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Parasitic Diseases in Chile*)

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Abstract. A general review is given of the most frequent parasites and parasitic diseases of man in Chile.

Chile is a very peculiar country in view of its geography extending from North to South, between the 17th and the 56th degrees of southern latitude, the 70th meridian forming its axis. The country covers 1,250,000 square km; 4,200 km in length and about 175 km in average width and has, at the present, 9 millions inhabitants. According to the characteristics of its geography, climate and vegetation, Chile can be divided into 5 zones (Fig. 1):

I. The desert zone. This extends from the 17th degree of southern latitude (the frontier with Peru) to the Copiapo-river in the province of Atacama. This zone (Atacama valley) is a most arid desert, its climate being hot and dry, vegetation and water scarce. Rainfall is exceptional. The average annual temperature varies from 19 °C (in Arica) to 15.9 °C (in Caldera).

II. The steppe zone, extending from the Copiapo-river to the Aconcagua-river (from the 27.3 degree to the 32nd degree of s. lat.). The climate is moderate with few oscillations in temperature; little rainfall in winter, some vegetation in the valleys. The rivers are moderate.

III. The brake-zone, extending from the Aconcagua-river to the "Mocha-island" (38th degree of s. lat.), has seasonal variations, spring, summer, autumn and winter, with rainfall in autumn and winter. It is excellent for agriculture, the average annual temperature is about 14 °C.

IV. The southern zone is covered with large forests extending from Malleco (38th parallel, s. lat.) to the southernmost part of the "Chiloe-island" (43.5 degree of s. lat.). Its climate is very moist. Rainfall is common in almost every month of the year, particularly in autumn and winter. The average annual temperature is about 11 °C, the vegetation is mostly high, forming extensive woods. It is an agricultural and cattle raising zone.

V. The austral zone is the most southern zone extending from Aisen to Magallanes. The climate is cold and rainy, with temperatures of about 7 °C on the average.

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The frequency of certain human parasitoses is highly influenced by geographical factors, but depends also on other factors of economical and cultural nature, on individual and family hygiene and on general sanitary conditions in the suburbs and their neighbourhood.

Amoebiasis. Geographical distribution: Infection with *Entamoeba histolytica* is found everywhere being particularly prevalent in the third zone, where an incidence of 19 % was established. In the desert zone, the infection rate is about 15 %, in the austral zone only 3 % (Neghme and Silva 1956).

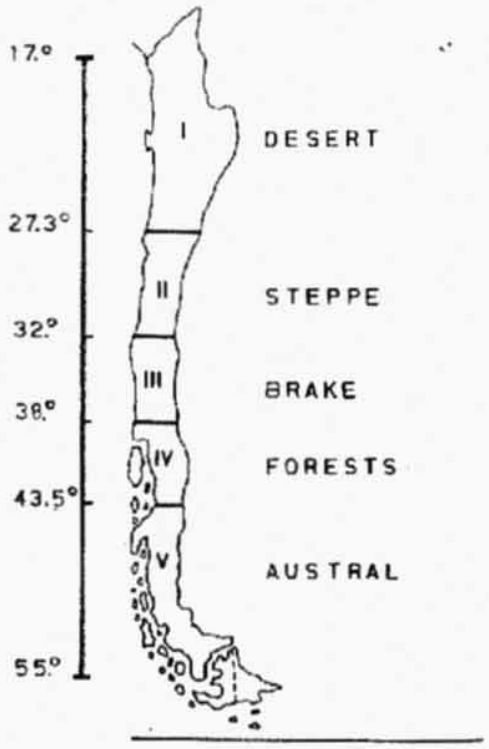

Fig. 1.

Most frequent pathology: In most of the acute cases diarrhea is the main symptom. Only recently, dysentery of amoebic origin has been observed exceptionally. In the chronic form of the infection diarrhea may occur as a predominant symptom alternating with intermittent normal periods and/or constipation. In other cases constipation may be the predominant feature, alternating with normal periods and intermittent diarrhea; finally a dispeptic syndrome may be the principal symptom. Most of the infected individuals are asymptomatic carriers, although they may sometimes develop the disease.

Of the extra-intestinal forms of amoebiasis, localization in the liver is the most frequent manifestation in Chile. The frequency of hepatic amoebiasis has greatly decreased in the last ten years. Its occurrence has become limited to patients from rural districts.

