

## STUDIES OF TAENIASIS IN TAIWAN

### VIII. Current Status of Taeniasis Among Atayal Aborigines in Nanao District, Ilan County, Northeast Taiwan<sup>1</sup>

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**Ping-Ching Fan, Chia-Hsi Chan, Wen-Cheng Chung, Mei-Ching Hsu and Chin-Cheng Wu** (1989) Studies of taeniasis in Taiwan. VIII. Current status of taeniasis among Atayal aborigines in Nanao District, Ilan County, northeast Taiwan. *Bull. Inst. Zool., Academia Sinica* 28(3): 157-164. From August 1986 to July 1987, 473 school children in 5 primary schools and 2,767 Atayal aborigines in 7 villages in Nanao District, Ilan County, Northeast Taiwan, were examined by Scotch tape perianal swab and questionnaire and demonstration of the proglottides for taeniasis, respectively. The infection rates of taeniasis and enterobiasis among the school children were 1% and 6%, respectively. For the Atayal aborigines, the overall infection rate of taeniasis was 10% and 336 cured cases were also discovered. The highest rate was found at Aohua (18%) and the lowest at Wuta (6%). *Taenia* infection increased with age from 1% among children under 10 years of age to a peak of 33% in the 41-50 age group. The infection was slightly higher in males (11%) than in females (9%). Thirty percent (212/705) of the families were found with one or more infected cases and one family with 5 cases. The majority (74%) of infected subjects often ate wild boar and flying squirrel. Other 8 kinds of animals were also consumed very often. Among 223 cases, 99% passed proglottides in the feces, 83% had pruritis ani, etc. Most patients passed *Taenia* proglottides less than 10 years.

**Key words:** Taeniasis, Clinical manifestations, Eating raw habits, Atayal aborigine.

After World War II, Huang *et al.* (1952) reported that both intestinal helminthic and protozoan infections as well as malaria were highly prevalent among the Atayal aborigines in Nanao Area. Among intestinal infections, they

noted that taeniasis was widespread. Thirty years later, a field survey and mass treatment were done by our Department for taeniasis, it was still highly prevalent among the residents in this area (Liu *et al.*, 1981).

In addition to the field study and

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mass therapy of taeniasis conducted among the general Atayal aboriginal population in Nanao District, primary and junior high school children in this

area were also examined and treated consecutively from 1979 to 1983. The infection rate reduced significantly after each mass treatment and reached zero

