUILDING RESEARCH INSTI-TUTE, 1965, pp. 686-687. (India, subterranean termite control measures in building construction, site clearance, mound poisoning, soil poisoning, barriers, concrete foundations, joint fillers.)
- RUDAKOVA, A. K., 1962, pp. 88-94. (S.S.R., methods of protection from termites of packing material for wires.)
- RUDNEV, D. F., 1963, pp. 127-131. (U.S.S.R., Ukraine, *Reticulitermes lucifugus* controlled by proper construction and the use of emulsions of DDT or HCH (benzene hexachloride) as soil poisons; also dipping wood in these emulsions.)
- ST. GEORGE, R. A., JOHNSTON, H. R., and KOWAL, R. J., 1963, pp. 1-30. (U.S., recommendations of Forest Service, following BRAB reports. Slightly revised from 1960 edition to include heptachlor as a soil poison.)
- SANDS, W. A., 1962, pp. 170-192. (West Africa, insecticides as soil and mound poisons against subterranean termites, aldrin or dieldrin mixed with top 6 inches of soil (loamy sand) in field after 33-34 months $\frac{1}{3}$ to $\frac{1}{3}$ of the insecticide remained in soil originally treated with 0.5, 2, and 5 pounds active ingredient per acre, tested by bioassay

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using workers of Trinervitermes ebenerianus.

T. ebenerianus very sensitive to dieldrin, general soil treatments might have adverse effects on termite aeration and penetration of water in tropical soils.

Dieldrin emulsion, I pound active ingredient per acre, divided among the planting holes per acre (1,225) resulted in a mean survival of 60% I-year old Eucalyptus trees. Pot grown seedlings similarly treated with emulsion or dust showed low mortality.

Colonies of Macrotermes natalensis successfully poisoned with $2\frac{1}{2}$ fluid ounces aldrin 40% emulsifiable concentrate in 6 gallons water applied through three auger holes made into central mound.)

- 1962a, pp. 1-14. (Nigeria, North Region, termites destructive to trees and crops.)
- SANKARAN, T., 1962, pp. 233-236. (India, Microtermes obesi and Odontotermes obesus and a few other species in the latter genus are most commonly encountered in plant protection work. Of the chlorinated hydrocarbons, BHC is the cheapest and most commonly used. Recently heptachlor has been reported as effective and cheaper than aldrin and dieldrin in controlling termites attacking sugarcane where a more expensive insecticide can be afforded. Insecticide applied to soil as dust before sowing BHC or aldrin 1/2 to I pound per acre. The annual loss to agricultural production: grain crops 280 million rupees; wheat 6% to 25%; coconut seedlings 20%; sugar lost in Bihar alone 1,400,000 pounds. Thousands of acres of land under various crops treated every year.)
- SARUP, A., 1962, pp. 213-215. (India, subterranean termites account for 95% of damage to buildings and contents, queen killing method control failure, structural alterations, soil and foundation poisoning, wood treatment most effective methods control, prevention during construction best, pipe system soil treatment and retreatment advantageous.)
- SAXAM, O., 1961, pp. 1-63. (U.S., protecting your home.)
- SCHMIDT, H., 1961, pp. 8-11. (Germany, effect of X-ray on wood-destroying insects.)
- SCHMUTTERER, H., 1961, pp. 479-489. (Sudan, Microtermes thoracalis, damage to cotton can be prevented by coating seed with a mixture of an insecticide (28.5 g./50%)

active dieldrin, 46% active aldrin 25% heptachlor or 20% lindane/kg. together with 4 g./kg. of ceresan UT. Treatment with aldrin gave the largest population of plants. Plots treated with lindane had less than one-third the damage control plots had. Peanuts are attacked in the seed and seedling stage. Shelled nuts were coated with 5 g./kg. of active material of dieldrin 50%, aldrin 40%, heptachlor 25%, chlordane 10% and lindane 20%, aldrin treatment gave a high yield.)

- SCHULER, S., 1964, pp. 124-126, 220, 224. (U.S., damage estimated by Dr. T. E. Snyder, Smithsonian at 250 million dollars annually, latest control methods for subterranean and drywood termites.)
- SCHWAB, R., 1963, pp. 57-58. (South Africa, apply highly penetrating wood preservatives to endangered timber, inject toxic smoke into nest system. Flood soil under suspended subfloors with a 5% solution of copper naphthenate or pentachlorphenol. Adequate ventilation and good established building practice should if necessary be improved.)
- SHELL CHEMICAL Co., New YORK, N.Y., 1963, pp. 1-11. (U.S., standard methods for pretreatment and existing structures illustrated.)
- SHIBAMOTO, T., 1962, pp. 2-4. (Japan, counter plan for insect attack to wood.)
- SIDDIQI, Z. A., RAJANI, V. G., and SINGH, O. P., 1959, pp. 227-232. (India, Uttar Pradesh, *Microtermes obesi*, in 1958 gamma BHC liquid at 0.75 pound per acre gave good protection to sugarcane when applied over setts at time of planting, the crop yield was also boosted.)
- SMEE, L., 1962, pp. 193-194. (Papua and New Guinea, control of the giant cacao termite (*Neotermes* sp.). Remove dead wood; treat infested wood with 0.05% dieldrin in water. Prevent attack to cacao and shade trees by coating pruned areas protectively.)
- SMITH, B. L., 1965, pp. 40-43-44. (U.S., Midwest, pretreatment soil with poison important. Method used in treating housing project by Chicago firm described and illustrated.)
- SMITH, D. N., 1964, pp. 1-11. (British Columbia, control of termites Zootermopsis and Reticulitermes for different types of buildings, both eradicative dusts and liquids and preconstruction soil poisoning, after sanitation and main-

taining a dry state, sound construction and inspection are recommended.)

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- SMITH, V. K., and JOHNSTON, H. R., 1962, pp. 1-7. (Eastern subterranean termite, U.S. prevention by sound construction, chemical treatment soil.)
- SPEAR, P., 1966, p. 80. (U.S., legal value inspection records, should show type of termite, location and extent damage. FHA requires minimum distance 100 feet from well to soil treatment, rodding accepted.)
- SRIVASTAVA, A. S., GUPTA, B. P., and AWASTHI, G. P., 1962, pp. 241-242. (India, Uttar Pradesh, Odontotermes obesus and Microtermes obesi the most common and destructive termites to agricultural crops. Dusting the infested wheat crop with 5% BHC at 25 pounds per acre with only an increase of 2.9% mortality in the plants after a month. For saving crops, nursery plants and fruit trees, dust with 5% aldrin at 20-25 pounds per acre, raking it into the soil. Do not use BHC where it might give flavor to the crop or retard growth. There has been an increase in the number of areas and trees treated since 1955.)
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- TEOTIA, T. P. S., GUPTA, K. M., RAJANI, V. G., and SAGAR, G., 1963, pp. 203-211. (Uttar Pradesh, India, termite damage to eye buds of sugarcane setts can be controlled by soil treatment with heptachlor sprays 0.5 to 1 pound per acre.)
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 - 1962a, pp. 39-46. (U.S., correspondence course on control nonsubterranean termites, inspection, treatment, fumigation, poison dusts or liquids injected by drilling, prevention silica aerogel dusts. Dampwood, drywood, powder post, and rotten wood termites discussed.)
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- VAN ARK, H., 1961, pp. 46-48. (South Africa, Karoo, control harvester termite *Hodotermes mossambicus.*)
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 - 1962g, p. 6 (U.S., California, Structural Pest 1st quarterly report on infestation by dampwood, (137) drywood, (18,303) and subterranean (25,424) termites by counties (51) for January, February, and March 1962, due to faulty grade level or earth contacts, 43,864.)
 - earth contacts, 43,864.) 1962i, p. 14. (U.S., Dr. T. E. Snyder estimates yearly damage to homes at about 250 million dollars, compared to 100 million about 15 years ago.)
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sion helpful in setting up an effective method to control submission of reports.)

YUNUS, E. A., 1960, pp. 255-260. (Malaya Coptotermes curvignathus, rubber trees, aldrin better than dieldrin in peat soil, inferior in other types soil, clay next to lose toxicity. Relative dosages chlordane, aldrin, dieldrin, 3: 2: 1.)

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adipose tissue: almost total loss of lipids and glycogene and great abundance of ribonucleic acid and diverse protids. The urate cells are much more rare, etc.)

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- TRUCKENBRODT, W., 1964, pp. 359-434. (Germany, cytological and physiological developmental researches on normal and parthenogenetic egg of *Kalotermes flavicollis*. Maturation, division, and development of the germination procedure, illustrated.)

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faulty grade level, or earth contacts 26,476 (36.8%), and 22,511 (31.3%) respectively.)

- 1963d, pp. 16-17. (U.S., California, Structural Pest Board quarterly report on infestation by county October, November, and December 1962, 55 counties. Due to dampwood termites: 302 (0.6%); to drywood: 20,552 (46.7%); to subterranean: 24,664 (56.1%). Total reports 43,953 (including damage by beetles and fungus), due to faulty grade level, or earth contacts: 22,184 (50.4%) and 18,-046 (41.0%) respectively.)
- 1963h, pp. 49-50, 52, 54, 64. (U.S., faulty drains may cause post-treatment trouble through accumulation of excessive moisture content in soil along a foundation. This may cause leaching of soil poisons. Illustrations are given of an ineffective and an effective drain.)
- 1963i, pp. 6-7. (U.S., California, Structural Pest Board yearly (1962) report on infestation by county, 57 counties. Total, due to dampwood termites: 997 (0.4%); to drywood: 86,203 (35.7%); to subterranean: 112, 177 (46.5%); grand total (including beetles and fungus): 240,926.

Due to faulty grade level, or earth contacts: 95,358 (39.5%) and 79,077 (32.8%) respectively.)

- 1963j, pp. 10-11. (U.S., California, Structural Pest Board quarterly report on infestation by county, January, February, and March 1963, 53 counties. Due to dampwood termites: 270 (0.3%); to drywood: 21,559 (31.1%); to subterranean: 31.501 (45.4%). Total reports 69,246 (including beetles and fungus.) Due to faulty grade level, or earth contacts: 26,293 (37.9%) and 21,829 (31.5%) respectively.)
- 19631, pp. 22-23. (U.S., California, Structural Pest Board quarterly report on infestation by county, April, May, and June, 1963, 55 counties. Due to dampwood termites: 320 (0.38%); to drywood 26,767 (32.5%); to subterranean: 35,793 (43.5%). Total reports 82,246 (including beetles and fungus.) Due to faulty grade level, or earth contacts; 31,186 (37.9%) and 26,120 (31.7%) respectively.)
- 1963p, pp. 18-19. (U.S., California, Structural Pest Board 3d quarterly report on infestation by county, July, August, and September, 1963, 53 counties. Due to dampwood termites: 360 (0.4%); to drywood: 26,102 (30.7%); to subterranean: 33,637 (39.5%). Total reports 84,953 (including beetles and fungus.) Due to faulty grade level, or earth contacts; 31,050 (36.5%) and 26,430 (31.1%) respectively.)
- 1964h, pp. 12-13. (U.S., California, Structural Pest Board 4th quarterly report on infestation by county. October, November, December, 1963, 55 counties. Due to dampwood termites: 382 (.53%); to drywood: 24,012 (33.31%); to subterranean: 29,410 (40.79%). Total reports 72,096 (including beetles and fungus). Due to faulty grade level, or earth contacts: 27,431 (38.05%) and 23,184 (32.16%) respectively.)
- 19640, pp. 22-23. (U.S., California, Structural Pest Board quarterly report on infestation by county, January, February, March, 1964, 54 counties. Due to dampwood termites: 296 (.39%); to drywood: 25,634 (34.13%); to subterranean: 32,580 (43.37%). Total reports 75,116 (including beetles and fungus). Due to faulty grade level, or earth contacts: 29,058 (38.68%) and 24,881 (33.12%) respectively.)

- 1964t, pp. 16-17. (U.S., California, Structural Pest Board 2d quarterly report on infestation by county, April, May, June, 1964, 54 counties. Due to dampwood termites: 297 (.33%); to drywood: 28, 124 (31.66%); to subterranean: 37,497 (42.21%). Total reports 88,827 (including beetles and fungus). Due to faulty grade level or earth contacts: 33,356 (37.55%) and 27,838 (31.34%) respectively.)
- 1964v, p. 3. (U.S., Kansas, Wichita, termites No. 2 school menace in this city of 240,000 population, according to Kansas City Star, 90 service calls for termite eradication were made at the city's public schools during a month's period. 240 hours were devoted to termite eradication treatments and the work required approximately 11,000 gallons of chemicals.)
- 1964w, pp. 24-25. (U.S., California, Structural Pest Board annual report on infestation by county 1963. 57 counties. Due to dampwood termites: 1,332 (.5%); to drywood; 98,440 (41.1%); to subterranean: 130,341 (54.4%). Total reports 239,295 (including beetles and fungus). Due to faulty grade level or earth contacts: 115,960 (48.4%) and 97,563 (40.7%) respectively.)
 1964y, pp. 16-17. (U.S., California, Structive Structure Stru
- 1964y, pp. 16-17. (U.S., California, Structural Pest Board 3d quarterly report on infestation by county, July, August, September, 1964, 55 counties. Due to dampwood termites: 279 (.32%); to drywood: 26,668 (30.66%); to subterranean: 33,-021 (38.05%). Total reports 86,784 (including beetles and fungus). Due to faulty grade level or earth contacts 32,284 (37.20%) and 26,652 (30.71%) respectively.)
- 1964z, p. 3. (U.S., California, summary Structural Pest Board annual report for 1933 on damage to buildings and stating use of chemically preserved lumber would prevent it.)
- 1965b, pp. 18-19. (U.S., California, Structural Pest Board 4th quarterly report on infestation by county, October, November, December, 1964, 54 counties. Due to dampwood termites: 429 (0.56%); to drywood: 25,577 (33.40%); to subterranean: 30,350 (39.63%). Total reports 76,581 (including beetles and fungus). Due to faulty grade level or earth contacts 29,189 (38.1%) and 24,004 (31.34%) respectively.)

- 1965f, pp. 18-19. (U.S., California, Structural Pest Board 1st quarterly report on infestation by county, January, February, March, 1965, 53 counties. Due to dampwood termites: 273 (0.35%); to drywood: 26,489 (33.83%); to subterranean: 32,322 (41.28%). Total reports 78,298 (including beetles and fungus). Due to faulty grade level or earth contacts 29,-934 (38.23%) and 25,203 (32.19%) respectively.)
- 1965i, pp. 18-19. (U.S., California, Structural Pest Board 2d quarterly report on infestation by county, April, May, and June, 1965, 56 counties. Due to dampwood termites: 291 (0.32%); to drywood: 27,762 (30.72%); to subterranean: 37,354 (41.33%). Total reports 90,375 (including beetles and fungus). Due to faulty grade level or earth contacts 33,-952 (37.57%) and 28,670 (31.72%) respectively.)
- 1965j, p. 61. (U.S., infestation report. *Reticulitermes hesperus* in structural beams in fair grounds building Lodi, San Joaquin Co., California, September.)
- 1966a, p. 46. (U.S., according to Dr. Thomas E. Snyder, termites prefer new houses, because of the juicier and tastier second-growth lumber, to older houses, although most infestations are found in older houses. It often takes 10-15 years for damage to become serious. New homes are centrally heated and built closer to the ground, often over existing colonies in recently forested suburban areas.)
- 1966e, p. 12. (U.S., California, Structural Pest Board 3d quarterly report on infestation by county, July, August, and September, 1965, 54 counties. Due to dampwood termites: 360 (0.41%); to drywood: 26,872 (30.78%); to subterranean: 33,191 (38.02%). Total reports 87,280 (including beetles and fungus.) Due to faulty grade level or earth contacts 31,942 (36.59%) and 26,912 (30.83%) respectively.)
- 1966f, p. 64. (U.S., California, Structural Pest Board 4th quarterly report on infestation by county, October, November, and December 1965, 56 counties. Due to dampwood termites: 377 (0.49%); to drywood: 23,649 (30.83%); to subterranean: 29,792 (38.83%). Total reports 76,719 (including beetles and fungus). Due to faulty grade level or earth con-

tacts 28,602 (37.28%) and 24,172 (31.51%) respectively.)

- BECKER, G., 1962b, pp. 95-109. (Germany, preconditions for damage to plastics by animals including termites described. Attack and deterioration of textiles, packaging material, cable insulations coverings, coats and glues reviewed, bibliography.)
- BEESLEY, J., 1961, pp. 3-4. (Australia, what is the termite hazard?)
- CLAGG, C. F., 1965, p. 3. (Hawaii, Oahu, Kaneohe, Marine Corps Air Station, *Coptotermes formosanus* damage to insulation of cable caused power failure in the runway lighting system, large branch nest near underground manhole, tubes built up to top concrete manhole and along inside cement-asbestos underground ducts joining manholes through which wiring is drawn extended 150 feet to second adjacent manhole, 20 feet from branch nest a short circuit had burned out insulation. Termites entered through drain at bottom manhole. Thousands workers and soldiers in nest.)
- COLWILL, D. J., 1964, pp. 393-487. (General, damage to transmission lines and cables.)
- DIFFIDENTI, G. A., 1963, pp. 45-54. Africa, biology, habits, damage by termites, *Bellicositermes natalensis* described and figured.)
- DOZINSKII, V. A., 1962, pp. 84-87. (Ukraine, *Reticulitermes lucifugus* in south are in virgin and long fallow land, migrate into various structures, orchards, vineyards, where more favorable conditions. Damage relatively insignificant.)
- FERNANDO, H. E., 1962, pp. 205-210. (Ceylon, damage to buildings by ground nesting termites more serious than by drywood termites, one cause is use of lime mortar.)
- GHILAROV, M. S., 1962a, pp. 131-135. (U.S.S.R., in European portion *Reticulitermes lucifugu*. in the Ukraine in the south which is the northern border of its range, sometimes introduced outside natural range, of no considerable importance. Central Asia, of the two species of *Anacanthotermes*, *A. turkestanicus* damages buildings in settlements, whereas *ahngerianus* inhabits more arid areas.)
- HERFS, A., 1954, pp. 1-37. (Economic importance of termites in tropical countries, pests wood, textiles.)
- INTERNAL REVENUE SERVICE, 1963. (U.S., Revenue Ruling 63-232 Nov. 12. A loss resulting from damage to property
caused by termites does not constitute a casualty loss within the meaning of 165(c)(3) of the Internal Revenue Code of 1954. Revenue Ruling 59-277, C.B. 1959-2,73 revoked. The new ruling is not retroactive. Any tax deduction after Nov. 12, 1963, will have to be proved a casualty loss in court. Leading authorities on termites have concluded that damage cannot be inflicted with the suddenness caused by fire, storm, etc.)

- KALSHOVEN, L. G. E., 1962, pp. 121-137. (Java, Coptotermes havilandi, attack material stored in godown in Surabaya, newspapers in house, Gedangan, roof of building, Djakarta, houses, Bogor, timber in yard, woodwork of small tanker.)
 - 1963, pp. 30-31. (West New Guinea, *Coptotermes hyaloapex* penetration into an underground cable, termite later proved to be *elisae* Desn.)
 - 1963c, pp. 223-229. (Indonesia, Coptotermes curvignathus gnaws into underground electric cables and other apparatus used in the jungle, attacking at a weak spot particularly in the joints. Soft material like asphaltum and lead are pierced, but not eaten. Iron bands eroded by Coptotermes sp. Bogor.)
- Kirby, J. L., 1961, pp. 69-71. (Termites rank No. 2 with P.C.O.s in New Jersey.)
- KRAUSS, N. L. H., 1965, pp. 2-4. (Hawaii, Oahu, damage to insulation of cables at Marine Corps Air Sta., Jan. 1964 by Coptotermes formosanus.)
- KURIR, A., 1962, pp. 1-8. (*Reticulitermes flavipes;* damage to wood and materials by this subterranean termite.)
- KUSHWAHA, K. S., 1964, pp. 105-107. (India, infestation by termites around Udaipur, Rajasthan.)
- LANGENDORF, G., 1961, pp. 158-159. (Southern Europe, *Calotermes flavicollis, Reticulitermes lucifugus* and *R. flavipes* injurious to wood, lumber.)
- Losinsky, W. A., 1962, pp. 84-87. (Ukraine, termites injurious to wood and plants.)
- MORRIS, W. J., 1963, pp. 44, 46. (U.S., Kent, Ohio, an addition to infested house infested from soil beneath addition, from May 9 to June 20 termites had built tubes up over concrete block foundation, 35 days after ground broken.)
- NASH, L. M., 1964, pp. 94-96. (U.S., habits and damage, rarely bring a house crashing down, know when to leave, 90% damage done by subterranean kind, 200 million dollars annual loss.)

- PAYNE, J. A., and CROSSLEY, D. A., JR., 1966, p. 44. (U.S., Oak Ridge, Tennessee, *Reticulitermes virginicus* and *R.* sp. in dry pig carrion.)
- PROTA, R., 1962, pp. 1-35. (Sardinia, *Reticulitermes lucifugus* infestation very extensive in towns and villages as well as farming areas in the country, particularly in populated districts, in other areas railway sleepers, swarm in spring and autumn)
- REINIGER, C. H., 1953, pp. 21-22. (Brazil termites which attack buildings and furniture.)
- Rescia, G., and Bonaventura, G., 1961, p. 260. (Italy, new foci of termite infestation.)
- RICCI, P., 1961, pp. 260-262. (Italy, a new termite focus of infestation in the Ministry of Public Instruction.)
- 1961a, pp. 262-263. (Italy, termite infestation in the Oratorio del Caravita.)
- ROONWAL, M. L., and CHHOTANI, O. B., 1961, pp. 89-96. (India, about 170 species of termites known from Indian region: Ceylon, Burma, Pakistan and Nepal, 42 species wood-inhabiting, 9 species do not inhabit wood, but destroy it. Species listed, particulars given about most important species.)
- RUDNEV, D. F., 1963, pp. 127-131. (U.S.S.R., Reticulitermes lucifugus has been in the Ukraine for 100 years. It damages from one to four buildings in each village, a few so badly they had to be rebuilt. Recently, outside its natural range, it has become established in the vicinity of Odessa, Nikolajew, and Cherson, where vineyards also have been injured. To some extent living trees are infested. Proper construction and the use of emulsions of DDT or HCH (BHC) as soil poisons are advisable. Also dipping wood in these emulsions is recommended.)
- SAMPAIO, E. J. F., 1960, pp. 1-8. (Portugal, pp. 1-2, damage to books by *Reticulitermes lucifugus*, live inside wood, use books as food, which they reach through passage galleries.)
- SCHWAB, R., 1963, pp. 57-58. (South Africa, damage to dwellings most every unprotected house in Provinces of Transvaal and Natal will be attacked once and many repeatedly by subterranean termites. South African termites which attack buildings are drywood type, sub-

terranean or carton nest builders, small and large fungus growers.)

- SNYDER, T. E., and FRANCIA, F. C., 1962, pp. 63-77. (Philippines, the drywood termites Cryptotermes cyanocephalus and C. dudleyi are of great economic importance because of their damage to the woodwork of buildings and wood products, furniture and lumber. Also infesting buildings is Heterotermes philippinensis. However Coptotermes flavicephalus and C. vastator are by far the most destructive of the subterranean termites. Species of Microcerotermes occasionally attack the woodwork of buildings as does the mound-building Macrotermes gilvus.)
- GIORDANI-SOIKA, A., 1963, pp. 42-46. (Italy, Venice, Calotermes flavicollis nests in stakes fixed at bottom of the Laguna as indicators of navigable channels or as anchorage of boats, since the wood is damp enough and they seem undisturbed by salinity. Reticulitermes lucifugus, more than once accidentally imported into Venice, has remained, till now, very localized, or even disappeared, probably because of the high dampness of the soil, often submerged by high water.)
- SWEENEY, R. C. H., 1961, p. 42. (South Africa, termite damage to stored products.)
- SWEETMAN, H. L., 1965, pp. 1-137. (U.S., damage by 15 domestic termite species and several other important families.)
- THEDEN, G., and BECKER, G., 1961, pp. 376-409. (Germany, testing and effectiveness of materials against organisms, including termites, in the laboratory, wood, plastics, etc., summary of results by others, bibliography.)
- U.S. DEPT. AGRICULTURE, PLANT PEST CON-TROL DIV., COOP. ECON. INSECT. REP., 1962, p. 47. (Afghanistan, Microcerotermes sp. damaged roof timbers mud houses, Helmand Valley; cardboard boxes medical supplies, storeroom Lashkah Gah.)
 - 1962b, p. 1063. (U.S., California, injury by termites to fruit and shade trees increased in past few years, now considered sources of structural infestations.)
 - 1962f, p. 125a. (U.S., Ohio, Loudonville, Knox County, *Reticulitermes flavipes*, discarded paper sacks perforated in house.)
 - 1963a, p. 82. (Ethiopia, Addis Ababa, Odontotermes sp. infesting a house.)

- 1963c, p. 310. (U.S., California, 240,962 inspections made in state in 1962, 64,307 infestations by termites found.)
- 1964, p. 150. (Hawaii, Oahu, Kaneohe, *Coptotermes formosanus* damaged insulation electrical cable Marine Corps Air Sta. leading to short circuit. Large branch nest, tubes. Main colony 250 feet distant. Thousands soldiers, workers. First reported damage in Kaneohe in 1953.) (Clagg.)
- 1964l, p. 1242. (U.S., Arizona, Yuma County, *Heterotermes aureus* infested public building.)
- 1965a, pp. 326-327. (U.S., termites were considered the most important structural pests in Indiana, Missouri, Arkansas, Alabama, Maryland, and Connecticut, in 1964. Western drywood termite (Incisitermes minor) and western subterranean termite Reticulitermes hesperus were extremely damaging to residences and other structures in California in 1964. R. hesperus caused heavy damage to the foundation of a house near Friday Harbor, San Juan County, Washington. Reports of damage by this species from all areas of Wyoming were received about as often as in 1963. A desert dampwood termite Paraneotermes simplicornis occurred in wood under a home in East Las Vegas, Clark County, Nevada, and swarms of adults were numerous in homes in that county. Infestations of subterranean termites (Reticulitermes sp.) in Nevada homes above 1963 level and equal to 1962 level. In Iron County, Utah, a few houses were found to be infested at Cedar City and elsewhere during the summer. In Kansas about 6,200 buildings were treated, a slight increase over previous years. Winged forms of Reticulitermes flavipes were reported in northwestern Arkansas on March 28; in all sections of North Carolina from February through May, with one swarm from Orange County on August 29. Large swarms were noted in New Castle County, Delaware, from mid-March through April and new infestations in houses rather numerous. In New Jersey swarms were more widespread than in 1963. The first winged forms were reported from Saunderstown, Washington County, Rhode Island, on February 18 with reports common through mid-May.)

- 1965c, p. 347. (U.S., Connecticut, swarming at Warehouse Point, Hartford County; Groton, New London County; and Wethersfield, Hartford County, April 7, 1965. New Jersey: swarms continue to be homeowners' primary insect concern. Delaware: *Reticulitermes flavipes* adult flights indicate several new house infestations in New Castle County.)
- 1965d, p. 388. (U.S. Massachusetts, in western section swarms causing increasing number inquiries from homeowners. Connecticut R. flavipes swarming statewide. New York termites frequent, problem in Nassau County for past few weeks (April 16). New Jersey swarms in many areas. Maryland swarms continue at high rate in central and southern sections of state. North Carolina R. flavipes swarming in Wake and Guilford Counties. Ohio, R. flavipes swarms in Cincinatti, Hamilton County and in Wayne and Wyandot Counties. Utah R. hesperus infesting several homes in the Garland-Tremonton area of Box Elder County. Idaho, R. hesperus flight at Homedale, Owyhee County, home infested at Orofino, Clearwater County. Washington, R. hesperus winged adults near Endicott, Whitman County.)
- 1965f, p. 456. (U.S., (week April 30), Maryland swarms *Reticulitermes* spp. in Anne Arundel and Prince Georges Counties and Baltimore. *R. virginicus* swarmed in home about April 27 in Cleveland County, North Carolina. *R. hesperus* heavy in three adjacent new homes in Reno, Washoe County, Nevada. California, winged forms, principally *R. hesperus*, quite prevalent.)
- 1965g, p. 490 (U.S., (week ending May 7). Rhode Island, first alates *Reticulitermes flavipes* on January 19, common since mid-March in all parts of state; Ohio swarming in Franklin and Hamilton Counties. Oklahoma *R. virginicus* swarming in several locations in Payne, Noble, and Kay Counties. Idaho home infested *R. hesperus*, Orofino, Clearwater County, alates on May 4, Challis, Custer County.)
- 1965h, p. 519. (U.S., (week ending May 14). Ohio *Reticulitermes flavipes* winged from Franklin and Morrow Counties indicate continued swarming in central area. Rhode Island reports and specimens continue. *Reticulitermes*

hesperus California infestation in bath area in Lafayette, Contra Costa County; Hollister, San Benito County; Sacramento, Sacramento County; Idaho, infestation in Blackfoot, Bingham County.

- 1965i, p. 555. (U.S., (week ending May 21.) Connecticut, *Reticulitermes* sp. still swarming statewide. *Reticulitermes hesperus* swarming in southern Washoe County, Nevada; treatments on increase in Reno-Sparks, Washoe County, and in Lake Tahoe area.
- 1965j, p. 586. (U.S., (week ending May 28), Michigan, *Reticulitermes* sp. swarming in Freeport, Barry County, May 16. Utah, in homes of Ogden area, Weber County.)
- 1965k, p. 657. (U.S., (week ending June 11), Maryland, *Reticulitermes virginicus* swarmed on numerous properties in Prince Georges County, more than normal number reports. Nevada, *Paraneotermes simplicicornis* heavy infestation floor home Las Vegas, Clark County, heavy damage. Nebraska, *Reticulitermes* sp. house infestations Lincoln County.)
- 1965m, p. 732. (U.S., (week ending June 25), North Carolina, *Reticulitermes virginicus* swarmed June 16 in Guilford County. New Hampshire, *R. flavipes* active in basement of home, Durham.)
- 1965q, p. 901. (Hawaii, Honolulu, *Incisitermes immigrans* (week ending July 30) caused considerable damage to bathroom floor, a rare case of infestation in a home of this lowland tree species.)
- 1965s, p. 944. (South Dakota, near Tyndall, Bon Homme County *Reticulitermes* sp. damaged slab-foundation home.)
- 1965t, p. 981. (California, Anaheim, Orange County, *Reticulitermes tibialis* damaged arch in home.)
- 1965v, p. 1015. (Minnesota, Windom, infestation in building, week ending August 20. Nebraska, Lincoln, Lancaster County, *Reticulitermes* spp. infesting several buildings.)
- 1965w, p. 1050. (Utah, Logan, Reticulitermes hesperus infesting buildings on campus Utah State Univ. and large school building. Wisconsin, La Crosse County, Reticulitermes flavipes first report of activity in large degree this season. Week ending August 27.)
- 1965y, p. 1080. (Wisconsin, Monroe County, Tomah, (week ending September 3), *Reticulitermes flavipes* in building, new county record.)

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NO. 3

- 1965z, p. 1081. (Oregon, Zootermopsis angusticollis (week ending September 3), causing usual concern to home owners in western section; heavy flights from coast and many mid-Willamette Valley towns.)
- 1965a¹, p. 1081. (Texas, Cooke County, *Reticulitermes virginicus* (week ending September 3), heavy damage to stored cotton clothing in warehouses.)
- 1965b¹, p. 1105. (Wyoming, Casper, (week ending September 10), *Reticulitermes* infested Natrona County Hospital. Utah, Sandy, Salt Lake County *R. hesperus* infested home.)
- 1965f², p. 1248. (Oklahoma, Oklahoma, Payne and Tulsa Counties, (week ending October 29), *Reticulitermes virginicus* continue swarming in some areas.)
- 1965i¹, p. 1346. (California, Eureka, Humboldt County (week ending December 24), *Reticulitermes hesperus* heavy infestation in city center building.)
- 1965j¹, p. 1346. (Oregon, Coos County (week ending December 24), *Reticulitermes tibialis* infesting trailer house.)
- 1966, p. 18. (Alabama, Auburn, Lee County, *Reticulitermes flavipes* (week ending Jan. 7), swarms from three homes during past 10 days; temperatures springlike for over 15 days; Maryland, Baltimore infesting new home.)
- 1966b, p. 68. (Oklahoma, Tulsa, Tulsa County, *Reticulitermes tibialis* swarming in basement, week ending Jan. 28.)
- 1966c, p. 75. (Hawaii, Oahu, Coptotermes formosanus and Cryptotermes brevis continue to cause considerable losses to many home owners; on Maui free of C. formosanus prior to 1966, eradication underway in Wailuku and Waikapu; Zootermopsis angusticollis in Douglas fir lumber introduced into Hilo, Hawaii and Honolulu, Oahu, week ending Jan. 28.)
- 1966f, p. 122. (Oklahoma, *Reticulitermes* spp. swarming in several areas of state, week ending Feb. 18.)
- 1966g, p. 174. (Maryland, Hyattsville, Prince Georges County, *Reticulitermes flavipes* winged emerged inside home, week ending Mar 4.)
- 1966h, p. 202. (New Jersey, *Reticulitermes* sp. winged forms active in many areas, week ending Mar. 11. Delaware, *Reticulitermes flavipes* first swarms in New Castle County first week March. Maryland, Hyattsville, Prince Georges County, *R. flavipes* swarming on several

properties, week ending Mar. 11. Virginia, *Reticulitermes* sp. adults collected in home in Sussex, Sussex County, week ending Mar. 11. North Carolina, *R. flavipes* swarmed in large number March 4 in Wake County, first swarm of season. Nevada, Reno, Washoe County, *R. hesperus* swarming in large numbers in office; week ending Mar. 11.)

