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- d. At least six weeks instruction in public health nursing in one of the recognized public health nursing courses, and one year's experience under adequate supervision, or, two years' experience under adequate supervision, or, a public health nursing course endorsed by the National Organization for Public Health Nursing.

Dr. Livingston Farrand, in the "Foreword" of the "Survey of Public Health Nursing" published in 1934 says: "The part which public health nursing plays, and must play, in any organized effort to improve human vitality under modern conditions is now so obvious that it no longer needs argument. The problem is to increase its effectiveness."

We would, therefore, request that a manual, or hand-book, in line with the "Syllabus of County Health Department Administration" be prepared by our State Health Department for the use of public health nurses, and that a loan library be made available; we would further request that provision be made within the borders of our state, as soon as practicable, for a training course for public health nursing, including in addition to the theoretical instruction, training in a well-developed practice field under the supervision of a competent public health nurse, and that provision be made in connection with such course for two six-week's courses during the summer months. We would also request that two to three day institutes be provided several times during each year, as "refresher courses" for public health nurses, and that these be so arranged as to be brought within a one hundred mile radius of each public health nurse in the State.

INSECTS AND PUBLIC HEALTH

By ROY NORTON, M.D., Rocky Mount

Opportunities to learn the prevention, diagnosis and treatment of insect-borne diseases are offered to us almost constantly. Few of us, however, pause long enough in the rush of routine duties to objectively study the "insignificant insect" in our midst. Except for malaria many consider the insect influence to be too far removed and fanciful to merit much serious concern from a public health official. Today the biological transmission of eight or nine serious human diseases and the mechanical transfer of a few dozen more by insects constitute only a part of their influence in human life. In numbers and in weight, insects exceed that of all other animal life combined. These hungry fecund hordes challenge man for every comfort he desires and even his absolute necessities of life. With increasingly rapid transportation, with intense cultivation of domestic plants and animals, and partly because of most of the methods of modern civilized life, the insect competition has become increasingly acute. As man struggles against disease, or for favorable geographical areas, an adequate food supply, clothing, shelter, comfort, or culture, his success or failure depends largely on the help or hindrance offered by insects.

Only a few hundred years ago, men believed that disease was due to the wrath of the gods. Later meteorological disturbances and bad air were

blamed. Men prayed, burned odoriferous concoctions and shut their windows at night—and died. During the last fifty years we have turned from such supposedly omniscient powers as the gods and weather to practical “prosaic matters such as the extermination of the mosquito, the killing of the rat and its fleas and the delousing of the traveler—and we live free from yellow fever, bubonic plague and epidemic typhus.”

Theobald Smith, Laveran, Ross, Manson, Carlos Finlay, Reed, and others turned scientific attention to the importance of insects in the transmission of disease to man and his animals and plants. One after another, great districts formerly known as the “white man’s grave” have been freed of a particular insect menace and enabled to flourish as only healthy communities could. With active medical efforts directed mainly against mosquitoes, the Panama Canal Zone is one of the most healthful districts in the world while its borders touch upon two of the least healthful.

Insects are responsible for the transmission of several of our worst diseases. Those not carrying diseases now may change habits and do so. Many unsuspected or unproved carriers may later be found guilty. Everything from filtrable viruses, bacteria and rickettsia, to protozoa and parasitic worms may be transferred by insects.

Diseases transmitted by the louse, flea and mosquito alone have turned the tide of war more often than all our generals; the same insects have shaped human destiny more than all our statesmen. In some cases, as in 1632, when Gustavus Adolphus and Wallenstein were at grips, both sides were defeated by insect-borne disease before an actual battle was fought. A million men were kept out of the struggle during the crucial early months of the world war by typhus. The civilizations of Greece and Rome crumbled largely because of insect-borne malaria and that of Yucatan probably because of yellow fever. Who can doubt that the progress of our own Southland has been retarded by mosquitoes and flies? The cultural backwardness of the tropics is due as much to insects as to climate.

