PEST CONTROL

JULY 1951

EVERY MONTH SINCE 1933

What pest control problems will arise, if this deadly mushroom sprouts over your city? Turn to page 11.

MAGAZINE OF THE PEST CONTROL AND ALLIED SANITATION SERVICE INDUSTRIES

What are the potential Pest Control Problems *in an* Atomic-Bombed Community?

by

Harold Elishewitz, Ph.D.

Assistant Professor of Parasitology
The Chicago Medical School

Part I

WE MAY classify the purely medical and public health phases of a Civilian Defense Program against the ravages of an atomic bomb attack into:

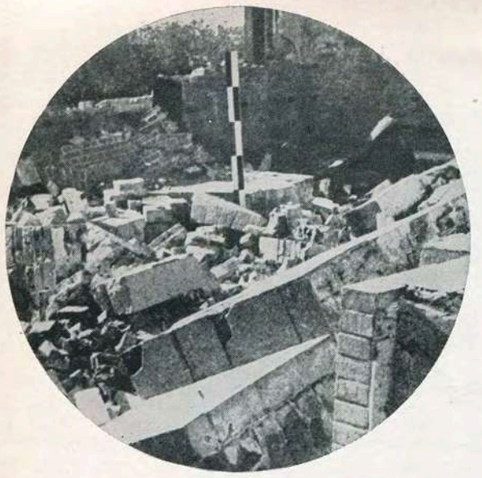
1. The *preventive*, i. e., those measures to be instituted *before* the attack takes place, such as the necessary planning, organization, training, stockpiling, and immunizing of the population against certain communicable diseases.

2. The *immediate*, i. e., measures to be instituted as soon *after* the disaster as possible. These refer mainly to the First Aid and hospitalization care of the wounded, burned, and those exposed to radiation.

3. The *delayed*, i. e., measures of less urgency whose introduction, although important, can be delayed until some time or even several days after the holocaust, —time for the general confusion, mass hysteria, and wild fleeing to calm down, or, if immediate, pertain to areas outside of the actually damaged areas. These are the public health and sanitary aspects.

Of course, the preventive measures are the very base on which the proper introduction and use of the other remedial measures depend. Intelligent plans for a complete defense can only be based on a full knowledge of the potentialities possessed by the attacker and *his plans* for using the means which he has available. At the present, much of the preventive planning is based upon one unknown factor piled upon another. Although much basic rational planning and organization

1. This article is based upon the prevailing and potential conditions existing in Chicago, Illinois, but is applicable to most larger cities of above 100,000 population in the northern half of the United States. Suitable modifications must be made, with respect to local conditions prevailing in other areas.



Rubble such as this, photographed at Hiroshima, will hide bodies of animals and humans, which are prime sources of fly and rodent infestations.

Atomic Energy Commission Photo

can and has been done, this planning is in an extremely fluid condition at the present time due to these many unknowns.

Major public health problems which are apt to arise following an atomic attack include: (1) water supply; (2) sewage; (3) vermin problems (insect-borne diseases, insect and rodent pests); (4) communicable diseases; (5) milk and food poisoning; (6) blood typing and vaccination; and (7) shelter and nutrition. We will consider here only group three—the vermin problems.[2]

Insect and Rodent Problems

Vermin problems can be separated into several distinct categories, each engendered by a different phase of the problem and each of which will require a different remedial measure; viz., flies and fly-borne diseases, skin parasites and ectoparasite-borne diseases, and rats and rodent-borne diseases.

a. Flies: Two distinct types of fly problems might present themselves. Their severity will depend upon the season of the year in which the catastrophe occurs. From the middle of spring, throughout summer and into mid-autumn, the problems could be severe; in winter, they will be practically non-existent.

The Breeding of Flesh Flies in Dead and Decaying Bodies

Several families of large flies, the Sarcophagidae, Calliphoridae, and some Muscidae, are scavengers and breed habitually in exposed meat. They are known commonly as flesh flies, blowflies, green or blue-bottle flies, houseflies and scavenger flies. At least 20 species are present in the Chicago area. The egg masses and maggots are common sights anyplace where meat has been left exposed in the open for a few hours.

During the past war in some Pacific and European battle areas, such fly breeding in dead bodies left on the battlefield was commonplace. The number of flies emerging after as little as a 5-7 day maturation period was prodigious. The stench and scourge of flies brought demands for remedial measures.

We might expect the same general type conditions in urban areas following an A-blast — scavenger and flesh fly populations reaching pestiferous properties.

In such an event, two additional complications could occur:

a. Bodies of both humans and animal pets will be buried in inaccessible places — buried under rubble, which will not only hamper and delay their excavation but will completely hide many bodies from the view of searchers. Also, the ruins themselves may be highly radioactive which will hinder clearing work. The flies, which have an exquisite sense of smell, however, might find them and begin breeding even though they are buried from view.[3]

b. The flies emerging from bodies in the radioactive zones may be radioactive themselves.[4] We cannot categorically state, and do not believe, that these radioactive flesh-breeding flies will constitute a flying danger themselves or will be dangerous as a result of their falling into drinking water. Nevertheless, the possibility, however remote, should be kept in mind.

In any case, the pest problem resulting from flesh flies may be severe enough to warrant remedial control measures. The flies are best controlled by proper insecticidal application, i. e., larvicidal treatment, wherein the maggots are killed by spraying their breeding places (the bodies in which they are breeding) with insecticide.

During the past war the Army and Marine Corps specifications called for a 56% solution of sodium arsenite. This is diluted to about 3% with water and sprayed on with 3 gallon knapsack or decontamination - can sprayers. However, now, some of the newer chlorinated or phosphorus insecticides like benzene hexachloride, dieldrin, aldrin, or parathion are more efficient larvicides for killing fly maggots and can well be used for this purpose. The first named are especially valuable and can be used as dilute as 0.5-1.0% concentration.