- 1966j, p. 223. (Maryland Reticulitermes flavipes swarming inside buildings statewide, week ending Mar. 18. Colorado, Cortez area, Montezuma County, R. tibialis swarming, week ending Mar. 18. Reticulitermes sp. swarming in Larimer County.)
- 1966l, pp. 246-247. (Alabama, Henry County, week ending March 25, *Reticulitermes flavipes*, first swarming from decaying tree. Maryland, swarming in homes Montgomery and Prince Georges Counties. Pennsylvania, swarming in Centre County. Connecticut, swarming in homes in Plantsville, Hamden, Windsor, New Haven, Somers, Bridgeport, and Fairfield, mostly last full week of March. South Dakota, *Reticulitermes* sp., week ending March 25, flight near home in White River, Mellette County.)
- 1966m, p. 286. (Hawaii, Honolulu, Oahu, Coptotermes formosanus first swarms of year in Manoa area, March 14.)
- 1966n, p. 311. (U.S., Maryland, week ending April 8, *Reticulitermes flavipes* swarmed inside and about houses in Prince Georges County. Ohio, peak swarming activity occurred mid- to late-February in southern half of state, persisted about 2 weeks, unusual early swarming. Utah, *R. hesperus* present in home in Salina, Sevier County, week ending April 8, pp. 325-326, summary termite activity 1965.)
- 19660, p. 342. (U.S., Connecticut, R. flavipes, April 13, 1966, swarming in East Haven, Branford, North Haven, Hamden, New Haven, West Haven, Bridgeport, and Thompsonville. Illinois, week ending April 15, 1966, R. flavipes swarming in Champaign-Urbana area. Texas, week ending April 15, 1966, R. flavipes swarming from house in Bay City, Matagorda County, house in Floresville, Wilson County, and several houses in Seguin, Guadalupe, County.)
- 1966p, p. 394. (U.S., Massachusetts, *Reticulitermes* sp., April 30, swarming near peak in eastern area. Alabama,

week ending April 29, Reticulitermes *flavipes* causing considerable damage to two farm barns in Clay County, and to home in Lee County. Nevada, R. tibialis medium infestation in home in Winnemucca, Humboldt County, week ending April 29; Reticulitermes sp. swarmed in Reno-Sparks area April 23-24, medium infestation home Reno, Washoe County. California, R. hesperus heavy infesta-

DAMAGE TO LIVING VEGETATION

- ARDLEY, J. H., CLIFFORD, L. T., and GAY, F. J., 1965, pp. 680-681. (New Guinea, Coptotermes elisae damage to plantationgrown hoop pine (Araucaria cunninghamii) grown for plywood. Infestation associated with rotting stumps. By 1963 infestation reached 7.2%. Treatment of infested trees by injecting 0.03% dieldrin emulsion; residual colonies destroyed by injecting arsenical dusts into galleries.)
- Bernard, J., 1964, pp. 83-85. (Tunis, agriculture.)
- BINDRA, O .S., 1961, pp. 277-282. (India, North West Madhya Pradesh, injury to crops, young orchard plants, by Odontotermes, Microtermes, Trinervitermes, Nasutitermes and Coptotermes.)
- BRUNCK, F., 1962, pp. 20-22. (Tropical Africa, 10 species termites in various genera pests of forest plantations in French-speaking states.)
- BUTANI, D. K., 1961, pp. 767-768. (India, Bihar, damage to sugarcane.)
- CABRAL, J. DE S. M. N., 1959, pp. 28-29. (Portugal, Reticulitermes lucifugus attacking trunks *Pinus pinaster*.)
- CASTEL-BRANCO, A. J. F., 1963, pp. 17-94. (Africa, Island S. Thomé nine species of Isoptera noted as pests of cacao.)
- CHATTERJEE, P. N., and THAKUR, M. L., 1963, pp. 635-637. (India, Sarvaritermes faveolus as pest Alnus nitida in Kulu valley, Punjab, attacks aged trees and partially dead parts, swarms in laboratory during monsoon in July.)
- Сннотали, О. В., 1963, pp. 287-288. (India, interior, Cryptotermes havilandi, distribution, injury to Ficus bengalensis.)
- CONROY, W. L., 1963, pp. 85, 86. (New Guinea, Neotermes, in New Ireland restricted to cacao in vicinity Lakuramau Plantation. Control of this ground-entering termite unsuccessful. Except in New Ireland and New Britain damage to

tions in air terminal building in El Toro, Orange County, Sacramento, Sacramento County, Atascadero, San Luis Obispo County, and Gilroy, Santa Clara County, week ending April 29.)

1966q, p. 417, week ending May 6, R. flavipes serious problem in Guilford County, North Carolina to school system, of 42 schools half with spot infestations.)

cacao by termites not significant. In Gazelle Peninsula, Neotermes was beginning to cause widespread damage although entry through the root system was still not commonly encountered. Damage by termites is largely a matter of faulty plantation management, remove Leucaena stumps, proper pruning. Introduce 0.5% solution dieldrin in downward sloping gallery, for largest colony 150 cc., p. 85. In pine plantations Coptotermes sp. caused increasing damage at Bulolo and Wau, p. 86.)

- CRUZ, B. P. B., FIGUEIREDO, M. B., ALMEIDA, E., 1962, pp. 189-195. (Brazil, São Paulo, Syntermes sp. damages roots ground nuts.)
- CUMBER, R. A., and EYLES, A. C., 1961, pp. 426-440. (New Zealand, North Island, (1) one Isoptera damaging major fodder crop, p. 429 Kalotermes brouni in turnips.)
- DAS, G. M., 1962, pp. 229-231. (North-East India, live-wood-eating termites Microcerotermes spp. cause damage of a permanent nature to tea and the ultimate death of the bushes, at least 15% of the crop is lost annually. Scavenging termite Odontotermes spp. may also occasionally cause severe damage to individual bushes after a long period. Attack is made through the heartwood, and the destruction of the frame is rapid in the case of live-wood-eating termites. From 50% to 100% of the bushes in Darrang and Cachar districts may be more or less seriously affected in most gardens.)
 - 1963, pp. 4-8. (India, termites as important pests of tea.)
- DAVID, A. L., KALYANARAMAN, V. M., and NARAYANASWAMY, P. S., 1964, p. 369. (India, Madras, Odontotermes obesus damage to sugarcane, notes on locality and infestation.)

- DOUROJEANNI RICORDI, M., 1965, p. 29. (Peru, termites that affect the exploitation of the forests of Peru.)
- DUTT, N., 1962, pp. 217-218. (India, Microtermes obesi injures jute since 1954, enters stem thorugh tap roots, feeds on stem reducing fiber yield, carry earth into plant.)
- FERNANDO, H. E., 1962, pp. 205-210. (Ceylon, Neotermes militaris, N. greeni and Glyptotermes dilatatus attack tea and rubber plants, shade and forest trees; Coptotermes ceylonicus rarely damages tea but usually rubber and forest trees, but Neotermes and Glyptotermes are considered to be among the major tea pests.)
- FORSYTH, J., 1966, pp. 76-78. (Ghana, list of termites attacking crops, notes on hosts, 1910-1960.)
- GENTRY, J. W., 1965, pp. 8-9. (Iran, Iraq, roots, stems, field crops damaged by *Amitermes vilis*. Sudan, crops damaged by *Macrotermes herus*. West Pakistan, India, *Microtermes obesi* attacks roots, crops, houses. Pakistan, India, *Odontotermes obesus* damages crops.)
- GIVEN, B. B., 1964, pp. 25-26. (Cook Islands, Calotermes (Neotermes) rainbowi first recorded infesting coconut tree trunks about 1904 on Anchorage Isld. In 1941 three-fourths of the palms were infested and palms were collapsing. A full scale attack on the present areas of infestation was recommended in 1960, after describing the manner of infestation.)
- GREAVES, T., 1961. Termites in forest trees, p. 39. In Commonwealth Sci. and Indus. Res. Org., Div. Ent. 1960-1961 Ann. Rept. (Australia, studies incipient colonies Porotermes adamsoni, gallery studies Coptotermes acinaciformis have been continued. Studies of the area covered by individual colonies of termites have shown that trees can be attacked from a central colony in a tree over 100 feet away.)
 - 1962, pp. 1-17. (Australia, studies were conducted to determine the comparative losses caused to felled Eucalyptus trees by termites, decay and fire, the percentages charged to termites varied from 45% to 95%.)
 - 1962a, p. 65. (Australia, N.S.W., Bago State Forest, *Porotermes adamsoni*, alpine ash, losses up to 14.15 pounds per acre. Little loss occurs in logs 5 feet in girth, if harvested under 7 feet and protected

from fire would be practically free from attack.)

- 1962c, pp. 630-651. (Australia, Coptotermes acinaciformis foraging galleries radiate from colonies in trees in coastal forests eastern Australia. In living tree central "pipe" eaten out filled with "mud gut" material, 15 living trees attacked from central colony, maximum length gallery 156 feet. In Western Australia after host trees have been eaten out colonies can persist in mounds. Coptotermes brunneus, in the Murchison River Basin, Western Australia, mound colonies occur in sclerophyll woodland and mallee. Foraging galleries, longest 150 feet, traced to Eucalyptus, adjacent sand impregnated with cementing substance. In both termites invasion of trees through living bark of a root or base of tree trunk. This is in contrast to entry of colony-founding pairs which can only enter through a tree injury.)
- 1963, pp. 74-76. (Australia, eastern Queensland, *Coptotermes acinaciformis* study showed possible relation of termite attack on tree to soil type.)
- 1964, pp. 1-4. (Australia, Coptotermes acinaciformis, C. frenchi, and Porotermes adamsoni are the major termite forest pests. In the tropical north Mastotermes darwiniensis, in the absence of hardwood forest, must be included because of exotic trees. Methods of attack varies with species termite. Fire scars main source of entry.)
- 1965, p. 46. (Australia, N.S.W., 300-400 year old blackbutt trees, termites caused 83%-95% loss; total losses by termites, decay and fire varied from 57-65 pounds per acre.)
- GREAVES, T., MCINNES, R. S., and Dowse, J. E., 1965, pp. 161-174. (Australia, Bago State Forest, N.S.W., losses in alpine forest trees 60-150 years old by *Porotermes adamsoni* were 80% of the damage, greater than that caused by decay 13%-36% and fire less than 5%.)
- GUAGLIUMI, P., 1962, pp. 405-409. (Venezuela, *Heterotermes crinitus* and *Nasutitermes* sp. pests sugarcane.)
- GUPTA, R., and AGARWAL, M. K., 1963, pp. 285-287. (India, *Odontotermes obesus* as a pest of Japanese mint.)
- HALL, D. W., 1956, p. 106. (East Africa, damage to ground nuts before and after harvest.)

BIBLIOGRAPHY OF TERMITES 1961-65: SUBJECTS-SNYDER

- HARRIS, W. V., 1961, pp. 1-187. (Tropical Africa, damage to agricultural crops, forest trees.)
 - 1962a, pp. 1-5. (General, termite control in afforestation can be obtained with 8 ounces of dieldrin per acre but might have serious consequences on the role of termites on soil fertility; damage to mature trees by species of *Coptotermes* in Australia, British Honduras, and south-east Asia occurs and by drywood termites in Java, Dominican Republic and East Africa. There is need for faunal surveys so that protection may be given from the more destructive termites until the transplants have outgrown the susceptible stage. The species of termites to which resistant or treated woods are exposed in tests should be listed to explain anomalous results in different areas.)
 - 1963b, pp. 193-201. (106 species phytophagous Isoptera in six families feed on cultivated trees and crops, list principal species given, methods feeding, and geographical distribution. Comparison made between termites feeding on tree cropcocoa and field crop-sugarcane.)

HERFS, A., 1954, pp. 1-37 (Tropics, plants.)

- HUSSAIN, A. A., 1963, pp. 345-348. (Iraq, borers on date palms including *Microcerotermes diversus*, seasonal incidence and damage described.)
- INDIAN COCONUT JOURNAL, 1962, pp. 165-166. (Isoptera South East Asia and Pacific region host list.)
- INDIAN INST. SUGARCANE RES., SUGARCANE BREEDING, 1962, p. 186. (India, termite control for sugarcane.)
 - 1962a, p. 190. (India, agricultural entomology, Isoptera.)
- KALSHOVEN, L. G. E., 1962, pp. 121-137. (Java, Coptotermes havilandi, damage to forest trees, Leguminosae preferred, Acacia tomentosa, and other legumes grow spontaneously in the largely uniform teak plantations, this termite rarely attacks teak, is selective in choice of host trees. Often nest in old dead trunks and stumps.)
 - 1963a, pp. 90-99. (Indonesia and Malaya, *Coptotermes curvignathus* causing death trees, host trees and susceptibility to attack. Monocotyls as hosts; Java, Sumatra, Borneo.)
- KAPUR, A. P., 1962, pp. 105-106. (India, Shillong, Assam, *Reticulitermes chinensis* injury to roots *Pinus longifolia* in forest.)

- KRISHNAMOORTHY, C., and RAMASUBBIAH, K., 1962, pp. 243-245. (India, Andhra Pradesh, *Microtermes obesi* and *Odontotermes obesus* are the principal termites damaging cultivated crops, the former wheat, the latter sugarcane, fruit plants and coconut.)
- KUSHWAHA, K. S., 1961, pp. 229-230. (India, Rajasthan, sugarcane crop.) 1964a, pp. 107-108. (Idem.)
- MATHEN, K., KURIAN, C., and MATHEW, J., 1964, pp. 127-136. (India, *Odontotermes obesus*, field control infesting germinating nuts in coconut nursery.)
- MATHUR, R. N., and SINGH, B., 1960, pp. 32, 34, 37, 41, 57, 73, 91, 110, 119, 136. (India, and adjacent countries, termites injurious to forest plants.)
 - 1960a, pp. 27, 30, 34, 41, 47, 70, 75, 83, 105, 111. India, and adjacent countries, termites injurious to forest plants.)
 - 1961, pp. 3, 6, 9, 14, 17, 21, 30, 33, 47, 57, 65, 72, 83, 85. (India, and adjacent countries, termites injurious to forest plants.)
 - 1961a, pp. 15-16, 35, 49, 92, 97, 106. (India, and adjacent countries, termites injurious to forest plants.)
- MENDES, M. A., 1959, pp. 136-137. (Portugal, Reticulitermes lucifugus attacking Castanea sativa.)
- MENON, K. R. V., and PANDALAI, K. M., 1958, p. 282. (India, Odontotermes obesus injury to coconut palm, control.)
- MINKO, G., 1965, pp. 1-3. (Australia, Victoria, Porotermes adamsoni in living Pinus radiata.)
- NEL, J. J. C., 1964, pp. 104-110. (South Africa, Orange Free State, *Hodotermes* mossambicus damage to veldt.)
- PEMBERTON, C. E., 1961, p. 197. Abstr., stalk borers sugarcane: Isoptera Heterotermes philippinensis Light Philippines; Mastotermes darwiniensis Frogg Queensland; Termes meridionalis Frogg; Macrotermes gilvus Hag. Philippines, Java; Capritermes nitobei Shir. Formosa; Odontotermes formosanus Shir. Formosa; Reticulitermes speratus Shir. Formosa.)
- PROTA, R., 1962, pp. 1-35. (Sardinia, Kalotermes flavicollis greatest damage done in vineyards and woody parts cork trees; in southern part of the island swarm toward end of Sept.; occur up to 3350 feet.)
- RANAWEERA, J. W., 1962, pp. 88-103. (Ceylon tea estates, genera, and species termites injurious to living plants, habits, types damage. Some scavengers become pests

NO. 3

when their galleries interfere with nutrition or wound healing of tea bushes. *Neotermes militaris* can be controlled by forcing dieldrin or chlordane emulsion at 10 pounds pressure into galleries opened by pruning, 2 pints per bush. Keys given for determination most important termites.)

- RAO, D. S., 1958, pp. 200-201. (India, Mysore, potato crop in soil, termites eat potato pieces, cutting germination.)
- REDPY, D. B., 1962, pp. 225-227. (India practically every important agricultural crop is attacked by termites at all stages of growth. Only eight species are important: Odontotermes obesus, O. assmuthi, O. feae, Microtermes obesi, Trinervitermes heimi, Coptotermes heimi, Heterotermes indicola and Neotermes gardneri. In 1912 the annual loss to grain crops was 18 million rupees. Microtermes obesi causes an annual loss of 6% and occasionally 25% to germinating wheat.)
- REISCH, J., 1961, pp. 113-117. (East Africa, Kenya, forest pests.)
- Rose, D. J. W., 1963. (Rhodesias, pests of maize and other cultivated crops.)
- SEMEDO, C. M. B., 1961, p. 101. (Portugal, Leucotermes (Reticulitermes) lucifugus injury to elm trees.)
- SEN-SARMA, P. K., and MATHUR, R. N., 1961, p. 252. (South India, Trinervitermes biformis, damage to plants.)
- SHARMA, R. C., 1964, pp. 28-30. (India, Ajmer, Rajasthan, Odontotermes obesus damaging sorghum.)
- SMEE, L., 1963, pp. 1-19. (Papua and New Guinea, two species of *Neotermes*; one in New Britain attacks through dead wood in aerial parts tree, one in New Ireland through roots.
 - 1964, p. 27. (Papua and New Guinea, Coptotermes elisae attacking live tissue Hevea brasiliensis trees, control.)
- SNYDER, T. E., and FRANCIA, F. C., 1962, pp. 63-77. (Philippines, Kalotermes mcgregori and K. taylori attack the living forest tree ipil-ipil (Leucaena glauca); species of Neotermes infest ipil-ipil, shade trees including avocado, cacao, and guava.)
- SZENT-IVANY, J. J. H., 1961, pp. 127-147. (Papua and New Guinea damage to cacao by *Calotermes papua* and *Microcerotermes biroi*.)
 - 1963, pp. 37-43. (Papua and New Guinea, Nasutitermes princeps (Desneux)

Matupi Plantation, Madang District makes primary attack on healthy cacao trees.)

- TEOTIA, T. P. S., GUPTA, K. M., RAJANI, V. G., and SAGAR, G., 1963, pp. 203-211. (Uttar Pradesh, India during hot weather termites destroy 30%-60% eye buds cane setts.)
- TEOTIA, T. P. S., RAJANI, V. G., and SAGAR, G., 1963, pp. 33-38. (India, Uttar Pradesh, treatment of the spring-planted sugarcane crop increased the yield, dipping the cane setts was as effective as spraying; 0.1% gamma BHC to control termites.)
- THOMAS, A. S., 1962, pp. 103-108. (Termite mounds of tropics have soils differing from those of grasslands in which they are built; some harvester termites destroy areas of pasture and large mounds of fungus-eating termites hinder mechanical cultivation.)
- THOMAS, R. T. S., 1962, pp. 57-58. (Dutch New Guinea, attack on trees and live, garden plants, lists, *Coptotermes hyaloapex.*)
- TSVETKOVA, V. P., 1963, pp. 28-36. (U.S.S.R., South of Ukraine, *Reticulitermes lucifugus* damage to trees, shrubs, grapevines.)
- U.S. DEPT. AGRICULTURE, PLANT PEST CON-TROL DIV., COOP. ECON. INSECT REP. 1962, p. 531. (Sudan, Khasim El Ghirba district, Macrotermes herus and Odontotermes sudanensis serious pests peanuts; p. 54, Sudan, Dongola Merowe district Odontotermes sudanensis seriously infested 35% of the date palms.)
 - 1962b, p. 1053. (U.S., California, Kalotermes minor, drywood termite heavy in apricot trees in yard, Woodside, San Mateo County, incidences of infestation in fruit and shade trees increased in past few years.)
 - 1963, p. 79-80. (Sudan, Odontotermes sudanensis attacked 60% of the date palms in the Dongola-Nile reach, Microtermes aluco was reported causing slight damage to cotton in most of the cottongrowing district.)
 - 1963d, p. 533. (Nevada, Pine Creek, Spring Mountains, Clark County, *Incisitermes minor* injuring velvet ash trees.)
 - 1963h, p. 1140. (California, *Reticulitermes hesperus*, western subterranean termite, peach fruit from old orchard found infested in packing shed on three occa-

sions; this was ripe fruit for cutting and drying; most fruit with split pits.)

- 1963i, p. 1178. (California, Ducas, Tulare County, *Reticulitermes hesperus* heavy on citrus trees, condition of trees not indicated.)
- 19631, p. 1264. (Alabama, *Reticulitermes flavipes* present in varying degrees in 55 corn fields in 11 west and southwest counties; 5%-10% of corn stalks completely "hulled" out and falling in some fields, especially in new ground areas and several fields near old home sites. No damage to grain or ears. Downed cornstalks will affect harvest.)
- 1963m, p. 1368. (Alabama, *Reticulitermes flavipes* in cornstalks in 13 counties in west and northwest areas; also in Clay, Coosa, and Chambers Counties.)
- 1964d, p. 360. (Florida, Cryptotermes cavifrons infested considerable number cabbage palms in Dixie County, in trunks some trees wind breakage followed. Aeticulitermes sp. severely damage yew at College Park, Prince Georges County, Md.)
- 1964g, p. 1131. (Florida, *Kalotermes approximatus* infesting dead wood area in living dogwood tree at Gainesville, Alachua County.)
- 1964h, p. 1164. (California, Fremont, Alameda County *Reticulitermes hesperus* invaded nursery cans of young citrus trees and girdled plants.)
- 1964i, p. 1186. (Alabama, *Reticulitermes flavipes* destroying cornstalks in southern parts state to Tennessee Valley, infestations heavier in late corn and smaller fields bordering woods and fence rows. In Lee County several stalks sugarcane destroyed.)
- 1964j, p. 1190. (Alabama, *Reticulitermes flavipes* destroying mature watermelons in Morgan County.)
- 1964k, p. 1192. (Florida, *Reticulitermes flavipes* 10% of 5000 peat and peperomia samples severely damaged in nursery at Apopka, Orange County.)
- 1965, p. 241. (California, Fresno, *Reticulitermes hesperus* damaging rooting grape cuttings.)
- 1965b, p. 340. (Florida, Fort Lauderdale, Broward County, *Reticulitermes hageni* in areas between bark and apparently healthy wood at ground level upward to 10-12 inches, grapefruit tree, not burrowed.)
- 1965e, p. 417. (Texas, Montague County,

Gnathamitermes sp. workers on pasture grasses.)

- 1965l, p. 655. (North Carolina, Kalotermes approximatus infested white oak near Newton Grove, Sampson County, infestation 30 feet above ground.)
- 1965n, p. 748. (Texas, Motley County, termites damaged large, spotted areas pasture grass in Motley County.)
- 1965p, p. 884. (Texas, Montague County (week ending July 30), *Amitermes* sp., light local infestations of range grasses.)
- 1965q, p. 901. (Honolulu, Hawaii, *Incisi*termes immigrans caused considerable damage to bathroom floor, rare case of infestation in a house of this lowland tree species—week ending July 30.)
- 1965u, p. 1002. (California, Summit City, Shasta County, medium infestation in roots pepper plants, week ending August 20.)
- 1965x, p. 1078. (Missouri, Callaway County, Fulton area, *Reticulitermes flavipes* infesting chrysanthemums, week ending September 3.)
- 1965c¹, p. 1125. (Delaware, New Castle County, *Reticulitermes flavipes* unusual infestation in stems living geranium plants, week ending September 17.)
- 1965d¹, p. 1184. (Ohio, Darke County, termites unspecified species feeding on sweet corn in garden, week October 8.)
- 1965g¹, p. 1264. (Oklahoma, Grandfield area, Tillman County (week ending Nov. 5) *Gnathamitermes tubiformans* moderate to heavy on grass and dead weeds on roadsides and in pastures.)
- 1965h¹, p. 1265. (North Carolina, Fayetteville, Cumberland County, July 9, Kalotermes approximatus in walnut tree.)
- 1966d, p. 96. (Texas, *Amitermes* sp. pest of small grains oats Madison County, week ending Feb. 4.)
- 1966i, p. 222. (Indiana, Richmond, Wayne County, *Reticulitermes* sp. workers attacking juniper grafts in greenhouse, week ending Mar. 18.)
- 1966k, p. 246. (Florida, Gainesville, Alachua County, *Kalotermes approximatus* in branch scars and tree holes laurel oak, mid-March.)
- UTHAISILP, C., 1962a, pp. 493-502. (Siam, control ground termites.)
- VAN ARK, H., 1961, pp. 46-48. (South Africa, Karoo, Hodotermes mossambicus damage by harvesting.)
 - 1964, pp. 121-124. (South Africa, Hodotermes mossambicus, Microhodotermes

viator and Trinervitermes harvesting termites pests of the karoo.)

- WEIDNER, H., 1962, pp. 86-93. (Sudan, pests of cotton, coffee, peanuts, wood stakes, *Microtermes thoracalis* most injurious, *Pseudacanthotermes harrisensis* damaged stakes.)
- WILKINSON, W., 1965, pp. 669-670. (Damage to living trees falls into two main divisions, colony based on and confined to single tree, restricted range termites; free range termites, forage distance from nests, colony attacks many trees. Former confined to primitive Kalotermitidae and Termopsidae, latter include Mastotermitidae, Hodotermitidae, Rhinotermitidae, and Termitidae. Free range termites in Africa damage both young and old trees in plantations. Coptotermes principal attacker grown trees. By far greatest damage to young trees by the Termitidae. Control by destruction nests or by preventing approach, former method uses toxic smoke or fluid, latter by repellents. Treatment young plants in

nursery most economical; insecticide mixed in potting soil as dust or watered on young stock as an emulsion. In deep planting field treatment necessary, mix insecticide in hole when planting.)

- WILLIAMS, R. M. C., 1965, pp. 675-676. British Honduras, Coptotermes niger attacking Pinus caribaea, 80% frequency infestation of this highly resinous forest tree in some areas. Brown rot, Lentinus pallidus, is present in all cases heartwood infestation; termite infestation wholly secondary. Laboratory tests show scarcely any feeding in sound untreated heartwood, length life in rotton heartwood grossly greater. Greater part of repellence to feeding removed by removal of turpentine fractions.)
 - 1965a, pp. 1-31. (Idem., also general collection of termites from British Honduras and adjacent countries.)
- WYNIGER, R., 1962, p. 12, 457-463. (Warm climates, Isoptera injury to crops, termite species listed under crops.)

DETECTION

- DEORAS, P. J., 1962, pp. 101-103. (India, Bombay, *Odontotermes* mound-building termites primary colony and queen cell located by magnetic compass, queen parallel to magnetic meridian.)
- HARRIS, W. V., 1961a, pp. 228-232. (General, drywood termites can be detected by small holes on surface of wood, closed by a hard plug and pellets of excrement. Subterranean termites build covered runways over surfaces, they use their excre-

DIGESTION

- RAO, K. P., 1962, pp. 71-72. (India, Heterotermes indicola, experiments with freshly collected termites and those with the symbiotic protozoa removed showed that termites possess in the middle and posterior regions of the gut a number of proteolytic enzymes for protein digestion. These enzymes are produced by the gut itself. Cathepsin, however, only present in the freshly collected termites, is produced by the symbionts, where with the protozoa its activity is highest in the anterior part of the gut.)
- SEIFERT, K., 1962, pp. 161-168. (Chemical change in the wood cell wall components under the influence of animal and plant

ment to seal off galleries. The mound builders bring up soil into their large galleries. 110 different species damage buildings, etc., in various parts of the world, 50 are regular pests.)

SCHERZINGER, B. C., 1962, p. 66. (U.S., subterfuges to cover up signs of infestations by subterranean termites in order to sell buildings. Paint walls and wood, tube will show under one coat paint, cover over damaged wood, etc.)

damage. The decomposition of the chemical elements of pine heartwood and sapwood during digestion by Kalotermes flavicollis was determined analytically after the insects had been kept on wood samples of given composition and weight. So the average feeding capacity and substance loss through respiration could be determined per specimen. Only a small remainder of cellulose, probably combined with lignin is left. The decisive effect on the hydrolysis of polysaccharides of termite protein is discussed. Lignin is decomposed to a smaller extent, in this process protocatechuic aldehyde is produced. Wood in an early stage of brown rot showed approximately the same degrees of decomposition as sound wood. Analysis of beech wood and termite pellets showed quite similar degradation, with some divergences.)

1963, pp. 85-96. (Chemical parallels in the decomposition of wood substance by organisms, fungi, and *Kalotermes flavicollis*. Chemically, decomposition of wood effected by animals and fungi according to definite laws. Metabolism as follows: participation of carbohydrates takes place within a major range of decomposition, when lignin can be decomposed imperfectly only. Decomposition wood determined by ferment system effective on the lignin. White rot fungi possess such a ferment, brown rot fungi do not. The defensive properties of wood can be detected biologically but not by chemical analysis. The activities of enzymes of wood destroyers react in the same way as the corresponding substrates are concentrated in the wood.)

YOKOE, Y., 1964, pp. 115-120. (Japan, cellulase activity in the termite *Leucotermes speratus*, with new evidence in support of a cellulase produced by the termite itself.)

DISEASES, HUMAN, PLANT, AND TERMITE

HAGLEY, E. A. C., 1964, pp. 905-906. (Role insects as vectors red ring disease coconut palm in Trinidad.)

DISTRIBUTION

- AHMAD, M., 1962, pp. 67-68. (West Pakistan, greater part arid, termite fauna not rich, yet 41 species occur including 8 undescribed. In the families Kalotermitidae, Hodotermitidae and Rhinotermitidae only two species occur in each. The termitid genera include Odontotermes, Microtermes, Microcerotermes, Eremotermes, Amitermes, Capritermes, and Angulitermes.)
- BASHIR, N. A., 1963, pp. 48-49. (Punjab, India, list 16 species termites in 10 genera and 4 families, soldiers and imagos measured, described, and drawn. Abstract paper presented at 34th ann. meeting Colo. State Univ., May 3-4, 1963.)
- BECKER, G., 1962, pp. 143-165. (Collecting notes and observations for India between September and December 1956, habitats and previous records are given, maps show distribution, nests, and damage figured, and the most important economically for buildings are listed; three new species were found, one the first representative of a new genus, have been described by others.)
- BEEBE, W., 1924, p. 101. (Galapagos Islands, Eden Island, under small bit of lava limited colony of termites, tunnels several inches into soil, no queen, soldiers like workers unusually elongated.)
- BEI-BIENKO, G. YA., 1964, pp. 174-176. (European SSSR, Kalotermitidae and Rhinotermitidae.)

- BOUILLON, A., 1958, pp. 198-209. (Africa, Katanga list of 2 families, 5 subfamilies, 22 genera, 54 species, and I subspecies (as of 1956), as comparing with 3 families, 7 subfamilies, 57 genera, 306 species, and II subspecies for the Belgian Congo.)
- BOUILLON, A., LEKIE, R., and MATHOT, G., 1962, pp. 1-35. (Africa, ecological problem nests *Apicotermes*, in forest, savanna, mobility of the society, horizontal and vertical distribution, influence of different microclimate, distribution species related to types of vegetation, altitude, soil, and the barrier which bounds the flow of the Congo River.)
- BULTER, G. D., 1961, p. 381. (Laysan Island, Cryptotermes brevis.)
- CLAGG, C. F., 1965a, p. 15. (Guam, a termite different from *Coptotermes formosanus* and *Prorhinotermes inopinatus* found within 100 yards of edge of Apra Inner Harbor. Nearly 1000 specimens workers, soldiers and a few nymphs found in 2 wooden boxes on ground. Two types soldiers present.)
- COATON, W. G. H., 1962b, pp. 144-156, pls. 1-6, 9-11. (South Africa, Kruger Natl. Park, survey of Isoptera, 330 termite accessions were gained in 1959-1960, in the families Kalotermitidae, Hodotermitidae, Rhinotermitidae, and Termitidae. Of the 32 genera of Isoptera recorded from the Republic of South Africa only 10 have

not been found in Kruger Natl. Park. A new species of *Apicotermes* was collected and the new genus *Fulleritermes* formed of species erroneously in *Coarctotermes* Holmgren, s. lat. Distribution maps for South Africa are appended for *Epicalotermes* Silv., *Bifditermes* Krish., *Odontotermes* Holmg., *Porotermes* Hag., *Kalotermes* Hag., *Trinervitermes* Holmg., *Apicotermes* Holmg, *Coarctotermes* Holmg. s. str., and *Fulleritermes* gen. nov.

