Journal of Animal and Veterinary Advances 2 (3): 179-183, 2003


# Hypodermosis in China

Hong Yin, Miling Ma, Gailing Yuan, Shouyun Huang, Zhijie Liu, Jianxun Luo, Guiquan Guan
Lanzhou Veterinary Research Institute, Chinese Academy of Agricultural Sciences,
Xujiaping 11, Lanzhou, Gansu, 730046, The People's Republic of China

**Abstract**: Hypodermosis is a very important disease affecting cattle, yaks and dairy cattle in China. Five species of hypodermosis have been recognized in livestock: *H. bovis, H. lineatum, H. sinense, H. qinghaiensis, H. diana.* Of these five species, the most common ones are *H. bovis* and *H. lineatum*. Both of these two species and *H. sinense* parasitise cattle, yak and dairy cattle. Deer is the natural host of *H. diana*. The host of *H. qinghaiensis* remains unknown. Bovine hypodermosis is widely distributed in China and the endemic areas covers 15 provinces. In some province, the average infestation rate is 80% and the infection rate of calves at age of 1-2 years old is higher than adult, and reaches 90-100%. The epidemiology of the disease is still poorly understood in some provinces. The national economic loss induced by hypodermosis is largely unknown, though some data on reduction of milk, meat and damage of skins are available. Losses caused by the migrating larvae themselves are responsible for the greater part of the cost of disease. In northern China, the annual economic loss on skins is estimated to be about 15,000,000 USD. Diagnosis of *Hypoderma* sp infection in live cattle relies on either observation of clinical signs or the palpation of second and third stage larvae on back of infected animals during the spring and summer months, and serological diagnostic tool is not available. There is no national eradication program in China. In most cases, the control of hypodermosis was based on the chemotherapy administrated by farmers themselves. The priority and suggestion on control of hypodermosis is also presented.

**Key words:** Hypodermosis and China

**Geo-climatic data**: China is one of the biggest countries in the world and the territory covers 9.60 million square kilometers. The distance between north and south is 5,500 kilometers, with tropical, subtropical, warm temperate zone, temperate zone and mild frigid zone. From east to west, it is 5,200 kilometers and the time difference is more than 4 hours. The landform of China is complex, including mountainous regions, altiplanos, hills, plains, and basins. The topology of China can be divided into three grades. The first one is the Tibetan plateau, where the altitude is more than 4000 meters and has many lakes, basins and grasslands , which represents the main pasturing areas. The second grade is about 1000-2000 meters high and includes three big basins and three plateaus, which represent the mixed areas of pasturing and agriculture. The third grade is about 500 meters high or less, where is near seas around China or in eastern part of China, and is the agricultural areas. The lowest temperature in China is in January and the average is 0 °C, but the difference among different areas is marked, e.g. in northeast areas, it is less than -10°C, and in some parts in south China, it is around 20 °C. July is the warmest month in China and the average temperature is 20-28°C. The difference of temperature among different areas is not more than 8.5°C in summer.

**China's animal industry**: Animal industry in China has developed rapidly since the open door police at the beginning of 1980', and the annual increase rate was more than 10%. In 1980, the average consumption per capita of meat, egg and milk was 12.2, 2.6 and 1.4 kilograms respectively, while in 1998 these numbers became 47.1, 16.6, and 6.1 kilograms. In 1998, yields of meat, egg, and dairy products were 57.23 million ton, 20.18 million ton and 7.44 million tons respectively. The number of swine, cattle, sheep, goats, chickens were 468 million, 116.5 million, 132.7 million, 171 million, 3.11billion respectively. The national income of livestock industry was 50.3 billion USD, accounting for 31.12% of income in China's agriculture. The rapid development of livestock industry created a marked increase in employment opportunity for rural areas. There are about 100 million people working or partially working in the livestock industry (Zhang *et al.*, 2000).