The adult flies can also be controlled through either direct contact spraying with the same spray materials or through residual insecticide spraying, wherein the insecticide is deposited on the rubble and other resting places where the flies will land at some future date. Five per cent DDT in kerosene or water emulsion would be valuable for this type of work before the flies built up a resistance to it.

Insecticides can be applied as a spray over the bodies with any type of larger spraying equipment, ranging from individually carried portable 3-gallon sprayers to airplanes. The various mosquito control abatement districts now in operation in the river valleys of suburbs and park districts, commercial pest control operators, or even orchardists or farmers in the suburban areas, are plentifully supplied with large-scale, high pressure truck-mounted tree sprayers, mist blowers, and aerosol fogging machines for this kind of control work. Their crews are already trained in the use and maintenance of this equipment and should be used. If necessary, plane spraying for fly control can be resorted to.

2. A more complete discussion of the various sanitary, public health, and epidemiological aspects of atomic-bomb attack which covers these other subjects as well as a discussion of the effects of atomic blast is to be found in Elishewitz (1951) (see bibliography at the end of Part III).

3. It is an old European exterminators' trick in locating the bodies of dead rats which have died inadvertently in inaccessible places, to release a few of these flesh flies and watch where they hover seeking an entrance. They locate at a spot over the body of the rat. Use of this principle could be made in locating dead bodies, i. e., the rescue squads could be on the lookout for congregations of these flies and start digging in the vicinity for victims.

4. We found here at The Chicago Medical School that small anthomyid flies breeding in the lead disposal jars on the bodies of sacrificed radioactive rabbits were themselves radioactive. In the 1/2 mile radius from point ZERO of an A-bomb ground-burst, bodies will be radioactive, as might the flies emerging from them.

House Flies and Dysentery

Even more important than the flesh fly problem is apt to be the house-fly problem and its concommitant mess-mates, epidemic dysenteries, and typhoid fever.

It is a well known fact, worldwide in distribution, that the incidence of various of the bacillary dysenteries is correlated with the population of *Musca domestica*, the common house-fly in the area. This is especially so in the infantile diarrheas of both urban and rural areas, but the various dysentery infections attack adults as well. They are major military problems in the field, causing a high degree of incapacity.[5] Epidemic outbreaks are characterized by a sudden onset, explosive violence, high incidence, and slow disappearance. Positive proof of this view that flies play a major role in diarrheal disease is brought about by Watt and Lindsay's (1948) fine study in Southern Texas, wherein they controlled flies with DDT and brought about a precipitous drop in the diarrhea rate. Besides carrying the dysentery and diarrhea bacteria, flies may play some role in transmitting poliomyelitis and amoebic dysentery.

Flies will breed in many different types of decaying or fermenting organic matter. They lay their eggs and their maggots develop in slaughter-house offal, garbage, refuse, dirty waste paper, decaying vegetation, decaying meat, sawdust sweepings, industrial and cannery wastes, sewage, and excreta or manure from many different types of animals including dogs, cats, horses, man, etc., and many other types of decaying organic materials. As they have a short life cycle of 8 to 12 days, or even less, have 5-8 generations per season, and produce large numbers of eggs, their population build-up is rapid and prodigious.

Here we have the complete cycle: Breeding in garbage and excreta, the flies feed incessantly on any type of sugary or fermenting food. They are specifically attracted to these foods, fly directly to them, and begin their probing, regurgitating, and sucking type of feeding. The disease microorganisms are carried on the numerous hairs of the feet and the body, on the mouthparts, and swarm in myriad numbers in the gut, from whence they are excreted via the anus as the fly feeds. The pathogenic organisms are capable of living for several days to prolonged periods in these locations. Since the diarrheas are all transmitted via food, we have here our infection source.

Most cities have high fly populations, due for the most part to their inadequate garbage-collecting system and refuse-littered alleys, the presence of stables, stock yards or slaughter houses within the city limits, and the non-cooperation of the average householder, with respect to elemental urban sanitation. Although usually restricted to a 1/4 mile radius zone of their breeding places, houseflies have a flight range of 2 to 7 miles, i. e., they are capable of migrating several miles to continuously reinfect sanitated areas. These conditions will not be lessened in the disorganization following an atomic attack and we may well expect an increase in fly-borne dysenteries.

Disorganization of the garbage collecting schedule could result directly in higher fly populations while the effects of the destruction of sewers and house toilet plumbing lines, sewage, pumping stations, and sewage treatment plants could result in two conditions. Firstly, fly breeding may well take place in the destroyed lines or in the overflowed sewage, or in the catch basins located on each block corner. Secondly, destruction of these utilities will result in the population of the area using emergency pit latrines to be constructed at frequent intervals.[6] Where the surface areas are heavily concreted, the pits can not be

(Continued on page 24)

5. Several campaigns during the past war were delayed in both the Pacific area and the European theater by fly-borne dysentery outbreaks. Such conditions are continuously with us in all unsanitized communities of whatever size. Numerous epidemiological analyses of typhoid outbreaks have shown that house-flies were one of the most important agents in the transmission of the disease.

6. Pit latrines will also have to be constructed in areas without water service, at reception centers, at emergency health and medical facilities, at mass feeding centers, and at other shelter areas. It is necessary to supply at least one latrine for men and one for women in each city block with at least one seat for each 25 persons.

Army-directed mosquito control operations like this would fall to civilians in time of atomic disaster. Every bomb and wreckage crater would become a potential breeding place.

— BOOK REVIEW —

The Natural History of Mosquitoes

By Dr. Marston Bates

Mosquito fighters, whether they be PCOs or city sanitarians, will find Dr. Bates' book gives them excellent background material in approaching control problems. While the author does not enumerate controls or make specific recommendations, his volume is a gold-mine of information on the complete life cycle of the mosquito, its habitat, disease-bearing potential and geographical distribution.

The book is based on Dr. Bates' research carried out in the small Colombian town of Villavicencio. In his preface he remarks that while such isolation may have kept him from using the best bibliographic references, he was at least "in constant touch with mosquitoes."