- 1963, pp. 38-50. (South Africa, Kalahari thornveld and bushveld, survey of Isoptera. The only mounds encountered in Kalahari Gemsbok Park were constructed by species of Trinervitermes; the only other termite with readily visible surface structures were the small peaked dumps of Hodotermes mossambicus. Maps show the route traveled, the distribution in the Republic of South Africa of the genera Hodotermes, Psammotermes, Microcerotermes, Amitermes, Lepidotermes, Cubitermes, Promirotermes, Angulitermes, Allodontermes, Macrotermes, Odontotermes, Microtermes. Trinervitermes. and Fulleritermes. Collecting sites and nests are figured.)
- 1964, pp. 90-103. (National survey termites South Africa, 31 genera, 6 Kalotermitidae, 4 Hodotermitidae, 3 Rhinotermitidae, the remaining genera 13 are Termitidae, distribution and nesting given.)
- FERNANDO, H. E., 1962, pp. 205-210. (Ceylon, 3 families, 23 genera, 61 species, 49 forms peculiar to Ceylon, lists 10 very common species, general biology, winged adults are produced at earliest in 2 years and 7 months, neoteinics develop as needed. Kalotermitidae damage tea and rubber.)
- GHILAROV, M. S., 1962a, pp. 131-135. (U.S.S.R., European portion, termites Reticulitermes lucifugus in Ukraine in south, northern border of range, subterranean type, Calotermes flavicollis occurs in Caucasus only. Central Asia, Turkmenia, Microcerotermes sp., Amitermes vilis, Anacanthotermes ahngerianus, and A. turkestanicus, two latter soil termites, associated with certain plant species, A. turkestanicus is less xerophilous and hence more injurious.)
- GONÇALVES, C. R., and SILVA, A. G. A., 1962, pp. 193-208. (Brazil, 51 species termites listed, with notes.)
- HARRIS, W. V., 1953, pp. 13-14. (St. Helena,

Jamestown, as early as 1863 termite damage to buildings occurred, supposedly introduced 20 years previously in timber from the Guinea Coast. This proved to be *Heterotermes platycephalus* Froggatt of Australia. *Cryptotermes brevis* was discovered at Jamestown in 1939, thus combining the damage caused by a drywood termite with that of a subterranean.)

- 1962, pp. 614-617. (Termites are found in France, Germany, and all countries on the Mediterranean and Black Sea; the native European Reticulitermes lucifugus a subterranean termite and Kalotermes flavicollis a drywood termite and the immigrant from the United States, Reticulitermes flavipes. In Italy growing concern for damage to old buildings between 1940 and 1945 led the government to set up a commission to study the problem. In France about the same time it was discovered damage was not restricted to old buildings and that they were present in 25 departments south of the River Loire in the southwest and south and in 4 "arrondisements" of Paris. Kalotermes flavicollis does not reach so far north, stopping at the Pyrenees. It not only damages vines, but the wood of bridges, mooring posts and buildings. Polyethylene and Polyurethane foam plastics have been damaged by termites, not for nourishment but to use in building shelter tubes.)
- 1963, pp. 1-9. (Hong Kong, 7 species termites known, 1 Kalotermitidae, 2 Rhinotermitidae, 4 Termitidae, compared with 25 for China.)
- 1963a, pp. 1-43. (Africa, Congo, Garamba Natl. Park, Guinean savanna type termite fauna, 34 species listed, 4 new; 1 Kalotermitidae, 2 Rhinotermitidae, 31 Termitidae.)
- HICKIN, N. E., 1963, pp. 267-284. (Europe, Reticulitermes lucifugus, var. santonensis of the Charente Maritime, France, has larger colonies and is more injurious than *R. lucifugus*, it is more robust than the typical form of the Dordogne Valley in the edges of woodland of maritime pine. Kalotermes flavicollis is found at Banyuls-sur-mer on the Mediterranean coast of France, it damages the stocks of the older grapevines. It cuts the life of the vine stock. *R. lucifugus* occurs in the Banyuls in dead pine stumps.)

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- IKEHARA, S. (1957) 1963, pp. 9-14. (Ryukyu Islands, termite fauna, 9 species, 4 Kalotermitidae, 2 Rhinotermitidae, 3 Termitidae, listed as common, rare and one Kalotermitidae as doubtful, map showing distribution, economic significance discussed, damage to buildings and trees and nests illustrated.)
 - 1961, pp. 1-3. (Japanese Archipelago, formula developed to determine the northernmost limits of geographical distribution of termites at the northern hemisphere. Data given on temperature (in C.) for knowing northwest limits of termites in Ryukyu and Japanese Archipelago. Pt (lowest preferred temperature) – At (mean daily temperature in coldest month) + DT(difference of mean daily temperature between inside the nest and outside in the coldest month at the northern limit.) Hodotermopsis japonicus—1.6; Kalotermes koshunensis —0.9, K. kotoensis—0.7, K. fuscus 0.5; Leucotermes speratus 7.6; Coptotermes formosanus-0.5; Odontotermes formosanus-1.3; Eutermes takasagoensis 1.3. A map shows the northern limits of termite distribution in the Ryukyu and Japanese Archipelago.)
- JACQUIOT, M. C., 1965, pp. 623-625. (France, a colony of *Reticulitermes santonensis* at Varennes-sur-Loire (Meuse et Loire.), damage in area and control.)
- KIRBY, C. S., 1965, pp. 310-314. (Ontario, Canada, *Reticulitermes flavipes* has been present for over 25 years. Economic damage was first reported in 1944 and has increased considerably in the last decade, particularly in the Toronto region. Termites have been found in four other localities in the Province.)
- KIRBY, C. S., and HARNDEN, A., 1963, p. I. (Canada, Ontario, termites in, *Reticulitermes flavipes* collected at Point Pelee, Essex County, 1929; more recently in Windsor and Oxley also in Essex County, Kincardine in Bruce County and Toronto in York County. In 1948 a survey in the City of Toronto showed eight heavy but extremely localized infestations in the southeastern part. Reexamination of the bait stakes in 1949 showed there had been very little spread except of an isolated case in the adjacent part of Scarborough Township. A second survey

of the Toronto area in 1952-1953 showed only slight extensions of previously known infested zones and no new infestations. More recent surveys in Toronto have indicated extensions of infestations both in the eastern and western parts of the city.)

- KRAUSS, N. L. H., 1961, p. 415. (Cook Islands, Aitutaki, Cryptotermes domesticus in plywood desk.)
- LINSLEY, E. G., and USINGER, R. L., 1966, pp. 125-126. (Galápagos Islands, list of six species of termites and distribution on various islands:

Fam. Kalotermitidae:

Kalotermes darwini Light

subgenus Cryptotermes

" galapagoensis Banks

- immigrans Snyder
- " fatulus Light
 - subgenus Cryptotermes

" pacificus Banks

Fam. Rhinotermitidae:

Heterotermes orthognathus Light.)

- LOSINSKY, W. A., 1958. (Termites in south Ukraine.)
- LÜSCHER, M., 1961, pp. 138-145. (Africa, airconditioning nests has made *Macrotermes* independent of outside temperature and humidity and the widest distribution of all African termites.)
- MACNAY, C. G., 1963, p. 105. (Canada, *Reticulitermes flavipes* near Kincardine railway station Ontario 10 years after report in 1954.)
- MATSUZAWA, H., 1963, pp. 99-104. (Japan, Shikoku Islands, distribution Kalotermes (Glyptotermes) fuscus (Oshima), K.
 (G.) satsumensis (Matsumura), Hodotermopsis japonicus Holmgren.)
- MATSUZAWA, H., and TANI, S., 1962, pp. 247-248. ((Formosa) Japan, distribution Katan termite *Glyptotermes fuscus* in southeastern district of Shikoku.)
- NOIROT, C., 1960, pp. 19-24. (South Africa, lists 1 Calotermitidae, 2 Termopsidae, 2 Hodotermitidae, 2 Rhinotermitidae, 5 Termitidae.)
- NUTTING, W. L., 1965a, pp. 1-5. (U.S., Southwest, northern Mexico, distribution seven species of economic importance.)
- PAULIAN, R., 1961, pp. 138, 385. (Malagasy: Order Isoptera comprises 66-67 species of which 4 are not endemic, distributed in 17 genera of which 2 are endemic. The affinities are clearly African, nevertheless Malagasitermes milloti is Asiatic. Microcerotermes is represented by 15

NO. 3

species, *Nasutitermes* by 10. Plate VIII, p. 148, shows *Coarctotermes clepsydra* mounds. *Neotermes europae* occurs on the Island of Europa.)

- 1962, p. 275. (*Cryptotermes brevis* collected at Tananarive, known distribution shown.)
- RICHMOND, E. A., 1962, p. 77. (U.S., Mississippi, Horn Island off Biloxi, Kalotermes snyderi, Reticulitermes sp.)
- ROONWAL, M. L., and BOSE, G., 1964, pp. VI-58. (India, Rajasthan, termite fauna recorded, 19 species and subspecies in 12 genera and 3 families, 3 new subspecies, divisions State Rajasthan shown on map as well as collecting sites.)
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- ROONWAL, M. L., CHHOTANI, O. B., and BOSE, G., 1962, pp. 51-54. (India, African genus *Psammotermes* and South American genus *Anoplotermes* found in desert areas of Rajasthan and Assam respectively, *P. rajasthanicus* Roonwal and Bose and *A. shillongensis* Roonwal and Chhotani, distribution maps.)
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- SPENCER, G. J., 1963, p. 18. (Canada, Queen Charlotte Islands, British Columbia, first record Zootermopsis; extension range.)
- SPRINGHETTI, A., 1963b, pp. 105-122. (Sicily, Kalotermes flavicollis is more frequent than Reticulitermes lucifugus but the two species have a very similar distribution. Both live from 0 to past 1000 meters above sea level, but along the coast it is a zone from a few meters to some hundred meters where R. lucifugus is

almost absent. A map shows this distribution.)

- STIRN, J., 1963, pp. 239-269. (Yugoslavia, distribution *Kalotermes flavicollis* and *Reticulitermes lucifugus*, localities on map.)
- U.S., DEPT, AGRICULTURE, PLANT PEST CON-TROL DIV., 1963d, p. 533. Miscellaneous insects. (Nevada, Pine Creek, Spring Mountains, Clark Co., *Incisitermes minor* injuring velvet ash trees.)
 - 1963e, p. 698. Hawaiian insect notes. (Maui, Wailuku, April 23, 1963, Coptotermes formosanus infesting building, another at Kahului; infestations localized and "ground termite free" Maui will attempt to eradicate this termite.)
 - 1963g, p. 1120. Household and Structural insects. (North Dakota, *Reticulitermes flavipes*, east central McKenzie County one location, and in central Billings County two locations. *Reticulitermes tibialis*, east-central McKenzie County and central Billings County, two locations, southwestern Slope County and northwestern Slope County, two locations. *Reticulitermes* sp. in eastern Emmons County.)
 - 1964a, p. 222. Hawaiian insect notes. Maui, Kahului, and Wailuku, *Coptotermes formosanus* discovered in April 1963, eradication program instituted.)
 - 1964e, p. 363. (Nye County, Nevada, Incisitermes minor recorded.)
- VISHNOI, H. S., 1962, pp. 107-109. (India, Delhi, list of termites and habits of 11 of 13 species recorded, *Eremotermes paradoxalis* do not shed wings until they pair, *Microtermes mycophagus* fungus bed in shelter tubes of damaged office table.)
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McKenzie and Billings counties: R. tibialis, McKenzie, Billings and Slope counties; Reticulitermes sp., workers, McKenzie, Billings and Emmons counties.)

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EMBRYOLOGY

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 - 1962a, pp. 247-254. (Human cultural evolution and its relation to organic evolution of termites; biological evolution of termites is toward improved homeostasis or an increased regulation of optimal conditions of existence and continuance, and cultural evolution of man are probably based upon similar principles.)
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Isoptera, Palearctic, Central China subregion, Oriental, China-Burma and Southern tropical, faunal regions.)

ZONDAG, R., and GILMOUR, J. W., 1963, pp. 40-42. (New Zealand, list of termites in plantations and shelter belts of exotic conifers.)

Droplets of neutral fats are found between the vitelline platelets. The constitution of the follicles is completed at the beginning of interphasis. Important histochemical modifications accompany the classical structural changes of follicle cells; to be noted in particular a great increase in the ribonucleic acid content. Polysaccharides, proteins, and neutral fats also appear in the follicle cells during previtellogenesis. These histochemical peculiarities are related to the part played by the follicular epithelium in building up the oocytes with various metabolites.)

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- EVOLUTION

to oviposition. Wood-eating cockroach *Cryptocercus punctulatus* only very distantly related to the Panesthiinae, should be placed in Cryptocercidae.)

1964, pp. 1-197. (Mastotermes darwiniensis description of genital area, figured and compared with that of cockroaches, no muscled specimens available, p. 52. The proventriculus of Mastotermes darwiniensis as well as those of Zootermopsis sp. and Nasutitermes sp. when compared with those of cockroaches is distinctly primitive, p. 74. Other authors present morphological and biological data to show the relationship between termites and cockroaches, pp. 98 on. Probably the Blattaria are a suborder of the Dictyoptera with the mantids and the termites the other suborders. Miss McKittrick believes cockroaches have slowly declined since the Carboniferous period?) 1965, pp. 18-22. (Morphological evidence

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indicates that the Blattaria and Isoptera are more closely allied than generally recognized. Five families of cockroaches are recognized. *Cryptocercus* is placed in the Cryptocercidae most closely allied to the Blattidae.)

EXPERIMENTATION

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- BREADY, J. K., and FRIEDMAN, S., 1963, pp. 337-347. (Reticulitermes flavipes, early death of premoult fifth instar workers exposed to high oxygen tensions under pressure due to oxygen and not pressure per se. Exposure for one-half hour to 40% oxygen mixed with nitrogen at 3.5 atmospheres of pressure produces early death, but carbon dioxide appears to exert a protective effect, since 70% or more oxygen is required to kill when mixed with this gas. The consequence of exposure to these concentrations of oxygen assumes its final form at the onset of ecdysis, when the premoult animals become paralyzed, incapable of moulting, and die within 2 days. The intestinal protozoa of the fifth instar worker are killed at a concentration of 30% oxygen when mixed with carbon dioxide and 60% oxygen when mixed with nitrogen at this pressure, so they are probably not involved in the poisoning of the termite. Adult secondary reproductives and soldiers are unaffected by oxygen at 3.5 atmospheres of pressure, as are second instar larvae.)
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- 1964a, pp. 491-510. (Comparison made on ability *Microcerotermes edentatus* to utilize sound wood and wood partially decayed by fungi; decayed wood preferred, termites attracted by degradation products. Some fungi produce toxic substances. *M. edentatus* possesses enzymes other than cellulase and cellobiase, which degrade lignin, termites modify wood differently than primitive species with intestinal flagellate symbiotes.)
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 - 1960a, pp. 115-135. (Italy, Kalotermes flavicollis, symptoms of BHC poisoning on termites confined with small sheet of glass sprayed with 1 or 0.5% BHC. Stages of initial and total knockdown. following a period of excitement, occurred after 5-20 and 30-55 minutes, respectively, on glass sprayed the same day and after 35-45 and 60-110 minutes on glass treated up to 12 days previously. Termites left in contact with the toxicant died in 3.5 days, but survived for up to 13 days if removed after knockdown. The loss of intestinal symbionts, either from gamma BHC or excessive excretion produced by it, prevented termites from assimilating wood.)
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- SEN-SARMA, P. K., 1962, pp. 292-297. (India, Dehra Dun, Odontotermes assmuthi flight 4th week June, only a single swarm after heavy shower rain, about 4:30 p.m. while enough sunlight, no flight when cloudy. Soldiers and workers guard

FOOD, TERMITES AS

CONNORS, J., 1963, p. 2B. (U.S., Hialeah, Florida, a case believed to be unique in medical history of a 26-year-old housewife, when hospitalized for severe cramps and abdominal pain, physicians discovered numerous termites living in her stomach. This case is described in the current issue of the Journal of the 1960b, pp. 141-145. (Italy, *Kalotermes flavicollis*, orthodichlorobenzene applied to filter paper above termites in a closed petri dish. The fumigant was rapid in action, and the stages of intoxication were not as distinct as for gamma BHC. Initial and total knockdown usually occurred in 2-10 and 12-36 minutes, respectively.)

- SCHMIDT, H., 1961, pp. 8-11. (Europe, Germany, the effect of X-ray on the wood destroying termite *Reticulitermes*.)
 - 1963, pp. 20-23. (Germany, results of experiments with *Reticulitermes flavipes* and *lucifugus* as laboratory animals, and their biological and test techniques characteristics were compared.)
- SEN-SARMA, P. K., 1964, pp. 300-314. (Effects of temperature and relative humidity on the longevity of pseudoworkers of *Kalotermes flavicollis* described and illustrated.)

FLIGHT *

exit holes, alates emerge singly. After swarm workers seal holes, sexes more or less equal in proportion. Wings shed by violent up and downward bending followed by lateral twist of abdomen. Calling attitude taken by female only after wings shed, attraction visual not scent. Tandem behavior only female male.)

WILKINSON, W., 1962, pp. 265-286. (West Africa, Nigeria, *Cryptotermes havilandi*, alate at first positively phototactic, main flights at dusk between 6 and 7 p.m.; heavy flights continue until 10 p.m. Peak of activity in drier months January and February but flights occur every month. After a change to negative phototaxis and shedding of wings, a nest site is sought; no tandem behavior.)

American Medical Association. The patient had been living in a 15-year-old frame house and eating dinner in a darkened room, while watching television. This room had sagging wooden strips hanging from the ceiling. Winged insects in the room had been identified as termites. The patient received no

^{*} Most records of indoor flights are under the heading "Damage."

therapy, the termites passed from her body, recovery was uneventful.) Fox, R. M., and Fox, J. W., 1964, p. 20.

- Fox, R. M., and Fox, J. W., 1964, p. 20. (Africa, swarming termites, dealated, fried in palm oil, eaten by tribes in W. African rain forest. In Leopoldville sold in native markets, analyzed found that each 100 grams was 44.4% fat, 36% protein, and included available calcium, sulfur, and iron; the caloric value was 561.)
- GOODALL, J., 1963, pp. 304-308. (Gombe Stream Reserve, Tanganyika, Gombe subspecies chimpanzee in forest fish for termites in mounds, use stems of grass, vines or twigs stripped of leaves, termite cling to these tools, chimpanzees eat winged termites off stems; clasp stem between short thumb and side of index finger. Termites form major part of diet for 2-month period. Chimpanzees carry tools to termite mounds. Method social

tradition, crude and primitive culture, unknown whether similar tradition among other chimpanzee populations.)

REYNOLDS, W. B., JR., 1963, p. 426. (U.S., Florida, 26-year-old white Hialeah, housewife when hospitalized for severe cramps and lower abdominal pain passed insects later identified as the nymphal stage of the common wood-eating termite by the Univ. of Miami School of Medicine. The insects were quite viable. The patient had been living in a 15-yearold wooden frame house and frequently ate dinner in a darkened room watching television. The room had sagging wooden strips hanging from the ceiling. Winged termites had been noted swarming in the room and outside the house. The patient received no therapy and recovery was uneventful. The family moved from the house.)

FOSSIL

- EMERSON, A. E., 1965, pp. 1-46. (Review Mastotermitidae, Uralotermes permianus removed from Isoptera and assigned to order Protorthoptera; Idomastotermes mysticus removed from Mastotermitidae to uncertain status; Diatermes sibiricus removed from Mastotermitidae but kept in Isoptera; Pliotermes placed in synonymy with Mastotermes; Spargotermes costalimae n. gen., n. sp. described and figured from Miocene-Pliocene, Fonseca, Minas Gerais, Brazil, winged holotype with most primitive venation. Synonymy of various species Mastotermes given. Maps world distribution included.)
- HURD, P. D., JR., SMITH, R. F., DURHAM, J. W., 1962, pp. 107-118. (Mexico, Chiapas, fossiliferous amber, late Oligocene or early Miocene, 15 orders insects, 81 families, 2 species termites, one still living.)
- LANGENHEIM, J. H., and BECK, C. W., 1965, pp. 52-54. (The consistency in infrared spectra in relating resin of living *Hymenaea courbaril* L. with amber from Chiapas, Mexico, has been corroborated by plant and insect fossils in this amber,

and habitat conditions. Little evidence for major evolutionary change since the Oligo-Miocene is presented.)

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- MARTYNOVA, O. M., 1962, In Rodendorf 1962, pp. 112-113. (Describes characteristics for order Isoptera, superfamily, five families, distribution, geological age, figures wings for six species.)
- TESSIER, F., 1959, pp. 91-132. (Africa, Senegal, Dakar, Neocene, fossil termitaria in laterite, structures described and illustrated.)
 - 1959a, pp. 3320-3322. (Africa, Dakar, in lateritic gravel, round or ovoid chambers connected by tunnels, fossil termitaria.)

FUMIGATION

ANONYMOUS, 1962d, p. 1. (U.S., Houston, Texas, fumigation floating drydock for *Coptotermes crassus*, 7 sections each 116 feet wide, 88 feet long, 50 feet high, pier 750 feet long, 50 feet wide, 20 feet above water line, ramp and wharf area approximately 700 feet long, 60 feet wide, 12 feet above water line, 2,500,000 cubic feet involved. Water was bottom seal tarps, gas induction hoses were installed in top of wing walls and ran across to pier to heat exchangers, some were 300 feet long, ¾-inch heavy duty rubber hose with Neoprene center. 8½ weeks or 5000 man hours required, 207,000 pounds methyl bromide, 16,000 square yards coated Nylon tarps. Hurricane Debra destroyed one week's work, \$3,500,000 worth equipment. Fumigation by Admiral Pest Control, Bellflower, Calif., successful.)

- 1962e, p. 4. (U.S., Neil A. Maclean Co. seminar on Vikane El Monte, Calif., distributed fumiguides to fumigators, slide rule type instrument fed data on variables met in fumigation, after proper adjustments on the guide, fumigator can read directly number of ounces Vikane per thousand cubic feet needed.)
- 1962k, pp. 10, 23. (California, specifications for sealing, application, circulation, dosage, etc.)
- EHMAN, N., 1963, pp. 18-19. (U.S., California, partial fumigations possible with Vikane, single rooms or portions of a house, careful sealing, 20 hours exposure, aired. Demand proportionately higher price, constant supervision.)
- GIPE, R. F., 1963, p. 62. (Philippines, Baguio City, fumigation of an old church, infested with subterranean termites, with ethylene dibromide. Drilled through concrete block floor, poured concentrated chemical in hole, tightly sealed hole. One week after treatment halide gas detector revealed no trace of soil fumigant, treatment effective; will be used with residual chemical in future control.)
- HASSLER, R. K., 1961, pp. 12, 14. (U.S., sufficient length ¹/₄-inch polyethylene tubing leading from desired spots to a measuring device necessary to obtain air samples. Other basic points outlined.)
- HICKIN, N. E., 1961a, pp. 205-206. (England, methyl bromide in laboratory Kalotermes, Reticulitermes, Zootermopsis, 48 hours, temperature average over 70° F., relative humidity about 60%, 100% kill.)
- LANCE, W. D., 1962, p. 16. (U.S., Florida, fumigation drywood termites with "Acritet 34-66," Acrylonitrile 34% carbon tetrachloride 66% (Acrylonitrile

also called Vinyl Cyanide or Cyanoethelene), warning odor, least toxic to man, ventilates rapidly, does not accumulate in human body.)

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- MEIKLE, R. W., STEWART, D., and GLOBUS, O. A., 1963, pp. 226-230. (U.S., fumigant mode action: drywood termite [Kalotermes minor] metabolism Vikane fumigant as shown by labeled pool technique. Inorganic fluoride the primary poison.)
- NoLAN, T., 1962, pp. 48, 52. (U.S., Miami, Florida, White Temple, Baptist Church, tarp fumigation with Acritet gas, 48-hour exposure, faulty wiring caused a fire, tents slightly damaged.)
- OGLE, J. A., JR., 1962, pp. 82, 84-86. (U.S., California, complete fumigation van, carries butane tank and heat exchanger for methyl bromide, aqualungs, tarps, fumigant cylinders, work tables, ladders, wheelbarrow, etc.)
- Ross, G. M., 1962, pp. 60, 62. (U.S., Tampa, Florida, seagoing schooner *Carrie Bernice* fumigated to kill drywood termites, wooden vessel covered with 10-ounce nylon tent, sash weights sunk tent below water line, attached by metal clamps. Methyl bromide 4 pounds per 1000 cubic feet space for 24 hours, fans used for circulation, successful, by Arab Termite and Pest Control.)
- STEWART, D., 1962, pp. 24, 26, 28. (U.S., California, drywood termites, use of Vikane, sulfuryl fluoride, successful fumigation depends on proper balance fumigant concentration, its confinement, exposure period and temperature.)
- STEWART, D., and MEIKLE, R. W., 1964, pp. 2, 14, 15, 16. (U.S., post-fumigation aeration of Vikane in termite infestation in buildings.)
- SUNDIN, B., 1963, pp. 12-13. (U.S., California, 79 Los Angeles County communities require fumigation reporting regulations: 24 hours report before commencing job; guard required; inspection required; Fire Department permits; panlocks required on sealing jobs; notice to Health Dept.; notice to Police Dept.)
- THOMAS, E. D., 1964, pp. 56-61. (South Africa, *Cryptotermes brevis* control by methyl bromide.)

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FUNGI, ASSOCIATION WITH

- BAKSHI, B. K., 1962, pp. 117-119. (Both *Termitosphaeria* and *Xylaria* simultaneously present in fungus comb, termites suppress latter. Fungi render wood cellulose more easily available to certain termites. In the Macrotermitinae double symbiosis fungus and bacteria. Some fungi parasitic on termites. Fungus gardens play large part in conditioning microclimate termite nests. Termites disseminate fungi, both break down cellulose.)
- BECKER, G., 1965a, pp. 95-156. (Observations in nature and in buildings indicate a preference of termites for wood attacked by fungi. Tests show differences exist in behavior of termite species and action of species and strains of fungi. Fungi influence on termites in the wood nutrition can be favorable or harmful.)
- BECKER, G., and KERNER-GANG, W., 1964, pp. 429-448. (Influence of about 30 species of mold fungi on 4 species of termites from temperate and tropical regions tested in laboratory. Effect ranges as toxic, to usefulness as a nutriment. Variations among different species of fungi but also with different strains of one species.)
- DAYAL, H. M., NIGAM, S. S., and SAXENA, M. S., 1965, p. 48-50. (India, role of *Termitomyces* species in termitarium of

Odontotermes obesus, white spheres in nests maintain suitable humidity.)

- LUND, A. E., 1962, pp. 30-34, 36, 60-61. (U.S., association wood-destroying fungi and subterranean termites, discusses influences in detail.)
- 1963, p. 78. (U.S., among wood-destroying fungi one fungus produces metabolites (end products) toxic to termites, another increases the laboratory life of termites, a third produces an attractant, a fourth which exhibits a repellent action and others that are neutral. One common soil fungus is harmful. Certain fungi may affect termites in more than one manner. As yet some relationships are not supported by laboratory or field evidence.)
- RUDMAN, P., 1965, pp. 52-58. (Causes of decay, termite resistance in *Callitris columelaris*, toxicity of wood extractives.)
- WILLIAMS, R. M. C., 1965, pp. 675-576. (British Honduras, Coptotermes niger attacking Pinus caribaea, brown rot, Lentinus pallidus, is present in all heartwood infestations, termites wholly secondary. Laboratory tests show scarcely any feeding in sound untreated heartwood; length life in rotton heartwood grossly greater. Greater part of repellence to feeding removed by removal of turpentine fractions.)

FUNGUS CULTIVATION

- CHEEMA, P. S., DAS, S. R., DAYAL, H. M., KOSHI, T., MAHESHWARI, K. L., NIGAM, S. S., and RANGANATHAN, S. K., 1962, pp. 145-149. (India, Odontotermes obesus, in fungus garden temperature constant during day 23°-33° C., humidity 86%-100%, variation from season to season, temperature during winter 18°-25° C., summer 28°-32° C., humidity varied between 85%-95%, can function under wide range.)
- DAS, S. R., MAHESHWARI, K. L., NIGAM, S. S., SHUKLA, R. K., and TANDON, R. N., 1962, pp. 163-165. (India, *Odontotermes obesus*, micro-organisms from fungus garden, fungi and bacteria, both listed, also from guts worker, soldier and

nymph termites, fungus spheres eaten as accessory food.)

- DIXON, P. A., 1959, pp. 93-94. (Africa, *Termitomyces striatus* reproductive capacity.)
- HARRIS, W. V., 1964a, pp. 78-81. (Africa, Sudan, *Pseudacanthotermes;* primitive fungus comb of *P. harrisensis,* other species possess a much more developed comb.)
- SANDS, W. A., 1960, pp. 251-259. (Ancistrotermes guineensis, laboratory colonies, fungus comb constructed from feces of worker, workers introduce basidiospores Termitomyces in foraging. Phylogeny Macrotermitinae reviewed.)

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GASEOUS ENVIRONMENT

- DAMASCHKE, K., and BECKER, G., 1964, pp. 157-160. (Increases of respiration occurred usually if the atmospherics showed minima independent of the daily rhythm, reductions of O₂ consumption with the occurrence of maxima. Atmospherics refer to temperature, humidity, and atmospheric pressure.)
- Howse, P. E., 1964, pp. 90-99. (Lüscher has shown that an "air-conditioning" system is present in the mounds of the African *Macrotermes natalensis*, whereby hot air arises from the center of the nest and is cooled in large canals near the surface of the mound. The air is in constant circulation and some gas exchange takes place near the surface of the mound; an
- BANERJEE, B., 1965, pp. 435-436. (Structure of the male reproductive organs of Odontotermes redemanni.)
- DEWILDE, J., In Rockstein 1964, p. 12. (Some termite queens have more than 2000 ovarioles in each ovary.)
- LEBRUN, D., 1961, pp. 235-242. (*Calotermes flavicollis*, evolution of the genital apparatus in the diverse castes, detailed descriptions, figures.)
- SPRINGHETTI, A., and GELMETTI, L., 1960, pp. 377-382. (Male genital apparatus morphology and functional activity studied in winged *Reticulitermes lucifugus*, *R. flavipes*, *R. hageni*, *R. tibialis*, and *R. hesperus*; for *lucifugus* other castes and stages have been studied.)
- SPRINGHETTI, A., and ODDONE, P., 1962, pp. 1-9. (Kalotermes flavicollis two oocytes in testicle soldier, structures compared
- BOYER, P., 1958, pp. 749-751. (Africa, effect of reworking by termites and of erosion on the pedogenetic development of the mounds of *Bellicositermes rex.*)
 - 1959, pp. 41-44. (Intertropical zone, influence of termites on the conformation of certain soils.)
- CONRAD, G., 1959, pp. 2089-2091. (Algeria, Béni-Abbès region, role of termites in Quaternary soil formations.)
- DAVIES, O., 1959, pp. 290-291. (Equatorial Africa, Ghana, termites and soil stratifica-

effective "respiratory system" is therefore present.)

Lüscher, M., 1961, pp. 138-145. (Africa, air conditioning and keeping the needed amount of oxygen in the Macrotermes mounds is accomplished by exterior ridges which serve as a conduit carrying half a dozen or more narrow channels that link the air chambers in the cellar and the attic. The mass of termites and fungi in the nest proper keep the interior of the mound considerably warmer than the outside. The air flowing in the upper ends of the ridges contains more carbon dioxide and more oxygen in the lower ends. Air-conditioning mounds Macrotermes has led to its widest distribution of African termites.)

GENITALIA

with those in hermaphrodites of Neotermes zuluensis and Anacanthotermes ochraceus.)

- 1963, pp. 143-152. (Rhinotermitidae, male genitalia of some castes and stages, with particular attention to the form of the seminal vesicles, their contents, and to the testicles activity.)
- 1963a, pp. 311-334. (The activity of the testicles and function of the seminal vesicles differ for individuals of homologous castes or stages of four different primitive species.)
- 1964, pp. 146-150. (The male reproductive internal system and the form and contents of the seminal vesicles of the Kalotermitidae and Termopsidae (Hodotermitidae in part) have been described and figured.)

GEOLOGIC AGENTS

tion. Building and breakdown of nests (up to 40 cu. ft.) of *Macrotermes bellicosus* brings soil (believed from base of profile) to the surface, without serious warping of levels.)