**Zootechnical data**: In China, cattle are raised in farmland and grazing areas. Within farmland areas, cattle are commonly raised in association with cropping enterprises and are used to draught or traction purpose. Extensive grazing areas exist in western areas of China and some of the cattle in this region are raised on a nomadic basis. Six out of 29 provinces in China contain areas where cattle are exclusively grazed. In these areas, cattle or yaks are

maintained by individual family. The number of herd is dependent on the family's grassland and number of people in one family. In Tibetan region, one family usually keeps 50-300 yaks. The dominant cattle production system in China is small-scale production of cattle for beef and draught purpose. Breeds such as cattle are found within in this system. Approximately 66% beef cattle are reared in farmland region, whilst the remainder is found in the grazing areas.

**Parasitic infection**

**Main parasitic infections**: Many parasites have been proved to affect cattle, yaks and dairy cattle. The representative helminthes are *Schistosoma japonicum, Fasciola hepatica, Dicrocoelium dendriti Paramphistomum sp, Dictyocaulidae viviparous,* intestine nematodes, etc. *Trypanosoma evansi, Babesia* sp, *Theileria* sp, *Anaplasma* sp are the major protozoans infective for cattle. Ticks and warble fly are the most important ectoparasites (Chen, *et al.*, 1993). In China, many species of hard tick infest cattle (Deng and Jiang, 1991), three species of tick, *Boophilus microplus, Hyalomma detritum, Haemaphysalis longicornis* are considered to be more important. Hypodermosis of livestock in China is caused by *H. bovis, H. lineatum, H. sinense, H. qinghaiensis, H. diana.* Of these five species, the most common ones are *H. bovis* and *H. lineatum*. Both of these two species and *H. sinense* parasitise cattle, yak and dairy cattle. Deer are the natural host of *H. diana*. The host of *H. qinghaiensis* remains unknown (Huang *et al.*, 1986a; Wang *et al.*, 1988; Xue and Zhao, 1996).

**Hypodermosis**: Bovine hypodermosis is widely distributed in China. The endemic areas covers Liaoning, Jilin, Helongjiang, Hebei, Inner Mogolia, Shaanxi, Shanxi, Gansu, Ningxia, Xingjiang, Qinghai, Tibetan, Sichuan, Yunnan, Guizhou provinces. Among these provinces, the infestation in Inner Mongolia, Gansu, Qinghai, Xingjiang and Tibet are the most serious, and the average infestation rate is 80%. The infection rate of calves at age of 1-2 years old was higher than adult, and reaches 90-100%. In some region, e.g. Changdu region in Tibet region, 100% of cattle or yaks are infected. (Cui, 1981; Huang and Ma 1985; Jing *et al.,* 1989; Jing and Chen, 1995; Li and Bao, 1992; Song *et al.*, 1997, Wang and Chen, 1991; Wei, 1994; Xia *et al.*, 1988; Yan *et al.*, 1993; Zhan and Zhao, 1996). Besides the 15 mentioned provinces, some cases of hypodermosis have also been described in Zhejiang and Jiangxi provinces. However, all the cattle are not from local farmers and have been probably imported from regions where hypodermosis is present. (Deng *et al.*, 1994; Wang *et al.*, 1990)

Investigation by Huang *et al* (1995) suggests that the infection rate of yaks in Haibei, Qinghai is 83.4%; the number of larvae found on one animal was from 10 to 300. The infection rates of yaks at age of 1, 2, 3, 5-6 and 8-10 years old range 98.4%, 98%, 63.15%, 5%, 3.3% respectively. In Gannan, Gansu province, the average infection rate is 71.86%, and that of yaks at age of 1-2 year old is 91.6%. The number larvae in one animal ranges from 11 to 462. In Ganzi, Sichuan province, the infection rate of yaks is 70.67%, and that of 1-2 year yaks is 96.77%. The number of larvae found on one animal is 1-315 (Jiang *et al.*, 1994a; Yan *et al.*, 1993: Yuan *et al.*, 1994).

The infection of human being by larvae has also been reported. In Qinghai province, from 1969 to 1982, 44 cases on human being infection have been described. In Maqu County, Gansu province, the infection rate of human being reaches 0.4-7% (Zhang and Li, 1993). Some cases have also been reported in Liaoning, Inner Mongolia, Hebei, and Tibet provinces. The infestation of *Hypoderma* sp of other animals, including horse, sheep, *Myospalax fontanieri* and *Capreolus capreolus* has also been described (Song and Zhang, 1988; Song and Zhang, 1989; Zhang, 1986).