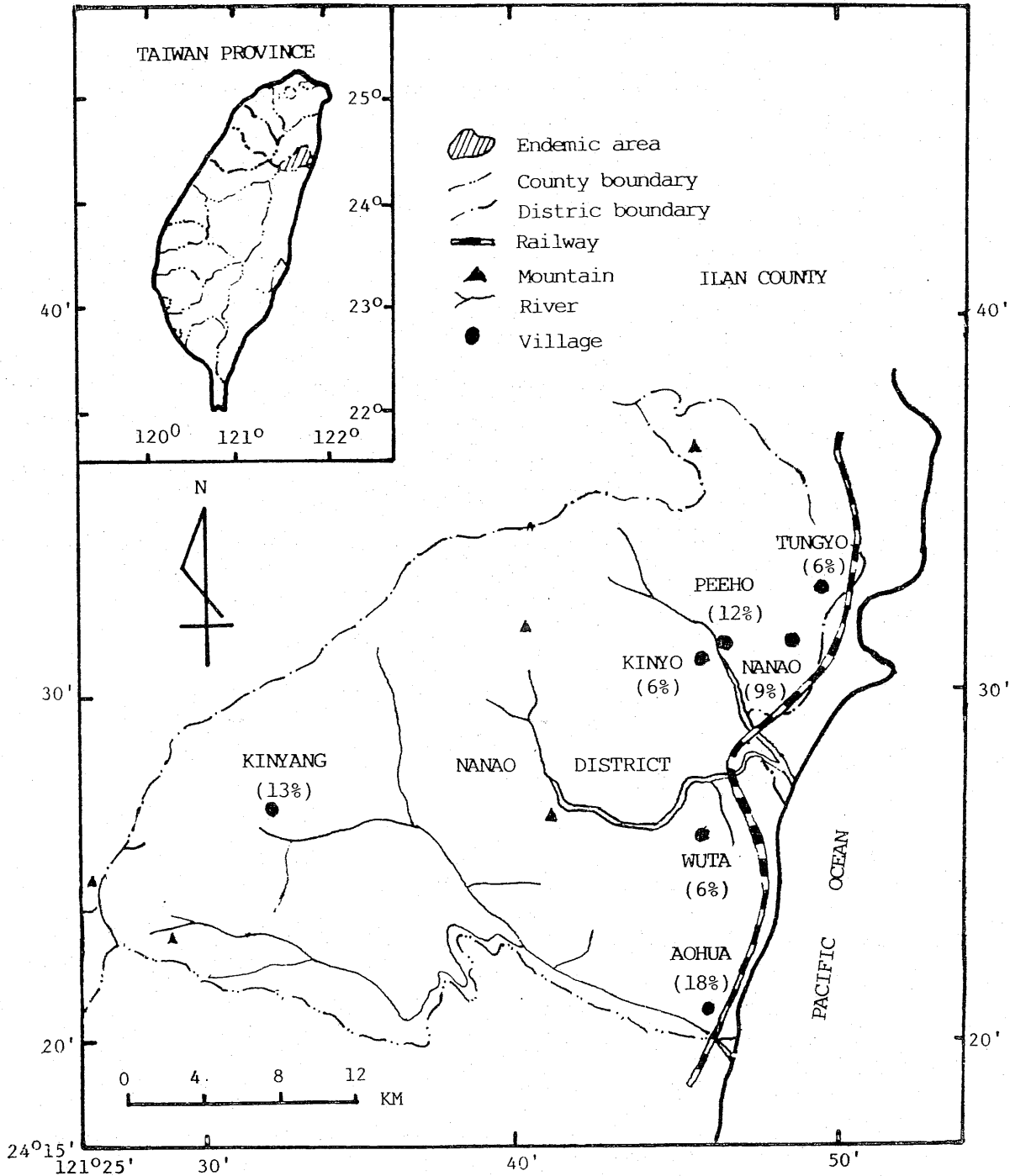


Fig. 1. Map showing the endemic areas of taeniasis in Nanao District, Ilan County, Northeastern Taiwan (1987).

prevalence. However, it returned to the previous level at the beginning of the following investigations (Fan *et al.*, 1981, 1982, 1984). This finding indicated that the aboriginal children still commonly ate raw meat and viscera of wild animals.

The present study attempts to determine the current status of prevalence of taeniasis among the Atayal aborigines in Nanao District. In the meantime, the eating raw habits, period of infection, clinical manifestations, and the natural intermediate host of tapeworm in this district were also investigated.

### STUDY AREA

Nanao District, one of the two mountainous districts of Ilan County, is situated at the northeast coast of Taiwan along the Pacific Ocean (24°20'-24°35' N at. and 121°28'-121°52' E long.). The highest altitude is 1,060 m above sea level. The study area consists of 7 villages (Nanao, Peeho, Tungyo, Wuta, Kinyo, Kinyang, and Aohua) with a total population of 3,795 Atayal aborigines. The East highway and the Ilan-Hualien railway pass through the main town, Nanao (Fig. 1).

Farming is the main occupation in this district. Sweet potato, corn, peanut, rice, and vegetables are the main crops. However, these crops can fulfill their food requirements only for 8 months. The aborigines buy vegetables, rice, meat, salt, clothes, etc. from Nanao Town. They also cultivate mushroom which is a high economic product. Some aborigines still hunt in the mountainous region. They often eat raw meat and viscera of wild animals. This custom is an important factor in the transmission of taeniasis.

In recent years, many of young aborigines have left this mountainous district and work outside. Young men usually work on boats or as temporary

laborers. Young girls usually work in the factories in Hualien and/or Taipei. The manpower in this mountainous area is therefore gradually decreasing. Although there is a primary school in each of the 6 villages, school attendance is not high.

### MATERIALS AND METHODS

The present study was conducted from August 1986 to July 1987. A total of 2,767 Atayal aborigines in the 7 villages and 473 children in 5 primary schools participated.

Two methods were employed in the study: questionnaire and demonstration of proglottides and Scotch tape perianal swab. Home visits were made among 705 families in the 7 villages. The proglottides of tapeworm were demonstrated to the aborigines during inquiry of the members in all families. This method has been shown to be the most convenient and sensitive for the detection of taeniasis (Chan *et al.*, 1987). The name, age, sex, eating raw habits, clinical manifestations, and the period of passing gravid segments in the feces were inquired and recorded. Children in the 5 primary schools of Nanao District were examined with the Scotch tape perianal swab. In the meantime, hunters, slaughter houses, and markets were visited. People were asked about finding cysticerci, and carcasses of wild and domestic animals were examined for cysticerci.

