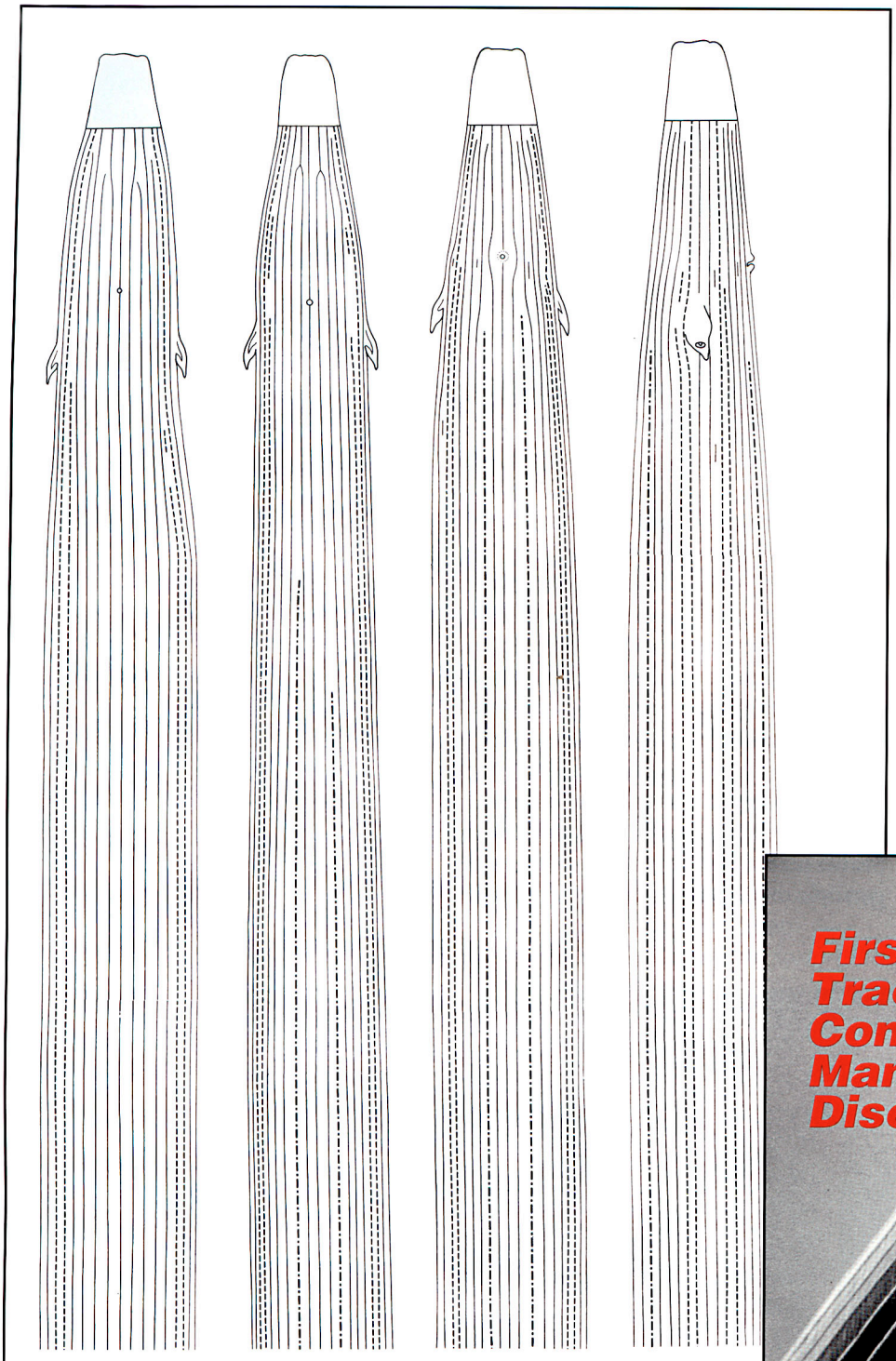
Fingerprinting Parasitic Worms



Patterns of ridges—synlophes—magnified about 400 times, can be used to differentiate harmful species of medium and large stomach worms that afflict ruminants such as cattle, goats, and sheep. Correct identification is important to the proper treatment of infections.

First Step in Tracing and Combating Many Animal Diseases

According to recent data reported in a Global Biodiversity Assessment by the United Nations, the world is home to about 13 million species of organisms.

Roughly 400,000 of these are nematodes, about 10 percent of which are parasites known to attack humans, other animals, and plants. Many others are still unknown or insufficiently described with regard to features and behavior to be recognizable.

"Nematodes are so numerous that if every part of the world were to disappear, except for them, you could still see the outline of the Earth," says J. Ralph Lichtenfels. A world expert on parasites, he is a zoologist with USDA's Agricultural Research Service and curator of the U.S. National Parasite Collection—the largest in the world.