In Qinghai province, the active period of adult flies of *H. lineatum* is May to July, the larvae may be found in esophagus in late September, and warbles are palpable on back of cattle in December; the third stage larvae drops to ground from mid March till May. For *H. bovis*, adult flies appeared in July; Warbles are palpable on the back of cattle in December; the third stage larvae drops to the ground from mid April till July. (Qinghai Vet Service, 1984). Wang *et al.* (1988) studied the biology of *H. sinense* and found that first stage larvae appears in yaks in late of August, and the peak period being in mid October; and could be found till next March. The warbles are visible from December till June. The third stage larvae drops to ground from March to June. The flies can be observed in July and August.

**Economic consequences attributable to hypodermosis**: The national economic loss induced by hypodermosis is largely unknown, though some data on reduction of milk, meat and damage of skins are available. Losses caused by the migrating larvae themselves are responsible for the greater part of the cost of disease. Growth of calves is delayed and general body condition deteriorated. Data from Qinghai province suggests that the milk reduction rate is about 20%, and as high as 25-40% in Inner Mongolia. In the pasturing areas, it is estimated that parasitism of larvae made the each animal

consumed about 500 kilograms of grass more each year. In northwest of Sichuan province, the result of treatment suggests that production performance of treated yaks could be considerable increased, and gain annually 12.5 kg milk, 0.066 kg wool, 11.19 kg weight (within 82 days). (Jiang *et al.*, 1994b). Due to the holes or spots produced by larvae of *Hypoderma*, about 30% of skins of animals is damaged. In Sichuan province, the data in 1980 estimated the annual output of bovine skins to 700,000 pieces, and the loss from *Hypoderma* spp to 150,000 USD. In Qinghai, in 1982, 100% of 30000 have been affected by the parasite and loss estimated to 132,000USD. In Tibetan region, 312,000 yaks have been slaughtered in 1989, with 305,000 USD losses on skin holes due to *Hypoderma*. In one leather factory in Lasa, 60,000 skins have been processed and the loss has reached 58,550USD (An, *et al.*, 1990). In northern China, about 1,000,000 cattle or yaks infected by *Hypoderma* are slaughtered annually, compared with a normal situation, the farmer's income is reduced by 15 USD per parasitized skin. It is therefore concluded that the economic loss of skins is estimated to be about 15,000,000 USD. For the loss due to the larval infestation, some statistical data suggested it is tremendous. The loss in Inner Mongolia was estimated to be 16,000,000 USD in 1958. In Gansu province 10,000,000 USD have been lost in 1981, and 30,000,000 USD in Xinjiang and Tibetan Autonomous Region (Jiang *et al.*, 1994; Shi *et al.*, 1995; Wang *et al.*, 1988).

During its active period, the fly nuisance to cattle is not inconsiderable. From July to September, when, in the presence of a fly cloud, the nuisance to the flocks of cattle or yaks is often observed. The animals stop eating grass and run away fearfully; the grazing animals often cannot take enough food and subsequently loss weight and produce less milk. Sometimes, the animals hurt themselves or die, abortion of pregnant female cattle sometimes occur during or after running. A report in Jilin province indicated that in 31 communes and 8 large national farms, from 1975-1978, 1579 cattle died due to fly worries. (Zhao and Ma, 1986).

**Prevention and Treatment**: Diagnosis of *Hypoderma* sp infection in live cattle relies on either observation of clinical signs or the palpation of second and third stage larvae on back of infected animals during the spring and summer months. The shortcoming of palpation method is that it may detect second or third stage and it is too late for treatment. Besides, direct clinical observation often results in an underestimation of infestation level unless animal is inspected regularly throughout the emergence period. The serological diagnostic test was not available up to date, but our laboratory is developing an ELISA assay that will be hopefully turned out this year.