Mosquitoes carry malaria, yellow and dengue fevers, and filariasis. Certain biting flies spread African sleeping sickness and tularemia. The common house fly mechanically transmits typhoid, cholera, dysentery, pink eye, smallpox, erysipelas, tuberculosis, and many other diseases. Ticks transfer Rocky Mountain spotted fever, tularemia, African relapsing fever and Texas cattle fever. Bedbugs and related insects transmit tularemia, Indian Kala-azar, European relapsing fever, and South American trypanosomiasis. Lice spread epidemic typhus fever, trench fever, and the relapsing fevers of Algeria, Asia and Europe. Fleas spread bubonic plague, endemic typhus, and possibly other diseases.

Several of these insect-borne diseases are taking a heavy toll in sickness and deaths among us now. Malaria is the worst with its two to four thousand days of disability for each recorded death. Some are of immediate potential danger such as yellow fever, filariasis, dengue, bubonic plague, trench fever and epidemic typhus. Besides malaria, we already

have among us tularemia, Rocky Mountain spotted fever and endemic typhus. We should be alert to study and recognize others now, or soon to be, among us. The progressive physician will need to know more and more about insects to cooperate in the control of insect-borne diseases. Prevention will require the intelligent cooperation of physicians, entomologists, farmers, sportsmen, engineers and practical administrators. In normal times the insect-borne diseases are a threat chiefly to the young, the weak, and the aged but the entire population is in danger when neglect, poverty, famine and war let down the bars of human defense.

One of man's big problems in maintaining health and life is to secure an adequate and balanced food supply. Insects spread disease and destruction among food plants and animals. Probably 90% of the damage done by insects is the result of their feeding or efforts to get food. They eat everything, and take a toll of ten to thirty per cent of every crop that man plants. The food of insects falls into three groups: growing plants, living animals, and the products derived from plants and animals which are stored and used by man for food, clothing, shelter, commerce, arts and trades.

Insects are direct and relentless competitors for nearly every one of man's necessities of life. Man fights consciously, intelligently, and in small numbers; insects attack blindly, instinctively, and in prodigious hordes with limitless reserves. There are fewer than fifty humans per square mile in the United States; experts of the Bureau of Entomology estimate the insect population at 25,000,000 over each square mile of earth surface.

In spite of the uncountable hordes of insects of ten million different species and endless variety of structure, colors, and habits, 99% of those ordinarily encountered can be placed into ten groups, four of which contain 87%:

Coleoptera (sheath-wings)—beetles and weevils, 40%.

Lepidoptera (scaly-winged)—moths and butterflies, 20%.

Hymenoptera (membrane-winged)—ants, bees and wasps, 14%.

Diptera (two-wings)—flies, mosquitoes and gnats, 13%.

Insects may also be classified according to the mouth parts into chewers, stabbers, and suckers, and the use of our chemical insecticides is largely determined by the feeding habits of the particular insect.

Man has certain natural advantages which are the result of intelligence. His tools are not restricted to the appendages of his own body. He makes tools to make other tools. Language, printing, fire, the lever and wheel have added unity and power. Man can use intelligence and study life histories of insects and then attack at the most vulnerable point or points in the cycle. Swatting and screening may be useful in occasional instances. Breeding places are frequently the most vulnerable points in a direct attack on harmful insects. Chemicals, drugs, quarantine, and variation of living habits and crop practices have been found useful in controlling insects.

Unfortunately, many of the present civilization methods favor the increase and spread of insects. Social, philanthropic and medical groups prevent the natural elimination of the misfit and unfit and encourage their rapid propagation while those of best natural equipment are killed and maimed in wars. Rich soil is stripped of vegetation and allowed to wash or blow away. Forests are cut or burned. Our natural allies, the fish and birds, are ruthlessly slaughtered, while flies, mosquitoes, ticks, cockroaches, fleas, beetles, weevils and lice breed unhindered. "So far, man's organized warfare against man, in groups large or small, has constituted his major industry." Fortunately for man, insects also attack each other and are cannibalistic especially when, like man, they seem about to get the upper hand.