### RESULTS

#### Prevalence of Taeniasis and Enterobiasis among School Children

Of 473 school children (240 boys and 233 girls) examined with Scotch tape perianal swab, 6 or 1% were found to be infected with *Taenia* and 28 or 6% with *Enterobius vermicularis*. The infection rates of taeniasis among girls (2%) was

Table 1  
Prevalence of taeniasis and enterobiasis among school children  
in Nanao District, Ilan County, Northeast Taiwan\*

Primary School	No. exam.	Male		No. exam.	Female	
		No. (%) posit.**			No. (%) posit.**	
		<i>Taenia</i>	<i>E. v.</i> #		<i>Taenia</i>	<i>E. v.</i> #
Kinyo	32	0(0)	0(0)	24	0(0)	0(0)
Tungyo	59	1(2)	8(14)	56	1(2)	7(13)
Nanao	60	0(0)	1(2)	55	0(0)	4(7)
Peeho	59	0(0)	2(3)	66	2(3)	5(8)
Kinyang	30	0(0)	0(0)	32	2(6)	1(3)
Total	240	1(<1)	11(5)	233	5(2)	17(7)

\* Examined by the Scotch tape perianal swab; 5 children were found infected with *Ascaris lumbricoides* and 7 with *Trichuris trichiura*.

\*\* Percentages to the nearest whole number.

# *E. v.* = *Enterobius vermicularis*.

higher than among boys (<1%). Moreover, 5 children were detected to harbor *Ascaris lumbricoides* and 7 with *Trichuris trichiura* (Table 1).

#### Prevalence of Taeniasis

Of 3,795 aborigines residing in the 7 villages, 2,767 or 73% were examined and 280 or 10% were found to be infected with *Taenia*. The highest rate was found at Aohua (18%) and the lowest at Wuta (6%), Kinyo (6%), and Tungyo (6%). In

addition, 336 treated and cured cases were also discovered (Table 2).

#### Prevalence by Age and Sex

Taeniasis was found in all age groups. The infection rate increased with age and reached a peak in the 41-50 age group (33%). The lowest rate was observed among children under 10 years of age (1%). Males (11%) were found to have a higher infection rate than females (9%) (Table 3).

Table 2  
Prevalence of taeniasis among aborigines  
in 7 villages of Nanao District, Ilan  
County, Northeast Taiwan

Village	No. exam.	No. posit.	% posit.*	Previous history**
Peeho	479	57	12	45
Wuta	254	14	6	32
Kinyo	304	17	6	13
Tungyo	319	20	6	21
Nanao	715	63	9	63
Kinyang	332	44	13	76
Aohua	364	65	18	86
Total	2,767	280	10	336

\* Percentages to the nearest whole number.

\*\* Already cured cases of taeniasis.

Table 3  
Infection rate of taeniasis by age  
and sex

Age (yr.)	Male		Female	
	No. exam.	No. (%) posit.*	No. exam.	No. (%) posit.*
<10	445	0(0)	421	3(1)
11-20	273	6(2)	274	3(1)
21-30	206	23(11)	237	22(9)
31-40	144	34(24)	115	24(21)
41-50	115	40(35)	93	29(31)
51-60	102	29(28)	125	34(27)
61-70	55	11(20)	81	10(12)
>70	29	5(17)	45	6(13)
Unknown	2	0(0)	5	1(20)
Total	1,371	148(11)	1,396	132(9)

\* Percentages to the nearest whole number.

Table 4  
Infection rate of Taiwan *Taenia* by family

Village	Family		No. (%) of infected families with*				
	No. exam.	No. (%) posit.*	1 pos.	2 pos.	3 pos.	4 pos.	5 pos.
Peeho	96	39(41)	25(64)	12(31)	1(3)	0(0)	1(3)
Wuta	58	13(22)	12(92)	1(8)			
Kinyo	85	13(15)	9(69)	4(31)			
Tungyo	75	16(21)	12(75)	4(25)			
Nanao	178	49(28)	36(73)	12(24)	1(3)		
Kinyang	103	33(32)	22(67)	11(33)			
Aohua	110	49(45)	34(69)	14(29)	1(2)		
Total	705	212(30)	150(71)	58(27)	3(1)	0(0)	1(<1)

\* Percentages to the nearest whole number.

#### Prevalence by Family

Of 705 families examined, 212 or 30% were found to have one or more infected subjects. Families with 1 (71%) or 2 (27%) infected persons were found in each of the 7 villages. Families with 3 infected subjects were found at Peeho, Nanao, and Aohua. A family with 5 infected persons was seen at Peeho (Table 4).

#### Period of Passing Proglottides in the Feces

Among 203 infected people, 26% had passed gravid segments in the feces less than 1 year, 23% for 1-3 years, 17% for 4-5 years, 18% for 6-10 years, 14% for 11-20 years, 2% for 21-30 years, and <1% for over 30 years.