Seventeen plates, snapped by the author in various countries throughout the world, illustrate possible breeding places of mosquitoes.

Dr. Bates begins his study with an analysis of adult mosquito behavior, their flights, orientation reactions, longevity, dispersal, seasonal distribution, sexual behavior, food habits, egg development and oviposition. He then devotes four chapters to larval stages, with special attention given to classification of breeding places.

This comprehensive, concisely written volume may be obtained by sending check or money order for $5.15 to *Pest Control*, 1900 Euclid Building, Cleveland 15, Ohio.

Pest Control In Atomic Attack

(from page 13)

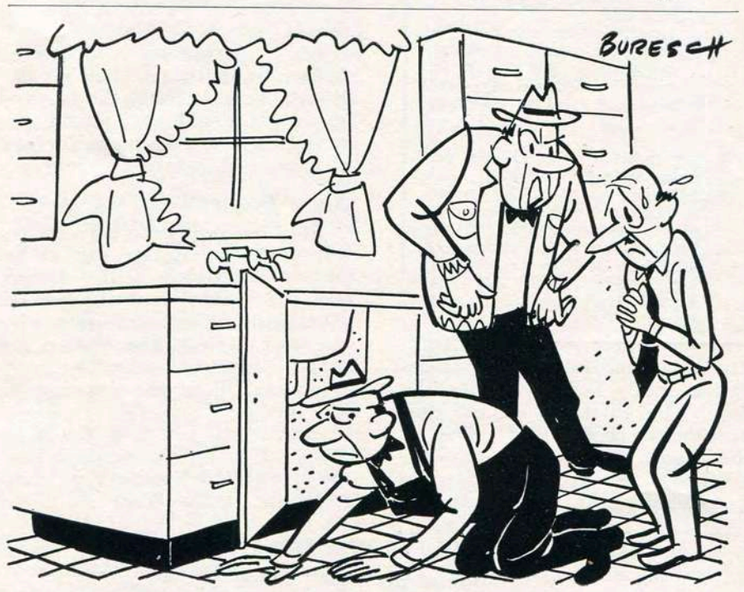
dug and shelters will be built over the catch basins themselves so as to permit the use of these openings as latrines. Such latrines have always been major sources of fly breeding and the reduction of fly-breeding in cities with modern sewer systems and housing codes is, to a large degree, attributable to the fact that pit latrines are no longer in use.

The use of these latrines will have to be policed at regular intervals, their contents covered with earth, sprinkled with quicklime, and sprayed with insecticide to reduce odors and prevent fly breeding.

Fly control is a two-phased problem; preventing the breeding of flies in the first place, via screening, proper sewage disposal, garbage collection and disposal, and general sanitation and fly eradication by insecticides. The result of an A-bomb attack probably will not only cause an increase in flies due to the destruction of part of the sewage system in the city, as well as worsen the garbage-collecting disorganization, but at the same time will prevent our using proper control measures against them.

We are, however, in a favorable position when it comes to using insecticides. Flies (the non-resistant strains) are extremely sensitive to DDT. They are killed by either contact with a direct spray or with a residual deposit. A residual deposit of 5% DDT when applied to walls or other places on which flies rest, causes their death in a short period of time and such a deposit retains its effectiveness for several weeks. The drawback to this procedure is that the flies, after several generations, through genetic selection, build up an immunity to the insecticide and become resistant. We are thus forced to repeat the sprayings with other insecticides like chlordane, lindane, toxaphene, aldrin, dieldrin, etc., all of which are as effective as DDT but lack its duration of residual effectiveness. Flies become resistant to each of these other insecticides in time, so their use will have to be rotated.

As is obvious from considering the biology and habits of the housefly, fly control is a community problem, and must be met on a community basis. Central mobile fly-control squads should be organized, equipped with either individual 3-gallon knapsack or hand sprayers, truck-mounted high-pressure sprayers, or aerosol machines. As pointed out previously, the vicinity of most large cities is well equipped with the equipment and trained crews who could do the work, if outlying mosquito abatement districts and pest control organizations are called upon to do the work as needed. Plane spraying of 5% DDT can and probably should be resorted to if the problem becomes sufficiently severe.



"So you're THE Mr. Barnswott who wrote the book on pest control that the boss thinks we ought to read up on!"

Next Month Part II

PEST CONTROL

AUGUST 1951

EVERY MONTH SINCE 1933

Situation above typifies field training that is part of CDC courses open to PCOs. See "Calendar," page 42.

MAGAZINE OF THE PEST CONTROL
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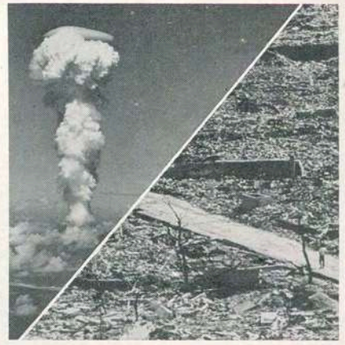


Part II

Epidemic Skin Parasitoses

A DIRECT RESULT of the crowding and unsanitary conditions under which refugee and homeless populations will live after an atomic explosion may well be outbreaks of various insect and fungal infections of the skin and hair. People will be forced to double-up, many living in one room in close proximity to one another, use the same clothing and bedding, and perhaps huddle together for mutual warmth. The lack of sanitary facilities for regular bathing will compound the difficulties.

Primitive and submarginal peoples with inadequate housing live under such conditions now. We, with our at present vaunted higher standards, find it difficult to believe that we would ever sink to that level. But in the general disorganization following an atomic attack, much of the displaced population will live in as primitive conditions as are found now in the slum areas of our cities. We do not have to look any further back than London during the years 1941-1943 when, during the period of almost constant air attack by the Germans, the people lived huddled together in the massive subway system. The result was an almost 100% incidence of scabies, up to a 60% or 70% incidence of pediculosis or lousiness, and a very high incidence of ringworm. We should be prepared to deal with all three conditions here in the United States. They have always been and are the handmaidens of field warfare as well as poverty and depressed conditions throughout the world.