- GHILAROV, M. S., 1962, p. 129. (Termite Conference formed in October 1960 in Ashkhabad, Turkmenia, U.S.S.R.; ecology; animals primary factors in soil formation, termites potent factors.)
 - 1962a, pp. 131-135. (U.S.S.R., termite tunnels contribute to decrease in evapora-

tion in soil, leads to better plant growth and soil formation.)

- GLOVER, P. E., TRUMP, E. C., and WATERIDGE, L. E. D., 1964, pp. 367-377. (Kenya, Loita plains, vegetation patterns based on numerous active termitaria of *Odontotermes* spp. Soil analyses suggest patterns develop on soil zones containing varying concentrations of colloidal matter washed by rainwater from the termitaria. Pattern shape is influenced by topography.)
- GOKHALE, N. G., SARMA, S. N., BHATTA-CHARYYA, N. G., et al. 1958, p. 229. (India, termites increase the potassium and calcium contents of tea soils, but decrease its nitrogen content.)
- GRASSÉ, P. P., and NOIROT, C., 1959, pp. 35-40. (Relationship between termites and tropical soils.)

- KEVAN, D. K., McE., 1962, pp. 55, 177-179, 184, 189 et seq. (Tropics, the role of termites in tropical soils, rapid disposal of cellulose-containing matter and the translocation of soil materials.)
- ROZANOV, B. G., 1963, pp. 63-67. (Burma, vital activity termites imparts favorable properties to soil, pH in upper layers changes from 6.2 to 7.5, the soil becomes enriched in nitrogen, the soil humus has a higher content of nitrogen and the soil becomes uniformly carbonaceous.)
- STEINBERG, D. M., 1962, pp. 11-16. (Central Asia, role of termites in soil formation processes, especially in takyr environments.)
- WATSON, J. P., 1962, pp. 46-51. (Southern Rhodesia, soil beneath termite mound.)

GLOSSARY

ERICSON, R. O., 1961, pp. 1-59. (United States, foreign language terms in entomology explained in English, illustrated drawings.) SNYDER, T. E., and FRANCIA, F. C., 1962, p. 77. (Glossary entomological terms used in keys.)

HUMIDITY

LÜSCHER, M., 1961, pp. 138-145. (Africa, Ivory Coast, humidity inside nest 98% to 99%, never below 96.2%.)

INTERNATIONAL COOPERATION

- KALSHOVEN, L. G. E., 1963b, pp. 289-294. (General, review, biology, damage, damage to forests, inorganic materials, influencing soil properties, research, international cooperation, control, physiology.)
- ROONWAL, M. L., 1962, pp. 9-16. (International cooperation required to solve several problems, introduction, standards of measurements in taxonomy, coordination in testing techniques, antitermite codes and specifications for buildings, assessment of damage.)

INTRODUCED

- ANONYMOUS, 1964a, p. 58. (East Central Africa, Uganda, *Cryptotermes dudleyi* found in woodwork of bus.)
 - 1964j, p. 94. (U. S., Cryptotermes brevis, Birmingham, Jefferson Co., Alabama.)
 - 1965i, p. 61. (U.S., infestation report, Incisitermes minor in shelf of home at Waukegan, Illinois, September. Zootermopsis angusticollis among Douglas fir lumber shipped from Honolulu to Hilo, Hawaii, February.)
- BALLANTYNE, W. J., 1964, pp. 50, 52, 54. (U.S., Chicago, Ill., Zootermopsis angusticollis infesting house, may have been in original lumber. Control by use of Woodtreat-TC with heptachlor, 8.5% pentachlorophenol and 0.5% heptachlor brushed on wood and mechanical repair.)
- BELL, J. L., 1965, pp. 46, 52. (U.S., Missouri, since 1961 drywood termites (Kalotermitidae) have been introduced in in-

fested furniture from California or Florida, three cases described, no spread to buildings, remedy fumigation.)

BESS, H. A., 1965, p. 1. (Hawaii, Coptotermes vastator Light, was collected for the first time on July 1, 1963, in boards from a building being demolished in the Kaimuki section of Honolulu by D. H. Lewis, a P.C.O. It was not identified as that species until early in 1965 by Dr. Frances Weesner Lechleitner. This destructive Philippine subterranean termite is closely related to C. formosanus Shiraki which has been a serious pest on Oahu for the past 50 years.

At present, no known infestation of *C. vastator* exist in Hawaii but it is probable that it has been established for some time. The colony from which the specimens were collected was strong and hundreds of alates were present. Survey studies will be made.)

- CONROY, W. L., 1963, p. 86. (First record outside Australia of *Mastotermes dar*winiensis found in Lae township area.)
- HICKIN, N. E., 1963, pp. 267-284. (Only five incidences accidental importation of termites into Britain recorded: Kalotermes sp. to Kew from E. Africa; Nasutitermes costalis to Spalding, Linc. from Martinique: Trinervitermes sp. to Croydon, Surrey; Zootermopsis angusticollis to London Docks or Bristol from W. Canada; and Cryptotermes brevis to Watford, Middx. from Trinidad.)
- MACNAY, C. G., 1961, pp. 135-136. (Ottawa, Ontario, Canada, *Reticulitermes flavipes* introduced from Florida, U.S. on cypress slab supports with potted *Philodendron*, May 1961.)
- MUMFORD, B. C., 1964, pp. 1-76. (U.S., plant pests intercepted July 1, 1962, through June 30, 1963, termites pp. 23, 24, 30, 33, 37, included Coptotermes formosanus, Cryptotermes brevis, Heterotermes convexinotatus, Incisitermes repandus, Kalotermes flavicollis, Nasutitermes chaquimayensis, N. corniger, N. ephratae, N. nigriceps and N. rippertii, as well as Reticulitermes flavipes and R. tibialis. The origin, hosts, and destination of the intercepted pests are given.)
 - 1965, pp. 1-76. (Idem, July 1, 1963, through June 30, 1964, termites pp. 3, 16, 22, 25, 26, 31, newly included termites are: Nasutitermes guayanae, Ncotermes chilensis, and Reticulitermes speratus.)

- 1966, pp. 1-88. (Idem, July I, 1964, through June 30, 1965, termites pp. 11, 19, 28, 30, 32, 38, 41, newly included termites are: Amitermes wheeleri, Coptotermes testaceus, Cryptotermes cavifrons, Heterotermes cardini, Microcerotermes arboreus, Neotermes connexus, Porotermes quadricollis, and Spinitermes trispinosus.)
- SNYDER, T. É., 1966, p. 73. (U.S., termite stowaways intercepted in United States from 1962 to 1966, list species.)
- U.S. DEPT. AGRICULTURE, PLANT PEST CON-TROL DIV., 1962a, p. 261. (Fort Smith, Sebastian County, Arkansas, *Kalotermes minor* introduced in furniture, March.)
 - 1962c, p. 1172. (Bethesda, Montgomery County, Maryland, *Kalotermes minor* in fir wood of building, October.)
 - 1962d, p. 1217. (Storm Lake, Buena Vista County, Iowa, *Kalotermes minor* infesting chest of drawers in home (October) brought from west coast 8 years ago.)
 - 1962e, p. 1252. (Kensington, Montgomery County, Maryland, *Cryptotermes brevis* damaged basement cupboard in home, part of wood came from Asia, infestation existed for several years. All insects and infested wood destroyed, November 24.)
 - 1963b, p. 119. (San Antonio, Bexar County, Texas, *Incisitermes (Kalotermes) minor* introduced in January in hardwood furniture.)
 - 1963f, p. 1087. (Wright-Patterson Air Force Base, near Fairborn, Greene County, Ohio, *Incisitermes minor* in wooden ceiling, June 18.)
 - 1963k, p. 1219. (Philadelphia, Penna., Incisitermes minor in wood paneling in basement of home August 19.)
 - 1964b, p. 319. (Denver, Colorado, Zootermopsis angusticollis introduced in shipment lumber from Northwest, March, 1964, all apterous nymphs.)
 - 1964c, p. 340. (Wilmington, New Castle County, Delaware, *Cryptotermes* sp. nymphs infested wicker furniture in home and attacked floor under furniture, March 9, 1964, P. P. Burbutis, origin unknown.)
 - 1964f, p. 953. (California, Menlo Park, San Mateo County, *Cryptotermes brevis* in bedframe in residence August 1964. Bed purchased out of state several years ago.)
 - 19650, p. 773. (Hawaii, Hilo, dealated adults Zootermopsis angusticollis (Hagen) found February 26, 1965

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among Douglas fir lumber from the Mainland. According to Dr. T. E. Snyder, Hawaii is the 21st state into which this termite has been transported.)

- 1965r, pp. 907-908. (Texas, Harris County, Houston, Coptotermes formosanus found in shipyard warehouse July 2 and 12. Source infestation unknown, established for some time. Species very destructive to structures, can live without soil contact if moisture elsewhere.)
- 1965e¹, p. 1235. (South Carolina, Charleston, *Cryptotermes dudleyi* Banks in plywood shipping crates from Recife, Brazil, 6-24-65.)

- 1966a, p. 53. (Oklahoma, Comanche County, Zootermopsis nevadensis in wood shipped from Pacific Coast, week ending January 21.)
- 1966c, p. 75. (Hawaii, Zootermopsis angusticollis introduced in Douglas fir lumber from mainland into Hilo, Hawaii, and Honolulu, Oahu, week ending January 28.)
- 1966e, p. 101. (Texas, Harris County, *Incisitermes minor* in driftwood, January 28, 1966, Simon.)
- U.S. DEPT. AGRICULTURE, PLANT QUARANTINE DIV., 1962, pp. 18, 25, 32, 36, and 42. (Termites intercepted, United States.)

LEGISLATION

- ANONYMOUS, 1962p, pp. 36, 38. (Wisconsin, Sheboygan in 1957 outlawed termites by ordinance requiring control, difficult to enforce. Recommendations for other cities.)
 - 1963a, p. 50. (Florida, Hollywood, city commissioners have banned termites from new buildings by passing an ordinance requiring structural pest control for all new construction. Require soil treatment, based on F.H.A. standards.)
 - 1964b, p. 3. (U.S., termite damage to residences no longer will be allowed as a deductible loss, according to a recent ruling by the Internal Revenue Service, which reverses a 4-year old position that homeowners could claim such casualty losses caused by insects over periods up to 15 months after infestation. The Service says it now finds, according to the latest scientific data, that severe termite damage does not result that suddenly.)
 - 1964l, pp. 6-7. (U.S., Calfornia, A.B. No. 93 deletes provision requiring \$5,000 indemnity bond, requires pest control operator to file \$2,000 with Structural Pest Control Board for benefit any person damaged as result of violation of law by operator. Provides for additional bond of not less than \$1,000 or more than \$8,000 as condition to reissuance of suspended or revoked license for specified grounds.)

- BONAVENTURA, G., 1961, pp. 237-254. (Italy, Inst. Pathology of Books and termite control in Italy, origin government act whereby since 1952 possible for government to conduct scientific research, antitermite protection and disinfestation. The chief control measures on the premises of State and Notarial Archives, Libraries, and National Monuments are listed.)
- CALIFORNIA, P.C.O.S, 1962, pp. 3, 4, 12. (U.S., California, proposed revision rules and regulations approved by California P.C.O.s submitted to Structural Pest Control Board in proposed revision. Report requirements, Sect. 1990, corrective measures, Sect. 1991, etc.)
- CHEMICAL SPECIALTIES MANUFACTURERS Asso-CIATION, 1961. (Pp. loose leaf to be added to compilation of economic poisons (pesticides) laws, state and federal regulations, and enforcement officials, and proposed model for uniform state insecticide, rodenticide, and fungicide act, list of states which have not yet accepted the act, and description of parts of the act.)
- DUCHANOIS, F. R., 1961, pp. 42, 44, 46, 55. (U.S., Florida, minimum prevention and control standards (state) for subterranean termites, based on Forest Service recommendations; fumigation preferred for drywood termite control.)
- SNYDER, T. E., 1963a, p. 13. (Review: Hickin, N. E. 1963, Britain legislation to prevent introduction termites.)

MORPHOLOGY

- ALAM, S. M., 1962, pp. 63-65. (Thorax most complex region body, degeneration of wing muscles in dealated adults important, early adaption of thoracic musculature to function of flight.)
- BERNARDINI, P., and PALESTRA, A. M., 1956, pp. 727-734. (Italy, *Calotermes flavicollis*, tentorial glands various castes and stages.)
- Deligne, J., 1965, pp. 179-186. (Africa, morphology and function soldier mandibles, in Glyptotermes denticulated mandibles, tips only slightly overlapping, work like shears against workers of other genera; in Macrotermitidae and in several Termitinae mandibles slender without denticules, move much more rapidly, widely overlapping, more lethal; in Termes mandibles slender, bent, and opposable at tips, which and their great elasticity give an amazing percussive power; in *Pericapritermes* mandibles very asymmetrical, they snap as in Termes in an even more perfected and powerful way, but only strike toward one side, using the left mandible. Different types fighting behavior considered as four different evolutionary grades acquired polyphyletically.)
- GHARAGOZLOU, I., 1962, pp. 2430-2432. (Calotermes flavicollis, anatomic and quantitative study of adipose tissue various castes and stages.)
- GRASSÉ, P. P., and GHARAGOZLOU, I., 1963, pp. 3546-3548. (France, *Calotermes flavicollis*, ergastoplasm development, and protein genesis in royal adipose tissues; describes adipose tissues; queen furnished saliva rich in protein by larvae, king much less; protein serves in the development of the vitellum of the egg.)
 - 1964, pp. 1045-1047. (France, *Calotermes flavicollis*, a new type of cell of the adipose royal tissue, endolophycyte.)
- GUPTA, S. D., 1962, pp. 169-194. (India, Anacanthotermes macrocephalus external anatomy of the soldier caste, head, headcapsule, head-appendages, neck, thorax, legs, and abdomen. The sexes indistinguishable externally.)
 - 1962a, pp. 195-222. (Idem., alates, workers, sexes distinguishable in alates only, externally, detailed descriptions, figures, distribution.)
- Howse, P. E., 1965a, pp. 137-146. (Zootermopsis angusticollis, description and

illustration subgenual organ and associated scolopidia and campaniform sensilla mechanoreceptors.)

- KUSHWAHA, K. S., 1960, pp. 209-227; 229-250. (India, external morphology *Odonto-termes obesus* described, illustrated, soldier, alate, worker.)
 - 1962a, pp. 71-114. (India, chaetotaxy soldier, worker, alate, *Odontotermes obesus* details of differences in arrangement of bristes in castes.)
 - 1963, pp. 296-310. (India, advances in study external morphology, musculature, mechanism feeding apparatus, the chaetotaxy of all castes *Odontotermes* (*O*) *obesus*, external genitalia.)
- MARKS, E. P., and LAWSON, F. A., 1962, pp. 129-171. (Comparative study of ovipositors mantis, *Mastotermes darwiniensis* and 24 species of cockroaches, evolution discussed. In termites humidity control and closed nests replaced ootheca as means protecting eggs from dessication.)
- FUDALEWICZ-NIEMCZYK, W., 1965, pp. 241-252. (Ontogenesis of the innervation of neurosensorial organs on antennae of *Reticulitermes lucifugus santonensis.*)
- 1965a, pp. 309-320. (Organogenesis of alary nerves and tracheae of *Reticulitermes lucifugus santonensis*, describe sensilla. Anatomy of alary nerves described. Three alary tracheae present in each termite except soldiers where medianal not recognizable.)
- NOIROT, C., and NOIROT-TIMOTHÉE, C., 1965, pp. 265-272. (Glandular swellings of the epidermis in the region of some abdominal sternites (sternal glands) are always present in termites. *Mastotermes darwiniensis* shows three glands, one on each of the 3rd, 4th, and 5th sternite. In the subfamilies Stolotermitinae, Porotermitinae, and Hodotermitinae there is a single sternal gland on the 4th sternite. In all other termites it is on the 5th. These glands occur on every caste, but regress in both imaginal and neoteinic functional reproductives.)
- NOIROT-TIMOTHÉE, C., and NOIROT, C., 1965, pp. 185-208. (Mid-gut queen higher termites *Cephalotermes rectangularis*, electron microscope study.)
- RICHARD, G., 1963, pp. 157-174. (Nervous system, survey present knowledge, description peripheral sense organs, two main

chordotonal systems: subgenual and Johnston's organs. Establishment general innervation during ontogenesis and regression; mushroom bodies of protocerebrum, eye development, and eye regression.)

- SATIR, P., and STUART, A. M., 1965, pp. 277-283. (A new apical microtubuleassociated organelle in sternal gland *Zootermopsis nevadensis* described and figured.)
 - 1965a, p. 494. (Structure sternal gland Zootermopsis nevadensis.)
- SPRINGHETTI, A., 1963a, pp. 155-159. (Italy, Kalotermes flavicollis, abnormal morphological characters described and figuredin various castes, divided pronotum, intercaste, and supernumerary segments of a tibia-tarsal complex.)

- VISHNOI, H. S., 1962, pp. 13-30. (India, Odontotermes obesus, cephalic musculature various castes, dissections and sections in detail.)
- ZUBERI, H. A., 1962, pp. 393-395. (General, comparative study head of various castes termites in three families termites, modifications inter- and intra-specific.)
 - 1963, pp. 147-208. (Structure brain and its nervous connections studied in detail in *Trinervitermes tchadensis*, with its high degree of polymorphism. A comparative study of the brain and its nervous connections in various castes of species in Mastotermitiae, Hodotermitidae and Termitidae was made. The results were compared with available data on the brain of social insects and cockroaches, etc.)

NESTS

- BECKER, G., 1962e, pp. 359-379. (India, observations on nests of Microcerotermes cameroni, Macrotermes estherae, Odontotermes spp., Microtermes spp., Nasutitermes anamalaiensis and N. beckeri, and Trinervitermes nigrirostris. Nests figured, biological data, swarming, etc.)
- BODOT, P., 1964, pp. 283-291. (Africa, north of "savane de Dabou," Ivory Coast, young nests Bellicositermes bellicosus and natalensis show a quite total identity. As nests grow bigger this likeness vanishes. To the development of the top height of B. natalensis nests is opposed the lateral development of the B. bellicosus nests, marked by the progressive disappearance of the "paraecie" as well as the idiotheca and the basement chamber. The dwelling place loses its individuality and divides into units more or less distinguishable.)
- CHOPARD, L., 1961, pp. 21-31. (Architectural art of termites, secrets of.)
- COATON, W. G. H., 1962, pp. 61-70. (Northern Rhodesia, nesting habits and mounds termites destroying young trees in new plantations of Eucalyptus. *Macrotermes* species constructed the most massive and striking mounds, one 18, another 25 feet high. Composed of sandy subsoil using saliva to wet clay binding material, remain without vegetation for long periods.)
 - 1962a, pp. 159-166. (Northern Rhodesia, origin and development massive vegetated mounds *Macrotermes* and *Odonto*.

termes, long succession mounds may arise on site original hummock inhabited by a variety of termites. Over a long period these hills become massive and vegetated. May be one hill to 1.42 acres over 285 acres.)

- GONÇALVES, C. R., and SILVA, A. G. A., 1962, pp. 193-208. (Brazil, observations on termites and figures of nests, 7 Kalotermitidae, 5 Rhinotermitidae, 39 Termitidae, 51 in all; nests figured are: Amitermes excellens Silv., Constrictotermes cyphergaster (Silv.), Cornitermes bequaerti Emer., and C. snyderi Emer.)
- GOODLAND, R. J. A., 1965, pp. 641-650. British Guiana, Northern Rupununi Savanna, ecological distribution termitaria Nasutitermes ephratae correlated with quantitative expressions of the vegetation and environmental factors. Termites impoverish surrounding soils, concentrate soil nutrients into mounds, reduce plant cover, decrease water-retaining capacity of soils; aid growth woody plants by improving drainage; part of savanna ecosystem; bibliography.)
- GRASSÉ, P. P., and NOIROT, C., 1961, pp. 311-359. (Africa, Bellicositermes bellicosus types of nest and variation; B. bellicosus subsp. rex, giant termitaria; B. natalensis, cathedral, dome, chimney, and round tumulus. Causes of variation, composition of mounds, growth, material clay mixed with saliva, food, size queens, no neoteinic reproductives.)

NO. 3

KRISHNA, K., 1965a, pp. 39-40. (Nesting habits of termites. Abstract.)

- LÜSCHER, M., 1961, pp. 138-145. (Africa, Ivory Coast, air-conditioned nests brilliantly designed to maintain temperature and humidity, while permitting oxygen to flow into nests and carbon dioxide to flow out. Microclimate nests best at 86° F. in tropics, 79° F. in temperate zone. Population medium mound *Macrotermes* in Africa two million individuals. Colony *Nasutitermes arboreus* will die in dry air.)
- NOIROT, C., and NOIROT-T. C., 1963, pp. 180-188. (Ivory Coast, *Cubitermes fungifaber* growth nest discontinuous, shows marked seasonal cycle, successive addition; type of new building (cylindrical or hat-shaped) quite independent from original; mutilation of nest followed by regeneration only if renewed portion was still in building.)
- NOIROT-T. C., and NOIROT, C., 1965, pp. 185-208. (Intestine of the queen of the higher termites, study with an electronic microscope.)
- PUCKETT, P. P., 1965, pp. 84-85. (The termite an ancient architect.)
- Roonwal, M. L., 1962b, pp. 131-150. (India, Dehra Dun, Odontotermes obesus, three forms; mound structure above ground 10 feet and nest and royal cell below ground; as many as 90,000 individuals, soldiers 5.5%-7.7%, workers 49-66.5%, nymphs 28-43.3% and usually one royal pair, queen as long as 75 mm. Eggsdepositories or fungus combs in rounded excavations, I egg laid per second. Moisture content of fungus comb mean 51.63% water.)
- ROONWAL, M. L., and CHHOTANI, O. B., 1962c, p. 85. (India, Orissa, Barkuda Island, Chilka Lake, Odontotermes feae usually purely subterranean, occasionally builds a mound. Low earthen, sprawling roughly dome-shaped. Several holes open on the surface and lead into tunnels where fungus combs lie in vaults, mound of multilocular type. Royal chamber is occentric, lies near ground level.)
- ROONWAL, M. L., and GUHA-ROY, S., 1965, pp. 114-129. (India, Odontotermes obesus, dimensions 270 mounds in Dehra Dun District measured and their interrelationships studied statistically. Height range mean 801 ± 24 mm., diameter 2249 ± 334.68 mm.)

- SANDS, W. A., 1961, pp. 177-188. (West Africa, Trinervitermes, structure and size distribution 5 species T. ebenerianus commonest, most widely distributed, mound 24 inches high; T. carbonarius mounds 18 inches to 4-5 feet in height, more massive, thicker walled; Τ. oeconomus similar, but considerable number open foraging holes; T. auriterrae mounds resemble those of ebenerianus. do not contain stored grass fragments, dark fecal lining deep-cut and distinct; T. suspensus rare, builds mounds of its own, stores grass fragments. Size distribution mounds arise from seasonal activities of the termites, each distribution representing the mounds of one year. Mean annual increment 4-5 inches diameter; colony expansion by erection of supplementary mounds after primary mounds 3-4 years old; mean number mounds per colony 3-6.)
 - 1965d, pp. 557-571. (West Africa, Zaria, Northern Nigeria, termite distribution in man-modified habitats with special reference to species segregation in the genus *Trinervitermes*. *T. ebenerianus*, densities mound populations higher in cleared areas.)
- SCHMIDT, R. S., 1960, pp. 357-368. (Africa, *Apicotermes* nests, wall perforations function as gas diffusion systems. In *Apicotermes arquieri* there is not a regression of pores, in *A. occultus* there is. Increase of diffusion surface may be an important function of the shagreen network and of the space or sand envelope surrounding nests.)
 - 1964, pp. 221-225. (Africa, *Apicotermes*, evolution nest building and functions some nest structures, revised phylogenetic tree of genus, based mainly on nest characteristics, is illustrated.)
- TSAI, PANG-HWA, CHEN, NING-SHENG, CHEN, AN-KUO, and CHEN, CHIH-HWEI, 1965, pp. 53-70. (China, architecture and development of the termitarium of Odontotermes (O.) formosanus.)
 - 1965a, pp. 128-139. (China, activity of Odontotermes (O.) formosanus on the ground of Yangtse-dike and its relation to the nest.)
- UICHANCO, L. B., 1961, pp. 215-218. (Philippines, *Macrotermes gilvus* probable relation to altitude in mound building, lowland and upland forms, ecological notes.)

NUTRITION

- ALIBERT, J., 1963, pp. 1-12. (France, Cubitermes fungifaber, in laboratory workers and soldiers received regurgitated food (stomodeal) detected by contamination with radioactive phosphorus. Queen first to be contaminated by salivary liquid from workers, receives constant nourishment; alates close to flight heavily loaded with saliva. Nymphs of last but one stage and king receive only poor quantity.)
 - 1964, pp. 5260-5263. (Evolution in time of fungi mounds constructed by termites, for nutrition.)
- BECKER, G., 1965, pp. 151-184. (Influence of wood and soil humidity on the choice of nutriment and quantity of feeding of six species of termites in five genera from temperate and tropical regions, tests made in the laboratory.

In food choice tests with wood pieces of different water content in glass dishes, Kalotermes flavicollis Fabr. preferred in case of pine sapwood with about 15% loss of weight due to attack by the Basidiomycete Merulius lacrimans specimens with a water content of 40% to 50%, in case of wood not attacked by fungi specimens with a water content of 20% to 30%. Zootermopsis nevadensis chose out of pine wood with a 6%-decomposition by the Basidiomycete Poria vaporaria specimens with a higher water content, viz., from 50% to 80%, than did the Kalotermes species. When Heterotermes indicola Wasmann and Reticulitermes lucifugus Rossi var. santonensis Feytaud were given, besides moistened pine sapwood slightly attacked by fungi, wet soil, the termites did not prefer any range of wood humidity. Without the addition of soil, the Heterotermes workers chose specimens with a water content of 80% to 100%. The Reticulitermes workers also preferred moist wood, but not so distinctly high a water content as the Heterotermes species did. Whether or not there was soil in the dishes, Nasutitermes ephratae Holmgren fed approximately the same quantity of beech wood with a water content of 50% to 100%. Only wood containing less than 40% to 50% water was deteriorated to a minor extent. Thus the range of humidity preferred by this species is relatively broad.

Glass tubes, 120 cm. long and vertically set up, were filled with humus-containing soil and wood specimens that were arranged with a distance of 10 cm. from one another so that the water content decreased from bottom to top. Heterotermes indicola, Reticulitermes lucifugus var santonensis, and R. flavipes Kollar behaved differently. An aerotaxis was more distinct with *H. indicola* than with the Reticulitermes species. Despite a low soil and wood humidity, all the three species fed most near the surface of the soil. Apparently because of an optimum humidity, the zone from 60 to 80 cm. deep under the surface was preferred, too, but not by all the species alike. The termites in their turn increased the water content of the wood specimens attacked by them.

In a third series of tests, the activity in feed and gallery building as well as the mortality of uniform groups of various termite species were determined. Wood specimens were deposited in plastic jars filled with sand or humuscontaining soil of differently gradated contents of humidity. The ranges of water content of sand and humuscontaining soil providing comparable amounts of feeding were very different. The lower limit for the feeding activity and a longer survival of the insects was with sand below a 1% water content, with humus-containing soil more or less below an 8% content. The upper limit was with sand partly at and partly above 20%, with humus-containing soil above 32%. According to the results, the quantity of feeding by the Rhinotermitidae species obviously did not depend on the moisture content of the wood which is correlated with the soil humidity, but on the soil humidity itself, at least above the fiber saturation of the wood. Not the absolute water quantity of the soil was decisive, but the quantity in proportion to the water-retaining capacity of the soil. With regard to the Nasutitermes species, carton material of the animals added on the top of the soil proved to be of influence. The most favorable range of water content varied somewhat with the termite species. In tests with humus-containing soil, it was with Reticulitermes flavipes and R. santonensis, the latter bred at 30° C., at

to 24%, with Zootermopsis 16% nevadensis and Nasutitermes ephratae, the latter with carton material, at 18% to 22%, with Reticulitermes santonensis, bred at 26° C., at 22% to 30%, with Heterotermes indicola and Nasutitermes ephratae, the latter without carton material, at 20% to 30%. In tests with sand, the most favorable water content was for Heterotermes indicola 6% to 10%, for *Nasutitermes ephratae* with nest material 6% to 14%. No significant difference was stated between 2% and 18% for the Reticulitermes species and for Nasutitermes without nest material. The Heterotermes species was most susceptible to minor humidity as well as to high water content of the soil.

The results obtained were related to the natural environmental conditions of the termites and their behavior in nature.)

BREADY, J. K., and FRIEDMAN, S., 1963, pp. 703-706. (*Reticulitermes flavipes* eggs were submerged in 0.1% aqueous solution of zephiran chloride to obtain sterile nymphs. Eggs so treated appeared anatomically normal and hatched successfully in the presence of older workers, but only those exposed to zephiran for as long as 10 minutes were found to be decontaminated when tested on sterile nutrient agar plates. First-instar nymphs, which normally are assisted from the eggs by older workers, were removed by hand with no detrimental effects, but died in 7 days unless fed proctodeal and/or stomodeal food by older instars. Neither synthetic nutrient solutions nor artifically fed fecal solutions served as substitutes for the normal diet. Inconclusive results were obtained in experiments to determine whether grooming by older workers was a requisite for increasing the longevity of the first-instar nymphs.)

- 1963a, pp. 706-708. (*Reticulitermes flavipes*, in an effort to obtain sterile third- and fifth-instar workers for nutritional studies, antifungal and antibacterial agents were incorporated into the diet. Methyl parahydroxy benzoate proved adequate as a fungicide at levels as low as 0.015 molar, but none of the antibiotics tested singly or in combination killed all of the termite-associated bacteria. Changes in materials and techniques were not effective in increasing the potency of the bactericides.)
- GAGLIARDI, P., 1963, pp. 350-356. (Termitin in animal nutrition.)
- KURIR, A., 1963a, pp. 101-107. (The white ball-shaped conidia of the fungus *Termitomyces* are food for the larvae of *Reticulitermes flavipes*, eggs usually carried by workers, also by a few soldiers. Fungi grows independently not cared for by termites.)

OBITUARY

- ANONYMOUS, 1962j, pp. 53-54. (U.S., Ruric C. Roark, 1887-1962). (Pioneer in pesticides, synthetic organic and those derived from plants, developing fumigants in U.S. Dept. Agriculture.)
- HODSON, A. C., 1965, p. 594. (Australia, Frederick G. Holdaway, 1902-1965). (Biology and control termites Australia, 1933-1936.)
- MICHELBACHER, A. E., 1965, pp. 207-234. (U.S., Edward Oliver Essig, 1884-1964). (Articles on western termites, 1914-1958.)
- NELSON, R. H., 1965, p. 770. (Brazil, Angelo da Costa Lima, 1887-1964.) (Publica-

tions on the insects of Brazil, including termites, 1936, 1939 and 1952.)

- Ремвектол, С. Е., 1965, pp. 39-45. (Hawaii, David Timmins Fullaway, 1880-1964.) (Publications on habits, damage, and control termites Hawaii 1920 to 1931 and 1945.)
- Springhetti, A., 1963, pp. 391-393. (Carlo Jucci, 1897-1962.) (Brief account of work on termites.)
- THURMAN, E. B., 1963, pp. 213-216. (U.S., Robert E. Snodgrass, 1875-1962, morphologist, extraordinary as an individual, morphology termites.)

PARASITES

BEAL, R. H., and KAIS, A. G., 1962, pp. 488-489. (U.S., Aspergillus flavus apparent infection subterranean termites Reticulitermes virginicus and R. flavipes. Fungus caused 80% mortality workers R. virginicus.)

