BOVINE EPHEMERAL FEVER AND RELATED RHABDOVIRUSES

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Bovine Ephemeral Fever in Indonesia

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Abstract

Ephemeral fever is considered an important disease of cattle in Indonesia. Serological surveys have shown that large ruminants throughout the country are infected. Monitoring of groups of sentinel cattle at intervals of 1000 or 2000 km across the country is starting to yield information on the seasonal pattern of infections, and also to allow opportunities for isolation of viruses.

INDONESIA, with its equatorial location, links the continents of Asia and Australia and has a variety of wet and drier tropical climates. The current paper reviews Indonesian reports of ephemeral fever and presents preliminary sero-epidemiological information of studies from BEF-group viruses.

Historical Perspective

The first report of ephemeral fever in Indonesia was by Merkens (1919) who described a new clinical syndrome in dairy cattle in Bandung, West Java which was consistent with the descriptions of three-day-sickness described in southern Africa and Egypt (Piot 1896, Bevan 1907). The next report of ephemeral fever in Indonesia was by Burggraaf (1932), who described cases in an epidemic between 1928 and 1931 on the east coast of Sumatra.

In 1978, an outbreak of ephemeral fever in East Java was investigated, (Soeharsono et al. 1982). Serum neutralisation tests showed that 22 of 25 animals had antibody to bovine ephemeral fever (BEF) virus. The disease persisted in the area for several years, and mortalities were at times quite high (Ronohardjo and Rastiko 1982). Clinical cases appeared to be still frequent in East Java in 1985 (Daniels et al. 1988). More recently another large outbreak of suspected clinical BEF has been reported, from the island of Kalimantan (Soleha et al. 1993a).

To promote the study of arboviruses in Indonesia, a sentinel herd program using groups of animals on several islands was commenced in 1987 (Sendow et al.1988, Daniels et al. 1991), and a serological capacity for the study of BEF-group viruses established (Soleha 1991; see Soleha et al. these proceedings).

Clinical Disease

The most complete clinical descriptions in Indonesia are from early reports. Merkens (1919) reported that dairy cattle said to be of Dutch and Australian origin were affected with a disease of sudden onset, high fever and increased respiration and heart rates. Inflamed conjunctiva, rumenal stasis, constipation, and muscular-skeletal lameness were also noted. Recumbent animals were observed and there were some mortalities.

Burggraaf (1932) reported a disease of sudden onset, with fever as high as 43 °C. There was inappetance, rumenal stasis and constipation, salivation, inflammation of the conjunctiva, lachrymation, increased heart rates and respiration. A shifting lameness caused by pain of joints and muscles was a characteristic of the disease. Cases becoming recumbent resembled parturient paresis. Aspiration pneumonia was a problem.

Epidemiology and Economics

Burggraaf (1932) reported a species difference in susceptibility with mortality being rare in *Bos indicus* cattle, and higher in dairy cattle. Of 80 dairy cows in one herd, 12 showed clinical signs, five died and

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four aborted. Of 27 heifers in the same herd, eight were affected and two died. No clinical signs were observed among 23 calves.

In East Java in the 1978–1982 outbreak, mortality was reported to be high, up to 36% of cases in the first year. Mortalities were fewer in subsequent years when a program of vaccination against haemorrhagic septicaemia and treatment of suspected cases with antibiotics was operational (Ronohardjo and Rastiko 1982). In the first year of the outbreak farmers were unfamiliar with ephemeral fever and may have slaughtered animals which they assumed would die.

In a rural economy based on smallholder farmers, such as in Indonesia, financial and economic costs of ephemeral fever are not only those of deaths and milk production losses. Cattle manure is an important source of fertilizer, and cattle are a major source of capital, personal wealth, fertiliser from manure and draught power (Ronohardjo and Rastiko 1982). The disease disrupts the farmer's efficiency and also his opportunity to earn extra cash through contract ploughing.

Burggraaf (1932) found the highest incidence of disease at the beginning of the wet season, when mosquitoes were abundant. Spread of disease occurred without direct contact, suggesting an insect vector. Ronohardjo and Rastiko (1982) noted that the spread of the disease in East Java was in the direction of the prevailing winds during the wet season, when monthly incidence of disease was highest. In the recent Kalimantan outbreak, peaks of disease were reported at the beginning and end of the wet season (Soleha et al. 1993a).