#### Eating Raw Habits

Among 278 infected subjects, all had the habit of eating raw meat and viscera: 74% ate wild boar (*Sus scrofa taiwanus*), 74% flying squirrel (*Petaurista petaurista grandis*), 69% wild goat (*Capricornis crispus swinhoei*), 69% muntjac (*Muntiacus reevesii micrurus*), 68% monkey (*Macaca cyclopis*), 63% wild rats, 45% wild hare (*Caprolagus sinensis formosus*), 27% pheasant (*Lophura swinhoei*), 26% wease (*Mustela sibirica davidiana*), and 6% civet cat (*Paguma larvata taiwana* and *Herpestes urva*).

#### Clinical Manifestations of Taeniasis

Fifteen gastrointestinal and nervous symptoms of taeniasis were reported by 223 infected persons: passing proglottides in the feces (99%) is the highest, followed by pruritis ani (83%), nausea (64%), dizziness (59%), increased appetite (52%), abdominal pain (50%), constipation (35%), headache (27%), diarrhea (26%), weakness (21%), tiredness (16%), loss of body weight (12%), feeling hunger (10%), abdominal discomfort (9%), and loss of appetite (2%).

#### Finding in Wild and Domestic Animals

In the present study, 4 wild boars (1 at Wuta and 3 at Kinyang), 5 domestic pigs (at Nanao) were examined grossly but no *Taenia* cysticerci were found in the livers and other parts of the carcasses.

#### DISCUSSION

In the present study, the overall infection rate of taeniasis was 10% (6-18%) among 2,767 Atayal aborigines. This rate was much lower than that reported by Liu *et al.* in 1981 (27%). The reason for the significant reduction in the prevalence of this infection is that most of the infected cases were treated

in our previous studies (Liu *et al.*, 1981; Fan *et al.*, 1982). However, in the present study, 336 treated and cured patients were found. From these findings, it could be estimated that 22.3% of Atayal aborigines in Nanao District had been infected with *Taenia*. In addition, many aborigines are still engaged in hunting and eat raw meat and viscera of wild animals. Cross *et al.* (1971) noted that Taiwan aborigines eat meat and viscera of goat, monkey, deer, wild boar, flying squirrel, and rodents immediately after killing and while the carcass is still warm. Chung mentioned that the aborigines are especially fond of eating the raw intestine and stomach of herbivorous animals. The people believe that these animals are clean and that the digestive organs are nutritious especially for pregnant women. The organs also have a better taste (Chung, personal communication, 1981).

Male aborigines had only a slighter prevalence (11%) of taeniasis than that of the females (9%), since eating raw food is equally spread among male and female aborigines. However, the prevalence increases with age and peaks in 41-50 age group. Hunting and eating the animals raw are widespread among the aged Atayal aborigines in Nanao District. This habit also exists among aboriginal people in area of Wulai (Chan *et al.*, 1987) and Lanyu (Chung *et al.*, 1987). Taeniasis is also familial among aboriginal population in the mountainous areas of Taiwan. In the present study, 29% of the families had 2 or more infected persons. In Wulai and Lanyu areas, 15% and 46% of the families surveyed had 2 or more infected subjects, respectively (Chan *et al.*, 1987; Chung *et al.*, 1987). Eating raw meat and especially liver of animals is common among all members of many families in the above districts.

In this study as well as in the previous reports (Chan *et al.*, 1987; Chung *et*

*al.*, 1987), passing proglottides in the feces were experienced nearly in all infected cases of taeniasis. This finding is an important indication of the infection. A history of passing proglottides in the feces is more convenient than stool examination and Scotch tape perianal swab for determining infection of *Taenia* (Chan *et al.*, 1987). Other important clinical manifestations noted including pruritis ani, increased appetite, nausea, dizziness abdominal pain, constipation or diarrhea, and abdominal discomfort. However, some infected subjects had loss appetite.

All *Taenia* infected persons eat raw meat or viscera of wild animals. The eating habits and transmission route of taeniasis are similar in the Atayal and the Yami aborigines (Chung *et al.*, 1987). These findings indicated that they have similar belief in nutrition and taste. The Yami people on Lanyu Island often eat raw liver and meat of domestic animals.

Although Taiwan has moved from a developing country to a developed one, taeniasis is still common among the aborigines in the mountainous areas. The eating raw habits among aborigines are the most important epidemiologic factor of this infection. Control program including chemotherapy and health education should be conducted among the different tribes of aborigines in the mountainous areas on Taiwan.