Scabies

Caused by the minute mite, *Sarcoptes scabiei*, which lives intradermally on all parts of the body but particularly on the fingers, groin, neck, elbows, wrists, ankles and back. The condition is similar to the mange in dogs, cats, horses, and other animals, caused by other subspecies or varieties of the one causing scabies in man.

The mites live and reproduce in minute tortuous burrows in the skin. They burrow extensively in the epidermal layers and only the gravid or pregnant females come to the surface. Here they are transferred to fresh hosts by contact, either directly or via contaminated clothing or bedding.[7] Upon entering the skin of a new host, the female begins to tunnel and deposits her eggs (about 50 in number) along the walls of the tunnel. The eggs hatch in 3-4 days. The larvae and the nymphal stages which follow mature rapidly and mate. The whole life cycle is completed in 1 week to 15 days. Population build-up thus, since the mites have no natural enemies, is rapid. The larvae and nymphs migrate to other parts of the body from the parent burrow and enter hair follicles or penetrate the skin directly, forming vesicles.

The mites carry no disease microorganisms themselves but in the course of their wanderings they set up an intolerable itching which results in an uncontrolable scratching. Thus, besides the dermatitis caused directly by the mites, secondary bacterial infections are set up.

Diagnosis is made by examining the skin lesions under a strong hand lens or by taking epidermal scrapings and examining microscopically. The mites are characteristic and when found are positive diagnosis for the disease.

The reservoir of individuals infected with scabies, just like those with lice or ringworm, are always with us, albeit at a low percentage. It takes only one or a few individuals, however, to start an epidemic under the proper unsanitary and substandard living conditions.

Treatment of scabies now is fairly simple. The material benzyl benzoate is a highly effective miticide and, since *Sarcoptes* is a mite, it is equally effective against this type. Incorporating benzyl benzoate along with benzocaine in either alcohol (for a liquid) or in a salve base make ideal agents. In addition, the gamma isomer of

7. Cast-off clothing and bedding of infected persons remains capable of infecting others for at least 11 days.

DDT dusts are best for preventing spread of epedemic disease-bearing lice and mites, Dr. Elishewitz says

benzene hexachloride (called "lindane"), widely used as insecticide, is also highly effective and may be used in the same types of preparations. Various of the pharmaceutical houses have these ointments commercially available. Treatment consists of a thorough washing of the skin with tincture of green soap and water followed by a widespread application of the scabicide ointment, well worked into the lesions. The materials have sufficient residual effectiveness to kill the larvae of the mites when they hatch from the eggs. Hence only one treatment is usually necessary.

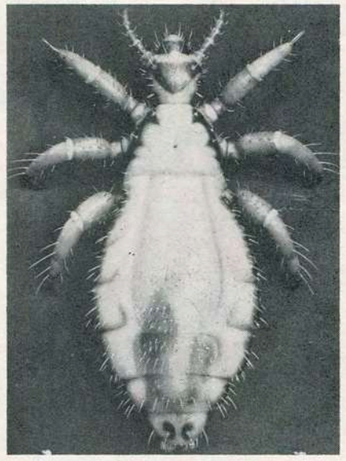
Prevention, however, is more difficult. The clothes of the patient must be thoroughly sterilized by laundering and ironing to prevent reinfection. Since scabies is essentially a social disease, not only must the clothes of the one patient be sterilized (by live steam, boiling water, dry cleaning, or hot ironing), but so also must the clothing of everyone else with which he is in intimate contact, as well as the bedding of all concerned.

Pediculosis (lousiness)

Many of the same things which were said about the epidemiology of scabies can be said about the epidemiology of pediculosis. There is a small reservoir of infected individuals always among us. When living under crowded conditions and using the same clothing and bedclothing, transfer of infection is easy and the parasite population build-up is rapid. This is especially true when the nutritional state of the individual is lowered and the community as a whole has a lowered personal sanitation level.

Two types of lice infect man, pubic lice ("crabs") and the head-body lice complex. The former, *Phthirius pubis*, can be dismissed from the present discussion because it is essentially a venereal disease. In addition, it is not known to serve as a vector of any infective disease. Venereal contact is the principal mode of transmission. However, it is not the only one, and the use of common or piled bath towels in dormitories or gymnasiums, and contact with dropped hairs bearing lice or eggs on clothing, bedding, or the seats of public toilets as a result of scratching by an infested person, should not be overlooked. Although a different segment of the population (i. e. the displaced) may become infested in addition to the groups which are ordinarily infested, the percentage of infestation is not likely to be raised to a high degree.

The head and body louse are two distinct forms or varieties of



Body Louse *(Pediculus humanus)*

Pediculus humanus (var. *capitis* and var. *corporis* respectively). They have different biologies and ecologies but are capable of interbreeding and of adaptation from one type to the other. Their specificity is not as sharp as once thought. The head louse spends its whole life cycle mainly in the hairs of the head, and on occasion in those of the eyebrows, chest and armpits. The eggs or "nits" are laid singly and glued directly to the hairs. The nymphs which hatch from the eggs in 5-9 days look like and behave just like the adults. They mature in 7-9 days. The whole life cycle is completed in 14 to 18 days. The body louse is found mainly on the body but leaves its host when not feeding and goes wandering off among the clothes. They lay their nits or eggs on and among the seams of the clothing or bedding, and can stay off their host for 48-72 hours at a time without harm and can survive up to 10 days without a blood meal. The body louse is the greater danger, not only because it can spread more easily from person to person, but also because it is a more efficient vector of the various diseases transmitted by lice. Outbreaks of mass lousiness are apt to be more severe in the winter than in the summer, because the population wears heavy clothing which they change infrequently.