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VOL. 152

- CIFERRI, R., 1963, pp. 235-252. (Dominican Republic, ectoparasitic fungi of the Termitariaceae including *Termitaria* snyderi found on Nasutitermes morio. A new genus Sylviacollaea, type termitaria described.)
- DESPORTES, I., 1963, pp. 4013-4015. (Development cycle of a new Gregarina: Diplocystis zootermopsidis sp. n. (Eugregarina, Diplocistidae).)
- ERNST, E., 1964a, pp. 569-576. (Ivory Coast and Eastern Congo, three forms of soldiers of *Acanthotermes acanthothorax* Sjöstd. had heads distorted by Dipterous larva and some have incompletely developed mandibles, they are myiagene soldiers.)
- GEIGY, R., HECKER, H., and KEISER, F., 1964, pp. 280-286. (Africa, phorid (Dipterous) larva is parasitic in head soldier *Bellicositermes bellicosus* in the form of myiasis causing aberration. Parasite described and figured as well as aberrant soldiers.)
- LUND, A. E., and ENGELHARDT, N. T., 1962, pp. 131-132. (U.S., *Absidia coerulea*, Bainier (Mucorales) parasite on subterranean termites.)
- MANIER, J. F., 1960, pp. 677-686. (France, Paracoleomitus grassei n. gen., n. sp. schizophyte in colon Calotermes flavicollis.)
- SMYTHE, R. V., and COPPEL, H. C., 1965, pp. 423-426. (U.S., Wisconsin, a soluble toxin preparation derived from *Bacillus* thuringiensis is toxic to *Reticulitermes* flavipes, R. virginicus, R. hesperus and Zootermopsis angusticollis; 75% mortality after 9 days; in combination with spores and inclusion bodies results in greater than 90% mortality in the laboratory.)
- WEISER, J., and HRDÝ, I., 1962, pp. 94-97. (Europe, two species of *Pyemotes* were

experimentally exposed to *Reticulitermes lucifugus* and *Kalotermes flavicollis* under controlled conditions in the laboratory. The mites attached themselves and in 5 days only exuvia remained. *Pyemotes* might be useful in the control of termites.)

- WELCH, H. E., 1965, pp. 275-302. (Entomophilic nematology is the branch of parasitology that deals with nematodes associated with insects. Nematodes can be utilized for biological control. An extensive survey of the literature is included.)
- YENDOL, W. G., 1965, p. 4881. (Entogenous fungi parasitic in Reticulitermes flavipes. the laboratory Entomophthora In coronata produced four times more conidia than E. virulenta. In pathogenicity tests with Reticulitermes flavipes. *E. coronata* produced mortalities of 98.5%, 48 hours after inoculation. *E.* virulenta was avirulent, and failed to produce a frank infection. Approximately 38% of the termites infected with E. coronata showed penetration of the fore intestine before death. Invading hyphae attacked the fat body and musculature first, then rapidly destroyed the remaining tissues as early as 32 hours after inoculation.)
- YENDOL, W. G., and PASCHKE, J. D., 1965, pp. 414-422. (U.S., Indiana, in laboratory tests *Entomophthora coronata* produced a mortality of 97%, 84 hours after inoculation of *Reticulitermes flavipes*. In the digestive tract germinating conidia penetrated the oesophageal wall, but not the crop, mid- and hind gut. Invading hyphae attacked the fat body and musculature, then rapidly destroyed the remaining tissues as early as 32 hours after inoculation.)

PHYLOGENY

KRISHNA, K., 1961, pp. 303-408. (World, phylogeny Kalotermitidae, chart.)

PHYSIOLOGY

BREADY, J. K., 1963, pp. 3039-3040. (Abstract, physiological investigations on *Reticuli*termes flavipes, egg production decreased in secondary reproductive pairs with fewer supporting workers, length life reproductive pair increased with increase in number supporting workers, oxygen toxic to protozoa.)

DELIGNE, J., and PASTEELS, J. M., 1963, p. 694. (Endocrine phenomena in the kidneys of *Microcerotermes* sp.)

Lüscher, M., 1959 (1960), pp. 161-166.

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(Physiology of the differentiation of castes in *Kalotermes flavicollis*.)

MISRA, J. N., 1964, pp. 131-136. (Physiology of digestion in termites.)

POPULATION

- BRIAN, M. V., 1965, pp. 6, 13 to 15, 19, 34, 43, 44, 47, 48, 58, 65, 70, 72, 76, 78, 83, 101, 105, 108-109. (General, populations, reproductives, fecundity, growth, gaseous exchange, mounds, maturation, age reproductives, structural limitations nests, flights, mating, food supply, mode of dispersion, intraspecific and intergeneric competition, predators and parasites, population regulation.)
- GREAVES, T., 1961, Termites in forest trees, p. 39. In Commonwealth Sci. and Indus. Res. Org., Divis. Ent. 1960-1961 Ann. Rept. (Australia, populations of two species of Coptotermes were studied and a total of 773,520 termites comprising 665,010 workers, 65,650 soldiers, 1,170 nymphs, and 41,690 juvenile forms was obtained from a colony of C. acinaciformis in a blackbutt at Pine Creek State Forest. A total of 697,500 termites was obtained from a peppermint (Eucalyptus robertsoni.)
 - 1962, pp. 1-17. (Australia, colonies of *Coptotermes acinaciformis* and *C. frenchi* in forest trees vary in numbers with the temperature, on cold nights the greatest number of the former was 796,900, the latter 700,000. Nests of *Porotermes adamsoni* numbered only a few thousand individuals.)
 - 1964, pp. 1-4. (Australia, the greatest aggregation in the nursery of *Coptotermes*

- STEINBERG, D. M., 1962a, pp. 37-48. (S.S.R., physiology of the development of the polymorphism in termites.)
 - *acinaciformis* occurred in winter, 796, 890, on July 5, 1960. Using a cooling system of dry ice, a total of 1,249,000 termites were obtained.)
 - 1965, p. 46. (Australia, N. S. W., Coptotermes frenchi population living tree 614,000 termites.)
- LÜSCHER, M., 1961, pp. 138-145. (Africa, *Macrotermes* nest medium mound 2 million individuals.)
- SANDS, W. A., 1965, pp. 49-58. (West Africa, savannah region Northern Nigeria, small-domed mounds harvester Trinervitermes ebenerianus were sampled with a sharpened tube, not a noisy pipe auger. Scrubby bushes and scattered trees occurred on upper slope reddish-brown sandy loam. Fluctuations in population density and percentage of young stages are related to a hypothetical annual cycle of activity depending on climatic conditions. Diurnal changes in mound populations cannot readily be related to climatic conditions, mound populations being in most cases depressed at night. When these movements take place, the alate nymphs are more rapidly affected, and more soldiers remain behind. Rough estimates of total populations in terms of individuals per acre are given, 2 to 5 million (up to 10 million), of these one or two hundred thousand per acre alates annually.)

PREDATORS

- ANNANDALE, N., 1910, pp. 201-202. (Calcutta, India, during heavy rainstorm termites flew into dining room destroyed by cockroach *Periplaneta americana*, gnawed abdomen, if disturbed carried prey away in mandibles.)
- ANONYMOUS, 1937, p. 123. (Cockroaches could eliminate termites from houses.) 1953, p. 50. (Hawaii, Honolulu, after a
 - methyl bromide fumigation for termites in homes, termite carcasses became an abundant food supply for mites, in the 2 months the dead termites were suitable for food, two generations of mites were produced; a heavy outbreak of human

skin lesions from the mites resulted when the food supply of dead termites was exhausted. Piperonyl butoxide and pyrethrins in an oil base eliminated the mite infestation.)

- BEIER, M., 1964, pp. 198-200. (New species pseudoscorpion in *Calocheiridius* from termite mounds in Congo.)
- BODOT, P., 1961, pp. 3053-3054. (Africa, Dorylus (Typhopone) dentifrons predaceous ant destroying mounds Bellicositermes natalensis.)
- CASIMER, M., 1960, pp. 230-232. (Australia, *Tegea atropicta*, Hemiptera: Reduviidae, an unusual predator, probably specific

on Nasutitermes exitiosus eastern half Australia.)

- EISENMANN, E., 1961, pp. 636-638. (Panama Canal Zone, Barro Colorado Island, birds of all kinds attracted to winged sexual adults. On May 11, 1961, in one spot 16 species birds, some primarily vegetarian, caught winged termites, an additional species observed elsewhere on same day.)
- FALLS, O., 1938, p. 18. (U.S., use cockroaches to control termites in buildings not feasible.)
- GRASSÉ, P. P., and NOIROT, C., 1961, pp. 311-359. (Africa, ant *Paltothyreus* battle with soldier *Bellicositermes natalensis*, latter with cutting grip, pl. 20.)
- KEVAN, D. K. McE., 1962, p. 18. (Africa, narrow-mouthed toad *Breviceps rosei* burrows underground to feed on subterranean termites.)
- MATHUR, R. N., 1962, pp. 137-139. (Ants of

PROTOZOA

- ABLIN, R. J., 1964, pp. 16-17. (Immunological response between flagellates symbiotic to a roach and a termite, rabbit.)
- 1965, pp 441-442. (Immunological response between protozoa symbiotic to a roach [Cryptocercus punctulatus] and a termite [Zootermopsis nevadensis].)
- BACCETTI, B., 1963, pp. 230-255. (In *Reticulitermes lucifugus*, Italy, a wide microfauna and microflora in workers and soldiers is harbored in their colon. The electron microscope proves that digestion of cellulose, and the absorption by the termite takes place in the mesenteron.)
- CLEVELAND, L. R., 1960, pp. 110-112. (Photographs of living centrioles in resting cells of *Trichonympha collaris*.)
 - 1960a, pp. 149-162. (*Trichomonas gigantea*, the centrioles supply the stimuli for the syntheses in their own reproduction in each cell generation but also for the production of flagella and other organelles.)
 - 1960b, *In* Stauber 1960, pp. 5-10, effects of insect hormones on the protozoa of *Cryptocercus* and termites.)
- CLEVELAND, L. R., and GRIMSTONE, A. V., 1964, pp. 668-685. (Mixotricha paradoxa, a large polymastigote flagellate from the gut of Mastotermes darwiniensis, uses its four flagella to steer it, its movements are brought about by coordinated undulations of many thousands of spiro-

several genera prey on termites in India, on alates, as do dragonflies and robberflies, muscid-flies, cockroaches, frogs and toads, lizards, birds, and mammals; predators and termites listed.)

- ROONWAL, M. L., and CHHOTANI, O. B., 1962b, pp. 281-406. (India, Manipur, common white-bellied rat ate swarming Odontotermes horni.)
- SMITH, H. M., 1957, p. 102. (Blind snake Leptotyphlops has curious habit eating termite workers by swallowing them from caudal end, but only as far as the cephalothorax, then sucking the contents from the abdomen, and regurgitating the deflated body.)
- WEBER, N. A., 1964, pp. 197-204. (Africa, lists ants from Belgian Congo preying on termites collected and identified by Dr. A. E. Emerson with notes by Emerson and Weber and references to Weber's previous papers, 20 ant species.)

chaetes which cover the body. The spirochaetes are attached to small brackets of complex internal structure, which arise in rows from the cell surface. In addition to one or more spirochaetes, each bracket is also associated with an extracellular bacterium.)

- DESAI, R. N., and UTTANGI, J. C., 1962, pp. 110-114. (India, Dharwar, Mysore, gregarine protozoan *Sphaerocystis termitis* n. sp. from Indian termite *Capritermes incola.*)
- DINI, W., and CESAR, H. C., 1960, pp. 403-407. (Symbiosis in *Heterotermes longiceps*, Brazil.)
- GRASSÉ, P. P., and HOLLANDE, A., 1963, pp. 749-792. (Flagellates of the genera Holomastigotoides and Rostronympha; chromosome structure and coiling cycle in Holomastigotoides psammotermitidis host is Psammotermes hybostoma.)
- GRIMSTONE, A. V., and CLEVELAND, L. R., 1965, pp. 387-400. (Morphology and function of axostyles of certain flagellates from the gut of termites and the woodfeeding roach *Cryptocercus punctulatus*.)
- GUZMAN, S. R., 1960, pp. 73-77. (Chile, *Calotermes chilensis*, lethal temperature flagellate protozoa 39° C. for living insects kept at that temperature in humid atmosphere for 24 hours, highest defaunation temperature for termites known, termites live 2 weeks.)

NO. 3

- 1961, pp. 83-96. (Chile, Oxymonas chilensis n. sp., flagellate symbiont of *Calotermes chilensis*, uncertain position of three structures in genus discussed.)
- 1962, pp. 57-63. (Chile, Stephanonympha calotermitis n. sp., flagellate symbiont (Calonymphidae) described from Calotermes chilensis, key to genera in family, distinguishing characters of Stephanonympha species.)
- HALDAR, D. P., and CHAKRAVARTY, M. M., 1964, pp. 377-381. (Sudanophilic simple and bound lipids in three species of termite flagellates.)
 - 1964a, pp. 77-81. (India, cytochemical studies on three species of termite flagellates.)
- HONIGEERG, B. M., 1963, pp. 20-63. (Evolutionary and systematic relationships in the flagellate order Trichomonadida Kirby. *Monocercomonas moskowitzi* n. sp. and *Trichomonas nonconforma* n. sp. are named and diagnosed. Keys to all families and subfamilies of order and genera of Monocercomonadidae and Trichomonadidae are included.)
- JAKOBI, H., and DE LOVOLAE, SILVA, J., 1959, pp. 113-117. (Brazil, chemical Acetarson, removed flagellate protozoa from *Eucryptotermes* sp. in 3 days, no harm to termites.)
- KRISHNA, K., 1961, pp. 303-408. (List in systematic order protozoa family Kalotermitidae. Generic differentiation protozoa took place before differentiation of Kalotermitid genera.)
- KRISHNAMOORTHY, R. V., 1960, pp. 156-161. (India, digestive enzymes of *Hetero*termes indicola.)
- LAVETTE, A., 1960, pp. 4202-4204. (General, polysaccharides of symbiotic flagellates.)

- 1964, pp. 1106-1108. (Lipides in flagellates symbiotic with termites colored by Sudan Black B.)
- 1964a, pp. 2211-2213. (Digestion of wood: cellulose and lignin by symbiotic flagellates.)
- MISRA, J. N., 1962, p. 153. (Intestinal cellulose digesting symbionts of two types: flagellates in lower termites, microbial flora in higher. Enzymes in *Odontotermes obesus*, bacteria in hind gut.)
- Rose, M., Arces, P. J. D'., and MAZZELLA, O., 1960, pp. 1-39. (Algeria, histochemical researches on the trophozoite adult of *Joenia annectens*, a joeniid flagellate symbiont of *Calotermes flavicollis*.)
- UTTANGI, J. C., and DESAI, R. N., 1962, pp. 97-109. (Dharwar, India, gregarine protozoa *Hirmocystis speculitermis* and *H. dharwarensis* and *Steinina termitis* in the non-xylophagous termite *Speculitermes cyclops sinhalensis*. Infection confined to fore gut of host.)
 - 1963, pp. 39-43. (India, Metaclevelandella termitis n. gen., n. sp. of heterotrichous ciliate (fam. Clevelandellidae) in Capritermes incola.)
- UTTANGI, J. C., and JOSEPH, K. J., 1962, pp. 155-161. (Flagellate symbionts, list of protozoa from India, live in rectal sac, contain enzymes digest cellulose, account for 1/3 to 1/3 weight termites, two important orders Polymastigida and Hypermastigida, over 200 species, 48 genera, 89 species 14 genera Indian region, de scription genera and specificity, physiology of digestion by enzymes, mode of transmission through proctodeal food, molts and reduce numbers.)

RACKET

BERNARD, C., pp. 8, 10-11. (U.S., California, C. Hodel in the April 1962 issue of the California Real Estate Magazine, page 10, published an article "Is the termite business becoming a legalized racket?" The author lacked knowledge of the Structural Pest Control Board laws of California and of the use of the Standard Inspection Report Form. History of legislation regulating industry 1935-1961 given and inspection report form explained in detail answering Hodel's criticism.)

- HALL, D. G., 1966, p. 8. (U.S., Georgia, racket, only 7 of 84 inspected infested houses by P.C.O. in Savannah in 1934 infested, reported to local sheriff.)
- HODEL, C., 1962, p. 10. (U.S., California, criticism of Structural Pest Control Board and Standard Inspection Report Form implying that the termite business was tending toward being a racket, summary of report in detail.)

RADIATION

- ALIBERT, J., 1963, pp. 1-12. (Frame, Cubitermes fungifaber in laboratory workers and soldiers received regurgitated food (stomodeal) detected by contamination with radioactive phosphorus. Queen is first to be contaminated by salivary liquid from workers, receives constant nourishment; alates close to flight heavily loaded with saliva. Nymphs of last but one stage and king receive only poor quantity.)
- BECKER, G., and BURMESTER, A., 1962, pp. 416-426. (The results published to date on the effect of y-radiation on wood properties compiled; in authors' own experiments pine, spruce, and beech wood exposed to different doses cobalt-60-radiation. Conditions for the development of termites (Heterotermes indicola) were studied, and the results on the eating activity on wood irradiated for different durations tabulated. The reaction to radiation differed for the three wood species. At the heavier dosages of radiation, the termites necessarily ate more wood to satisfy their requirements since the constituents, carbohydrates, were changed; at wood lightly radiated, the termites ate less wood, less than untreated.)
- Gösswald, K., and Kloff, W., 1961, pp. 7-12. (Germany laboratory radiobiological experiments with insects including termites, use of radioactive isotopes as tracers in social life opens new field. Young termites are not helpless. Marking food with isotopes gives data of great interest. Young of first and second stadia do not feed themselves, fed by other termites as are soldiers. No asocial tendencies in sexual males. In case of many termites one caste which has suddenly become overabundant will be completely eaten even though fully sound.)
 - 1963, pp. 25-42. (Tracer experiments on food exchange using labeled food studies were made to determine for *Kalotermes flavicollis* which stages and castes are capable of direct feeding or are receptors of stomodeally or proctodeally given trophallactic food. Pseudoworkers are most effective. Tracer methods were also used to explain the greater longevity and agressiveness of termites when in groups rather than as single individuals. Pseudoworkers were labeled with 1^{1an} The tracer remained longer in groups.

The greater economy in the use of food and other substances may be contributory factor to the "group-effect" in social insects.)

- KURIR, A., 1963, pp. 67-70. (For radical control of termites in open places radioactive isotopes in the form of atomic wastes lowered into the ground to a depth of 1-2 mm. where the queens are. By weak doses the gonads of the two sexes could be weakened and fertility reduced. After a few years the populous termite community can be radically destroyed. Precautions outlined for control work.)
- MCMAHAN, E. A., 1963, pp. 74-82. (U.S., Cryptotermes brevis food exchange relationships by nymphs traced by radioisotopes, soldiers and supplementary reproductives had smaller feeding capacities than nymphs of same weight. Strontium-labeled donors lost a much larger percentage of their nuclide via pellets than cobalt-labeled donors; the strontium tended to be concentrated in the malpighian tubules, the cobalt in the hindgut. It is suggested that the symbiotic protozoa and bacteria concentrated the cobalt. Pellet production at the rate of 0.65 pellet per termite per day, molting caused cessation.)
 - 1963a, pp. 32-34, 36. (U.S., Cryptotermes brevis, radioactive tests show how termites feed, food exchange: feed the dependent young and soldiers, distributes the ectohormones affecting caste differentiation, distributes the symbiotic cellulose digesting protozoa. Proctodeal food from the hindgut was the most usual way of exchange. Tracing these habits by radioisotopes permits study of termite activities under relatively natural condition.)
- NAKAJIMA, S., SHIMIZU, K., and NAKAJIMA, Y., 1963, pp. 340-346. (Japan, biological influence of Formosan termites exposed to Co⁶⁰ gamma source. The longevity of the termite was reduced in proportion with the increase of the radiation dosage from 3000 to 12,000 roentgens, but the reduction was not remarkable in the $\Re r \times \delta r$ and the $\Re \times \delta r$ exposed to 3000 r. In proportion to the radiation dosage from 3000 r to 12,000 r, the number of the sets depositing eggs as well as the total number of eggs deposited were reduced. The emergence of the soldier

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caste in the $\Im \times \Im r$ decreased with the increase of the radiation dosage. The degree of the biological influence of the

REARING

- AUSAT, A., CHEEMA, P. S., KOSHI, T., PERTI, S. L., and RANGANATHAN, S. K., 1962, pp. 121-125. (Laboratory culturing Odontotermes obesus, India, pair of alates in tube with moist soil, also when foraging started colony transferred to larger container with pieces of Semul wood added, maximum duration 947 days. Also termites collected from mound without queen, with sawdust, agar and soil; and with fungus garden added; survived for 3 months, as against 20 days without. Eggs laid 3-4 days after pairing, hatch after 19-21 days, workers appear after 12-14 days.)
- BECKER, G., 1965b, pp. 385-398. (Small termite groups can be maintained and observed between glass plates; asbestos cement containers suitable for larger colonies. Some species can be maintained without soil.)
- Ніскім, N. E., 1961, pp. 84-86. (England, European, and tropical Reticulitermes.

RATNASWAMY, M. C., 1961, pp. 341-344. (India, anatomical studies in the Italian

RESISTANT WOODS, FIBER, PLASTICS

RESISTANT PLANTS

ANONYMOUS, 1960b, pp. 1-6. (Tanganyika, natural durability timbers.)

1960c. (Resistance, West African timbers.) 1962n, p. 81. (Australia, reference to published papers.)

- AUSAT, A., CHEEMA, P. S., KOSHI, T., PERTI, S. L., and RANCHANATHAN, S. K., 1962a, pp. 199-202. (Natural resistance woods to Heterotermes indicola, India in laboratory, longevity termites in sawdust of woods show great agreement with field trials.)
- BECKER, G., 1961, pp. 278-290. (German and Indonesian woods tested in laboratory, termites Kalotermes flavicollis, Zootermopsis angusticollis, Reticulitermes lucifugus, var. santonensis, Heterotermes indicola, and Nasutitermes ephratae. Resistance varied with termite species. Tectona grandis, small heartwood Khaya anthoteca, Diptocarpus sp., Cotylelobium

termites exposed to Co⁶⁰ from 3000 r to 12,000 r is in the following order: $\hat{\mathbf{q}} \times \hat{\mathbf{d}} \mathbf{r} < \hat{\mathbf{q}} \times \hat{\mathbf{d}} < \hat{\mathbf{q}} \mathbf{r} \times \hat{\mathbf{d}} \mathbf{r}.$

Cryptotermes, and Kalotermes maintained under controlled conditions in laboratory in tubes, jars, and plates, partially rotted soft woods used for food.)

- 1963, pp. 267-284. (Britain, rearing termites in laboratory, historical and recent, at Felcourt large general receptacle, battery jar, Jucci-Grassé tube, Lüscher plate-type termitarium.)
- SAMPAIO, E. J. F., 1963, pp. 32-41. (Portugal, Reticulitermes lucifugus, method rearing colonies 100, 0.4% mortality of colonies, high number reproducing colonies (50%), low cost maintenance in laboratory, 300 colonies (about 30,000 termites kept March 1960 till July 1961.) SENSKE, W. M., 1966, p. 24. (Washington,
- Spokane, portable termite colony to boost sales described and illustrated. Cover infested section wood with sheet of tightly glued glass and place in dish of water; one colony lived 9 months.)

millet (Setaria italica Beauv.) in relation to termite resistance.)

melanoxylon, Koompassia malacensis, Shorea sp., Shorea stenoptera resistant, last three failed in case of one termite species each. Resistance differs in different parts stem of wood.)

- 1963b, pp. 132-145. (Laboratory testing the natural resistance of 14 Indonesian and 7 German species of woods against 5 species of termites from temperate and tropical regions proved that results obtained by tests with one termite species cannot be applied to others.)
- COUDREAU, J., FOUGEROUSSE, M., BRESSY, O., and Lucas, S., 1960, pp. 40-51. (France, new method testing resistance tropical woods to Reticulitermes lucifugus. Rapid laboratory tests, criterion loss weight wood and number of termites involved; at beginning and end of test. Average percentage wood destroyed given in parentheses; Eucalyptus resinifera

(15.6%), Distemonanthus benthamianus (14.2%), Tarrietia utilis (11%), Anopyxis klaineana (9.6%), Piptadenia africana (9.4%), Tarrietia javanica (6.6%), Eucalyptus robusta (5%), Afzelia africana (5%), Mammea africana (3.9%), Guibourtia demeusei (3.5%), Chlorophora regia (2 samples) (3.5%) and (2.8%), Nauclea diderrichii (3.4%), Mansonia altissima (3%), Autranella congolensis (1%), Lophira alata (negligible attack). None of the termites survived the test of these woods. Colonies were established in tubes with fragments of wood on a column of damp sand.)

- DA COSTA, E. W. B., RUDMAN, P., and GAY, F. J., 1958, pp. 291-298. (Melbourne, Australia, resistance of teak *Tectona* grandis to decay dependent on extractives, as was resistance to *Coptotermess lacteus* and *Nasutitermes exitiosus*, correlation between age of tree and extractive content, most in durable outer heart wood.)
 - 1960, (Relationships of growth factors to the durability of teak.)
 - 1961, pp. 308-319. (Idem.)
- DAS, N. R., CHANDOLA, L. P., and RAMOLA, B.C., 1965, pp. 6-12. (India, New Forest, Dehra-Dun, inspection in 1964 of tests on natural durability of timbers in test yard.)
- GAY, F. J., 1961, pp. 37-38. (Australia, laboratory studies, pp. 37-38, field studies, p. 38; laboratory testing of 10 Western Australian commercial timbers with Coptotermes lacteus now in progress. Field tests of the same woods with Coptotermes acinaciformis, Heterotermes ferox, and Microcerotermes implacidus after 3 years show high susceptibility of Eucalyptus gomphocephala and E. diversicolor, and high resistance of E. marginata, E. redunca, and Acacia acuminata.)
 - 1962, p. 62. (Field tests after 4 years show high resistance of the above three species of commercial timbers.)
 - 1963c, pp. 71-72. (Australia, laboratory studies, employing Nasutitermes exitiosus, Coptotermes lacteus, and C. acinaciformis show powder bark (Eucalyptus accedens has same resistance as wandoo (E. redunca) and would be a satisfactory substitute as a pole timber. The Central American Achras zapota is almost immune to attack. Polyethylenes with a

low melt flow more resistant than with high index. Field tests, employing Coptotermes acinaciformis, Heterotermes ferox, and Microcerotermes implacidus, 10 commercial timbers from Western Australia fall into 4 durability groups; highly resistant: Acacia acuminata; resistant: Eucalyptus redunea, E. marginata, E. patens; moderately resistant: E. guilfoylei, E. jacksoni, E. astringens; susceptible to very susceptible: E. calophylla, E. gomphocephala, E. diversicolor.)

- 1965, pp. 47-48. (Australia, laboratory tests with the same species of termites as used in 1963 showed that plantation-grown cypress pine (Callitris intratropica) is as resistant as naturally grown trees. Natural resistance of brigalow, Acacia harpophylla, is superior to tallowwood Eucalyptus microcorys and equivalent to spotted gum E. maculata. Hardboard with 0.025% heptachlor is highly resistant. Airfield lighting cable with polythene sheath and Nylon II jacket immune. Field tests, Acacia acuminata and Eucalyptus redunca highly resistant to Coptotermes acinaciformis, Heterotermes ferox, and Microcerotermes implacidus, former Western Australian timber after 6 years.)
- GAY, F. J., and WETHERLY, A. H., 1962, pp. 1-31. (Australia, plasticized polyvinyl chloride, polyethylene and cellulose esters are liable to severe damage by termites; plastics are more liable to attack by species of Coptotermes than by Nasutitermes exitiosus. Changes in nature and amount plasticizer can improve resistance plasticized polyvinyl chloride and similar improvement can be effected in polyethylene by a change from low to high density material. Thickness important factor in susceptibility but hardness more important, although limiting flexibility. The addition of aldrin or dieldrin might produce toxic hazard. The addition of a nontoxic mineral filler reduces susceptibility without affecting the physical properties of the plastic adversely.)
- HOLMGREN, L., 1963, pp. 1-4. (Resistance Ethiopian timbers to termite attack.)
- HRDÝ, I., 1961, pp. 41-50. (Czechoslovakia, resistance wood and plastics to *Reticulitermes lucifugus.*)
 - 1961a, pp. 546-556. (Czechoslovakia, *Reticulitermes clypeatus* and *lucifugus* in laboratory in Petri dishes on moist filter
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paper and in moist soil, the termites escape after eating through the specimens, a rapid test. None of the specimens can be termed resistant. Field tests at Canton, China (250) days determined *Fraxinus chinensis* the most resistant.)

- 1961b, pp. 557-565. (Czechoslovakia, *Reticulitermes lucifugus* slightly damaged *Fraxinus chinensis, Machilus* sp., and *Ternstroemia gymnothera*, other woods and plastics tested not resistant.)
- 1961d, pp. 133-148. (Czechoslovakia, natural resistance timbers.)
- KONDO, T., KUROTORI, S., TESHIMA, M., and SUMIMOTA, M., 1963, pp. 125-129. (Japan, the termicidal wood extractive from *Kalopanax septemlobus*.)
- MARTÍNEZ, J. B., 1963, pp. 87-119. (Peninsula, Spanish Guinea, Brazil, list of woods resistant to *Reticulitermes lucifugus;* list of woods resistant to *Cryptotermes brevis,* Canary Islds. Extractives which give wood resistance.)
- ORTIZ CESPEDES, M. R., 1964, pp. 21-22. (Wood (*Pinus radiata*) and wood products exposed to *Calotermes chilensis;* durability particle board.)
- ROONWAL, M. L., CHATTERJEE, P. N., and THAPA, R. S., 1962a, pp. 1-3. (India, a proprietary cloth "PAN" Nos. 4, 5, and 6 made of synthetic fiber was tested for 25 months underground at Dehra Dun. The cloth, wrapped about or between blocks of wood, showed more or less full resistance to Odontotermes assmuthi and O. parvidens up to about 16 months, but thereafter was attacked in varying degrees. "Control" muslin was destroyed within 5 months and plain wood within 16 months.)
- RUDMAN, P., 1959, pp. 112-115. (Australia, some conspicuous phenolic components from extractives in heartwood of eucalypts and their relation to decay resistance.)
 - 1960, pp. 1356-1357. (Australia, anthraquinones of teak (*Tectona grandis*.)
 - 1965, pp. 52-58. (Australia, resistance in *Callitris columellaris*, toxicity wood extractives.)
- RUDMAN, P., and DA COSTA, E. W. B., 1959, pp. 33-42. (Australia, variation in extractive content and decay resistance in the heartwood of *Tectona grandis*.)
 - 1960. (Australia, investigations on durability of teak, Asia-Pacific Forestry Commission.)

- 1961, pp. 10-15. (Australia, variation in the role of toxic extractives in the resistance of durable eucalypts to decay.)
- RUDMAN, P., and GAY, F. J., 1961, pp. 50-53. (Australia, cause natural resistance tallowwood (*Eucalyptus microcorys*) heartwood to attack by *Nasutitermes exitiosus* indicate extractives of major importance, act as repellent, major constituent *cyclo* eucalenol repellent not termiticide, antitermite activity destroyed by saponification.)
 - 1961a, pp. 117-120. (Australia, measurements of antitermite properties of anthraquinones from *Tectona grandis* L. f. by a rapid semimicromethod.)
 - 1963, pp. 21-25. (Australia, a number of anthracenes, anthrones, anthraquinones and xanthones have been tested with *Nasutitermes exitiosus* for antitermitic activity. Many of the substances, while not toxic, act as deterrents. Aurofusarin, which is possibly a naphtoquinonylpyrone, was equally effective.)
 - 1964, pp. 113-116. (Australia, Coptotermes lacteus, intraspecific variations in termite resistance to cypress pine (Callitris columellaris F. Muell.)
- SCHULTZE-DEWITZ, G., 1960, pp. 64-68. (Natural resistance of the heartwood of exotic woods to *Reticulitermes lucifugus*, Germany.)
 - 1960a, pp. 365, 367, 413-415, 445-446. (Resistance to *Reticulitermes lucifugus* of woods of various structures and density. Tests of spring and summer wood.)
 - 1961, pp. 29-31. (Differences in the extent of damage by *Reticulitermes lucifugus* and *R. flavipes* to heartwood of *Pinus* sylvestris, *Picea abies* and *Quercus* robur.)
 - 1963, pp. 24-31. (Laboratory tests of termite-resistant woods *Fitzroya cupressoides* and *Sequoia dendron giganteum* exposed to *Reticulitermes lucifugus* showed that by increasing the number of test organisms (1000 workers) these woods were considerably attacked, Germany.)
 - 1965, pp. 127-134. (Laboratory tests of sapwood and heartwood of Scots pine and Douglas fir using 200 workers of *Reticulitermes lucifugus* indicated that a period of 4 to 6 weeks gave sufficient results. Untreated sapwood of Douglas fir was more resistant even after 8 years

of storage than the heartwood was at the beginning. This difference seems to disappear after I month of attack by a wood-destroying fungus, Germany.)

SEN-SARMA, P. K., 1963, pp. 1-10. (India, *Heterotermes indicola* longevity in sawdust from 40 common Indian timbers; deodar, 6 days, laurel, 9; 11-20 days: white cedar, sal, etc.; 21-30 days: toon, teak, etc. Accelerated laboratory tests of 37 common Indian timbers; highly resistant: deodar, sal, teak, etc.; moderately susceptible: toon, laurel, etc.)