There is no national eradication program in China. The control of hypodermosis was based on the chemotherapy administrated by farmers themselves, though in some provinces, relatively large scale program are completed with the help of the local government (Wang, 1995). Treatment of hypodermosis relies exclusively on chemical compounds, for example, chlorophenothane, hexacholrobene, coumaphu, fenthion, etc (Huang, 1984; Lai *et al.*, 1992; Li and Yang, 1988; Yang and Liu, 1990; Yuan, 1988). The most commonly used chemical is fethion administrated by injection or pour on (Yu, 1992; Yuan *et al.*, 1988). However, the narrow safety of this chemical and the presence of residues in milk, meat and pollution of environment limit its use in a large-scale programme. Guo and Fu (1983) reported that following the treatment 160,397 cattle with a fenthion injection in 1982 in Gongca county, 530 of them showed intoxication and 49 died. Ivermectin has also been recently used for the treatment of hypodermosis (Jiang *et al.*, 1991; Huang *et al.*, 1986b). A test in Sichuan province suggests that injection of 200ug/kg is efficient (Jiang *et al.*, 1994b). Zhang and Wang (1998) reported that avermectin pour on (0.2, 0.4 and 0.5 mg/kg) and injection (0.2mg/kg) could kill 99.4% of third stage larvae.

## Conclusion

Hypodermosis is still a very important disease affecting cattle, yaks and dairy cattle in China. Though some studies have been carried out in Qinghai, Gansu, Sichuan and Hebei province, the epidemiology of the disease is still poorly understood in other provinces. It is suggested that more studies should be performed nationally to assess the distribution and biology and economic impact of the parasite that could help to define the optimum period for treatment in each different climatic area. A national eradication programme should be conducted. As a good coordination for the control is key for a successful eradication program, the government should be actively involved and contribute to the program. The veterinary services at different levels (national, province, county and community) should be very well organized by the government. The owner of bovine, especially those people in the regions where education is poor and of minor nationality, who had a custom that they just concerned the number of animals and believe everything was correct if their animals would not die, e.g. Tibetan people, should be informed about the impact of

hypodermosis and benefit of control program, and be encourage to participate the program. In order to keep the safety of milk, meat and to avoid pollution of environment and death of cattle, the use of organic phosphorus compound, e.g. injection of fenthion, should be reduced. And as an alternative, the more safe and environment friendly chemical, e.g. microdosage of ivermectin, should be recommended to be used by farmer or small holder of cattle. Some more accurate and specific serological diagnostic tools should be developed to detect infestation of the parasite in early stage and therefore treat the animals before the parasite leave the host. For the sustainable control of hypodermosis, the study and development of subunit vaccine should be carried out as early as possible.

## Acknowledgements

This study was partially supported by Hypodermosis control project( ICA4-CT-2000-30036) coordinated by Dr. Chantal Boulard at INRA, France, INCO-DEV programme of the Europeans Commission, Brussels, Belgium.

## References

An, J.S., H. C. Yao, Q. M. Ji, H. B. Huang and Y. C. Gao, 1990. Investigation on the impact of hypodermosis in yaks in Tibetan Region. Tibetan Journal of Veterinary and Husbandry, 3: 48-51.

Chen, Y.C., Z. Y. Qiu, Y. L. Jia, J. L. Feng and Q. Liu, 1993. History of Animal Diseases in China. pp: 326-400. Beijing: Science Press.

Cui, D.S., 1981. Epidemiology and treatment of hypodermosis in Yanbian distrtict Jilin province. J. Yanbian Agricultural College, 2: 49-56.

Deng, K.F. and Z. J. Jiang, 1991. Economic insect fauna of China: Acari: Ixodidae fasc 39. pp44-358. Beijing: Science Press.

Deng, S.S., S. Q. Liu and B. Z. Quan, 1994. Preventing disease in north moving to south: Hypodermosis discovered in Jiangxi province. Jiangxi J. Vet. and Husbandry Sci., 1: 39-40.

Guo, R.M. and G. Z. Fu, 1982. Efficiency of injection of fenthion against hypodermosis in Gangca County in 1982. Qinghai Journal of Veterinary and Husbandry, 3: 42-44.

Huang, C.G., 1984. Effect of chemotherapy on hypodermosis in Gonghe County Qinghai province. Qinghai Journal of Animal Husbandry, 37: 11-12.

Huang, S.Y. and J. W. Ma, 1985. Investigation on hypodermosis in Baiyu and Jiulong districts in Sichuan province. Chinese Journal of Veterinary Science and Technology, 8: 19-20.