He and his small staff in the Biosystematics and National Parasite Collection Unit at Beltsville, Mary-

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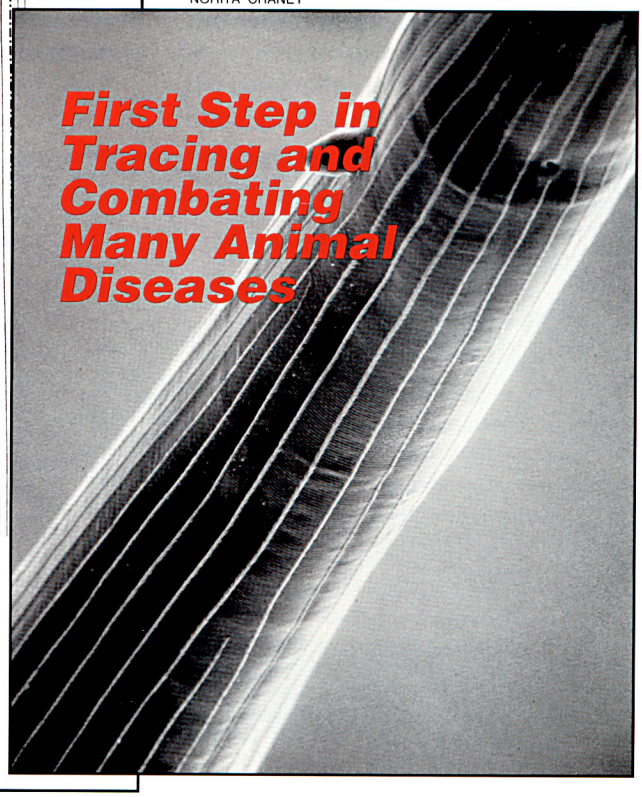

land, research and classify all manner of parasites—from tapeworms to roundworms.

"Correctly identifying a strange or mysterious parasite is critical to tracing the origins of a specific disease and taking steps to combat it," he says.

Recently, Lichtenfels discovered that medium and large stomach roundworms—two of the most important pathogens causing diseases in cattle and sheep in the United States and the world—have distinctive patterns of ridges on their outer cuticular surface. About 40 of these ridges run along the length of the worms. He has proven that these ridges can be used as "fingerprints" to identify them.

The pattern of ridges, called the synlophe, can be used by parasitologists and veterinarians to identify the highly pathogenic species of medium and large stomach worms afflicting ruminants such as cattle, goats, and sheep. Magnified 400 times under a microscope, the synlophes of both living and preserved specimens become visible.

Identifying harmful species is important, says Lichtenfels, because "in the southeastern United States, these parasites are called the bankrupt worm. The severe losses of young animals, cost of treatment, and loss of use of contaminated pasture cost about $400 million each year."

Ranchers have to leave pastures empty when parasite infestations are heavy—as in spring, when the weather warms up. Since roundworm parasites live in the stomachs of ruminant animals, their eggs get deposited on pastures during grazing. Animals pick up the worms by grazing grass infected with the larvae that hatch.

Worldwide, three species of large stomach worms, *Haemonchus,* are parasites of sheep, cattle, and goats. These half-inch-long worms are nicknamed the "barber pole worm" because of the red and white stripes caused by intertwining of the blood in the intestines with white, egg-filled ovaries along their spaghetti-like bodies.

H. contortus is mainly a pest of domestic sheep but can infect many other domestic and wild ruminants. *H. placei* infects mainly domestic cattle but has been found in domestic sheep, white-tail deer, and pronghorn antelope. And *H. similis* infects domestic cattle in a few southern states and white-tail deer in Florida.

Identifying a strange or mysterious parasite is critical to tracing the origins of a specific disease.

Using the pattern and numbers of ridges in the synlophe, Lichtenfels has developed an illustrated key that makes it possible, for the first time, to identify individual male and female worms of these three species of *Haemonchus*. Even more importantly, Lichtenfels' new identification method ends a century-long controversy over whether the large stomach worms of cattle and of sheep are different species; they are.

The new method also distinguishes among species of the medium stomach worm, or *Ostertagiinae,* that are also parasites of domestic and wild ruminants. "In many parts of the world, they are the most pathogenic nematode parasites in cattle, sheep, and goats," says Lichtenfels.

So he developed a key for identifying all 15 species of the subfamily Ostertagiinae in North American ruminants. Nine attack domestic ruminants, and six infect wild native North American ruminants. One species, *O. leptospicularis,* is a parasite of deer and a severe pathogen of cattle in some parts of the world. Recently, it has been discovered in Oregon and Montana.

Lichtenfels explains why he has included in his descriptive keys the six worm species that infect native wildlife but are not known to be hazardous to domestic ruminants.

"Native wild ruminants like caribou, moose, and other deer and some wild sheep and goats often share pasture with domestic cattle, sheep, and goats in many regions of North America," he says. "Because the medium stomach worms can attack a broad range of hosts, we must regard the species known to be present in wild ruminants as potential parasites of domestic cattle and sheep."

Recognizing the nematodes in cattle and sheep as separate species will improve control measures for them, says Lichtenfels. It will also speed development of other diagnostic tools that can be used to identify eggs passed by infected hosts. And having accurate, easy-to-use diagnostic tools will prevent new parasite pests from being imported into the United States along with exotic hosts.

Veterinarians will welcome the new information. By more accurately identifying the nematode causing an infection, they will be better able to target treatments and prescribe drugs. And new strategies can be devised so that drugs can be used more judiciously in treating heavily infected animals. Their overuse can cause these roundworm parasites to develop immunity.—By **Hank Becker,** ARS.

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