1963a, pp. 51-56. (India, Kalotermes flavi-

REVIEWS AND ABSTRACTS

- CHATTERJEE, P. N., 1961, P. I. (India, review in detail contributions to the systematics of oriental termites, Roonwal and Sen-Sarma 1960. First of a series of entomological monographs to be issued by the Indian Council of Agricultural Research, it is the outcome of taxonomic work at the Forest Research Inst. 1953-1956. There are five articles, out of which two are revision works, new species, a new family, keys, redescriptions of known species and a new term "pseudoworker" to designate immature worker-like individuals who perform the duties of workers in the Kalotermitidae.)
- DAVIES, R. G., 1962, p. 152. (Review: General, growing economic importance termites in tropics, immense biological interest shown in "Termites; their recognition and control," Harris, W. V. 1961, Extensive experience as head of the Colonial Office Termite Research Unit has led to an excellent well-illustrated account of termites, how they affect man's welfare and how to control them.
- GHILAROV, M. S., 1961, pp. 393-397. (Review and abstracts of papers on termites in the humid tropics at an international symposium in India in 1960.)
- RILEY, N. D., 1962, pp. 916-917. (Review: General, termites; their recognition and control. Harris, W. V., 1961. Damage important in tropics; as head of Colonial Office Termite Research Unit, Dr. Harris

collis accelerated laboratory tests nine species Indian woods.)

- 1963b, pp. 57-65. (Europe, methods testing materials.)
- SEN-SARMA, P. K., and CHATTERJEE, P. N., 1965a, pp. 805-813. (India, laboratory tests, qualitative and quantitative, resistance 16 species Indian woods against *Neotermes bosei.*)
- SOLIMAN, A. A., 1964, pp. 305-307. (Egypt, *Hodotermes ochraceus,* the susceptible level to both DDT and BHC is low, BHC is more toxic at lower concentrations and is recommended for control.)

has specialized experience in biology, morphology, classification and identificaiton. Injury to crops as well as buildings dealt with on a geographical basis, control given.)

- SNYDER, T. E., 1962, pp. 48, 50. (Abstracts: General, summary of 13 papers on termites presented at the 4th Congress Internatl. Union Study Social Insects, Pavia, Italy, Sept. 9-14, 1961. Subjects: endocrinology, biology, control, damage, resistant woods, protozoa, taxonomy.)
 - 1962a, p. 50. (Review: General, termites; their recognition and control. Harris, W. V. 1961. Damage as world problem, to buildings and products, living crops, lists injurious termites, distribution, habits, detection, and control.)
 - 1963a, p. 13. (Review: Insect factor in wood decay. Hicken, N. E. 1963. Damage by wood-boring insects, especially wood worm in Britain. Legislation in Britain to prevent introduction termites.)
 - 1966a, p. 231. (Review. The termites of the United States. A handbook. Weesner, F. M. 1965. Written for the information of commercial pest control operators, discusses classification, structure, castes, habits and introductions. Data on indoor flights species of *Reticulitermes* on regional basis for 1964 and 1965 with cooperation of 200 operators, keys to species.)

SECRETIONS

FUJII, N., SEGAWA, M., OCHIAI, N., and SHIMIZU, K., 1962, pp. 7-11. (Japan, distribution of free Amino acids in egg, worker and soldier of *Coptotermes* formosanus by one dimensional ascending paper chromatography. Isolated were leucine, valine, tyrosine, alanine, glutamic acid, serine, lysine, and cystine.) NO. 3

- HERLANT-MEEWIS, H., and PASTEELS, J. M., 1961, pp. 3078-3080. (*Calotermes flavicollis*, moulting glands, prothoracic, in all castes; persistency in soldiers.)
- HRDÝ, and Novák, V. J. A., 1960, pp. 222-225. (Czechoslovakia, exohormone of the queen honeybee and *Kalotermes flavi*collis pseudoergates found nonspecific.)
- LÜSCHER, M., 1959, pp. 161-166. (Kalotermes flavicollis, development polymorphism under influence pheromones and factor of nourishment, corpora allata activity determines differentiation of the castes.)
 - (1960), 1962, pp. 579-582. (Social hormones play an important role in social insects. In termites pheromones are responsible for the differentiation of castes and social regulation, as well as trail marking.)
 - 1961a, pp. 57-67. (Social control of polymorphism, differentiation of castes due to pheromones, the termite colony may be regarded as a superorganism which reacts as a whole to disturbances.)
 - 1962, pp. 1-11. (Kalotermes flavicollis, metamorphosis and caste differentiation controlled by hormones. Juvenile and gonadotropic hormones of corpora allata most important; juvenile hormone being responsible for competence and stationary and regressive molts, gonadotropic for soldier differentiation. Hormone-like substances or pheromones are given off by reproductives and probably also by other castes. They circulate within the colony and influence the endocrine system of the larvae and nymphs which receive them. They are responsible for social regulation within the colony while the hormones bring about or inhibit specific determinations within the individual termite.)
 - 1962a, p. 615. (Sex pheromones in the termite superorganism.)
 - 1963a, pp. 1-11. (Kalotermes flavicollis full-grown larvae or pseudergates have four different development possibilities at each molt, direction induced by intrinsic environmental factors, if colony regarded as a superorganism. Soldier and alate development seem to be dependent on nutrition. There is strong evidence that pheromones (social hormones) are involved in supplementary reproductive development, probably induced by a massive release of brain hormone in a pseudergate with a high juvenile hormone titer. Caste differentia-

tion controlled chiefly by a mechanism of differential timing of hormone secretions, which itself is regulated by pheromones and nutritional influences.)

- 1963b, pp. 189-192. (Zootermopsis nevadensis, demonstration of a trail pheromone showed how an ether solution of a gland on the 5th sternite brushed on glass would lead this termite to follow a trail.)
- 1964 pp. 79-90. (Kalotermes flavicollis, specific effect of male and female functional replacement reproductives upon transformation of the larvae and 1st stage nymphs into replacement reproductives. Female reproductives always produce a sex-specific inhibitory pheromone, while males only produce a comparable pheromone when in the presence of a female. Single male reproductives have a stimulatory effect upon the transformation of female larvae and nymphs into replacement reproductives.)
- MOORE, B. P., 1962, pp. 13-15. (Australia, Nasutitermes exitiosus, evidence for existence soldier controlling pheromone. Chemistry scent-trail, three component pheromones isolated, others exist in active concentrates. Defensive secretion preponderance unsaturated terpene-like hydrocarbons, 80% of total volatile fraction. Chemical nature coumarin-like substance isolated from haemolymph Nasutitermes sp., nasutins appear to be derivatives of ellagic acid and may function as antibiotics in the living insects.)
 - 1962a, pp. 1101-1102. (Australia, coumarinlike substances, nasutins from *Nasutitermes* spp.)
 - 1963, pp. 12-13. (Australia, chemical characterization of scent-trail pheromones of Nasutitermes exitiosus: are lipid in nature, show activity as low as 10-6 molar in inert solvent. Trails of purified main component are also readily followed by other species of Nasutitermes which possess no ventral gland, but are ignored by Coptotermes lacteus and similar species, where a prominent ventral scent gland is present. Preliminary analyses of the lipids of N. walkeri and C. lacteus show neither species to contain the exitiosus pheromone although in N. walkeri closely related compounds are present. Trail activity of this type may prove to be genus-rather than speciesspecific. The soldier-defensive secretions of Nasutitermes have in exitiosus,

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walkeri, and *graveolus* terpenoid hydrocarbons, the same four are present in each species although in differing proportions. One of these is an alphapinene, a characteristic component of oil of turpentine, and it is likely that other constituents of turpentine are also present in the termite secretions. There appears to be a relationship between these nasutins and the plant metabolite, ellagic acid, which may function as antibiotic.)

- 1964, pp. 371-375. (Australia, Nasutitermes soldiers, as above, alpha-pinene has been identified as a major volatile component of defensive secretions of three species; beta-pinene and other monoterpenoid hydrocarbons also present in significant amounts. Terpenes function largely as solvent-carriers for the resinous constituents of the secretions but may also serve as alarm substances.)
- 1965, pp. 17-18. (Australia, active main scent-trail pheromone of *Nasutitermes exitiosus natural* concentration in active termites less than one part per million, less during winter. Soldier-defensivesecretions important in biology. Monoterpenoid hydrocarbons wide spread in specialized family Termitidae, alarm pheromones, not present in more primitive families.)
- MOSCONI, P. B., 1963, pp. 22-28. (Italy, by general staining methods the morphology of the endocrine system of five species of termites in different families has been described comparing it with similar researches on Blattoidea. By histological and histochemical methods for demonstrating the neurosecretion, the tentorial behavior of stomodeal and central nervous system and endocrine organs of some castes of these species have been examined, especially neuter

castes of *Reticulitermes lucifugus*. Best results have been obtained by Gomori's chrome-haematoxylin-philoxin method: Gomori positive-material has been found in the cell's cytoplasm of the frontal ganglion, of the proto- and deutocerebrum, of the thoracic and abdominal ganglia. Secretion granules have been observed in corpora cardiaca, and allataand relative nerves-and in the tentorial (ventral) gland. The same results have been obtained by aldehyde-fuchsin technique. Argentaffine granules are present in the corpora allata.)

- SCHNEIDERMAN, H. A., and GILBERT, L. I., 1964, pp. 325-333. (Several growth hormones appear to be isoprenoid derivatives, and some may act upon the cell nucleus. Insect hormones have been crystallized. There are now known more than a dozen chemicals which can simulate the effects of insect hormones. Findings suggest: ecdysone, juvenile hormone, gonadotropic hormone and perhaps brain hormone may be related chemically; these substances may all be polyisoprenoid derivatives. Some insect hormones are steroids, then either they must be modifying a dietary sterol or different pathways of sterol biosynthesis exist in insects than those reported in microorganisms and mammals.)
- STUART, A. M., 1963, pp. 69-84. (Origin of trail in *Nasutitermes corniger* and *Zootermopsis nevadensis*, odor trails, substance in sternal gland.)
 - 1964, pp. 43-52. (Structure and function sternal gland Zootermopsis nevadensis, morphology, histology described, discussed, illustrated, secretion probably a grease passed through the cuticle. When alarmed lays a trail by dragging its abdomen.)

SENSE ORGANS

- ABUSHAMA, F. T., 1964a, pp. 145-147. (Olfactory receptors on antenna of Zootermopsis angusticollis.)
- Howse, P. E., 1962, pp. 457-459. (Zootermopsis angusticollis, perception of vibration by the subgenual organ, responses recorded from the nerve cord.)
 - 1963, pp. 258-267. (Zootermopsis angusticollis, evolution of the production of vibrations as a communication means.)
 - 1963a, pp. 256-268. (Zootermopsis angusticollis, several types of vibration move-

ment or jerking behavior by individuals, recognized each occurring under different conditions of stimulation. Main behavior pattern giving rise to substratum vibration and usually audible sound which has been recorded.)

1964a, pp. 409-424. (Zootermopsis angusticollis, action potentials deriving from tibial subgenual organ have been recorded from termite nerve cord preparations. The two kinds of cells in the organ, which are differently disposed, will be set into transient oscillation following their displacement from steady-state conditions. The natural frequency of the two kinds of cell will be different, and for the short time that the transient vibrations last rapidly changing forces will act about the junctions of the two

- ANONYMOUS. 1962i, p. 14. (U.S., shielding repudiated, had become a racket, in disrepute.)
 - 1964g, p. 3. (U.S., shields effective if properly designed, installed, and inspected, but now in disrepute because improperly installed.)
 - 1964r, pp. 11-, 14-15. (U.S., survey shows shield ineffective, J. B. Cobb, University of Georgia, study in northeast Georgia determines shields as installed in area afford little protection, 310 houses (crawl
 - SOIL POISONS, BAITS, DUSTS, REPELLENTS
- ALLEN, T. C., ESENTHER, G. R., and LICHT-ENSTEIN, E. P., 1964, pp. 26-29. (U.S., Madison, Wisconsin, *Reticulitermes flavipes*, dieldrin-concrete mixtures (0.1% and 1.6% wettable powder in waterless toxic), laboratory aging of mixture left a stable residual toxicity. Mixtures that were subjected to outdoor weathering for 22 months were equal in toxicity to newly prepared mixtures. Exposures of 10 species of termites to dieldrin-concrete showed all species affected; the 4 subterranean species were more sensitive than were 5 nonsubterranean species.)
- ANONYMOUS. 1962l, p. 24. (U.S., tristate PCO convention Jekyll Island, Ga., Aug. 16-18, new bioassay technique described to measure amount toxicant remains after treatment, and how effective they remain. Will determine whether retreatment is necessary; whether enough chemical is being used; able to determine what happens to termiticides as they are absorbed through the soil in penetration studies.)
 - 1964s, pp. 52, 54, 56. (U.S., on the basis of research conducted by Chisholm, Koblitsky, and Westlake and discussed under Soil Poisons 1962 and 1962a, detailed instructions are given on how to use FHA-developed soil test kit to check termiticide residue.)

kinds of cell, and these forces could initiate nervous discharges.)

PRESTAGE, J. J., SLIFER, E. H., and STEPHENS, L. B., 1963, pp. 874-878. (U.S., *Reticulitermes flavipes*, thin-walled sensory pegs on antenna worker, most numerous at ends of distal subsegments, described and illustrated.)

SHIELDS

space) inspected. Lists 1,423 installation defects, 31% improper design; 61% careless installation; interference by service installations after shields in place.)

- HAMILTON, J. R., and COBB, J. B., 1964, pp. 1-7. (U.S., Georgia, metal shields in small home construction. Conclusions: as installed in northeast Georgia afford little protection against termites, too many defects, alternate control methods suggested.)
- Attfield, J. G., 1962, pp. 252-253. (Insecticides.)
- BEAL, R. H., and SMITH, V. K., 1964, p. 771. (U.S., Mississippi, granules of aldrin 0.5 pound per 10 feet soil surface, gamma benzene hexachloride 0.9 pound, chlordane 1.0 pound, dieldrin 0.5 pound and heptachlor 0.5 pound all 100% effective after a 5-year exposure. The tests will have to continue longer to determine whether granules are as effective as emulsions.)
- BERZAI, L. J., 1964, p. 46. (U.S., Indiana, with colored dyes mixed into termite soil poisons, operators can check on the placement and effectiveness of treatment and see if any movement of chemical occurs after application. Red iron oxide (10 pounds added to each 250 gallons of water emulsion) colors spray light red. Useful in treating water-logged soil; where seepage occurs dye material will have "run." Cost dye 10 cents per pound.)
- BROOK, T. S., 1965, pp. 42, 44. (U.S., Mississippi State Univ., studies distribution termiticides in soil in test plots, 6 weeks after treatment dieldrin had moved more than chlordane with greater mortality. Studies of extent of termite feeding on test wooden blocks are being made.)

- CASIDA, J. E., 1964, pp. 1011-1017. (Organophosphates and carbamates are used primarily as contact insecticides. Of lower mammalian toxicity and problems of residues and resistance of the chlorinated hydrocarbons will result in a shift to esterase inhibitors for pest control. Listed with formulae are organophosphates including parathion, malathion, diazinon, dichlorvos, tepp, dimethoate, and ronnel; carbamates, including isolan and carbaryl.)
- CHATTERJEE, P. N., 1963, p. 148. (India, mixture of BHC (gammexane) and dieldrin has much higher residual effect than these insecticides when used alone.)
- CHISHOLM, R. D., KOBLITSKY, L., and WEST-LAKE, W. E., 1962, pp. 1-8. (U.S., rapid methods of estimating residues of aldrin and chlordane in soils treated for termites.)
 - 1962a, pp. 48, 50-53, 66. (U.S., methods of estimating residues of aldrin and chlordane in soils treated for termites, both by color and organic chloride analysis.)
- COLEMAN, V. R., 1966, pp. 32, 34, 36-38. (U.S., tests of Cecil Series subsoil southern Piedmont Region using fruit fly to assay soils treated with chlordane, aldrin, dieldrin, and heptachlor. Chemicals did not lose their residual effectiveness for 1-, 3-, and 6-month test. Details technique given.)
- DECKER, G. C., BRUCE, W. N., and BIGGER, J. H., 1965, pp. 266-271. (U.S., Illinois data are presented to delineate (1) the rate and extent of aldrin conversion to dieldrin and (2) the rate of residue (aldrin + dieldrin) dissipation in soils. It is concluded that under cornbelt conditions the probability that the annual applications of aldrin over a period of 10 years or more will result in accumulations in excess of the annual application rate is remote.)
- EBELING, W., and WAGNER, R. E., 1961, pp. 1, 4. (California, field tests, pretreatment for subterranean termite prevention.)
 - 1962, pp. 16, 18, 20. (California, inspections now being made 5 years after treatment using FHA dosages, and methods, (8 insecticides), except no outside trench, instead liquid poured into depression left when form board was removed. Both joist type and slab on ground houses included. Laboratory

tests of 10 chemicals in clay loam and fine sand, after $2\frac{1}{2}$ years the treated soil was toxic at very low concentrations. It is more effective to change the carrier than the insecticide, in wet soil use half the volume of water, double the concentration of the insecticide; in dry soil, vice versa.)

- FLEMING, W. E., PARKER, L. B., MAINES, W. W., PLASKET, E. L., and McCABE, P. J., 1962, pp. 1-44. (U.S., residues of chlorinated hydrocarbon insecticides may persist in soil for several years. Comparable results obtained in biological and chemical determinations, but as the insecticides weathered, bioassay appeared more reliable. Amounts of insecticides inactivated varied with type soil, muck most adsorbent inactivated 90%, more attention should be given to nature soil, less insecticide needed for mineral soils; bibliography.)
- GAY, F. J., 1961. (Field studies, p. 38. In Commonwealth Sci. and Indus. Res. Org., Divis. Ent. 1960-1961 Ann. Rept.) (Australia, Riverina, soil treatment tests, against Nasutitermes exitiosus, 0.1% and 0.2% lindane, 1% and 2% chlordane, and tetrachlorbenzene (1:3 in diesel distillate or creosote) have given complete protection for 6 years; against Coptotermes lacteus, 0.1% dieldrin and 2% chlordane for 7 years; and 0.1% and 0.2% aldrin and tetrachlorbenzene for 6 years; against a termite complex in the Riverina, 5% pentachlorophenol, 5% sodium pentachlorophenate, 2% chlordane, and creosote for 8 years; while 0.5% lindane, 0.5% aldrin, 0.5% dieldrin, and 1% chlordane have given 5-year protection to date.)
 - 1962, p. 62. (The above tests have proven effective for another year.)
 - 1963a, pp. 1-4. (Australia, soil poison tests in New South Wales at Sutton, Braidwood and Riverina, which vary in soil types, climate and termite fauna, tests described and illustrated. The most effective chemicals are chlordane, aldrin, dieldrin, or lindane for periods of 7-10 years; soil poisoning is the simplest method of protection. Details of protective treatments given.)
 - 1963c, pp. 71-74. (Australia, against Nasutitermes exitiosus, 0.2% lindane, 1% and 2% chlordane, and tetrachlorbenzene (1:3 diesel distillate or creosote) have

all given complete protection for 8 years. Against *Coptotermes lacteus*, 2% chlordane has given protection for 9 years, tetrachlorbenzene for 8 years. Against a termite complex in the Riverina, 2% chlordane has been completely effective for 10 years, 0.5% lindane, aldrin, or dieldrin and 1% chlordane has given 7 years of protection so far.)

- 1965, p. 48. (Australia, field tests against Nasutitermes exitiosus 0.5% aldrin 0.5% dieldrin completely effective after 8 years in soil; 1% and 2% chlordane after 10 years; 0.25% and 0.5% heptachlor after 2¹/₂ years. Breakdown: Sevin 0.5% after 3 years; 0.25% and 0.5% Thiodan after 5 years; tetrachlorbenzene in diesel oil after 10 years. Against Coptotermes *lacteus* the following are still completely effective: 0.25% and 0.5% heptachlor after $2\frac{1}{2}$ years; 0.5% aldrin after 8 years; and 2% chlordane after 11 years. Breakdown: 0.5% Sevin after 3 years; 0.25% Thiodan after 5 years; and tetrachlorbenzene in creosote after 10 years. Against a termite complex of at least three species in the Riverina 1% chlordane completely effective after 9 years, 2% after 12 years; 0.5% aldrin, dieldrin, and lindane for 9 years.)
- HETRICK, L. A., 1962, pp. 270-271. (U.S., Florida, comparative toxicity of DDT, TDE, methoxychlor, BHC (gamma), chlordane, toxaphene, pentachlorophenol, and sodium pentachlorophenate dilutions as soil poisons 15-year test, *Reticulitermes flavipes*, sandy soil. Comparative toxicity 100% knockdown for aldrin, dieldrin, heptachlor dilutions, new organic insecticides superior.)
- JOHNSTON, H. R., 1963, p. 27. (U.S., Gulfport, Mississippi, tests begun in 1944 were examined in October 1962, 18-year test, ground-board and stake tests and site described. Aldrin 0.5% (actual) in water emulsion, 100% effective after 13 years; chlordane 1.0% (technical) in water emulsion, 100%, 14 years; dieldrin 0.5% (actual) in water emulsion, 100%, 13 years; heptachlor 0.5% (actual) in water emulsion, 100%, 10 years; benezene hexachloride 0.8% gamma in water emulsion, 100%, 7 years, less than 50%, 12 years; DDT 8.0% (technical) in oil, 100%, 5 years, 90%, 11 years, less than 50%, 14 years.)
 - 1965a, p. 687. (U.S., Gulfport, Mississippi,

above tests, environment described, two species *Reticulitermes* involved, chlordane 100% effective after 15 years, aldrin and dieldrin after 14 years, heptachlor after 11 years. Since 1958 granular formulations of these chemicals applied to the surface have been 100% effective. Benzene hexachloride and DDT failed after about 10 years. Protection duration depends to some extent on the quantity of chemical applied; cost chemical small part of total cost of treating a building, false economy to reduce quantity applied.)

- KATZ, H., 1962, p. 60. (U.S., in pretreatment slabs, treat drain pipes near footing to prevent entrance termites, etc.)
 - 1962a, pp. 44, 46. (U.S., micronized dusts applied in same hole used to inject liquid to the footing, one or two strokes to the opening in wall void, 6% chlordane in microcel or 1% lindane micronized, more effective than solutions.)
 - 1962b, p. 44. (U.S., Pittsburgh, Pennsylvania states that French drains, rockfills of various sizes in a stratified layer on the uphill side of a house, with a trench and drain tile at bottom, last 2 feet covered with soil are a problem. In rodding soil poison goes down drain. Remedy use quick-breaking emulsion which will adhere to rock.)
- LICHTENSTEIN, E. P., SCHULZ, K. R., and COWLEY, G. T., 1963, pp. 485-489. (U.S., in laboratory in a silt loam soil inhibition of conversion of aldrin to dieldrin with methylenedioxyphenyl synergists showed sesamex inhibited conversion more than any other; sesamol, a breakdown product of sesamex, did not inhibit it significantly and maize oil increased it.)
- MARSHALL, C. W., 1966, pp. 72, 74, 76. (U.S., rodding techniques for soil poisoning under slabs, vertical drilling, short rodding and long rodding; first method preferred, short rodding more expensive than long rodding.)
- MOORE, A. D., 1964, pp. 1-3. (U.S., Beltsville, Maryland, aerial test circle in 1963 DDT and DDE residues in soil, after aerial spraying from 1951 through 1958, 5% to 7% DDT and 1.2% to 2% DDE still present in soil in 1963.)
- O'BRIEN, R. E., REED, J. K., and Fox, R. C., 1965, pp. 14-15, 42, 44. (This study indicated that there were wide differ-

ences in the horizontal and vertical movement of insecticide applied by different injector rods to different types of soil. To be effective the above mentioned conditions must be considered if rods are used.)

- SPEAR, P. J., 1962, pp. 1-3. (U.S., new product development for and by the pest control industry, statistics on size pest control industry 5000 firms, amount business annually 300 million dollars, 7-10% expansion in recent years, 30 million dollars per year market for pesticides, special chemicals for special insects, chlordane and dieldrin most common soil poisons used in termite control.)
- U.S. DEPT. AGRICULTURE, FOREST SERVICE. 1961, pp. 1-8. (U.S., soil treatment, an aid in termite control.)
- WHEATLEY, G. A., and HARDMAN, J. A., 1960, pp. 423-427. (Bioassay of residues of insecticides in soil.)
- WIESE, I. H., 1964, pp. 823-835. (South Africa, five chlorinated hydrocarbons inactivated by soils of different types of texture, in loam soil only half as active, in clay only ½ or ¼ as active as in sand, test termite *Trinervitermes trinervoides*.)
- WOLCOTT, G. N., 1953, pp. 1-5. (Residual effectiveness of insecticides against soil inhabiting insects, aldrin most effective against white grubs in Puerto Rico.)

SOUND

- FRINGS, H., and FRINGS, M., 1962, pp. 13-20. (U.S., possibilities of use of sound as means of killing insects, too costly, sound fields restricted in extent, animal must be brought to them.)
- HASKELL, P. T., 1961, pp. 29, 59, 153. (Leucotermes tenuis numbers of individuals tap ground in unison at a rate of 10 times per second, hammering with head produces faint drumming noise. If colonies of Cornitermes similis are disturbed, soldiers will tap heads on ground and may continue for half a minute. This tapping is rhythmical and in unison and is said to act as a warning to the remainder of the colony. Sound produced by adult as result impact against substrate.)
- Howse, P. E., 1963a, pp. 256-268. (Zootermopsis angusticollis, vibration movement or jerking behavior give rise to sound as result of impact against substrate, means recognition.)
 - 1964b, pp. 284-300. (Zootermopsis angusticollis, significance of sound, apparatus for analyzing patterns of sounds described. The .convulsive .movement (Vertical Oscillary Movement) is affected by substratum vibration, not by airborne sound; it has the same effect as a warning signal. Elaborate tests indicate that a "language" making use of variations in the sound pattern could not be expected in Z. angusticollis.)

SUPERORGANISM

Lüscher,	M.,	1961a,	pp.	57-6	7.	(T	ermite	
colony	may	7 be	regard	led	as	a	super-	

organism which reacts as a whole to disturbances.)

TAXONOMY

- AHMAD, M., 1963, pp. 395-399. (Thailand, Indotermes thailandis n. sp. soldier holotype, workers, Tung Sa-Lang Luang Natl. Park, Pitsanulok Prov. Indotermes does not deserve a family rank, belongs to subfamily Amitermitinae, family Termitidae, very closely related to Speculitermes.)
 - 1965, pp. 1-114. (Thailand, 74 species recorded, 29 genera, 32 new species described; holotypes in Dept. Zool., Univ. Panjab, Lahore, Pakistan, paratypes in A.M.N.H. Lists of localities and species

and keys to genera and species, imagos and soldiers included. Species figured; known species redescribed, figured.

Postelectrotermes tongyaii n. sp., imago holotype, Ka-Chong. Glyptotermes kachongensis n. sp., soldiers holotype and paratype, Ka-Chong. Cryptotermes thailandis n. sp., soldier holotype, imago morphotype, Klang Dong. Coptotermes premarasmii n. sp., soldier holotype, imago morphotype, Ka-Chong. Prorhinotermes tibiaoensifornis n. sp., soldier holotype, Wang Nok An. Schedorhinotermes rectangularis n. sp., major and minor soldiers holotype, worker morphotype, Chantaburi. Macrotermes chaiglomi n. sp., major soldier holotype, minor soldier morphotype, 20 km. east of Mae Sod on road to Tak. M. maesodensis n. sp., soldiers major and minor holotype, workers morphotype, 20 km. east of Mae Sod on road to Tak. Odontotermes maesodensis n. sp., soldier holotype, imago morphotype, 20 km. east of Mae Sod on road to Tak. O. proformosanus n. sp., soldier holotype, king morphotype, Ka-Chong. O. paraoblongatus n. sp., soldier holotype, Muaek Lek. O. takensis n. sp., soldier holotype, Tak. Hypotermes makhamensis n. sp., queen, soldiers holotype, paratypes, king morphotype. Muaek Lek. Speculitermes macrodentatus n. sp., soldier holotype, queen morphotype. Tung sa-lang Luang Natl. Park. Microcerotermes minutus n. sp., soldier holotype, imagoes morphotypes. Wang Nok An. M. paracelebensis n. sp., soldier holotype, imagoes morphotypes. Ka-Chong. Amitermes longignathus n. sp., soldier holotypes, paratypes. Huay Yang. Havilanditermes proatripennis n. sp., soldier holotype, imago morphotype. Ka-Chong. Nasutitermes tungsalangensis n. sp., soldier holotype, imago morphotype. Tung Sa-Lang Luang. N. dimorphus n. sp., major soldier holotype, minor soldier morphotype. Kan Tang. N. perparvus n. sp., soldiers holotype, paratype. Wang Nok An. Bulbitermes makhamensis n. sp., soldiers holotypes, paratypes. Makham. B. parapusillus n. sp., soldier holotype, imago morphotype. Prew. B. laticephalus n. sp., soldier holotype, imago morphotype. Tung Sa-Lang Luang. Termes huayangensis n. sp., soldier holotype, imago morphotype. Huay Yang. Mirocapritermes latignathus n. sp., soldiers holotype, paratypes. Ka-Chong. M. concaveus n. sp., soldiers holotype, paratype. Khao Yai. M. prewensis n. sp., soldiers holotype, paratypes. Prew. Dicuspiditermes makhamensis n. sp., soldier holotype, queen morphotype. Makham. Procapritermes prosetiger n. sp., soldiers holotype, paratypes, Ka-Chong. P. longignathus n. sp., soldier holotype. Tung Sa-Lang Luang. Pseudocapritermes parasilvaticus n. sp., soldier holotype, dealate morphotype. Tung Sa-Lang Luang.)

- ARAUJO, R. L., 1961, pp. 105-111. (Brazil, Dihoplotermes inusitatus n. sp., major and minor soldier, imago; major soldier holotype; Morumbia; near Cornicapritermes. First case of two types (dimorphic) soldiers in Termitinae.)
- BANKS, F. A., 1946, pp. i-iii, 1-28. (U.S., distinction of species in *Reticulitermes*, list of species, distribution of genus, keys to species of eastern United States, descriptions, measurements, diagrams, illustrations.)
- BEI-BIENKO, G. YA., 1964, pp. 174-176. (SSSR, European part, key to Kalotermitidae and Rhinotermitidae, with their included genera and species.)
- BOUILLON, A., and MATHOT, G., 1965, pp. 1-115. (Africa, catalog, 613 species in Africa. Keys to families, genera systematic discussion, measurements and indices, variation, morphology soldiers. Names and numbers African genera and species. A series of 25 plates gives detailed morphological drawings of African termites.)
- CHATTERJEE, P. N., and SEN-SARMA, P. K., 1962a, pp. 822-826. (Burma, Odontotermes paralatigula n. sp., soldier, holotype, Hlegu Range, Insein Forest Divis.)
- CHATTERJEE, P. N., and THAKUR, M. L., 1963, pp. 171-203. (Indo-Malayan Region, revision genus (Hypotermes (Termitidae:Macrotermitinae), redescriptions Hypotermes nonpriangi Roonwal and Sen-Sarma, soldier, worker, Assam; obscuriceps (Wasmann), imago, soldier, worker, figured, variations in soldier and worker castes figured. Ceylon, South India; sumatrensis (Holmgren), soldier, worker figured, East Sumatra; winifredi (Ahmad), imago, soldier figured, Ceylon; xenotermitis (Wasmann), soldier, worker figured, Burma.)
 - 1964, pp. 1-6. (India, Kashmir, *Microcerotermes rambanensis* n. sp. soldier holotype, worker morphotype, Maitra Forest, Ramban, India. Types Forest Research Institute, Dehra Dun, India.)
 - 1964a, pp. 7-16. (India, redescription Odontotermes gurdaspurensis Holmg. and Holmg., imago, soldier, major and minor workers, described and figured, mostly from Gurdaspur, Punjab.)
 - 1964b, pp. 149-162. (India, Kulu Valley, Punjab, *Sarvitermes faveolus* gen. et sp. nov., family Stylotermitidae, described and figured, soldier holotype, imago and

worker morphotype, Kulu Saw Mills, Sarvari Village, types in Natl. collection, Zoological Survey of India, Calcutta. Relationship family Stylotermitidae discussed, key to the genera.)