Huang, S.Y., Z. Q. Jing and J. F. Liu 1986a. Protein comparison of *Hypoderma lineatum* and *Hypoderma sinense* with Isoelectric focus electrophoresis. Chinese J. Vet. Sci. and Tech., 9: 37-38.

Huang, S.Y., Z. Q. Jing and J. F. Liu, 1986b. Effects of Ivermectin against larvae of *Hypoderma* sp and intestine nematoda in cattle. Chinese J. Vet. Sci. and Tech., 5: 36-37.

Jiang, X.S., Huang, X.B., Sun, Y.J. and He, S.M. 1991. Effect of Ivomec on the second and third stage larvae of *Hypoderma lineatum.* China Yak. 37, 40-41.

Jiang, X.S., X. B. Huang, Y. J. Song, S. M. He and W. Chang, 1992. Effect of Ivomec on the larvae of *Hypoderma* sp in yaks. China Yak, 1: 23-26.

Jiang, X.S., X. B. Huang, Y. J. Sun, S. M. He and W. Chang, 1994a. Ecological characterization of bovine hypodermosis in grassland in northwest part of Sichuan province. China Yak, 1: 43-49.

Jiang, X.S., X. B. Huang, Y. J. Sun, S. M. He and W. Chang, 1994b. Economic benefit on the control of hypodermosis with Ivomec. China Yak, 1: 54-57.

Jiang, X.S., X. B. Huang, X. N. Yang, Y. J. Song, S. M. He and W. Chang, 1996. Study on bovine hypodermosis on the northwest grassland in Sichuan province. Journal of Southwest Nationalities College (Natural Sciences Edition), 22: 185-190.

Jing, X.M., S. Y. Xue, X. W. Miao, R. Z. Wang, B. Q. Wu and C. H. Ji, 1989. Effect of "Piyindi" a pour on preparation against *Hypoderma* sp infection. Journal of Hebei Veterinary and Animal Husbandry, 4: 16-17.

Jing, Z.Q., J. F. Liu, L. Zhang, J. J. Lu and Z. R. Chang, 1995. Control of bovine hypodermosis by stopping laying eggs of flies. Chinese Journal of Veterinary Sciences and Technology, 25: 32-33.

Jing, B. and R. T. Chen, 1995. A preliminary report on the infection and control of hypodermosis in yaks in Luqu county. China Yak, 1: 50-51.

Lai, D.L., Yang, D.C., Sun, Y.J. and S. M. He, 1992. Control of bovine hypodermosis in Aba district Sichuan Province. China Yak, 1: 39-42.

Li, L.C. and Y. Bao, 1992. Effects of "Miechongding" on larvae of *Hypoderma lineatum.* Chinese Journal of Veterinary Sciences and Technology, 22: 36.

Li, X.L. and Q. X. Yang, 1998. Control of hypodermosis in Gonghe county Qinghai province. Qinghai J. Vet. and Husb., 1: 39.

Qinghai Veterinary Service, 1984. Biological observation of *Hypoderma* sp in Datong farm. Qinghai J. Vet. and Husb. Sci., 3, 10-13.

Shi, X.Z., D. H. Song, Z. R. Yan, Y. Shi, W. Zhou and C. Q. Wu, 1995. Standardization of the assessment of the economic benefit of control of bovine hypodermosis. Chinese Journal of Veterinary Parasitology, 3: 50.

Song, K. and Y. Zhang, 1988. A report on the infection of *Hypoderma* sp in wild *Myospalax fontanieri* and *Capreolus capreolus.* Journal of Qinghai Veterinary and Husbandry College, 5: 56.

Song, K. and Y. Zhang, 1989. Two cases of infestation of *Hypoderma* sp in horses. Qinghai Journal of Veterinary and Husbandry, 48.

Song, W.D., S. C. Zhang and W. X. Sha, 1997. Diagnosis and treatment of bovine hypodermosis in Ninglang county Yunnan province. Yunnan J. Vet. and Husb. Sci., 3: 54.

Wang, F.X., W. Li, O. Li, H. N. Shi, Q. Sai, J. Z. Cai and F. L. Yang, 1988. Effects of *Hypoderma* sp infection on the production of yaks. Qinghai Journal of Veterinary and Husbandry, 4: 18-19.