Besides the direct and marked effect of the bites themselves (intense itching, and small hemorrhages at the site of the innumerable feeding stab wounds) and the secondary bacterial skin and blood infections as a result of the laceration produced by incessant scratching, a variety of ill-defined psychic disturbances result from the attendant loss of sleep, irritation, and restlessness. Even more important, however, is the fact that body lice are capable of transmitting various infections of man: epidemic typhus, trench fever, and epidemic relapsing fever, as well as favus and impetigo. A listing of the ravages and epidemics of typhus, trench fever, and relapsing fever reads like a compendium of every war, famine, depression, and mass migration man has ever partaken in. The course of history has been changed several times by the losses and debilitations of troops due to these diseases. The diseases are world-wide in distribution and may occur wherever human lice are abundant.

Epidemic typhus (including Brill's disease), and trench fever, are caused by closely related types of rickettsiae *(Rickettsia prowazeki, R. wolhynica = pediculi)*. Their debilitating effect on a population or army is immediate — sudden and high continuous fevers, severe headache and marked prostration, hemorrhages throughout the mucosa and skin, and widespread skin rashes which are characteristic. The mortality rate varies from 5% to 70% but averages 20%. Preventive measures are by far the recommended procedure in the control of these diseases. The Naples (Italy) epidemic of 1943 and its dramatic and rapid control thru dusting the population with 10% DDT is still fresh in our memory.

(Continued on page 46)

PESTALES

Bacteriologist Defies Mouse

Dr. Homer F. Marsh, bacteriologist at the University of Oklahoma Medical School, gave the deciding testimony recently in an $8,000 damage suit based on finding a dead mouse in a bottle of soft drink.

The plaintiff, Thomas M. Owen, maintained that after drinking the liquid he suffered stomach spasms and nausea.

As star witness for the defending bottle company, Dr. Marsh stated that acids in the soft drink would destroy all harmful bacteria in 72 hours. Challenged by the prosecuting attorney, Dr. Marsh volunteered to drink the liquid, while the mouse still rested, martini-like, inside. He took the bottle, removed the cap and drained the contents.

"Just tastes a little musty, that's all," said Dr. Marsh, licking his chops.

The judge quickly directed a verdict for the bottling company.

We'll remember that, doc, next time we run out of olives.

* * *

Mice Reject Practical Joke

Twelve grade school boys, bent on frightening their female playmates, went out into a nearby pasture to catch some field mice. The wary mice, however, bit the youngsters so badly that all twelve required treatment from the public health nurse.

Spoilsports!

* * *

Turnabout

Traditional animal lore has taken a sudden switch in Salt Lake City. Mrs. Alice Beverly, a housewife, reports her cat has developed what she terms "a sympathetic strain." Seems the cat, instead of killing mice, goes out into fields, hunts them down, and then carts them back to the house and sets them free.

Said Mrs. Beverly, perched high atop her kitchen chair, "My house is just teeming with them."

Look in the yellow pages of your phone book, Mrs. B.

ADVERTISERS' INDEX

Pest Control In Atomic Attack

(from page 16)

Control of lousiness among civilian populations or troops is relatively easy. Ten per cent DDT powder (i. e. DDT diluted with talc) is blown into the hair, over the whole body, and beneath and onto the clothing in a systematic fashion with any type of hand duster. Equipment is available for the mass delousing of populations so that 1000 or more individuals can be dusted in 1 hour with one apparatus. The insecticide is highly effective against the lice and retains its effectiveness for a sufficient time to kill the nymphs as they emerge from the eggs. The clothing which is not being worn and the bedding should also be treated either by dusting with DDT or by dipping into a DDT solution or emulsion and then drying. The latter is to be preferred because by impregnating the clothing with 2% DDT solution, the clothes will remain lethal to lice several months.

(To be concluded next month)

OBITUARIES

Anna G. Burdge

Mrs. Anna G. Burdge, wife of J. Harrie Burdge, Structural Pest Control Service, Raymond, Maine, died suddenly July 2.

David F. Mason

David F. Mason of West Haven, Conn., and past president of Connecticut Pest Control Association, died June 14 in New Haven. He formerly operated the Mason Exterminating Co.

Lewis Ambrose

Lewis Ambrose, associated for the past eight years with Orkin Exterminating Company in Atlanta, died June 7 in that city. He was 67.

William B. Ratner

William B. Ratner, one of the pioneers in the pest control industry, died May 13, in Atlantic City, New Jersey.

Ratner, who was head of Ratner Pest Control Operators, is survived by his wife and two sons.