Giardiasis. Geographical distribution: Throughout the whole territory. Frequency of giardiasis is in direct proportion to population density (13 % of infection in zone III, 10 % of infection in zone V and 8 % in zone IV). The infection is more common in children than in adults. Thus in zone III, 25 % of infection was established in 1—6 year-old children, 8 % in adults of 21 and 30 years of age. Most frequent pathology: nearly 75 % of the infected children became clinically ill, suffering mostly from longlasting diarrhea and/or dispeptic syndrome and/or syndrome of ulcer. Only about 25 % of the infected adults showed clinical illness with the same pathology as observed in the children.

Isosporosis. The prevalence of this infection in Chile is not known. However, in Santiago a total of 394 cases of isosporosis (causative agent *Isospora belli*) have been diagnosed from 1955 to 1963, representing 3.17 % of the total of patients studied during this period. However, only selected material could be studied, because all the patients suffered from digestive disturbances and, therefore, asked for medical examination. The more common clinical picture observed in our patients

with isospora infection is characterized by a diarrhetic syndrome of acute or subacute development, fever and general illness (JARPA 1966).

Balantidiasis. During the last 50 years 100 cases have been recorded in Chile (NEGHME 1951). Important pathology: dysenteric syndrome and persistent diarrhea.

Chagas disease or American trypanosomiasis. Geographical distribution: Chagas disease has been recorded from the province of Tarapacá (17th degree of s. lat.) to the southern provinces of O'Higgins and Colchagua (35th degree of s. lat.).

Frequency: In the endemic areas 10 % of the population, i.e. about 250,000 persons, are infected with *Trypanosoma cruzi*. Studies on *Triatoma infestans*, captured in different endemic areas, revealed an incidence of 36 % (NEGHME and SCHENONE 1960). Some domestic and wild animals are reservoir hosts of *T. cruzi*. The following infection rates were detected: domestic dogs 9.1 %, cats 11.9 %; wild animals: *Octodon degus* 2.1 %, *Dusicyon griseus* 5.4 %, *Dusicyon culpeus* 5.2 %

Most frequent pathology: In Chile cases of acute Chagas disease are exceptional and, therefore, most of us have seen neither patients with the classic ophthalmo-lymphatic syndrome (or other primary chagoma = first local lesions), nor those, suffering from acute meningoencephalitis. More frequent are chronic cases of the Chagas disease: patients suffering from myocardiopathy or megaformations (such as megacolon and megaesophagus).

Special attention is given to the congenital form of the Chagas disease. Since 1957, 39 cases have been diagnosed and parasitologically confirmed in Chile. The most frequent symptoms: premature aging, enlargement of liver and spleen and involvement of the central nervous system (HOWARD 1962).

Toxoplasmosis. Geographical distribution: At the present there is no complete epidemiological survey available to establish the exact values of *Toxoplasma gondii* infection in the different age groups of the population living in the various parts of the country. However, serological results obtained in adults (similar age distribution over 15 years) in different geographical zones of the Chilean Continent and on the Island of Juan Fernandez (Robinson Crusoe Island) and Easter Island, render some useful information: a) *Toxoplasma* infection was found in every part of the country where it was looked for; b) Incidence of positive serological results*) revealed a more or less equal (or at least similar) distribution in the six male groups and three female groups of the Continent; its average value was 45 %. c) Incidence of positives was higher in females of Chiloe (66 %) and was exceedingly high in the inhabitants of both islands (75 % and 87 %; 1 : 16 and higher and nearly 100 % when including 1 : 4 positives).

No satisfactory explanation of these facts has yet been found. Additional information is completely lacking for Chiloe and the Robinson Crusoe Island; information is incomplete for the Easter Island. In spite of these facts, some conclusions may be drawn:

a) The difference cannot be explained by climatic factors as indicated by the essential differences

*) Dye-test and/or haemagglutination techniques were employed. Titers of 1 : 16 and higher are included as positives. Titers are given according to the initial dilution of sera in saline; this may account for lower titer levels (in a fourfold dilution) in comparison with European values.

existing between the climates of the islands, and conversely, by climatic similarities with the Robinson Crusoe Island.

b) We do not believe that the standard of living (individual or common hygiene and/or animal contact) plays an important role in relation to the subject. On the Easter Island the population lives under better conditions than some of the examined people of the Continent (for instance the rural population of Temuco and Colchagua).

c) Importance of culinary habits cannot be ruled out. The only thing we know so far is that there are many sheep on Easter Island (but not on R. Cr. Isl.); that people eat much mutton and that some of them like it underdone (NIEDMANN, THIERMANN and NECHME 1963).

Human toxoplasmosis has been studied in a total of 704 cases in the Department of Parasitology in Santiago since 1951; in 37 clinical cases *T. gondii* could be demonstrated by animal inoculation.

