

THE EPIDEMIOLOGY OF THE BOVINE EPHEMERAL FEVER IN TAIWAN 1984

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Bovine Ephemeral Fever (BEF) outbroken late in 1983 and in the Spring of 1984 was studied. Two months after the disappearance of the first epidemic, the disease outbroke again at the same focus, Chiayi, and rapidly spread to whole island. The disease affected 5,650 heads (20.1%) in the total dairy cattle population of 28,117 in Taiwan in 1984. A number of 340 heads (6.0%) out of 5,650 either died or were culled and 189 aborted. As the result, the dairy farmers sustained a heavy loss from the death of animals, abortions, lower milk yield, slowed growth rate.

The commonest clinical signs seen were acute pyrexia, tachypnea, anorexia, depression, excessive salivation and nasal discharges, and lameness. Grossly, trachea showed severe congestions and hemorrhages, and the lungs, marked emphysema. Histopathologically, dilatation of alveoli was very eminent.

During the study, the authors encountered an instance of clinical case of bovine ephemeral fever in deer (*Cervus nippon Taiouanus*). The symptoms were similar to that of BEF in cattle.

Bovine Ephemeral Fever (BEF) is the clinical disease of cattle, i.e. *Bos taurus* and *Bos indicus*, and water buffaloes, *Bubalus bubalis*. Out-breaks of BEF have been reported in South Africa, Kenya, India, Australia, Japan and the other tropical and subtropical countries in Africa and Asia since early 1900s.^(1,2,3,4,11,12,13,14,18) Ephemeral fever, Three-day-sickness, Stiff sickness, Bovine epizootic fever and Bovine influenza have been given to call this viral disease in the different countries at different times.^(4,9,11,13,16)

It is believed that the disease, called Bovine Influenza, has long existed in Taiwan. But no description had been made until Lin⁽⁹⁾ and Otte⁽¹⁵⁾ first reported the outbreak of the disease in Kaohsiung,

Southern Taiwan in 1967. Of the 4,441 heads of dairy cattle investigated, 1,183 (26.6%) were infected, 62 (5.2%) either died or were culled and 31 aborted. The disease was confirmed as BEF by the serological tests with the serum samples sent to the National Institute of Animal Health, Ministry of Agriculture, Forestry and Fisheries, Japan. Thereafter, no further study of any sort on this disease has been reported in Taiwan.

No study on the BEF of domestic animals other than dairy cattle (Holstein, *Bos taurus*) has been made in Taiwan. St. George described in his unpublished paper that no neutralizing antibody has been found in 850 sheep serum samples in Australia, when the sheep could have

been expected to have been infected. The effort to transmit the disease to sheep and pigs (Snowdon, 1970), horses (Rabagliati, 1924), goats and rabbits (Mulhearn, 1937) and a camel (Rabagliati, 1924) were unsuccessful. St. George et al. also described (Unpublished data) that deer maintained high neutralization antibody titre, but no clinical case was presented.

Bovine ephemeral fever could occur without noticeable clinical signs. But the features of the clinical disease described in various countries, e.g. South Africa (Bevan, 1907), Australia (Seddon, 1938), Japan (Inaba, 1973) were primarily the same, i.e. increment of temperature, nasal discharges, salivations and lameness.^(4,10,17,19)

MATERIAL AND METHOD

Reporting Clinical Disease

The large part of information relating to the occurrence of BEF was derived from the telephone calls and the monthly reports from the Livestock Disease Control Centers (LDCC). The LDCC, one in each Prefecture or City, is primarily responsible for the collection of epizootic information, diagnosis and the enforcement of control measures for all animal diseases.

Post Mortem Examinations

Autopsys of dairy cattle which showed typical BEF clinical symptoms, were conducted.