Besides having six legs to man's two, insects have certain other advantages. In passing from egg to larva to pupa to adult stages insects are able to feed conveniently and resist the rigors of climatic changes. The greater antiquity of insects, their smaller size, and their rapid successive generations favor greater stability and adaptability. The insect's strong octoskeletal body structure and his respiratory, digestive, excretory and circulatory systems have certain advantages. They reproduce almost unbelievably fast. Powers of concealment or camouflage and rapidity of motion are advantageous to insects.

An interesting and dangerous characteristic of insects is their adaptability for survival in changed and unfavorable environment. Until the clearing of forests, cultivating of crops and domestication of animals, insects were chiefly botanical and biological scavengers. From sucking plant juices, mites, ticks, mosquitoes, lice, and certain flies and bugs changed to sucking blood. Clothes moths began as scavengers of cast off wool and hair in ancient forests. In ten years the many generations of boll weevils became resistant to freezing temperatures. Certain insects have adapted themselves to extreme acids, or alkalies and others to living in old salt mines or petroleum wells. Some insects live in arctic regions and certain forms can live at 121° F. Others can live in water at a depth of 160 fathoms. When the wingless female winter moth was hindered from crawling up tree trunks to foliage above by a poisonous sticky band, the winged male learned in three years to fly with, and deposit her, in the foliage. Should any environmental change exceedingly dangerous to the survival of existing forms of animal life take place, insects could make adaptations hundreds, and in some cases thousands, of times as rapidly as man could. We may as well recognize the hardihood of our competitors.

In the fullness of man's indolence, insects are unconquered. Man's superior intelligence in competition or even in direct attack has not given him all of earth's good things. And the insect can lay claim to doing by blind instinct certain things, which, when accomplished by man, seemingly required intelligence. Among these achievements are flying, paper making, traps to catch food, preserving and storing food, anesthetics, weaving, air-conditioned homes, rocket principle in transportation, incandescent

light, enslavement of their fellows, domestication of animals and plants, and highly organized clans or communities in which workers engage in many diversified special occupations. The insect's inventions of the use of biochemical stimuli in diet, in determining the sex of offspring and polymorphism go deeper into the secrets of nature than our radio or use of tools. The admirably efficient feudal matriarchy of the bee hive is superior to any comparable achievement in general contentment by man. The communistic organization of ants and termites appears to represent the ultimate perfection of modern Russian aspirations.

Insects are, however, by no means unmitigated evils. They destroy weeds, pollenize plants, and serve as scavengers, as makers of soil, as food for poultry and song-birds and food-fishes, as makers of clothing and as suppliers of human food, but especially as destroyers of injurious insects. Man's ingenuity is putting them to new uses almost daily. It is impossible and even undesirable to exterminate all insects; so that we are following our own parasitic inclination and using them. Putting maggots on to clear the debris of an old osteomyelitis is among our later accomplishments.

It is true of insects, as of bacteria, that most forms are helpful to man, but on account of man's ignorance, prejudice, superstition or the insect's appearance, man fails to recognize his friends among the insects and has frequently waged war on spiders, praying mantids, dragonflies, and practically all the ants, bees and wasps. Only within the last few years has man learned that these insects may ally with man in the fight against particularly harmful and destructive insects. The ant is an eternal enemy of the termite. Encouraging the ladybird bug is the best means of controlling San Jose scale and certain wasps are our best preventives of insect ravages in some fruits. Experiments are being carried out to discover other insect allies of man in the fight against our insect enemies, and further progress is hoped for along this line.

One of our disadvantages in this life and death struggle with insects is that "the bug fight cannot be given the pride and pomp of human war. We could not march to it with flags flying and bands playing. And I am afraid there would be no chance for the frenzied profiteering that is so stimulating to patriotism." Man, however, has existed only a million or so years and many insects have existed in their present form for perhaps 100,000,000 years. We should not be too much discouraged by observing such frequent failure to use our recently acquired intelligence. In another million years the outlook for man in his competition with the insect may be much brighter.