Most of our patients showed the classic picture of toxoplasma lymphadenopathy; many cases of toxoplasma chorioretinitis have been diagnosed during recent years. Bilateral macular chorioretinitis and strabismus is especially frequent in congenital cases.

Toxoplasma aetiology has also been studied in patients with heart diseases (myocarditis), neurological disorders and particularly obstetrical cases. Toxoplasma infection in women with abortus, premature birth, stillbirth, etc., induced us to administrate antitoxoplasma therapy in these pregnant women. On the basis of the experiences obtained during several years in our outpatient clinic, we feel that prophylactic antitoxoplasma treatment is justified—and perhaps successful—in certain cases. It is important, however, to use special criteria for selecting these cases and to control the patients during and after treatment (ATÍAS et al. 1967).

Toxoplasma infection in animals: Dogs and cats with clinical signs of possible toxoplasmosis, or those living with toxoplasma patients showed a rather high percentage of infection, e.g. 45 % in 144 dogs with clinical signs of distemper (Table 1).

Trichomoniasis. Geographical distribution: *Trichomonas vaginalis* is prevalent all over the country.

Frequency: It is more frequent in women than in men. The parasite was detected in about 72.3 % of women with leukorrhea, examined in gynaecologic centers in Chile. In the male the incidence of infection is about 68 % in persons with urethritis

Table 1. Results of serological surveys on domestic animals and on wild mammals from the mountains near Santiago

	Total tested	% positives (D.T. ⩾ 1:16)		Total tested	% positives 1:16
Swine (Santiago)	50	56	*Octodon degus*	169	12
Swine (Easter Island)	34	47	*Dusicyon culpeus*	217	11
Sheep (Easter Island)	64	67	*Dusicyon griseus*	25	28
Dogs (Santiago)	100	43	*Crytolagus cuniculi*	79	79

of non-gonococcic origin, this being 20.4 %of the total of urethritis (COUTTS et al. 1955).

Most frequent pathology: In women, leukorrhea. In men, acute features (15 %) or chronical manifestations (85 %).

Malaria. Some years ago malaria constituted a serious parasitological problem in Chile. It was observed in an area extending from the 17th degree of s. lat. (Arica) to the 20 1/2 s. lat. (Pica and Matilla). In 1937, anti-malarial control measures were introduced. Ten years later malaria was eradicated, thus underlining the importance of sanitary measures introduced by Prof. J. Noe and his co-workers. After 1947, only a few cases have been observed in the country, these being limited to foreigners or Chilean people returning from endemic areas of foreign countries.

Taeniasis. Geographic distribution: throughout the country.

Frequency: Epidemiological surveys rendered a 0.5 % incidence as an average value for *Taenia* sp. invasion. In large population centers (urban conglomerates) taeniasis due to *Taenia saginata* is more frequent than *T. solium* invasions. In the outpatient clinic of the Dept. of Parasitology, 768 cases of taeniasis have been observed from 1960—1967, of these 688 were due to *T. saginata* and 80 to *T. solium*, the rate being 9 : 1 in favour of *T. saginata*.

Cysticercosis. Geographical distribution: Cysticercosis throughout the country.

Frequency: The invasion rate of the general population of Chile is about 38 cases in 100,000. In autopsy of patients at the psychiatric Hospital in Santiago cysticercosis was detected in 760 out of 100,000 cases, this value being 20 times higher than in the general population (BARRIENTOS et al. 1967). 7 % of brain tumors, diagnosed at the Institute of Neurosurgery and Brain Research during a period of 20 year (1940—1960), were caused by *Cysticercus cellulosae*; this parasite was found in 0.9 % of all patients examined during this period (145 out of a total of 15,710 patients).

Most frequent pathology: Neurological (neurocysticercosis) and ocular forms. Patients with neurocysticercosis show a syndrome of increased intracranial pressure, focal signs in relation to the localization of the cysticercus, psychic disturbances (such as changed personality). In the ocular forms, in addition to alteration of vision, the patients also complain about grotesque shapes in the visual fields (FAIGUENBAUM 1961).

Hymenolepiasis. Geographical distribution: *Hymenolepis nana* has been found all over the country.

Frequency: The average rate of invasion is 5.5 %, the incidence decreases with age. Thus a 9.3 % of invasion has been established in children of 1—6 years, while only 2 % in persons over 31. Hymenolepidosis is particularly prevalent in the second (10.5 %) and in the third zone (9.4 %). It is the most frequent taeniasis in Chile.

Most frequent pathology: irritability, insomnia, diarrhea and abdominal pain.