RESULT

Outbreak

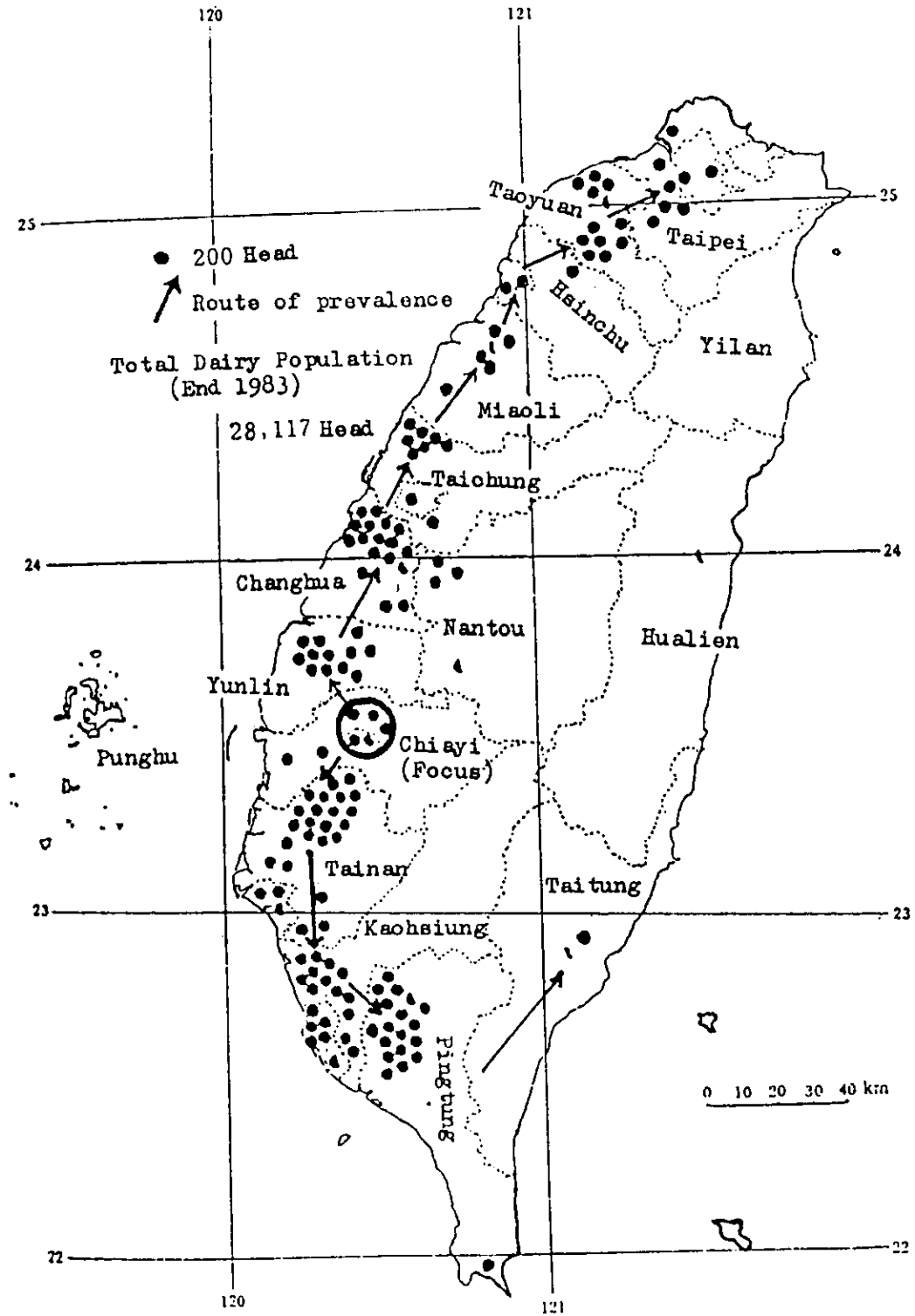
An acute febrile disease among the dairy herds was first reported in Chiayi,

Southern Taiwan in October 1983. The disease, with the clinical signs of pyrexia, excessive salivation, nasal discharges, and labored respiration, spread to the neighbouring prefectures to the north and south. But it disappeared by December 1983.