- 1964c, pp. 348-353. (North India, Angulitermes akhorisainensis n. sp. imago, soldier, worker, Termitinae. Characters given to separate from A. dehraensis (Gardner) and A. acutus Mathur and Sen-Sarma. A. akhorisainensis n. sp., all castes described and figured. Soldier holotype, imago, and worker morphotype from Uttar Pradesh, Akhorisan block. Types of Natl. Zoological coll., Zoolog. Survey India, Calcutta.)
- 1964d, pp. 219-260. (Revision genus Microtermes Wasmann from the Indian region, genus and species redescribed and figured. Key to species, list of species; map of world to show geographical distribution Microtermes.)
- CHATTERJEE, P. N., and THAPA, R. S., 1963, pp. 20-26. (India, Madras, *Beesonitermes* n. gen., *topslipensis* n. sp., soldier type species, holotype, workers paramorphotypes, Mt. Stuart, Top Slip, Madras.)
 - 1964, pp. 210-214. (India, *Grallatotermes niger* n. sp., soldier, holotype, worker, morphotype, Mt. Stuart Block, Top Slip, Madras.)
 - 1964a, pp. 514-516. (India, Speculitermes chadaensis n. sp., worker holotype, Chada, South Mandla Forest Divis., Madhya Pradesh. Imago and soldier unknown, Termitidae, Amitermitinae.)
- CHIAROMONTE, A., 1964, pp. 114-116. (Discussion of gender of name *Termes*; species previously described, with neutral specific names need to be revised since *Termes* is a female genus.)
- COATON, W. G. H., 1962b, pp. 114-156. (South Africa, Kruger Natl. Park, *Fulleritermes* gen. nov. type species contractus Sjöstd., pp. 151, 152, figs. 11, 12, list of species formerly in *Coarctotermes* Holmgren, imago-worker mandible diagnosis, pp. 153, 154, fig. 12.)
- CONNECTICUT UNIVERSITY COLLEGE OF AGRI-CULTURE EXTENSION SERV., 1964, p. 1. (U.S., Connecticut, differences between termite and ant.)
- EMERSON, A. E., and BANKS, F. A., 1965, pp. 1-33. (The structure, relationships, phylogeny, distribution, origin, nests, ecology, and associated termitophiles of the South American termite genus Labio-

termes are described and discussed. L. labralis (Holmgren) and L. longilabius (Silvestri) are redescribed and figured. L. brevilabius, n. sp. from Brazil and L. pelliceus, n. sp. from British Guiana are described and figured. A map showing the localities for each species and a key to the known species of imagoes and soldiers are included. Labiotermes brevilabius n. sp., soldier holotype, Novo Horizonte. Brazil, morphotype female imago, São Paulo, Brazil. L. pelliceus n. sp., soldier holotype. Itabu Creek, British Guiana. Types in Amer. Mus. Nat. Hist.)

- ERNST, E., 1963, pp. 276-279. (Tanganyika, Africa *Pseudacanthotermes* spp. biology, nests, keys to soldiers grandiceps, militaris, spiniger.)
 - 1964, pp. 173-178. (Ibid., *P. laticeps* placed as variety of *militaris*, new distribution records.)
- GAY, F. J., 1963, pp. 421-423. (New Guinea, *Coptotermes hyaloapex* Holmgren is synonym of *C. elisae* (Desneux), widely distributed throughout the island, seriously damages living trees and shrubs and timber in service.)
- GRASSÉ, P. P., and NOIROT, C., 1961, pp. 311-359. (Africa, comparison *Bellicositermes* goliath imago, major soldier with *B.* bellicosus, *B.* bellicosus rex, var. nov., *B.* bellicosus jeanneli, geographical variations.)
- HARRIS, W. V., 1961, pp. 1-187. (Africa, tropics identification winged and soldier, illustrated.)
 - 1962d, pp. 311-318. (Africa, map distribution Angulitermes, list world species, measurements soldiers of A. braunsi, elsenburgi, frontalis, and imago and soldier of nilensis n. sp. and truncatus given. A. nilensis alate female holotype, soldier morphotype, Sudan, Khartoum, Burri Woods. A. dehraensis and obtusus from India and hussaini from W. Pakistan are the other species.)
 - 1963a, pp. 1-43. (Africa, Congo, Garamba Natl. Park, Guinean savanna, Basidentitermes demoulini n. sp., soldier holotype, Garamba; Pericapritermes desaegeri n. sp., soldier holotype, Garamba; Promirotermes pygmaeus n. sp., alate male holotype, soldier morphotype, Garamba; Odontotermes garambae n. sp., alate female holotype, soldier morphotype, Garamba. Holotypes in Inst. Pares Nat. Congo, paratypes Brit. Mus.)

- 1964, pp. 171-172. (Israel, Angulitermes quadriceps n. sp., soldier holotype, Sodom area, type in Brit. Mus., Nat. Hist. Species compared with A. nilensis, figured.)
- 1964b, pp. 479-481. (Saudi Arabia, *Microtermes najdensis*, n. sp. soldier holotype, Riyadh on citrus, further record, Mecca. British Museum.)
- 1965a, pp. 10-18. (Western Congo, 21 species Termitidae listed, one new species Termitinae, *Unguitermes bouilloni*, soldier holotype, Takundi, R. Kwango.)
- 1966, pp. 11-17. (Malaysia and South Africa, list of type localities of Isoptera described by Haviland.)
- HELFER, J. R., 1963, pp. 63-80. (North America, how to know termites, keys to winged adults and soldiers with notes on distribution and habits.)
- HRDÝ, I., 1961c, pp. 97-107. (European species *Reticulitermes clypeatus, lucifugus* and *lucifugus santonensis* separated by morphological and biological differences.)
- HSIA, KAI-LING, and FAN, SHU-TEH, 1965, pp. 360-382. (China, eight species and one subspecies, keys based on soldiers and winged, including table, p. 381 for Chinese species. Described and figured are: Reticulitermes grandis n. sp., soldier holotype, Yunnan; Chinping; R. affinis n. sp., soldier holotype, Fukien: Nanping, also winged; R. chinesis leptomandibularis n. sp. soldier holotype, Fukien: Yungan, also winged; R. labralis n. sp., soldier holotype, Shanghai; also winged; and R. curvatus n. sp., soldier holotype, Chekiang: Kingyuan. All types in East China Entomological Institute, Academia Sinica.)
- KRISHNA, K., 1961, pp. 303-408. (World, Kalotermitidae, generic revision, fossil genus Eotermes removed, placed in Hodotermitidae, new genera, new species, phylogeny, list of protozoa symbiotic in Kalotermitidae. Postelectrotermes n. gen., type species praecox (Hagen), Baltic amber, E. Prussia, Upper Eocene. Ceratokalotermes n. gen., type species spoliator (Hill), Federal Capital Territory, Australia, Comatermes n. gen., type species perfectus (Hagen), locality unknown. Incisitermes n. gen., type species schwarzi (Banks), Paradise Key, Fla. Allotermes Wasmann, type species paradoxus Wasmann, S.W. Madagascar. Marginitermes n. gen., type species hub-

bardi (Banks), Sabino Canyon, Santa Catalina Mountains, Arizona. Tauritermes n. gen., type species taurocephalus (Silvestri), Brazil, Corumbà. Proneotermes Holmgren, type species perezi Holmgren, Costa Rica. Bifiditermes n. gen., type species madagascariensis (Wasmann), Nossibé, Madagascar. Bicornitermes n. gen., type species bicornis Krishna n. sp., Camp Putnam, on Epulu River, Congo, soldier holotype, winged morphotype. Epicalotermes Silvestri, type species aethiopicus Silvestri. A list of the genera and new combinations are included.)

- 1962, pp. 1-13. (Mexico; Calcaritermes colei n. sp. soldier holotype near El Naranjo, San Luis Potosi; C. rioensis n. sp. soldier holotype, Ilha Grande, state of Rio, Brazil; C. snyderi n. sp. imago morphotype, soldier holotype, El Salvador, Volcan de Santa Ana, Dept. Santa Ana; C. temnocephalus Silvestri imago morphotype, Maracas Valley, Trinidad, West Indies.)
- 1962a, pp. 1-25. (Allotermes denticulatus n. sp., soldiers holotype and paratype, Madagascar, 39 kilometers east of Tsihombe; A. papillifer n. sp., soldiers holotype and paratype, dealate morphotype, Madagascar, 8 kilometers south of Mahabo. Bicornitermes emersoni n. sp., soldier holotype, Africa, Congo, Leopoldville. Epicalotermes planifrons n. sp., soldiers holotype and paratype, queen and king morphotype and paramorphotype, Madagascar, 15 kilometers southeast of Tuléar. Procryptotermes corniceps (Snyder), species originally described from Puerto Rico redescribed from specimens from Jamaica; P. falcifer n. sp., soldiers holotype and paratype, imagos morphotype and paramorphotype, Mauritius Isld., Réunion Isld., 1 mile east of Port de Galles; P. krishnae Emerson imago morphotype described for first time, Noumea, New Caledonia; P. speiseri N. and K. Holmgren, soldier in Museum Basel redescribed from Emerson's notes, Ambryn, New Hebrides.)
- 1963, pp. 1-22. (Africa, Foraminitermes tubifrons Holmgren winged redescribed, soldier described, Lolodorf, Cameroon; F. coatoni n. sp. described, soldier holotype, winged morphotype, Kalina Woods. Leopoldville, Congo; F. corniferus (Sjöstedt) n. comb., soldier redescribed, Mukimbungu; F. harrisi n. sp., soldier,

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holotype, Keyberg; F. rhinoceros (Sjöstedt) n. comb., soldier redescribed, Mukimbungu, F. valens (Silvestri) n. comb., dealate imago described, soldier redescribed, Mamou, Guinea. Ceratotermes regulated to synonomy. Keys to soldiers.)

- 1963a, pp. 202-209. (Evolution family Kalotermitidae, Isoptera, primitive in its morphology, nesting behavior, social organization. Consists of a number of living genera which have existed since Cretaceous times. The transitional forms in the phylogenetic sequence have persisted, so that there are living fossils or connecting links between many genera. Included are 354 living and fossil species under 24 genera. Eight are new: Postelectrotermes, Ceratokalotermes, Comatermes, Incisitermes, Marginitermes, Tauritermes, Bifiditermes, and Bicornitermes. The genera Proneotermes, Pterotermes, Allotermes, and Epicalotermes are resurrected.)
- 1965, pp. 1-34. (Burma, two families of termites are found in Burma, the Rhinotermitidae and the Termitidae. This study brings the total valid reported spp. to 39, grouped into 20 genera. Out of the 39 spp., 21 are reported in this paper. In the present paper one new genus, DICUSPIDITERMES, is described, with Capritermes obtusus Silvestri as its type species. Ten spp. previously included in the genus Capritermes are transferred to Dicuspiditermes. Two of these spp. D. garthwaitei (Gardner) and D. laetus (Silvestri), are from Burma. Six new spp., Microcerotermes uncatus, Angulitermes paanensis, Angulitermes resimus, Mirocapritermes valeriae. Bulbitermes prabhae, and Aciculitermes maymyoensis, are described and illustrated. The imago of Euhamitermes hamatus is described for the first time. Two spp. previously described under the names Capritermes semarangi Holmgren and Capritermes tetraphilus Silvestri are now transferred to Pericapritermes semarangi (Holmgren), new combination, and Pericapritermes tetraphilus (Silvestri), new combination. The following 10 spp. and 9 forms and spp. have been relegated into synonymy: Globitermes audax Silvestri, Microcerotermes burmanicus Ahmad, Capritermes orientalis Mathur and Sen-Sarma, Macrotermes azarellii

(Wasmann), Odontotermes assamensis Holmgren, Odontotermes bangalorenis Holmgren, Odontotermes orissae (Snyder), Hypotermes nongpriangi Roonwal and Sen-Sarma, Microtermes pallidus (Haviland), Microtermes umsae Roonwal and Chhotani, Macrotermes gilvus f. angusticeps Kemner, Macrotermes gilvus var. borneensis Kemner, Macrotermes gilvus f. kalshoveni Kemner, Macro. termes gilvus f. latinotum Kemner, Macrotermes gilvus subsp. madurensis Kemner, Macrotermes gilvus subsp. malayanus (Haviland), Macrotermes gilvus f. padangensis Kemner, Macrotermes gilvus f. philippinensis (Oshima), and Odontotermes obesus var. oculatus Silvestri. The genus Angulitermes and four spp., Euhamitermes hamatus, Pericapritermes semarangi, Odontotermes hainanensis, and Microtermes obesi, are reported here for the first time from Burma. List of species of Burma. Microcerotermes uncatus n. sp., soldier holotype, Maymyo; Angulitermes paansis n. sp., soldier holotype, Yegaw, Pa-an, Karen State, A. resimus n. sp., soldier holotype Maymyo: Microcapritermes valeriae n. sp., soldier holotype, Maymyo; Dicuspiditermes n. gen. Capritermes obtusus Silvestri type species; Bulbitermes prabhae n. sp., soldier holotype, Maymyo; Aciculitermes maymyoensis n. sp., soldier holotype, Maymyo. All types in Amer. Mus. Nat. Hist., New York.)

KRISHNA, K., and EMERSON, A. E., 1962, pp. 1-65. (Papuan: Glyptotermes guamensis n. sp., soldier holotype, Yigo, Guam; G. lighti n. sp., imago, Marshall Islds., morphotype, soldier holotype; G. nissanensis n. sp., soldier holotype, Nissan Isld., Green Islands; G. palauensis n. sp., imago, Koror Isld., Palau Islands, morphotype, soldier holotype; G. schmidti n. sp., soldier holotype, Hog Harbor, Espiritu Santo Isld., New Hebrides. Oriental: G. concavifrons n. sp., dealate, Bandjar, Seng-kong VII, West Java, morphotype, soldier holotype; G. kirbyi n. sp., imago, swamp forest of Kateman, east coast southern Sumatra, soldier holotype. Ethiopian: G. hendrickxi n. sp., soldier holotype, Tchibinda Forest on Mt. Bukulumusa above Mulungu. Congo; G. jurioni n. sp. imago, Yangambi, Congo, morphotype, soldier holotype; G. longuisculus n. sp., imago, 28 miles south of Rutshuru, Congo, morphotype, soldier holotype; G. parki n. sp., dealate female, Kakitumba, Ruanda-Urundi, Congo, morphotype, soldier holotype; G. sinomalatus n. sp., dealate Camp Putnam, Epulu River, Congo, morphotype, soldier holotype. Neotropical: G. adamsoni n. sp. imago, near Arima, Trinidad, W. Indies, morphotype, soldier holotype; G. contracticornis (Snyder) imago, morphotype San José, Costa Rica; G. longipennis n. sp., imago holotype, San Antonio, Colombia; G. parvoculatus n. sp., imago, Trinidad, W. Indies, morphotype, soldier holotype; G. rotundifrons n. sp., Barro Colorado Isld., Panama Canal Zone, morphotype, soldier holotype; G. seeversi n. sp., imago, Cordoba, Veracruz, Mexico, morphotype, soldier holotype; G. sicki n. sp., imago (dealate), Ilha Grande, Rio de Janeiro, Brazil, morphotype, soldier holotype; G. truncatus n. sp., imago. Porcecito, Colombia, morphotype, soldier holotype; G. tuberifer n. sp., imago, Sandy Bay. St. Vincent Island, West Indies, morphotype, soldier holotype.)

- KUSHWAHA, K. S., 1962, pp. 55-62. (India, taxonomic differentiation based on bristles on oral appendages and thoracic tergites of Odontotermes (O.) obesus, assmuthi and horni, soldiers and workers.)
- MATHUR, R. N., and SEN-SARMA, P. K., 1961, pp. 1-4. (Burma, *Capritermes orientalis* n. sp., soldier, Maymyo.)
 - 1962a, pp. 7-12. (India, Odontotermes assmuthi, winged described.)
- MATHUR, R. N., and THAPA, R. S., 1961, pp. 3-7. (South India, *Pseudocapritermes fontanellus* n. sp., soldier holotype, worker morphotype, Forest Res. Inst., Dehra Dun, type locality So. India, Top Slip, Madras.)
 - 1962, pp. 49-52. (India, Termitidae. Nasutitermitinae: Ampoulitermes n. gen., type A. wynaadensis n. sp., holotype: soldier, morphotype: worker; paratypes, Forest Research Inst., Dehra Dun; type locality: South India: Periyar R. F. (Reserve Forest); Wynaad, Madras.)
 - 1962a, pp. 370-375. (India, Termitinae, *Microcapritermes* n. gen., type *pilosus* n. sp. soldier, worker Madras.)
 - 1962b, pp. 4-8. (India, Stylotermitinae, Stylotermes chakratensis n. sp. holotype soldier, morphotype worker, Uttar Pradesh, Chakrata, type Forest Research Inst., Dehra Dun.)

- 1962c, pp. 1-122. (India, Forest Research Institute, Dehra Dun, revised catalog Isoptera (white ants) of Entomological Reference Collection.)
- NUTTING, W. L., 1965a, pp. 1-5. (U.S., Southwest, northern Mexico, descriptions and field keys winged and soldiers seven most important species.)
- PRASHAD, B., and SEN-SARMA, P. K., 1959, pp. 1-66. (Indian region, list 20 species, revision Nasutitermes, distribution. Keys to species, imago, soldier castes, N. anamalaiensis Snyder, India, soldier, worker redescribed,; N. beckeri n. sp., imago, soldier, worker, soldier holotype, worker morphotype, India, Western Ghats, Neriamangalam; N. brunneus Snyder, India, imago, soldier redescribed; N. ceylonicus (Holmgren), Ceylon, imago, soldier, worker redescribed; N. crassicornis (K. and N. Holmgren), India, soldier, worker redescribed; N. emersoni Snyder, India, soldier, worker redescribed; N. fletcheri (K. and N. Holmgren), India, soldier, worker re-described; N. gardneri Snyder, India, soldier, worker redescribed; N. horni (Wasmann), Ceylon, soldier, worker, original description; N. indicola (K. and N. Holmgren), India, soldier, worker redescribed; N. jalpaigurensis n. sp., soldier, worker, soldier holotype, worker morphotype, India, West Bengal, Teesta Forest Divis.; N. lacustris (Bugnion), Cevlon, imago, soldier, worker redescribed; N. matangensis (Haviland), North Borneo, Sarawak, imago, soldier, worker redescribed, form matangensiodes (Holmgren) valid form; N. matangensis matangensiformis (Holmgren), North Borneo, Sarawak, imago, soldier, worker redescribed; N. moratus (Silvestri), India, Abor, soldier, nymph, original description; N. oculatus (Holmgren), Ceylon, imago, soldier, worker rede-scribed; N. processionarius (Schmitz), India, Western Ghats, Navoor, soldier, worker redescribed; N. roboratus (Silvestri), Lower Burma, Moulemin, N. thanensis n. sp., soldier, worker, soldier holotype, worker morphotype, India, Dehra Dun, Thano; N. suknensis n. sp., soldier, soldier holotype, India, West Bengal, Sukna.)
 - 1960, pp. 1-32. (Indian region, revision *Hospitalitermes*, description, 25 of 26 species occur in Oriental region, 1 in Papuan, relationships. Descriptions of

H. ataramensis n. sp., soldier, worker, major, minor, soldier, holotype, workers morphotypes, Burma: Pokabo Reserve (Ataram); H. blairi Roonwal and Sen-Sarma soldier, workers, Andaman Islds. H. birmanicus Snyder, soldier, Burma: Hsipaw. H. brevirostratus n. sp., soldier, holotype, Burma: Maymyo. H. jepsoni Snyder, soldier, workers, major, minor, Burma: Kaing Range, Pyinmana. H. madrasi Snyder soldier, workers, major, minor, India, North Vellore (Madras). H. monoceros (Koenig), imago, soldier, workers, major, minor. Ceylon.)

- ROONWAL, M. L., 1962a, pp. 31-50. (Recent developments in termite systematics, 1949-1960, history world from 1779, classification and phylogeny, soldier caste in *Speculitermes*, morphology, zoogeography, lists new genera and species since 1949, and new species and authors from geographical regions, bibliography.)
 - 1964, pp. 69-75. (Measurements and indices, with the aid of precisely defined measurements, exact comparisons can be made between allied taxa. List of references.)
- ROONWAL, M. L., and BOSE, G., 1961, pp. 580-594. (India, Odontotermes bellahunisensis Holmg. and Holmg, Mysore, redescribed, new subsp. guptai described, soldiers and workers from Rajasthan.)
 - 1962, pp. 151-158. (India, Rajasthan, African genus *Psammotermes* in Indian fauna, fuller description *P. rajasthanicus*, soldier and worker.)
 - 1964, pp. VI+58. (India, Rajasthan, 19 species and subspecies in 12 genera and 3 families recorded, 3 new subspecies described and figured. Microcerotermes tenuignathus laxmi n. subsp. soldier holotype worker morphotype, Kolayat, Bikaner Dist. Microcerotermes championi raja n. subsp. soldier holotype, worker morphotype, Balsamand, Jodhpur Dist. Odontotermes brunneus kushwahai n. subsp. soldier holotype, worker morphotype, Bhupalsagar, Udaipur Dist. All types deposited in National Zoological Collections, Zoological Survey India, Calcutta. Keys to differentiate soldiers of new subspecies given.)
- ROONWAL, M. L., and CHHOTANI, O. B., 1962, pp. 57-63. (India, new species and subspecies Speculitermes deccanensis deccanensis, worker, Bababudin Hills, Mysore; S. deccanensis paivai, "Madhupur Bengal" (Bihar.).)

- 1962a, pp. 308-316. (Burma, Rangoon, Macrotermes gilvus malayanus mound builder, soldier major, minor, worker major, minor; king; physogastric queen; eggs; nymphs.)
- 1962b, pp. 281-406. (India, Assam, region described, 34 species described, 13 new species or subspecies, keys given. New species are:
 - Reticulitermes saraswati n. sp., soldier, holotype, worker major and minor, morphotypes, type locality Shillong, Assam; Speculitermes cyclops rongrensis n. subsp., worker, holotype, Rongrengiri, Assam; Pseudocapritermes tikadari n. sp., soldier, holotype, worker, morphotype, Cherrapungi, Assam; Capritermes latignathus durga n. subsp., soldier, holotype, worker, morphotype, Cherrapungi, Assam; Macrotermes khajuriai n. sp., major soldier, holotype, morphotypes, minor soldier, worker, Umsa Nong-kharai, Assam; Odontotermes giriensis, holotype, soldier, morphotypes, major and minor workers, Rongrengiri, Assam: O. horae n. sp., holotype, soldier, morphotype, worker, Nong-Priang stream, Assam; O. kapuri n. sp., holotype, soldier, morphotype, worker, Cherrapungi, Assam; Microtermes imphalensis n. sp., holotype, imago, Imphal Valley, Manipur, eastern India; M. umsae n. sp., holotype soldier, morphotypes, major and minor workers, Umsa Nongkharai, Assam; Nasutitermes cherraensis n. sp., holotype, major soldier, morphotypes, minor soldier, worker, Cherrapungi, Assam; N. garoensis n. sp., holotype, soldier, morphotypes, major and minor workers, Rongrengiri, Assam; N. kali n. sp., holotype, soldier, morphotypes, major and minor workers Umsa Nongkharai, Assam.)
- 1962d, pp. 1-115. (Indian region, eight species *Coptotermes* described and illustrated, including one new species *C. kishori*, soldier holotype, worker morphotype, Berhampur, West Bengal, India; keys to winged and soldiers.)
- 1962e, pp. 159-168a. (India, Assam, new Neotropical element *Anoplotermes; A. shillongensis*, worker holotype, Shillong.)
- 1963a, pp. 265-273. (India, *Procryptotermes dhari* n. sp., soldier holotype, pseudoworker morphotype, Coimbatore, Madras.)
- 1964, pp. 45-52. (India, Odontotermes

mathadi n. sp., soldier holotype, worker morphotype, Badani, Bijapur Distr., Mysore, described and figured, obesus group, but largest; Odontotermes meturensis R. and C. imago described and figured, from Bangalore southern India with soldiers and workers.)

- 1964a, pp. 120-130. (India, Speculitermes dharwarensis n. sp., imago dealate female holotype, morphotype worker, Dharwar, Mysore State, close to S. cyclops cyclops, S. goesswaldi n. sp., holotype imago dealate female, morphotype worker, Dharwar, Mysore State, comparison with other species, types deposited in Zoological Survey of India, Calcutta.)
- ROONWAL, M. L., and MAITI, P. K., 1965, pp. 255-261. (India, Postelectrotermes bhimi n. sp. soldier holotype, pseudoworkers paratypes, Vendiperiyar village, Kerala State, types in Natl. Zool. Coll., Zool. Survey of India, Calcutta.)
- ROONWAL, M. L., and SEN-SARMA, P. K., 1960, pp. 1-420. (I. Systematics of Oriental termites No. 4. A new species of Synhamitermes Holmg. from Ceylon and the imago of S. quadriceps (Wasm.) (Termitidae: Amitermitinae, pp. 1-14, figs. 1-5, tables I-II. S. colombensis n. sp., soldier holotype, Colombo, (West Province, Ceylon); S. quadriceps (Wasm.) imago, India; key to separate S. quadriceps and S. ceylonicus (Holmg.) imagos.) (II. No. 5. New and littleknown species of the genera Speculitermes, Capritermes and Odontotermes, pp. 15-39, figs. 6-10, pls. I-VI, tables III-IX. Speculitermes cyclops cyclops Wasm. redescribed, India; S. cyclops sinhalensis n. subsp., worker holotype Ceylon, Vavuniya, (North Province); S. triangularis n. sp., worker holotype, India, Dehra Dun, keys to worker. Capritermes dunensis n. sp., soldier holotype, India, Dehra Dun. Odontotermes microdentatus n. sp., soldier holotype, imago morphotype and worker, India, Dehra Dun, Uttar Pradesh.) (III. On a new termite, Indotermes maymensis Roonwal and Sen-Sarma (gen. and sp. nov.) from Burma (family Indotermitidae nov., pp. 40-45, pls. VII-VIII, table X. Indotermes maymensis n. sp., soldier holotype, Burma, Maymyo, genus compared with Stylotermes, Cornitermes.) (IV. Revision of the termite genus Eremotermes Silvestri (Isoptera: Termitidae: Amitermiti-

nae), pp. 46-93, figs. 11-17, pls. IX-XVIII, tables XI-XXI. *Eremotermes* redescribed, key to species, relationships and geographical distribution, E. dehraduni n. sp., soldier holotype, worker morphotype, 12 miles northwest of Dehra Dun, imago described may be dehraduni from Dehra Dun, New Forest, swarming at 2:30 p.m. 14, VI, 1955 after shower; E. fletcheri Holmgren and Holmgren redescribed, imago, soldier, workers, India, maliki Ahmad a synonym; E. indicatus Silvestri redescribed, imago, soldier, worker, North Africa, Tunis: Kairouan; E. madrasicus n. sp., soldier holotype, workers morphotype, Villivakkam 10 miles north of Madras; E. neoparadoxalis Ahmad redescribed soldier, workers West Pakistan and India; E. paradoxalis N. Holmgren redescribed, imago, soldier, worker, major, minor, India and West Pakistan.) (V. Systematic monograph of Oriental Kalotermitidae (Isoptera) Part 1. Genera Kalotermes and Neotermes, pp. 94-275, figs. 18-46, pls. XIX-LXV, tables XXII-XXXIX. Description family Kalotermitidae, keys to genera, imago and soldier castes. Description genus Kalotermes, castes, geographical distribution, keys to Oriental species, imago, and soldier. Kalotermes beesoni Gardner, redescribed, imago, soldier, pseudoworker, India, and West Pakistan; K. inamurae Oshima, original description, dealated female, soldier, two forms, Formosa: K. indicus Holmgren, redescribed, imago, Bangkok, Thailand; K. jepsoni Kemner, redescribed, imago, soldier, pseudoworker, Maskeliya, Ceylon; K. mcgregori Light, original description, imago, soldier, two forms, larvae, Philippines: Luzon Island: Culi Culi near Manila; K. pintoi Kemner, redescribed, imago, soldier, pseudoworker, Ceylon, India; K. taylori, redescribed, soldier, Philippines, Mindanao Is. Description of the genus Neotermes, castes, world distribution, list of 28 Oriental species, keys to Oriental species, imago and soldier. Neotermes andamanensis Snyder, original description, dealated female, North Andaman Is.; N. artocarpi (Haviland), redescribed, imago, soldier, pseudoworker, Indonesia, Borneo, Sarawak; N. assmuthi N. Holmgren, redescribed, imago, soldier, pseudoworker, India, Mysore, Bangalore; N.

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bosei Snyder, redescribed, imago, soldier, pseudoworker, India, Dehra Dun, Uttar Pradesh, N. gardneri Snyder is a synonym; N. buxensis n. sp., imago, soldier, pseudoworker, soldier holotype, imago, and pseudoworker morphotype, India, North Bengal, Buxa Forest Division; N. dalbergiae Kalshoven, redescribed. imago, soldier, pseudoworker, Indonesia, Java, Banjoemas, and Kedoe; N. fletcheri Holmgren and Holmgren, redescribed, imago, soldier, pseudoworker, South India, Madras, Coimbatore; N. grandis Light, redescribed, soldier, pseudo-worker, Philippines, Luzon; N. greeni (Desneux), redescribed, imago, soldier, pseudoworker, Ceylon; N. kemneri n. sp., soldier, pseudoworker, soldier holotype, pseudoworker morphotype, Ceylon, Gannoruwa, (Paradeniya) N. ketelensis Kemner, redescribed, soldier, pseudoworker, soldier lectotype, pseudoworker lectomorphotype, Oceania: Djampea Island; N. koshunensis (Shiraki), redescribed, imago, soldier, pseudoworker, Formosa, south Japan, E. China, N. lagunensis (Oshima), redescribed, soldier, pseudoworker, soldier paratype, Philippines, Luzon; N. longipennis Kemner, redescribed, imago, imago holotype, Sumatra, Fort de Kock; N. malatensis (Oshima), redescribed, imago, soldier, pseudoworker, imago paratype, Philippines, Luzon Island; N. mangiferae n. sp., soldier, pseudoworker, soldier holotype, pseudoworker morphotype, India, Calcutta; N. medius Oshima, original description, imago, imago cotype, Sumatra, Labuan Badjau, Simalur Island; N. megaoculatus megaoculatus n. sp., soldier, pseudoworker, soldier holotype, pseudoworker, morphotype, India, Dehra Dun, New Forest; N. megaoculatus lakhimpuri n. subsp., soldier, pseudoworker, soldier holotype, pseudoworker morphotype, India, Assam, Makum, Lakhimpur; N. microculatus n. sp., soldier, pseudoergate, soldier holotype, pseudoworker morphotype, India, Dehra Dun, Uttar Pradesh; N. microphthalmus Light, redescribed imago, imago cotype, Philippines, Negros Island; N. militaris (Desneux), redescribed, imago, soldier, pseudoworker, soldier holotype, Ceylon, N. militaris, var. unidentatus (Kemner), soldier, Ceylon, is a snyonym; N. parviscutatus Light, redescribed, imago, soldier, pseudoworker, cotypes Philip-

pines, Negros Island; N. pishinensis Ahmad, original description, soldier, soldier holotype, West Pakistan, Pishin; N. saleierensis Kemner, redescribed, imago, soldier, pseudoworker; soldier lectotype, dealated female and worker lectomorphotypes, Oceania, Saleier Island; N. sinensis (Light), redescribed, soldier, soldier holotype, China, Kwangtung Prov., Ting Wu Shan Monastery; N. sonneratiae Kemner, redescribed, imago, soldier, pseudoworker, soldier lectotype, imagos, and pseudoworkers lectomorphotypes, Java, Batavia; N. tectonae (Dammerman), redescribed, imago, soldier, pseudoworker, Java, Keodoing-Djate.)

- ROONWAL, M. L., and THAKUR, M. L., 1963, pp. 102-117. (Andaman Islands, Bay of Bengal, Rhinotermitidae, *Prorhinotermes* shiva n. sp., soldier holotype, major and minor workers morphotypes, India, Long Island, Middle Andaman group. Schedorhinotermes tiwarii n. sp., soldier major holotype, soldier minor, and worker morphotypes, South Andaman Island.)
- SANDS, W. A., 1965b, pp. 1-172. (Africa, revision of subfamily Nasutitermitinae for the Ethiopian region. 47 species recognized, 7 new, in 14 genera, 4 new; 77 names synonymous, of which 62 are newly established synonyms, 4 species removed from subfamily. Phylogeny subfamily discussed; keys to genera and species. Distribution of species and genera related to vegetation types. Notes on biology. List of species and synonyms.)

Nasutitermes hirticeps n. sp., soldier holotype, S. Thomé, Binda, type A.M.N.H. Leptomyxotermes n. gen., imago, soldier syntype, Eutermes doriae Silvestri generitype, I. Fernando Poo, Basilé, type A.M.N.H. Fulleritermes coatoni n. sp., imago holotype, soldiers and workers paratypes N.C.I., Pretoria Rhadinotermes n. gen., imago, soldiers and workers syntype, Eutermes coarctatus Sjöstedt generitype, Nyasaland, Zomba, A.M.N.H. Mycterotermes n. gen., meringocephalus n. sp., generitype, major soldier holotype, minor soldier morphotype, Aden, B.M. (N.H.) Trinervitermes saudiensis n. sp., male imago holotype, Saudi Arabia, Jidda B.M. (N.H.) Baucaliotermes n. gen., imago (queen) morphotype, Subulitermes hainesi (Fuller) generitype, South Africa, Kliprand,

BIBLIOGRAPHY OF TERMITES 1961-65: SUBJECTS-SNYDER

N.C.I. Eutermellus abruptus n. sp., female imago holotype, soldier morphotype, Congo, Njili, A.M.N.H. E. aquilinus n. sp., female imago holotype, soldier morphotype Ghana, Awura, B.M. (N.H.) E. undulans n. sp., female imago holotype, soldier morphotype, Ghana 3 m. from Larabanga, B.M. (N.H.) 1965c, pp. 132-136. (Africa, Nasutitermes diabolus (Sjöstedt) imago morphotype described and figured, male from Gabon, type in British Museum. Mimeutermes majusculus n. sp., described and figured holotype male imago, Tanganyika, Mbeya, type in British Museum.)