Diphyllobothriasis. Geographical distribution: It is endemic in the south of the country—in the zone of the lakes (39 to 41.5 degree of s. lat.) (IV).

Frequency: In surveys of population groups living near the lakes, about 30 cases have been diagnosed while studies of the salmon fishes of this region indicate an invasion rate of 30 %. Differences between the low invasion incidence in man and the relatively high incidence in the fishes are easily explained by the biological characteristics of the parasite.

Most frequent pathology: Pathological signs are very similar to those in other taeniases. It seems important to call attention to the fact that, in Chile, cases of megaloblastic anemia are not related to this taeniasis.

Ascariasis. Geographical distribution: *Ascaris lumbricoides* has been found all over the country.

Frequency: In Chile, the frequency of *A. lumbricoides* is about 33.4 %. The invasion is more frequent in children under 6 years of age (42 %), less frequent in adults of 21 –30 years of age (31 %). (Average of different zones—see Table 2.)

Table 2. Incidence of ascariasis in the various zones of Chile

Zone	% of invasion
I. Desert zone	1.27
II. Steppe zone	19.82
III. Brake zone	24.60
IV. Southern wood zone	54.62
V. Austral zone	1.35

The highest incidence observed in the fourth zone (Table 2) seems to show a direct relationship to rainfall and humidity of the soil, these being particularly favourable conditions for the dissemination of the parasite (Neghme and Silva 1963).

Most frequent pathology: Acute abdominal pain with colics and diarrhea. In the zones with a high incidence, cases of intestinal obstruction may be observed. In some regions a great proportion of infected children expell the worms via the anal or oral route.

Trichuriasis. Geographical distribution: All over the country; its prevalence is somewhat similar to that of ascariasis with the highest incidence in zone IV.

It is interesting that eggs of this parasite were found in the intestinal contents of an Inkaic mummy, conserved for more than 450 years in a mountain of the Chilean Andes (Plomo-mountain) at an altitude of 5,200 meters. The frozen body of this Inkaic boy was in perfect condition in a primitive construction.

Frequency: About 30 % of the Chilean population is invaded with *Trichuris trichiura*. The frequency of invaded persons increases in relation to the humidity of the environment. Thus in zone I, where rainfall is exceptional, the incidence is about 4.8 % while in zone IV with its perennial vegetation and permanent rains it reaches 60.9 %. On the other hand, in zone V with its low temperature and more rigorous climate, and also higher living standards (better economic, cultural and sanitary conditions), invasion rates are only 14 %.

In Chile, trichuriasis in children and adults is seldom manifested by apparent symptoms of the disease, because the worm burden is relatively low. Only exceptionally, if the worm load is very light, symptoms of dysentheric syndrome and anemia have been observed in children.

Enterobiasis. Geographical distribution: *Enterobius vermicularis* has been found all over the country.

Frequency: The average incidence in Chile is about 34 %; in school children from 6—15 years 44 %, in persons from the 16th year old onwards 34 % (MENESES 1952).

Ancylostomosis. *Ancylostoma duodenale* has been observed in Chile in the coal mines of the Provinces of Concepción and Arauco. The first studies, performed in 1919, revealed a percentage of infection ranging from 72 % (Lirquén, Prov. of Concepción) to 3.6 % in Mine 6 (Prov. Arauco). In 1952, in consequence of some sanitary measures the incidence in Lirquén was only 8.2 %. No new cases of hookworm disease have been observed during the last ten years.

Echinococcosis (hydatidosis). Geographical distribution: Distributed throughout the country (Table 3).

Table 3. Geographical distribution of patients with hydatidosis in Chile in 1945—1965

Geographical zone	Number of cases	Distribution %
I. Desert zone	236	2.7
II. Steppe zone	803	9.0
III. Brake zone	5,121	57.6
IV. Forest zone	2,330	26.2
V. Austral zone	291	1.2
Total	8,887	100.0

Frequency: In the general population 200 in 100,000. In patients of the Psychiatric Hospital 605 in 100,000. In animals: cattle 40 %, sheep 35 %, swine 30 % (NEGHME 1958). 28 % of stray dogs, captured near the slaughter-house of the Chilean capital, were invaded by *E. granulosus*. In sheep and cattle, dogs of the region of Aysén (Far South) the invasion reached 33 % (NEGHME and SILVA 1961).