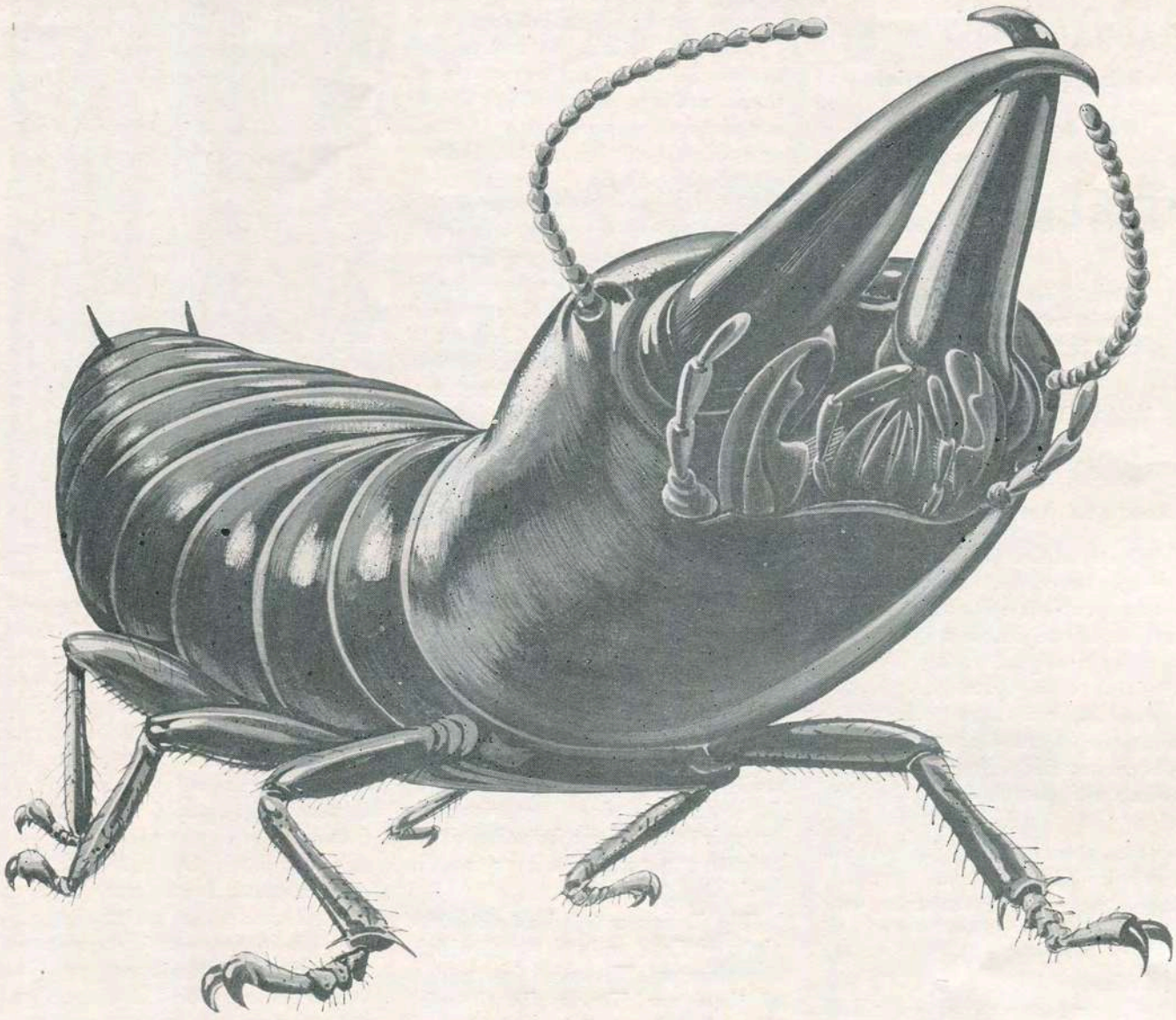
PEST CONTROL

SEPTEMBER 1951

EVERY MONTH SINCE 1933

Dr. Thomas E. Snyder, renowned wood borer authority, whose bi-monthly column begins this month, page 32.

PCOs and The Kansas City Flood - See Page 16



STOP IT...with MONSANTO PENTA

Monsanto Penta (pentachlorophenol) is one of the most effective chemicals known for controlling termites either in soil or in wood. Used as a soil poison, penta cleans out colonies of subterranean termites and prevents migrating hordes from becoming established. Employed as a wood preservative, penta repels termite attacks.

For soil poisoning or wood treatment an effective solution can be compounded by using 5% Monsanto Penta in suitable oil. For soil treatment, it is common practice to use 1 to 2 gallons thoroughly mixed with 5 cu. ft. of soil.

For new construction or repair work, wood pressure-treated with Monsanto Penta is the most effective method of preventing termite attacks. In extermination work, penta solutions may be applied by pressure, spray or brush.

For complete information on the use of Monsanto Penta, contact the nearest Monsanto Sales Office or write for Monsanto Technical Bulletin No. O-13. MONSANTO CHEMICAL COMPANY, 1700 South Second Street, St. Louis 4, Missouri.

MONSANTO CHEMICALS FOR TERMITE CONTROL

Santophen* 20 (pentachlorophenol) . . . trichlorobenzene . . . ortho-Dichlorobenzene . . . Santobrite* . . . DDT.

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MONSANTO
CHEMICALS AND PLASTICS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

What Are The Potential Pest Control Problems in an Atomic-Bombed Community?

by

Harold Elishewitz, Ph.D.

Assistant Professor of Parasitology
The Chicago Medical School

Part III

Rats And Rat-Borne Diseases

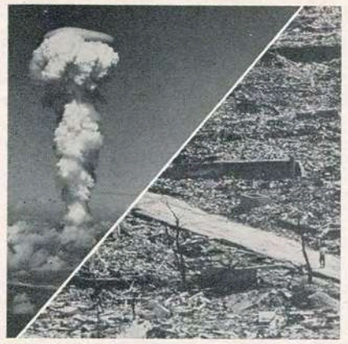
OF MORE PROBABLE importance than insects as a vermin problem will be the rats and rat-borne diseases prevalent after an atomic attack. The severe structural damage and attendant debris along with accumulations of uncollected garbage will produce ideal breeding places, feeding sites, and harborages for rats.

Rats, of course, are important reservoirs of murine typhus, plague, bacterial dysenteries, and fully seventeen other types of viral, rickettsial, and bacterial infections of man, as e. g. Weil's Disease or hemorrhagic jaundice, rat-bite fever (Sodoku), trichinosis, etc. Only the first three named need concern us at present. We will neglect entirely the extensive depredations to foodstuffs and structures caused by rats as well as their role in biting sleeping children.

For a proper understanding of the problem, we must take into account some of the habits of the commensal or domestic rats of man in this area. The rat involved is almost entirely *Rattus norvegicus*, the Norway or Brown rat.

