

RELATION OF PARASITES TO MAN IN RURAL COMMUNITIES.

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Scourges and devastating epidemics have forced cities with their concentrated populations to devote the necessary time and effort in developing pure water supplies, safeguarding food and milk, and establishing more or less efficient methods of waste disposal, although in some unfortunate instances the latter has consisted of conducting the offensive material away from the city into the rural districts.

To a great extent our rural population has been unaware of the grave dangers of certain practices, especially those leading to soil and water pollution. Customs still prevail which became established at the time the country was new and supported a very sparse rural population. The increasing density of our rural population, combined in at least some instances with an increasing degree of infestation with certain parasites, has increased the dangers of many common practices. Our present economic custom of employing transient farm laborers who while employed live in more or less intimate contact with their employer's family, combined with an increasing tendency for travel among the rural population have greatly increased the danger of parasites being introduced into rural communities.

In the past our rural communities have been protected from the importation of foreign parasites by the small amount of foreign travel and the long time travelers were in transit, which greatly reduced the chances of a parasite gaining a foothold in an area. Our splendid isolation from heavily parasitized populations is fast being swept away and our systems of protective sanitation should be planned to protect not only against parasites known to be present, but against those that can easily be introduced. According to Chandler (1922) 65 per cent of the homes in southern United States were estimated to be without privies of any kind. In this region at present such a condition is difficult to find. However many privies are poorly constructed, allowing free access to flies, and in extremely wet weather over-

flowing often polluting the community water supply. Children, laborers, and sometimes others, are often guilty of not using the privy upon many occasions, increasing the ease with which parasites may be spread.

We may expect the introduction of parasitic diseases which are not at present endemic in this country. Many of these, due to the natural or acquired tolerance of races who have lived with them for centuries, cause little disturbance in their natural habitat, but when introduced into a favorable environment in less resistant populations may prove serious.

Until about forty years ago sleeping sickness was confined to a limited part of tropical Africa, but with the coming of the Europeans with their definite lines and more rapid means of travel the disease was carried to new regions where the people had not acquired a partial immunity to it. Accordingly the population of one district in Central Africa was reduced from 300,000 to 100,000 in the course of seven years (1901 to 1908).

The Greeks did not begin to decline until they conquered Asia Minor, bringing back the malaria parasite with them. Their description of the symptoms of the disease leave little doubt as to its identity. The Romans easily conquered these parasitized Greeks, only to introduce the disease into Italy where it still remains. It is probably that it was as a means of treating the symptoms of this disease that the famous Roman baths were constructed, and the disease no doubt contributed to the ease with which the northern tribes were able to defeat the Romans of this later period.

Fortunately the introduction of a new parasite does not always infest new areas. Probably many introductions are necessary before conditions are found favorable to its multiplication. In the case of a parasite requiring one or more intermediate hosts, the chances of the parasite and the necessary intermediate hosts being introduced under favorable conditions are remote, yet with repeated introductions infestation may occur.

The African eye worm, *Filaria loa*, has been introduced into this country many times without gaining a footing. The Guinea worm, *Dracunculus medinensis*, was brought to the New World with the slave trade, and while it failed to gain a foothold in this country it has become endemic in West Indies and in certain parts of South America.

A classical example of a recently introduced parasite is *Diphyllobothrium latum*, the broad fish tapeworm of man. This

parasite is common among the people of Northern Europe, and in spite of the fact that two intermediate hosts, a copepod and later a fish, are required for its propagation, it has gained firm foothold in our northern states. Lack of suitable care in the disposal of feces allowing pollution of streams and lakes, combined with the practice of eating smoked or pickled fish not properly cooked were two customs which formerly had been relatively harmless, but after the introduction of this parasite these customs were fraught with danger.

All trematodes have an extremely complicated life history. We have in this country liver flukes of cattle and sheep and lung flukes of swine, but do not have those flukes which in certain countries prove a serious detriment to the well-being of the population. In Egypt over half of the population is said to be infested with the Egyptian blood fluke, *Schistosoma haematobium*. In the case of this parasite the eggs are deposited into the bladder, and are spread by water contaminated by the urine of infested individuals. Since infestation may occur not only by drinking water containing the cercarial, but by bathing in contaminated water, the prevalent custom of urinating in streams would prove deleterious should this trematode be introduced into this country and adapt itself to utilizing our fresh water snails as an intermediate host.

When the hookworm was introduced by infested slaves from Africa, the custom in regard to waste disposal of the English blooded pioneers in the mountainous regions of the south were such as to furnish an ideal environment for these parasites. The custom of defecating in a wooded thicket, which previously had little or no bearing upon their well being, now proved to be the means of disseminating this parasite accompanied by intellectual and economic decline.

Trichiniasis is a real menace. Urban communities are at least partly protected by our systems of meat inspection, but in our rural communities the slaughter houses are not efficiently inspected. In one which I frequently visited, the viscera, diaphragm and also abnormal appearing pieces of meat are fed raw to swine. In this particular slaughter house rats are abundant. Introduction of *Trichinella spiralis* into such a slaughter house would probably result in a local epidemic of trichiniasis. Only the fortunate circumstance of the parasite not having been introduced under suitable conditions and the generally prevalent custom of thoroughly cooking pork have prevented serious out-

breaks. "Hamburger stands", especially in rural villages, frequently serve sausage from such slaughter houses. Often this meat is served without being thoroughly cooked.

Many parasites normally present in domestic animals may prove injurious to human health, especially in those instances where the animals live in fairly close contact with people. *Ascaris lumbricoides* of human and porcine origin, while apparently morphologically identical, are physiologically distinct. This, however, does not prevent the infestive ova from the porcine strain hatching in the human digestive system, boring through the intestinal mucosa, reaching the liver, going next to the lungs and after sufficient development causing the typical verminous cough.

While I know of no experimental work done on the subject, the case of the whipworm, *Trichuris trichiura*, of man and swine, may be parallel to that of *Ascaris lumbricoides*. Swartze reports that the whipworms of man and swine are morphologically identical.

In the case of *Balantidium coli*, one of the pathogenic intestinal protozoa of man, the pig is supposed to be the reservoir of infestation. In a series of instances of human infestation with *B. coli*, Kofoid was able to trace the information to pigs. In many instances we find pig pens in close proximity to unscreened dwellings in our rural regions. House flies are abundant. It has been found that the house fly will hastily feed upon material, then retire to a more quiet spot and regurgitate the contents of the cecum. In the laboratory flies will readily ingest material containing *Ascaris* eggs, carry it considerable distances and regurgitate it. They will eat only a part of the regurgitated material and leave the eggs as part of the fly speck. In this manner the eggs of various parasites may be spread by house flies.

The time is rapidly passing when we can safely rely upon distance as an effective barrier against the introduction of parasites. Our splendid isolation from heavily parasitized populations is rapidly passing. It is imperative that our population be educated against these increasing dangers. In the grammar schools and high schools suitable training in sanitation and the rudiments of parasitology should be taught by suitably trained teachers. The support of the local veterinarians and physicians should be enlisted, and by the education of our rural population as to the dangers of certain customs, it should be largely possible to prevent many of these parasites from gaining a foothold even tho accidentally introduced.