- Scott, H. G., 1961, p. 46. (North America, keys to winged and soldier common termites North America, illustrated.)
- SNYDER, T. E., and FRANCIA, F. C., 1962, pp. 63-77. (Philippines, list species, keys to winged and soldiers, glossary.)
- SPAETH, V. A., 1964, pp. 27-33. (Israel, Termitidae, Amitermitinae: three new species, Amitermes wahrmani soldier holotype, Pardes Hanna, Eremotermes arctus, imago holotype, Beror Hayil, Israel, and Microcerotermes palestinensis soldier holotype, imago and worker morphotype, Negev, Wadi Abyad (Nahal Lavan). All types are in American Museum Natural History.)
- TIETZ, H. M., 1963, p. 116. (North America, Keys to four families of Isoptera, based on winged adult characters, ocelli, frontal gland, wings, cerci, wing stubs.)
- TSAI, PANG-HAU, and CHEN, NING-SHENG, 1963, pp. 167-198. (South China, 21 new species, in 12 genera, from Provinces Kwangtung, Fukien, Kwangsi, Yunnan, Hainan, and Chekiang Kalotermitidae: Cryptotermes declivis n. sp., soldier, winged, Chaochow, Kwangtung; Lobitermes nigrifrons n. sp., soldier, Chinping, Yunnan; Glyptotermes chinpingensis n. sp., soldier, winged, Chinping. Rhinotermitidae: Heterotermes latilabrum n. sp., soldier, Cheli, Yunnan; Reticulitermes longicephalus n. sp., soldier Changting, Fukien; Schedorhinotermes magnus n. sp., major, minor soldier, Chinping. Termitidae: Eurytermes isodentatus n. sp., soldier, winged, Menghan, Yunnan; Procapritermes albipennis n. sp., soldier, winged, Chinping; Capritermes pseudolaetus n. sp., soldier, Chinping; C. minutus soldier, Chinping;

Odontotermes (O) yunnanensis n. sp., soldier, winged, Puerh, Yunnan; O. angustignathus n. sp., soldier, Cheli; Microtermes dimorphus n. sp., soldier, winged, Chinping; Nasutitermes fuluus n. sp., soldier, Chinping, N. deltocephalus n. sp., soldier, winged, Chinping; N. orthonasus n. sp., major and minor soldier, Chinping; N. erectinasus n. sp., major and minor soldier, Lohwei,, Hainan; N. grandinasus n. sp., soldier, Kienow, Fukien; N. communis n. sp., soldier, Nantsing, Fukien; N. sinuosus n. sp., soldier, Chinping; N. parafulvus n. sp., soldier, Chinping; N. parafulvus n. sp., soldier, Chinping; described and figured.)

- 1964, pp. 25-37. (Geographical distribution 62 known species termites of China discussed; north boundary line each region related to climatic factors.)
- WEBB, G. C., 1961, pp. 1-34. (Africa, keys to genera African termites adapted from Revision der Termiten Afrikas, vol. 3, Monographie, Y. Sjöstedt 1926.)
- WEIDNER, H., 1961, pp. 15-76. (Africa, Angola, key to major soldiers African *Macrotermes.*)
 - 1962, pp. 129-133. (Burma, *Macrotermes* azarelii, annandalei, serrulatus and serrulatus hopini, distribution, keys to soldiers.)
 - 1962b, pp. 86-93. (Africa, Sudan, *Pseudacanthotermes harrisensis* n. sp., major, minor soldiers, workers, holotype major soldier, Tozi Research Farm, paratypes one major two minor soldiers, major and minor workers.)
- WHEELER, G. C., and WHEELER, J., 1963, pp. 190-193. (U.S., North Dakota, distinguishing characters *Reticulitermes flavipes* and *R. tibialis* winged and soldiers.)
- WILLIAMS, R. M. C., 1962, pp. 127-130. (East Africa, Termitinae, correction, Crenetermes umbraticola Williams 1954; according to A. E. Emerson, consists of two genera. Williams redescribes the imagos as Euchilotermes umbraticola comb. n. holotype, soldier, morphotype, S. E. Kenya, Kwale. Crenetermes mixtus nom. nov., holotype soldier, morphotype of original description; morphotype king.)
- YU, C. W., and PING, C. M., 1964a, pp. 344-361. (China, Yunnan Province and Hainan Island, *Operculitermes* Yu et Ping n. gen., family Rhinotermitidae, Heterotermitinae, O. sinensis Yu et Ping

n. sp., imago, soldier. O. sinensis sinensis (subsp. typ), O. sinensis latipedunculus (subsp. nov.), O. sinensis inclinatus (subsp. nov., O. latilabrum (Tsai et Chen), O. minutus Yu et Ping n. sp. Key to genus and to soldiers. Types and morphotypes deposited in the South-China Institute of Researches for Subtropical crops.) ZIMSEN, E., 1964, pp. 612-613. (Type material of J. C. Fabricius: Termes destructor synonym of Nasutitermes nigriceps (Haldemann), det. Emerson 1957. Termes arda, Termes mordax, Termes morio synonym Coptotermes testaceus (Linn.), det. Emerson 1957. Termes flavicollis synonym Kalotermes flavicollis selected as lectotype Emerson 1937.)

TEMPERATURE

- BECKER, G., 1963c, pp. 286-295. (Germany, laboratory, Nasutitermes ephratae from Mexico young colonies dependent on temperature. Hardly influenced by a temperature between 24° C. and 32° C., egg deposition began after a few days. Embryonic development is shortest at a temperature between 30° C. and 32° C., also shortest for first workers, whereas 29° C. most favorable for first soldiers. This termite needs less time developmental stages than any other observed.)
- GREAVES, T., 1961, Termites in forest trees, p. 39. In Commonwealth Sci. and Indus. Res. Org., Division Ent. 1960-1961 Ann. Rept. (Australia, seasonal studies made of temperature in living trees, temperature of a colony of Coptotermes acinaciformis infesting a large blackbutt tree at Pine Creek State Forest, Coff's Harbour studied for several weeks.)
 - 1962, pp. 1-17. (Australia, fluctuations in temperature of colonies of *Coptotermes* acinaciformis in living trees at center of nursery was 35° C. =95° F. in midwinter rising to 37.8° C. in summer. Vibrations caused a drop in temperature.)
 - 1963, pp. 74-75. (Australia, termites in colonies of *Coptotermes acinaciformis* aggregate in the nursery in cooler weather to maintain the required high nursery temperature. To obtain a more accurate population estimate, a colony in a tree was frozen with dry ice. The temperature cooled rapidly under the bark to -19° C. and after 66 hours the whole tree section was below 0° C. The cooling resulted in a temporary migration of part of the colony to galleries above the nursery.

Porotermes adamsoni cannot thrive at 78° F. Of 100 pairs installed in January 1961, a brood was present in only one of

the 42 surviving colonies in June 1961. At 60° F. 73 of the 101 pairs survived of which 52 have a brood. The maximum number in any one colony at 2 years was 22.)

- 1964a, pp. 250-262. (Australia, temperature inside colonies of Coptotermes acinaciformis and C. frenchi in living trees are well above those in neighboring, uninfested, parts of the tree. In a colony of the former temperature readings varied from 33° C. to 38° C., i.e., 13° C. to 20° C. above that at the centre of the tree trunk. The movement of termites in the colony was reflected in changes in the nursery temperature, in a C. frenchi colony there was little diurnal variation, 27° C. to 36° C., the highest temperature in November when alates were present. The tree insulated against fluctuating air temperature in the same way as a mound insulates a colony of C. lacteus. Studies of this kind have been useful in assessing the results of insecticide treatments.)
- 1965a, pp. 175-180. (Australia, temperature sound buffered tree trunks compared with that of trees infested with *Coptotermes frenchi*, forest buffered fluctuation temperature.)
- IKEHARA, S., 1961, pp. 1-3. (Japanese Archipelago, data given on temperature (Centigrade) for knowing northwest limits of termites. Formula: Pt (lowest preferred temperature) At (mean daily temperature in coldest month) + Dt (difference of mean daily temperature between inside the nest and outside in the coldest month at the northern limit. Hodotermopsis japonicus-1.6; Kalotermes koshunensis-0.9; K. kotoensis -0.7, K. fuscus 0.5; Leucotermes speratus 7.6; Coptotermes formosanus -0.5; Odontotermes formosanus-1.3;

Eutermes takasagoensis 1.3. A general formula Pt - At + Dt.)

LÜSCHER, M., 1961, pp. 138-145. (Africa, microclimate nests best at 86° F. in tropics, 79° F. in temperate zone.)

TERMITOPHILES

- BADONNEL, A., 1955, (Africa, Dundo, psocid Hemiseopsis machadoi n. sp. in termitarium Macrotermes natalensis described and figured, pp. 40-41. Dundo (Luachimo) Seopsis termitophilus n. sp. in termitarium Procubitermes? described and figured, pp. 44-45.)
- BENOIT, P. L. G., 1964, pp. 174-187. (Africa, anophthalmic-eyeless-Oonopidae (Araneae) in termite nests.)
- BEYER, E. M., 1965, pp. 181-187. (South Africa, lists little known termitophiles and hosts and describes and figures *Paratermitoxenia* n. gen., and *coatoni* n. sp., from fungus garden cell *Allodontermes rhodesiensis* Sjöst. 14 miles from Heilbron towards Edenville.)
- BORGMEIER, T., 1959, pp. 289-308. (Costa Rica and Brazil, four new genera and several new species Staphilinidae, in *Termitonasus* n.g., *Termitohospes*, and *Termitognathus* n.g.)
- DELACHAMBRE, J., 1965, pp. 273-283. (Ivory Coast, forest of Bolo, 50 km. from Sassandra, Termitoxeniidae, Diptera Termitostroma ivorensis n. sp. physogastric adult and larva, with Protermes prorepens described and figured.)
- DYBAS, H. S., 1961, pp. 57-62. (Bolivia, Ptiliidae in termite nests, *Xenopteryx* n. gen., *setosus* n. sp., with *Speculitermes* n. sp. Emerson, Cachuela Esperanza, Beni Prov.)
- HAVERSCHMIDT, F., 1960, pp. 53-54. (Australia, nesting of birds in arboreal termites' nest: Xiphorhynchus picus, Progne chalybea, Troglodytes musculus, and Aratinga pertinax surinama.)
- JAKUBSKI, A. W., 1965, pp. 168-169. (Revision of family Termitococcidae (Hemiptera, Coccoidea), *Termitococcus aster* Silvestri in nests of *Leucotermes tenuis* (Hag.), Paraguay, Tacuru Pucu; *T. brevicornis*

LUND, A. E., 1962, pp. 36, 60. (U.S., *Reticulitermes flavipes* in laboratory average lower lethal temperature -11°C., -17.5°C. for winged alates, average upper lethal temperature 48.5°C.)

Silvestri in nest *Capritermes opacus parvus* Silv., Brazil, Coxipo Cuyaba.)

- JOSEPH, K. J., and MATHAD, S. B., 1963, pp. 379-386. (India, Thysanura, Nicoletidae, *Neatelura* gen. n., *yellapurensis* sp. n. Atelurinae termitophilous with *Microcerotermes fletcheri* at Yellapure, Mysore State; female holotype.)
- MOCKFORD, E. L., 1965, pp. 169-176. (South Africa, Psocoptera from termite nests, four species including *Liposcelis bostrychophilus termitophilus* n. subsp. in nest *Odontotermes badius* in Transvaal.)
- MUESEBECK, C. F. W., 1965, pp. 187-190. (South Africa, Pretoria, Hymenoptera, Diapriidae, parasite in Syntermitoxenia pseudonanna, termitoxeniid from fungus comb in nest Odontotermes latericius, Termitopria n. gen., sheasbyi n. sp.)
- PACLT, J., 1965, pp. 59-60. (Africa, Transvaal, Collembolan, Cyphoderus trinervoidis n. sp. in nest Trinervitermes trinervoides.)
- PHELPS, A., 1965, p. 705. (Respiration rate of the termophilic mite *Thermocarus nevadiensis*.)
- Roth, L. M., and Willis, E. R., 1960, pp. 57, 69, 102, 310-311, 316, 317, 320. (General, termites hosts of commensal cockroaches, U.S. and tropics, bibliography, illus.)
- SAMSINAK, K., 1961, pp. 193-207. (China, termitophilous Acarina, Anoetus myrmicarum, Acotyledon n. spp., and Hypoaspis (Cosmolaelaps) hrdvi.)
- SCHEERPELTZ, O., 1963, pp. 136-140. (East India, Staphylinidae, Zyras beckeri n. sp.)
- VERCAMMEN-GRANDJEAN, P. H., 1965, pp. 259-265. (Africa, *Tenotrombicula minteri* n. gen., n. sp., Trombiculidae, Acarina.)
- WYGODZINSKY, P., 1961, pp. 104-109. (South Africa, North Transvaal, Thysanura Ecnomatelura coatoni with Hodotermes mossambicus.)

TOXICOLOGY

ANONYMOUS. 1962, p. 43. (U.S., what to do when breathing stops; technique of artificial respiration, clear throat, tilt head back, lift jaw forward, pinch and close nostrils, form tight seal with lips, exhale firmly into mouth, remove mouth and breath in. Repeat 12 to 20 times per minute, illustrated by 2 diagrams.)

- 1963e, p. 2. (U.S., deaths due to pesticides last year, all accidents in applying the chemicals were 89; aspirin killed 150. DDT alone is credited with saving 5 million lives and preventing 100 million illnesses due to insect carriers.)
- 1964, pp. 22, 24, 26, 28, 30, 32-34. (U.S., interindustry safety conference seeks proper perspective for antipesticide publicity at Univ. Oklahoma November 20-22, 1963. Proper labeling, application, use of poison control centers, counteract carelessness; government officials participated.)
- DREISBACH, R. H., 1961, pp. 1-460. (U.S., handbook of poisoning, diagnosis and treatment, including bites and stings of Arachnids and insects, illustrated.)
- FECHINO, A., 1961, pp. 67-75. (Toxicology of insecticides antidotes and preventatives. A, review, 23 references, chlorinated hydrocarbons: DDT, methoxychlor, BHC (HCH), lindane, heptachlor, aldrin, dieldrin, isodrin, toxaphene and chlordane; organo-phosphorus compounds: TEPP, parathion, diazinon, malathion, etc.)
- FECHNER, J., 1962, pp. 111-115. (Acute toxicity, chlorinated hydrocarbons less than that of organic phosphorous compounds, but chronic apt to be greater. Dieldrin, aldrin and endrin stored in fatty tissue in relatively large amount; chlordane, heptachlor and toxaphene have less tendency to be stored. Problem of residues and toxicity of pesticides should be solved on an international basis.)
- FISHBEIN, W. I., WHITE, J. V., and ISAACS, H. J., 1964, pp. 726-727. (U.S., 15 workers under constant, though minimal exposure to chlordane over periods ranging from 1 to 15 years showed no evidence of injury to any of the organic systems subject to study. There is little if any hazard from the use of chlordane when properly employed.)
- FULTON, R. A., SMITH, F. F., and BUSBEY, R. L., 1962, pp. 1-15. (U.S., chemical cartridge respirators and gas masks and their uses described for protection against certain pesticides, list of type, conditions requiring, care of.)
 - 1964, pp. 1-12. (U.S., list of pesticides and type respirator to use, life of canister, precautions, illustrations.)

- HAYES, W. J., JR., 1963, pp. 1-144. (U.S., clinical handbook on economic poisons. Emergency information for treating poisoning. Organic phosphorus insecticide, carbamate, chlorinated hydrocarbons, botanical, solvents, rodenticides, fungicides, herbicides, illustrations artificial respiration.)
- HEAL, R. E., 1964, pp. 82-84. (U.S., urges careful objectives and scientific investigation to establish the realities of hazard from the use of aldrin and dieldrin as soil poisons in termite control before action is taken to limit their applications further. The soil toxicants that may be considered as alternates for aldrin, dieldrin, chlordane, or heptachlor are markedly less efficient, protection would be reduced from 10-15 years to 3-5, with no reduction of toxicological hazard, but would impose a great financial burden on the public. Termite shields, concrete foundations or reinforced concrete caps on masonry foundations are not effective with slab-on-ground construction. The use of some minimum amount of pressure-treated lumber seems impractical under current recommendations. National Pest Control Association has 1000 structural pest control firms as members, and 28 state or local affiliates, do 75% of the work; 84% of the members do termite control work. This statement was presented to the U.S. Dept. of Agriculture April 16, 1964, at a hearing at Memphis, Tenn. The U.S.D.A. is currently reexamining registration of several pesticides including those cited above.)
- INGLE, L., 1965, pp. 1-88. (Chlordane, toxicological, and pharmacological properties, references.)
- LAWS, E. R., 1966, pp. 8-10. (U.S., how to handle pesticides safely and principles of treatment of pesticide accidents, safety regulations.)
- LEWALLEN, L. L., 1962, pp. 1-29. (Glossary of insect toxicology, over 300 technical terms.)
- McLEAN, L. A., 1962, pp. 1-19. (U.S., safety of pesticides, practical hazard misuse, most important to consider poisoning in connection with children, in 1956 out of 152 deaths only 58 were adults. A manufacturer of a pesticide is required to spend an average of a million dollars and 6 years in research and testing before marketing is permitted.)

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- MANNS, M., 1963, pp. 9, 11, 12, 14, 63. (U.S., how to use insecticides and fumigants safely, read label, warning placards, safety equipment, safe handling, don't work alone, safety kits.)
- STEIN, W. J., and HAYES, W. J., 1964, pp. 549-555. (U.S., through cooperation with the National Pest Control Association a survey of the health of pest control operators was conducted by questionnaires distributed to member firms and their employees, 12% of all companies represented by the N.P.C.A. responded, most of the personnel were white males. Cases of acute poisoning, dermatitis, and allergy were revealed in persons with heavy direct exposure to pesticides, but failed to suggest the association of pesticides with any other disease.
- Томоv, A., 1962, pp. 67-70. (Relative toxicology for chlorinated hydrocarbon insecticides to man and warm-blooded mammals. Acute oral toxicities indicated dieldrin and aldrin more toxic than chlordane or DDT.)
- U.S. DEPT. AGRIC., AGRICULTURAL RESEARCH SERVICE, 1964, pp. 1-6. (U.S., safe disposal of empty pesticide containers and surplus pesticides. Keep pesticides in separate room or building. Drain any pesticide remaining into a sandy soil pit. Dispose of large metal drums by returning to supplier or selling. Dispose on dump or incinerator after breaking or puncturing. Select a safe private disposal site. Burn combustible containers. Use pesticides safely; read the label.)

- U.S. PUBLIC HEALTH SERVICE, 1965, pp. 1-40. (Entire U.S., lists location, telephone number, and officer to be contacted at poison control centers, facilities which provide the medical profession on a 24-hour daily basis information concerning the prevention and treatment of accidents involving ingestion of or contact with poisonous or potentially poisonous substances. Treatment is available at most of the centers.)
- WARD, J. C., 1962, pp. 9, 11-12, 14-15. (U.S., public acceptance of pesticides depends on safe use, Poison Control Centers attempt to reduce accidents by education, death certificates not too accurate, 10% due to pesticides, deaths between 1954 and 1959—134 to 166. Fear makes chemicals respected. Residues must be guarded against. Safety record will determine public acceptance of chemical. Pest control operator can't make same mistake twice in handling toxic gas. Safe use of pesticides will lower insurance rate.)
- WEST, I., and KLEINMAN, G., 1964, p. 21. (California Dept. Public Health statistics accidents attributed to pesticide poisoning of structural pest control employees from January 1961 through September 1963 shows 29, 2 attributable to fumigation, 16 to general pest, and 11 to termite work. 14 were skin irritations, no deaths reported.)
- WHITNEY, W. K., 1961, pp. 16-21. (Fumigation hazards, types fumigants, properties, limitations of warning agents.)

USES IN INDUSTRY, ARTS, AND RELIGION

- DAS, G. M., 1957, pp. 8-9. (India, remove termite mounds or mix with an equal amount of cattle manure plus 1 ounce flowers of sulfur per mound of soil and scatter widely in tea culture. The site
- should be hoed and treated with sulfur to increase acidity. A green crop should be grown and plowed in before planting tea.)

WOOD PRESERVATION, POISONS FOR FABRICS, FIBER BOARDS, INSULATION, ETC.

- ANONYMOUS. 1960a, pp. 37-38. (Australia, timber preservation by dip diffusion for nonleaching locations, free-flowing preservative which can be supplied in premixed form.)
 - 1961, pp. 5-7, 10-11, 14-15, 18-19, 20-21. (U.S., where to buy pressure-treated wood products.)
- 1961e, p. 35. (Australia, plastics polythene and polyvinyl chloride susceptibility to termites increases with additions of plasticizer. This can be decreased by the use of phosphate instead of phthalate plasticizers, the incorporation of 5% of inert fillers such as hard silica, zircon flour, or diatomaceous earth, and addi-

tions of small amounts of aldrin and dieldrin during processing.)

- 1962i, p. 14. (U.S., pressure-treat house under-structure to avoid termite damage.)
- 1962s, pp. 10-23. (U.S., alphabetical list of AWPI member treating companies and their sales offices addresses. 1963 National Guide, where you can buy pressure preserved wood products.)
- 1964c, pp. 12-23. (U.S., 1964 National Guide, where you can buy pressure preserved wood products.)
- 1964k, p. 3. (U.S., preferential fire insurance rates for FRT, fire retardant treated wood used as building material in 49 states, approved by all four of nation's model building codes, treated wood resistant to rot and termites.)
- 1964p, pp. 1-51. (U.S., Mississippi State Highway Dept. report on wood preservatives in test garden, Jackson, Miss., pp. 1-36. After the 1963 inspection only coal tar creosote (80-20) pressure 16 pounds per cubic feet 100%; crewood hot oil dip 86%; Reilly transparent creosote pressure 79%; another lot of same 38%; pentachlorophenol 5% pressure 10.72 pounds per cubic feet 89%; chemonite pressure 91%; all treated wood posts dense pine except coal tar creosote. Guard rail posts on Mississippi highways, pp. 37-51. After the 1963 inspection only coal tar creosote, pressure 12 pounds per cubic feet, pine square posts, 67 remaining in test since 1931, 58 showing decay and another lot 98 remaining, since 1938, 47 showing decay, and still another lot, Douglas fir 96 remaining since 1944, none showing decay, some posts were removed because of construction causes. The other posts, resistant or treated wood, were removed earlier because of low rating or construction causes.)
- 1965, pp. 5, 7, 9, 11, 15, 17, 19, 21, 22-23. (U.S., 1965 National buyers guide for pressure preserved wood, list and addresses companies.)
- 1966b, pp. 16-39. (U.S., 1966 buyers guide for pressure preserved wood products, lumber, etc., names and addresses companies.)
- 1966h, pp. 15-17. (Idem. 1966—supplement.)
- ATTFIELD, J. G., 1961, pp. 108-110, 112-113. Australia, dieldrin as a wood preservative.)

- BECKER, G., 1961b, pp. 1-7. (Germany, Berlin-Dahlem, 25 years of wood preservation and testing against decay, beetles, and termites.)
 - 1962a, pp. 215-222. (General, survey on testing in the laboratories in various countries durability of materials and efficacy of wood preservatives, 20 species termites employed, 80 most important publications listed.)
 - 1962c, pp. 17-40. (General report given of results from 1950-1961, preference given to work at the Bundesantalt für Materialprüfing, Berlin-Dahlem, Germany, spread wood pests in Germany and the rest of the world, summary most important contributions to biology, improvements in control using organic materials, water soluble and oily wood preservatives, hot air and irradiation methods, bibliography 300 references.)
 - 1962f, pp. 476-486. (Tests of wood and wood preservatives with *Heterotermes indicola*, effects of temperature and humidity on this tropical termite, test results influenced by different factors, termite suitable for tests in nontropical country of resistance of woods and wood preservatives.)
 - 1963, pp. 1-4. (Tropics, discussion most suitable preservatives and methods, penetration, etc.)
 - 1965c, pp. 469-478. (Tests of synthetic contact insecticides in pine sapwood against four termite species, Aldrin, dieldrin and E605f proved the most effective after various periods; the termite species showed differing sensitiveness. After storage of the treated wood for 11 to 14 years, 1 to 2 kg. of the most effective insecticides are required per m^a of wood; they are comparatively permanent. This improves their value as protectives with a repellent effect.)
- BECKER, G., and THEDEN, G., 1963, pp. 1-258. (Wood protection.)
- BLEW, J. O., Jr., 1962, pp. 1-9. (Compares wood preservatives used on southern yellow pine tests stakes in five sites in the United States and one in the Canal Zone, Panama. Superficial treatments do not prolong the life of the wood as long as the pressure treatments. Details given in tables dating back to 1938.)
 - 1963, pp. 1-9. (Continuation of reports on tests, latest December 1962. Some waterborne preservatives, during the time

tested, compare favorably with standard preservative oils.)

- 1964, pp. 1-9. (Continuation of reports on tests, latest December 1963. Details given in tables dating dack to 1938.)
- BLEW, J. O., and KULP, J. W., 1962, pp. 1-15. (U.S., Mississippi, posts installed from 1936 to 1941 that have had failures totaling 10% or less treated with 3% and 4.8% pentachlorophenol in crankcase oil; copper sulfate and sodium arsenate applied by double diffusion; and zinc meta arsenite should last 39 years or longer on an average; treated with other preservatives 8-38 years.)
 - 1963, pp. 1-15. (Continuation above tests, with another year's life record.)
 - 1964, pp. 1-15. (Continuation above tests, with another year's life record.)
 - 1965, pp. 1-15. (U.S., Mississippi, posts installed from 1936 to 1941 that have had failures totaling 10% or less treated with 4.8% pentachlorophenol in crankcase oil; copper sulfate and sodium arsenate applied by double diffusion; and zinc meta arsenite should last 42 years or longer on an average; treated with other preservatives 8-41 years.)
 - 1965a, pp. 1-9. (Continuation of comparative tests of wood preservatives used on southern yellow pine stakes in five sites in the United States and one in the Canal Zone, Panama, inspections were made in December 1964. Details are given in tables, with a summary of results in table 45, the average life of the treated wood ranged from 2.5 to 24 years, the most effective having no failures after 13-24 years.)
- CHATTERJEE, P. N., and SEN-SARMA, P. K., 1963, pp. 280-285. (India, commercial sample of shell liquid of cashew nut (*Anacardium occidentale*, aldrin and dieldrin tested as 1 minute dips (after overnight drying) in "grave-yard" plot for 4 years, termites *Odontotermes* spp. Preference should be given to aldrin at 2% concentration; cashew nut shell can be discarded as a wood preservative.)
- ERNST, E., 1961. (Resistance of treated plastics.)
- GAY, F. J., 1961. (Laboratory studies, pp. 37-38, field studies, p. 38. In Commonwealth Sci. and Indus. Res. Org., Divis. Ent. 1960-1961 Ann. Rept.) (Australia, laboratory tests of plastics show better termite resistance of polyvinyl chloride plasticized with tricresyl phosphate com-

pared with phthalate-plasticized material, and increasing resistance by adding small amounts of inert fillers such as hard silica or zircon flour to polyvinyl chloride. Laboratory colony groups of Nasutitermes exitiosus exposed to untreated wood, or wood treated with low loadings of arsenic pentoxide, show that at levels below 0.008% the termites do not discriminate. Small-scale laboratory colonies of Nasutitermes exitiosus with an initial population of 49, are being used to investigate the repellent and/or toxic properties of anthraquinones. Field studies show surface treatments 10% sodium arsenite only material giving complete protection against Coptotermes lacteus after 3 years. At Rollingstone, Queens-land field tests of cables and cable sheathings showed 98% showed evidence of contact by termites the first year and more than 15% were destroyed. Polyethylene sheathings more resistant than polyvinyl chloride especially by the addition of a Nylon coating.)

- 1962, pp. 60-62. (Laboratory studies with colonies standard of Nasutitermes exitiosus, Coptotermes lacteus and C. acinaciformis with insulation corkboard, plastics, etc.; cellulose acetate butrate piping was attacked by Coptotermes acinaciformis 0.1% dieldrin in strawboard or 0.01% to 0.05% aldrin in hardboard protected against termites, acetal resin (polyoxymethylene) highly resistant to termites. Two anthraquinone derivatives showed comparative activity to the active principle in teak. Field studies, surface treatments with 10% sodium arsenite continue to give complete protection against C. lacteus after 4 years, failing against N. exitiosus the first year.)
- 1963c, pp. 71-74. (Laboratory studies. Water-borne preservatives of the fluorchrome-arsenic type retain their high toxicity to termites after severe leaching. Building board formed of *Pinus radiata* wood wool bonded with magnesium carbonate not susceptible. Polyethylenes with a low melt flow index are more resistant than those with a high. Field studies. Surface treatments of *Pinus radiata* with 10% sodium arsenite continues to give complete protection for 5 years against *Coptotermes lacteus*. At Rollingstone, Queensland tests of cables

and cable sheathings against *Mastotermes* darwiniensis show polythene sheathings superior to polyvinyl chloride and nylon sheathing giving satisfactory resistance.)

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benzene proved most resistant in laboratory. The least damage was done to samples protected by these combinations: 5% DDT plus 2% PCP in TCB (extent of damage, 4% of original weight of sample, mortality at end of test roo%); 2% DDT plus 5% PCP in TCB (damage, 5%, mortality roo%); 5% BHC plus 2% PCP in TCB (damage 27%, mortality 97%); and 5% BHC plus 5% PCP in TCB (damage, 29%, mortality roo%. Field tests corroborated laboratory tests, both showed greater resistance of samples protected by combined agents.)

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 - 1962, pp. 253-287. (U.S., in 1961 the volume of wood treated was 215.4 million cubic feet a decrease of less than 700 thousand cubic feet or less than one-half of 1% from 1960. Use of creosote, coal tar, and petroleum decreased 2.6%, while the use of salts increased 8%. Pentachlorophenol increased 5%, Tanalith 5%, chromated zinc chloride 2%, Pyresote and Protexol 4%, Minalith 11%, Boliden Salts more than doubled. In 1961 creosote or a creosote solution was used for 68% of material treated, petroleumpentachlorophenol for 19%, and creosotepentachlorophenol for 4%. All other

preservatives and fire retardants were used for 9% of the material.)

- 1963, pp. 235-269. (U.S., in 1962 the volume of wood treated was 213.9 million cubic feet—a decrease of 1.5 million cubic feet or less than 1% from 1961. Use of creosote, coal tar and petroleum increased 7 million gallons, or 4%, from 1961, while the use of solids increased 4 million pounds or 17%. Pentachlorophenol increased 21%. Others showing increased use include Tanalith, Non-Com, chromated zinc chloride and Boliden Salts. The comparative percentage of preservatives used showed slight changes from 1961.)
- 1964, pp. 201-235. (U.S., in 1963 the volume of wood treated was 217.4 million cubic feet (with preservatives and fire retardants), 3.5 million cubic feet or 1.6% more than in 1962. Use of creosote, coal tar, and petroleum increased about onehalf million gallons, or less than one-half of 1%; use of solids increased about 800 thousand pounds or 2.8%. Pentachlorophenol decreased, but the use of Tanalith, chromated zinc chloride, Celcure and Osmosalts increased about 33%.)
- 1965, pp. 267-301. (U.S., in 1964 the volume of material treated was 237 million cubic feet (with preservatives and fire retardants), nearly 19.7 million cubic feet or 9% more than in 1963, the greatest volume in any year since 1957. Use of creosote, straight and in solutions, increased 9 million gallons or 7%. Use of water-borne preservatives and fire retardants increased nearly 6 million pounds or 20%. Pentachlorophenol increased 2.7 million pounds or 17%, Tanalith increased 0.5 million pounds or 14%. Creosote is the most widely used preservative. Straight or with coal tar or petroleum it accounted for 65% of all material treated as in 1962 and 1963. Petroleum-pentachlorophenol was used for 21% of the total, 1% more than in Creosote-pentachlorophenol was 1963. used for 5% and all other preservatives and fire retardants for 9% of the total volume of all material treated. A 5-year summary of annual consumption of preservatives is given.)
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