Rats nest under accumulated debris, in between walls and lathes, in any type of hollow or enclosed space, and under packing crates, etc.; in short, wherever security can be found within reasonable distance of food and water. Hence the possibilities of harborage are almost endless. They are capable of digging burrows in the ground, usually under foundations, and run along definite runways between their feeding areas and their nesting sites. They have completely omnivorous tastes, and will eat any kind of food consumed by man — meats, fish fruits, fresh or dried vegetables, bread, flours, or any types of stored products and, of course, garbage. Their litters are large (up to 12-14) and they reach sexual maturity quickly (6-7 weeks). The gestation period averages only 25 days, litters are spaced at 60-day intervals, and there may be 5-7 litters a year. Hence, their population build-up is rapid. They are agile climbers and can climb up a wall or cross a thin wire; they are strong diggers and can dig under walls; and they are powerful gnawers, being able to work their way through wood crates, walls, doors, lead pipes, and occasionally concrete. Their incisor teeth grow from 4 to 6 inches a year. They are extremely stealthy and wary, and venture forth mainly in the dark. They do, occasionally, come into the light but then it is only to run across an area, not to feed.

The Brown rat is host to a variety of fleas, only three of which are common. The most important of these are *Xenopsylla cheopis*, the oriental rat flea, and *Nosopsyllus fasciatus*, the northern rat flea. These fleas live as adults as ectoparasites on the rats, sucking their blood. However, they lay their eggs and their larvae live and develop in the rats' nests. The rat fleas find man as ready and as acceptable a host as the rat and, in the absence of rats, will readily attack man. This is the basis for the primary transmission of murine typhus and plague. Bacillary dysentery and Weil's Disease transmission is tied in with the proximity with which rats live with man's food and water supply.



Rats themselves are natural reservoirs of these various diseases. They transmit them either directly or indirectly. The cycle of murine typhus is rat to man via the excreta of the rat flea, and between the rats themselves via either rat lice or rat fleas; the cycle of plague is from either the domestic rat or wild rodent to domestic rat by wild rodent or rat fleas, and to man from the domestic rat via the rat flea, and, on occasion, from man to man pneumonically; in bacterial dysentery it is from rat to man via man's food contaminated with rat excreta; in Weil's Disease from rat to man via water contaminated with rat urine.

Keep in mind this one fact — rats are your closest neighbors, closer than your next-door human neighbors, and, in addition, they have first call on your food supplies while they are still stored in the warehouses or grocers' shelves.

Some of these diseases, especially plague, are important, and

Adequate rodent control *cannot* be established after the A-Bomb strikes. Control programs must be organized and underway beforehand

have been highly important in history.[8] The importance and rather high incidence of murine typhus, especially in the Southern United States, has only recently been appreciated, with the differential diagnosis of this disease from spotted fever, epidemic typhus, and a variety of other infections. Plague is caused by the bacterium *Pasteurella pestis*, murine typhus by the rickettsia, *Rickettsia typhi* (formerly *R. prowazeka* var. *mooseri*), Weil's Disease by the spirochete, *Leptospira icterohemorrhagiae*, and bacterial dysentery or salmonellosis by *Salmonella enteriditis*. This last is a typical food infection characterized by diarrhea, abdominal cramps, fever, nausea and vomiting.

The incidences of these various diseases depends upon the presence of reservoirs; that is, infected rats, their flea populations, and the populations of rats themselves.

The main factor which has prevented outbreaks of plague here in Chicago is the lack of infected rats, while outbreaks of murine typhus have possibly been absent because of the low population of rat fleas on the rats.[9,10] Salmonellosis and Weil's Disease are with us here in the city at a rate probably above its reported or even suspected levels. (From 3 to 52% of the rats in Chicago have been found infected with *Leptospira icterohemorrhagiae*.)

Rat control is a complex battle and a never-ending one. It involves first structural modifications in buildings, homes, and warehouses to "build out" the rats; that is, to rat-proof (isolate) structurally by metal sheeting or barriers, wire guards, deep foundations, closing or guarding of all openings, etc., so that the rats cannot gain entrance into buildings for either breeding or depredation. Then comes cleanliness, to starve the rats out. Proper garbage containers tightly closed, and an efficient city garbage collection system up to and including the final refuse disposal at the garbage dumps are primary requisites in decreasing the rat population by starvation. Proper storage and warehousing methods and good housekeeping in markets, meat plants, commissaries, and food stores and warehouses are also important. Rat eradication programs by trapping and using the newer rodenticides, ANTU, 1080, Warfarin, etc., mixed with food or water in baits and placed in easy accessibility to the rats, can, if properly carried out, kill off large numbers of rats. These palliatives, however, rarely eradicate the rats and their populations build up again. In this latter program it is essential to carry out concomitantly a DDT-dusting program along the runways and into the burrows and nests of the rats to kill their flea ectoparasites. If not, upon the death of the rats, the fleas tend to attack man as their only other source of food and the danger of disease transmission is thereby increased. Finally, stringent and adequately and honestly enforced legal regulations in the building and sanitation codes pertaining to rat-proof construction in old and new buildings, maintenance of garbage in inaccessible containers and its collection and disposal, and regular sanitary inspection of all food and drink processing plants, restaurants, warehouses and stores round out an adequate but far from complete rat control program.

The rat problem here in Chicago, as well as in many other cities, is so severe that an adequate control or eradication program could not be carried out after an A-bomb explosion. It is one phase which should be started, organized, and gotten well underway *beforehand*. The Civilian Defense Group here in Chicago considered the present rat problem sufficiently serious that it has strongly recommended that such a control program be initiated now as a preventative measure. However, until the Bureau of Sanitation revises its garbage-collection procedures and procures additional equipment and until the city code is modified to provide enforcement of regulations ensuring that householders cooperate by not throwing garbage in the alleys, not much progress will be made.

Other Household and Stored Products Insects

It is difficult to see how an atomic disaster will alter the problem of the other household insects of medical and sanitary importance, i. e., bedbugs, cockroaches, dog and cat fleas, firebrats, etc., or increase their role

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8. Plague, on a world-wide basis, has always been mankind's worst enemy. Its history is long and well recorded by numerous chroniclers from antiquity to the present. Homer described plague among the Greeks besieging Troy in 1184 B.C. The Great Plague of Justinian in the Sixth Century is reported to have killed half the population of the Roman Empire and its build-up probably played an important role in the final disorganization of that empire after the "Fall of Rome." During the early Middle Ages, the Fourteenth Century, 25 to 40% of the population of all Europe and England was decimated by plague. Called the "Black Death" it killed some 25 million people and set Western Civilization back several centuries. The course of history has been changed several times due to the ravages of this disease on different armies. The present pandemic, which began in the Orient in 1894, is the most widespread of all. It has invaded every continent and nearly every country. In India alone 12 million deaths have occurred in the past 55 years.