In March 1984, the disease recurred in the same focus of the first outbreak, and it became very contagious and virulent. It rapidly spread to Yunlin, Changhua, Taichung, Hsinchu, Taoyuan and Taipei to the north, and Tainan, Kaohsiung and Pingtung to the south. And it finally reached Taitung and Hualien in eastern Taiwan by July 1984 (Map 1).

Characterized by severe clinical symptoms; difficult to treat and poor prognosis, the disease affected 324 farms (35.2%) out of 921 dairy farms. It caused the clinical disease in 5,650 heads (20.1%) in the total dairy population of 28,117. During the lapse of epidemic, 340 (6.0%) died or were culled and 189 aborted. The incidence in each area was irregular, from the high of 94.9% to the low of 0.8%, though it spread all over the island (Table 1).

At the height of the prevalence, i.e. June 1984, a herd (42 heads) of nippon sica (*Cervus nippon Taiouanus*) in Taipei was infected. Anorexia, pyrexia, depression, excessive salivations and nasal discharges were recorded in 5 deer. The deer recovered gradually at a lapse of 10 days, except the one which died on the 5th day. The post mortem examinations revealed severe pulmonary emphsema, congestions and hemorrhages of trachea and bronchi, and cardiac edema. Leucopenie was also observed. The clinical signs and pathological findings resembled to those of the BEF in cattle.



Map 1. The Distribution of Dairy Cattle and the Route of Bovine Ephemeral Fever Epidemics, 1984.

Table 1. The Morbidity and Mortality of Bovine Ephemeral Fever in Taiwan, 1984

Area	No. of farm Infected (%)	No. of cattle Infected (%)	No. died or culled (%)	No. aborted
1. Yilan	*1/2 (50.0)	**3/10 (30.0)	0 (0.0)	0
2. Taipei	7/47 (25.0)	12/1,551 (0.8)	0 (0.0)	0
3. Taoyuan	1/58 (1.7)	423/2,231 (19.0)	4 (0.9)	8
4. Hsinchu	8/15 (53.3)	160/502 (31.9)	2 (1.3)	19
5. Miaoli	10/84 (11.9)	442/1,091 (40.5)	14 (3.2)	0
6. Taichung	29/46 (63.0)	212/1,790 (11.8)	9 (4.2)	33
7. Changhua	93/125 (74.4)	1,103/1,309 (33.3)	76 (6.9)	28
8. Nantou	3/66 (4.5)	16/737 (2.2)	0 (0.0)	0
9. Yunlin	62/81 (76.5)	1,335/2,388 (55.9)	25 (1.9)	0
10. Chiayi	32/57 (56.1)	1,010/1,350 (74.8)	137 (13.6)	7
11. Tainan	40/154 (26.0)	128/5,190 (2.5)	10 (8.6)	4
12. Kaohsiung	31/56 (55.4)	487/3,820 (12.7)	49 (10.1)	89
13. Pingtung	5/118 (4.2)	251/3,749 (6.7)	5 (2.0)	0
14. Taitung	1/9 (11.1)	226/281 (94.7)	3 (1.1)	0
15. Hualien	1/2 (50.0)	28/115 (24.3)	6 (21.4)	0
Total 15	324/921 (35.2)	5,650/28,117 (20.1)	340 (6.0)	189

*Number of farm infected/Total number of farm

**Number of cattle infected/Total number of cattle

Clinical Signs

Pyrexia, symptoms of respiratory system and the lameness caused by articular pain were the main characteristics seen in the natural infections. Body temperature went up to 41.8°C and quickly dropped after retaining 2 to 3 days. During the course infected animals showed marked loss of appetite and depression.