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### REFERENCES

- Chan, C.H., P.C. Fan, W.C. Chung, Y.A. Chen, C.C. Wu, M.C. Hsu and D. Chao (1987) Studies of taeniasis in Taiwan. I. Prevalence of taeniasis among aborigines in Wulai District, Taipei County, Northern Taiwan. *Proceedings of the First Sino-American Symposium on Biotechnology and Parasitic Diseases* 1: 65-77.
- Chung, W.C., P.C. Fan, C.H. Chan, Y.A. Chen, M.C. Hsu, C.C. Wu and D. Chao (1987) Studies of taeniasis in Taiwan. II. Prevalence of taeniasis among aborigines in Lanyu (Orchid Island) District, Taitung County, East Taiwan with reference to domestic pigs (Lanyu strain), which can be considered as the intermediate host of Taiwan *Taenia* (?). *Proceedings of the First Sino-American Symposium on Biotechnology and Parasitic Diseases* 1: 78-90.
- Cross, J.H., K.D. Murrell and M.D. Cates (1971) Survey for intestinal parasite in aborigines in Nantou County, Central Taiwan, with a report of two spurious of *Macranthorhynchus hirudineus*. *Chinese J. Microbiol.* 4: 116-122.
- Fan, P.C., D. Chao, H.Y. Liu, K.M. Lee, F.Y. Cheng, C.H. Wang and C.C. Wu (1981) Comparative study on prevalence of common intestinal nematode parasite in the tap-water and non-tap-water supported areas on Taiwan. Part II. Prevalence of common intestinal parasites among children in the remote area of Taiwan and determination of the minimum effective dose of new board spectrum anthelmintics against the common intestinal parasites. *Natl. Sci. Council. Monthly* 9: 159-175.
- Fan, P.C., W.C. Chung, C.H. Chan, K.M. Lee, C.C. Wang and C.C. Wu (1982) A pilot control study of common intestinal parasites and head louse among aboriginal children in Nanao and Tatung Districts, Ilan County, Northeast Taiwan. *Natl. Sci. Council. Monthly* 10: 773-789.
- Fan, P.C., W.C. Chung, C.H. Chan, F.Y. Cheng, Y.A. Chen and M.C. Hsu (1984) A pilot control study of common intestinal parasites and head louse among aboriginal children in Taiwan, ROC. II. The 2nd year survey and treatment of intestinal helminths and head louse infections among aboriginal children in Ta-tung and Nan-ao Districts, Ilan County, Northeastern Taiwan. *Natl. Sci. Council. Monthly* 11: 1511-1535.
- Huang, W.H., W.T. Loo, P.T. Tseng and C.L. Wu (1952) Parasitology investigations on the aborigines in Taipeh Prefecture, Formosa. Part III. Parasitological investigations on the aborigines in Nanao District. *Memoirs of the Faculty of Medicine, National Taiwan University* 2: 33-47.
- Liu, H.Y., D. Chao and P.C. Fan (1981) Prevalence and chemotherapy of taeniasis among the aborigines in Nan-ao District, I-lan County, Northeastern Taiwan. *Proc. Natl. Sci. Council. Part A: Applied Sci.* 5: 188-195.

## 臺灣條蟲病之研究

### VIII. 宜蘭縣南澳鄉泰雅族山胞條蟲病之流行現況

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許美卿 吳金正

本項研究自民國 75 年 8 月至 76 年 7 月間在宜蘭縣南澳鄉應用玻璃膠帶肛圍擦拭法檢查 5 所學民小學 473 位學童及在問卷時並展示受孕節片法詢問 7 村泰雅族山胞 2,767 人。學童條蟲平均傳染率 1%，及蟯蟲 4%，山胞條蟲平均傳染率 10%。同時，334 位已治癒條蟲患者也被發現。條蟲傳染率以澳花村最高 (18%)，武塔村最低 (6%)。各年齡羣均有條蟲患者，其傳染率隨年齡而增高。10 歲以下者最低 (1%)，41~50 歲者最高 (33%)。男性 (11%) 略高於女性 (9%)。278 位患者之受孕體節常隨大便排出，最長者超過 30 年。30% 家庭具有 1 位或多位患者。74% 患者常生吃山豬及飛鼠之肌肉及內臟，69% 患者生吃山羊及羌，68% 患者生吃猴，及其他 5 種山野動物 (兔，山鼠，雉，貂及麝香貓)。在 223 位患者中，99% 條蟲體節常排入大便，83% 肛門搔癢，其他常見之臨床症狀：惡心 (64%)，眩暈 (59%)，增加胃口 (52%) 及腹痛等 (50%)。