Most frequent pathology: The symptomatology changes with the location of the hydatid cyst; the most frequent sites are the liver and the lungs. The incidence in these organs is about 40 % in each of them, the other 20 % are due to other locations (in the bones [osseous cyst], brain, spleen, kidney, abdomen, etc). It must be mentioned that in one out of every 3rd patient with a hydatid cyst extirpated from the lung the cyntigram revealed a hydatid cyst of the liver. The most frequent symptoms of hepatic echinococcosis are: appreciable enlargement of the liver (hepatomegaly) of retarded evolution with slight involvement of the general state. If the lung is affected, cough and haemoptisis are prevalent; these symptoms induce the patients to see the doctor.

Trichinosis. Geographical distribution: *Trichinella spiralis* has been observed all over the country (SCHENONE et al. 1967).

Frequency: In autopsy (nonselected material) 2.2 % of trichinosis was detected in 1,000 cases. In rats the percentage of infection varies (25 % of rats at slaughterhouses were invaded). In pigs slaughtered in the main abattoir of Santiago, the infection was 3 in 1,000. In dogs of the abattoir it was 75 %. In stray dogs collected in the streets, the percentage of infection was only 4 %, in cats 2 %.

Most frequent pathology: Fever, muscle pain (myalgia) and edema of the eyelids or/and the face.

Fascioliasis. Geographical distribution: *Fasciola hepatica* has been found in the whole country.

Frequency: We have no exact information on the prevalence of fascioliasis in the Chilean human population. In the hospital of Santiago a total of 47 cases of human fascioliasis have been recorded from 1955—1960. In the provinces of Talca and Linares the invasion is widespread in domestic animals; in sheep 60—80 %, in cattle 70 %, and in swine 30 to 40 %.

Pathology: In acute fascioliasis hepatomegaly with fever is most frequent. The appearance of high eosinophilia allows differentiation from hepatic amoebiasis. The chronic forms show dyspeptic disorders, abdominal pain (in the upper right quadrant of the abdomen), urticaria and involvement of the general stage. The clinical picture is similar to biliary lithiasis (FAIGUENBAUM et al. 1962).

In addition to the parasites mentioned above, some others such as *Hymenolepis diminuta*, *Dipylidium caninum*, *Strongyloides stercoralis*, *Trichostrongylus* sp., *Pneumocystis carinii*, have been found in Chile.

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PSEUDASPIDODERA MORENOI SP. N. AND OTHER NEMATODES PARASITIZING *PAVO CRISTATUS* L. IN CUBA

A total of 19 nematode species have been recorded by Baruš (Torreia 5: 1—22, 1968) from Cuban galliform birds; of these, only one species—*Capillaria obsignata* Madsen, 1945— was found in *Pavo cristatus* L. In additional post-mortem examinations of 5 peacocks from the Zoological garden in Havana more nematode species were found. These were: *Ascaridia galli* (Schrank, 1788), *Heterakis gallinarum* (Schrank, 1788), *Dispharynx nasuta* (Rudolphi, 1819) and a new nematode species, which is described in the text.

Pseudaspidodera morenoi sp. n. Fig. 1

This species was found in the caecum of *P. cristatus*. Our material contained one female nematode belonging to the family Aspidoderidae, subfamily *Spinaspidoderinae* Freitas, 1956. When comparing the morphology of this nematode with all other species of the subfamily in consideration, we found a sufficiently high number of features, distinguishing it distinctly from all species recorded until the present.

Type (female): Body yellowish, cuticle with distinct transverse striation. Mouth bearing 3 lips. Cephalic cordons commencing backwards from the slits between the lips, then turning forwards and becoming slightly attenuated

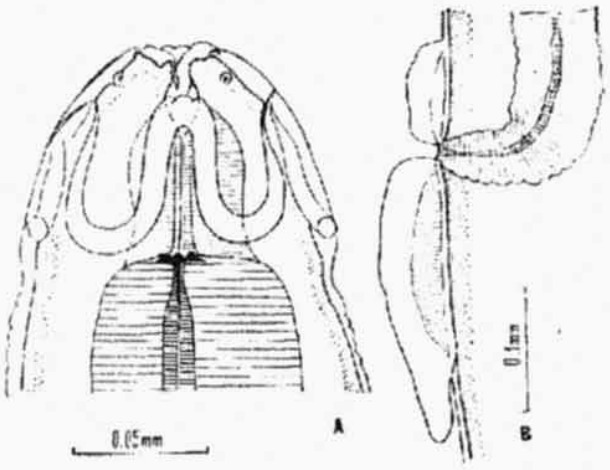

Fig. 1. *Pseudaspidodera morenoi* sp. n. from the caecum of *Pavo cristatus* L. A—anterior portion of the body (ventral view); B— vulva region (lateral view).