Muzzle was dry, but the nose was with excessive watery discharges and the mouth with large amount of salivations (Fig. 1). Dyspnea and tachypnea caused animal to open the mouth with protruding tongue (Fig. 2) was often encountered. Whitish mucous bubbles was eminently seen in saliva.

The rate of respiration increased markedly (70-110/min.), and the expiration noise from labored respiration was so big that it could be heard from the distance of 20 to 30 meters away. Coughings were

observed in some animals. Some ocular discharges and congestion, hemorrhages and light edema in conjunctiva were also observed.

Marked depression, standing lonely, reduced movement around the exercise lot, shivering skin were noticed in the infected herd when it was put out to the exercise yard. Articular pain caused lameness and some recumbencies. Some recumbencies had never recovered, i.e. died or were culled (Fig. 3).

With the onset of the disease, milking cows reduced milk yield, often only to 1/5 of the normal yield. Abortions occurred regardless the age of gestation.

Pathology

Of the 272 dairy and beef cattle of Taiwan Livestock Research Institute, Hsinhua, Tainan, 66 heads (24.3%) manifested the clinical signs of BEF in July 14, 1984,



Fig. 1. Excessive nasal discharges and salivations of a natural Bovine Ephemeral Fever infection.



Fig. 2. Tachypnea characterized by protruding tongue in a natural infection of Bovine Ephemeral Fever.



Fig. 3. Recumbent heifer, caused by articular pain in a natural infection of Bovine Ephemeral



Fig. 4. Severe tracheal congestion and hemorrhage, Bovine Ephemeral Fever.

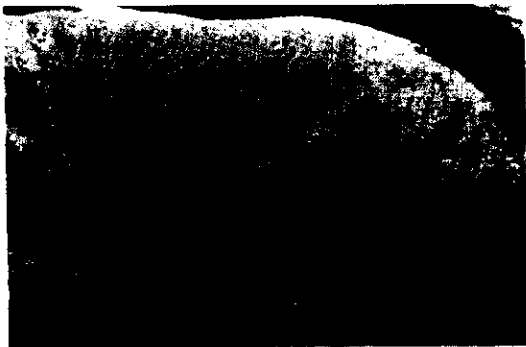


Fig. 5. Pulmonary emphysema, Bovine Ephemeral



Fig. 6. Rupture of posterior lobular of right lung, Bovine Ephemeral Fever.



Fig. 7. Mucous bubbles in congestive and hemorrhagic tracheal tract, Bovine Ephemeral Fever.



Fig. 8. Rupture of alveolar septa, Bovine Ephemeral Fever.

Table 2. Materials for the Pathological Study of Bovine Ephemeral Fever

Cattle No.	Age	Sex	Breed	Body Weight	Nutrition	Coat	Lapse of Disease
	yr			Kg			day
484	1.7	F	Holstein	415	Good	Coarse	1
384	3.0	F	Holstein	410	Fair	Coarse	6

and 8 heads died within several days. A dairy heifer which died within 24 hours after the onset of the disease, and another heifer which became recumbent (Fig. 3) for 6 days and then was bled, were used as the materials for the pathological study (Table 2).

(1) Pathological findings in Cattle No. 384

Muzzle was dry and thick pustular mucosal discharges occupied the nostrils. Large amount of mucous bubbles filled the mouth.

Severe congestions and hemorrhages were seen in the mucous membrane of trachea (Fig. 4) with some yellowish mucous fluid inside. Transcent or whitish mucous fluid also filled the laryngopharyngeal part.

The anterior and posterior lobulars of both lungs showed medium rate of emphysema, while the peripheries of the lungs were attached with light reddish fibrins.

Both auricles and ventricles were filled with large amount of blood clots.

No evident pathological change was found in the other organs, but fibrinous exudate was full in the joint sinuses of hinter legs.