9. A general abundance in any given locality of at least one oriental rat flea **(Xenopsylla cheopis)** per rat usually is regarded as the minimum required to support plague among domestic rats, and hence serve as a source of infecting humans. The rate here in Chicago varies but is frequently much higher than that. Although in the United States no plague outbreaks due to bites of fleas have occurred where the average midwinter (i.e. January) temperature is lower than 45° F (it is 25° F in Chicago), or where the mean relative humidity at noon in July is less than 60% (it is between 55 and 60% here in Chicago), this is not an inviolable rule governing the distribution of the disease. Numerous areas in the world, including the pandemic focus in Manchuria, have and have had the disease endemically, where their mean midwinter temperatures and mean summer relative humidities are lower than those given as the rule here in the U.S.A.

   The U. S. has a tremendous endemic reservoir of plague infection in its wild rodent population. Infected wild rats, ground squirrels, gophers, voles, meadowmice, etc., have been found as far east as Kansas (1945-1946) and North Dakota, and appear to be continually spreading eastward from their original focus in California. This infection in wild rodents is a constant potential source for the infection of domestic rodents in urban communities located in the vicinity of rural plague foci. Murine typhus fever is a common infection among domestic rats of the Southern U. S. Its rate approaches 100% of the rat population in some urban business districts, and in many rural counties over 50% of the rats caught yielded positive murine typhus complement fixation tests.

10. The danger of a plague or murine typhus outbreak in Chicago is real, not so much from the effects of an A-bomb disaster **per se**, but from one of two possibilities: that, in bacteriological warfare, either infected fleas will be dropped from planes and thus infect the rodent population here, or that the causative organisms will be released into the air as a spray or an aerosol. In the former case, the results would be problematical but would be worth an attempt if it were not for the more certain and more deadly results which could be obtained with the latter. (see Elishewitz (1951,b)).

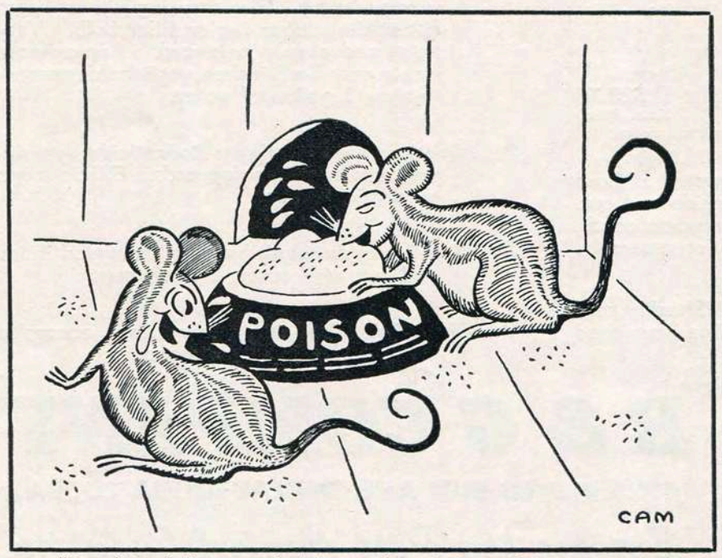
as a public health problem. Hence these can be neglected.

Mosquitoes

In the city itself, i. e., in the built-up areas, there are no anopheline mosquitoes, and pest mosquitoes are a minor problem, breeding mainly in the park ponds, rain catchment areas, and pools in house cellars. The attack will, presumably, be directed against just such areas, if it comes. In the event of an atomic bomb attack in the spring or summer, it is probable that *Culex pipiens*, and several species of *Aedes* will breed in the temporary water pools among the rubble. As Bond (1950) pointed out, an adequate water supply for fire-fighting plays an important part in Civil Defense. Since the danger of destroyed water mains and low water pressures are grave, to insure this adequate water supply, basements of buildings will have to be flooded and maintained in a flooded condition. Thus they will serve as water-storage reservoirs from which water can be pumped for fire fighting as needed. These innumerable loci offer the most fertile field for pest mosquito breeding.[11] Control of these mosquitoes could, if necessary, be carried out at the same time and with the same equipment and materials as will be used in fly control.

The problem of outbreaks of St. Louis encephalitis, other viral encephalitides, and dengue fever can not be completely dismissed but can be discussed under bacterial warfare, as can the use of insects, such as fleas and mosquitoes, etc., to spread other diseases.

11. Dr. M. T. Morgan, Medical Officer for the Port of London, England, pointed out (see PEST CONTROL, Vol. 19, No. 5, May, 1951, Pg. 44) that these sumps of static water for fire fighting "gave a considerable amount of trouble in mosquito breeding" during the "Blitz" on London in 1940-1943. The fire departments would not permit, naturally, the oiling of these bodies of water to prevent such breeding because of the danger of spreading fires. DDT dusts or aqueous emulsions could now safely be used.



"I can't read the menu but it sure is a tasty, well prepared dish!"

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Six Legs Give Insects Balance

Most insects would be wobbly if they didn't have three pairs of legs to support them, Dr. Urless N. Lanham of Ann Arbor says.

Dr. Lanham, zoologist at the University of Michigan, believes nature has endowed insects with three pairs of legs as a minimum support for external-skeletoned creatures. He explains his theory by observing that insects walk by lifting two legs on one side and the middle leg on the other, sweeping forward and lowering simultaneously. The three legs remaining on the ground furnish a tripod support while a step is being taken.