Wang, F.X., H. N. Shi, Q. Sai and F. L. Yang, 1988. Morphological observation on *Hypoderma sinense.* Qinghai J. Vet. and Husb. Sci., 1: 1-3.

Wang, F.X., T. L. Zhu, H. N. Shi, Q. Sai, W. Li and F. L. Yang, 1988. Studies on the biological characterization of Hypoderma sinense. Qinghai J. Vet. and Husb., 2: 7-9.

Wang, J., S. S. Li, G. Z. Lu, L. Guan and M. J. La, 1986. Investigation on the bovine hypodermosis in Guoluo district in Qinghai province. Chinese J. Vet. Sci. and Tech. (supplement), 133-136.

Wang, W.Q., W. H. Xu, Z. X. Song, C. Q. Pan, X. M. Fang and G. F. Yu, 1990. A report of hypodermosis in cattle in Ningbo Zhejiang province. Zhejiang J. Vet. and Husbandry Sci., 4: 40.

Wang, X.B. and W. H. Chen, 1991. Investigation and control test of hypodermosis of yaks in Luqu county Gansu province. Gansu J Vet. and Animal Husb., 21: 11-12.

Wang, Z.W., 1995. A large scale programme for control of hypodermosis in Ximeng district Inner Mongolia. Chinese J. Vet. Medicine, 21: 61.

Wei, C.F., 1994. Larvae infection of four species of flies. Guizhou J. Vet. and Husb. Sci., 18: 28-29.

Xia, W.X., S. K. Tan, Z. M. Yu and S. H. Song, 1998. Investigation and treatment of "three flies of livestock" in Qiqihar Heilongjiang province. Chinese J. Vet. Sci. and Tech., 28: 40.

Xue, W.Q. and J. M. Zhao, 1996. Flies of China. pp2230-2251. Shenyang: Liaoning Science and Technology Press.

Yan, H., Hu, G.H. and X. Q. Gao, 1993. Impact and treatment of hypodermosis of yaks in Xiahe county Gansu province. Chinese J. Vet. Sci. and Tech., 23: 35-36.

Yang, D.Y. and D. S. Liu, 1990. Effect of Fenthion on bovine hypodermosis. J. Xingjiang Animal Husbandry. 5: 45-46.

Yu, Y.S., 1992. A summary on the control of hypodermosis in yaks in Sunan county Gansu province. China Yak, 3: 52-53.

Yuan, Z.P., 1988. Chemotherapy of hypodermosis with different compounds. Science and Technology in Gannan, 2: 30-334.

Yuan, Z.P., Z. R. Zhou, F. Z. Huang, H. D. Du and X. Y. Li, 1988. Test on the efficacy of chemotherapy of bovine hypodermosis. Chinese J. Vet. Sci. and Tech. (supplement). 82-83.

Yuan, Z.P., M. L. Wei, G. H. Ge, H. D. Du, X. L. Min. G. H. Hu, K. Yang, Z. R. Ma and Z. R. Wang, 1994. Epidemiology and impact of hypodermosis in Gannan district Gansu province. China Yak, 1: 60-62.

Zhan, N.X. and H. F. Zhao, 1996. Investigation on the infection of *Hypoderma* in yaks in Delinha region Qinghai province. Qinghai Journal of Animal Husbandry, 46: 28.

Zhang, G., 1986. A report of larvae of *Hypoderma lineatum* in Mongolia sheep. Chinese Journal of Veterinary Sciences and Technology (supplement): 136.

Zhang, X. and D. C. Li, 1993. Zoonoses. Vol: III. pp 338-339. Beijing: Bluesky Press.

Zhang, J.C., H. Y. Qian and C. S. Li, 2000. Animal Husbandry in the five decades in China. pp1-5. Beijing: China Picture Press.

Zhang, Q. and Z. Y. Wang, 1998. Effect of pour on of avermectin on the third stage larvae of *Hypoderma* sp. Chinese J. Vet. Sci. and Tech., 28: 12-14.

Zhao, H.Y. and C. Ma, 1986. Economic benefit of control of bovine hypodermosis. Chinese J. Vet. Sci. and Tech.,7: 42-43.