(2) Pathological findings in cattle No. 484

This heifer died within 24 hours after the manifestation of clinical signs of BEF. Large blood clots filled up all auricles

and ventricles, and hemorrhagic dots were seen on the coronary and pericardiac membrane. Gross examinations revealed severeness of the pathological changes in pulmonary system. Pulmonary emphysema and plasmal edema were very apparent (Fig. 5). The anterior lobular of both lungs showed marked hepatizations. A rupture with an orifice of 4 x 15 cm was seen in the posterior lobular of right lung (Fig. 6).

Yellowish mucous bubbles filled the tracheal sinuses, and severe congestions and hemorrhages were observed under the mucosa wide spread hemorrhages were also observed under the mucosa of the laryngeal region (Fig. 7). Esophagus was congestive and so was the pharyngeal lymphnodes. Abdomen was contaminated because of the rupture of the omasum, but there was no pathological change in rumen, reticulum, abomasum and intestines. Fibrinous exudate filled the spinal cord and the joint sinuses of legs.

(3) Histopathological findings

Microscopically, all lymphnodes in both above mentioned cases were congestive. Severe dilatations of alveoli and thinned alveolar septa some of them ruptured (Fig. 8), characterized the condition of the disease. Fibrinous exudates containing gangrenous cells and chips, such as macrophages, erythrocytes, granular lymphocytes, etc. filled alveolar and bronchiolous cavities.

Slight swelling of hepatic cells and disintegrations of hepatic cords were observed. The proliferations of the connective tissues of omentum with the exudation of lymphocytes and monocytes were also seen microscopically.

The serosa of small intestines was edematous. The white matter of spinal marrow showed dilatations and Wallerian degenerations.

DISCUSSION

The second out-break of the BEF in March 1984 occurred only 2 months after the end of the first outbreak at the same focus. It became an explosive epidemic and affected the cattle of all ages. Increased virulence and contagiousness of the BEF virus in the second outbreak caused a rapid spread of the disease to whole island, and a large economical loss to the farmers.

The means of transmission was not studied in the outbreaks, however, trans-ovarian transmission through blood sucking vector insects to the second outbreak was suspected at the same focus, in where there were many low or none antibody cattle still existed after the first outbreak. It is known that 18 *Culicoides* Spp mosquitoes exist in Taiwan,^(5,6,7,8) and further study is required for clarifying the role of *Culicoides* Spp and the other blood sucking insects in the epizootics of BEF.

The other route of transmission, e.g. viremic ruminants as the reservoir of the virus, was also possible. The authors also understood that the foci of the two outbreaks were in southern Taiwan, as it was in 1967 outbreak, in where the climate is warm throughout the year.

The morbidity of 20.1% was compar-

able to that of the outbreaks in Australia and the other countries.^(4,13,16,18,20) But the mortality of 6.0%, which is comparable to the figure of 5.2% in Lin's report (1969), was much higher than that in the other countries (usually around 1%). What caused this difference was not clear, but differences in cattle breed, feeding and management, natural environment, virulence of virus and treatment of clinical cattle might be able to explain part of this.

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1983-4 年發生牛流行熱的疫學研究

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1983年10月及1984年3月在台灣發生的牛流行熱加以疫學的研究。在第一次發生流行消失後2個月後在同一地區—嘉義，再度發生，並蔓延至全省各地。至1984年9月止調查乳牛頭數28,117頭中有5,650頭(20.1%)受到感染，其中340頭(6.0%)死亡或淘汰，另有189頭發生流產。結果酪農受到牛隻死亡、流產、牛乳減產，生長遲緩等重大損

失。

最顯著的臨床症狀有發熱、呼吸困難，食欲減退，元氣消沈、流涎、鼻漏及跛腳。主要解剖所見為氣管嚴重充血與出血、肺氣腫。病理組織切片檢查結果發現氣胞顯著擴大。

在本研究中遭遇到梅花鹿感染牛流行熱及死亡病例，其臨床症狀與牛感染時症狀相似。