Current Studies

Procedures

A program for the study of arboviral infections of livestock in Indonesia (Daniels et al. 1991) includes ephemeral fever. The program is based on monitoring sentinel cattle, pigs and chickens and collecting samples for serology and virus isolation. Insects are also collected at sentinel sites, and identified to species, with the emphasis on *Culicoides* spp. Insects collected close to the laboratory are processed fresh for virus isolation, while those at distant sites are collected into alcohol.

Because of the problem of cross-reactions among BEF-group viruses in serum neutralisation tests (Cybinski 1987) a range of BEF group viruses for which reagents were available, were obtained from CSIRO Long Pocket Laboratories, Australia. These included BEF virus strain BB7721 (Doherty et al. 1969), Berrimah strain DPP63 (Gard et al. 1983), Kimberley virus strain CS368 (Cybinski and Zakrzewski 1983) and Adelaide River strain DPP61 (Gard et al. 1984).

Serological surveys

Cattle sera obtained from a serum bank were tested for neutralising antibodies to BEF virus at a dilution of 1:4 according to the method of Soleha (1991). The results, presented in Table 1, show that infection with BEF virus occurs throughout Indonesia. The results of more intensive serological surveys undertaken in Irian Jaya and Timor (Soleha et al 1993b) are presented in Table 2. The cattle sampled in consecutive years were from the same herds. All districts studied were coastal, except for Jayawijaya, which is in the central highlands of Irian Jaya. The results confirm that BEF or closely related viruses, are widely spread in eastern Indonesia.

Table 1. Prevalence of serum neutralising antibodies to bovine ephemeral fever virus in cattle in several provinces of Indonesia.

Province	Cattle	
	No. tested	No. antibody positive (%)
Aceh (Sumatra)	55	11 (20)
Lampung (Sumatra)	55	18 (33)
West Java	40	11 (28)
Central Java	55	14 (26)
East Java	24	9 (38)
Bali	47	6 (13)
Nusa Tenggara Barat	55	15 (27)
Nusa Tenggara Timur	29	8 (28)
South Kalimantan	55	14 (26)
South Sulawesi	18	3 (17)
North Sulawesi	39	7 (18)
Irian Jaya	55	9 (16)
Total	**527**	**125 (23.7)**

Considering first the districts surveyed in Irian Jaya, Jayapura is a high rainfall area, 2750 mm per year, with rainfall usually not falling below 150 mm in any month. In this district the sero-prevalence in over 120 cattle in the two consecutive years was the same (24%). In the drier district of Merauke, on the south coast adjacent to northern Australia, the rainfall is 1750 mm per year and occurs predominantly in a four-month wet season, with an eight-month dry season. Here the sero-prevalence was similar each year (7–9%), but much lower than in wetter Jayapura. In contrast, the district of Kupang has a much lower rainfall (1250 mm per year), but the sero-prevalence (14%, 42%) in the two years of the study

Table 2. Prevalence of serum neutralising antibodies to bovine ephemeral fever virus in cattle in eastern Indonesia — including a comparison of data collected in two successive years.

Province/District	1989 % antibody positive (No. tested)	1990 % antibody positive (No. tested)
Irian Jaya		
Jayapura[1]	24% (122)	24% (156)
Jayawijaya	0% (9)	—
Merauke[1]	9% (86)	7% (128)
Fak Fak	2% (28)	—
Sorong	—	25% (28)
Biak Numfur	—	44% (25)
Nusa Tenggara Timor		
Kupang[1]	17% (105)	42% (113)

[1] Sentinel cattle sites
— Data not available

was higher than for Merauke, and showed considerable variation between years, perhaps indicating an effect of season. Merauke is more isolated than Kupang. It is separated from the Jayapura district by a wide mountainous area, Jayawijaya, where antibodies to BEF virus have not been detected (Table 2). The cattle population of Timor, where Kupang is placed, is approximately half a million, while the cattle population of Merauke is approximately 10 000. The cattle population of the south coast of Irian Jaya is being increased with imports from other provinces, especially Nusa Tenggara Timor (Kupang) and Nusa Tenggara Barat.

Seroconversions in sentinel cattle

To provide more information on the role of other viruses in the BEF virus group, detailed studies were carried out in Bali, Kupang and Jayapura, using Bali cattle (*Bos javanicus*). The sera were tested at a dilution of 1:4 in a serum neutralisation test (Soleha 1991).

The data available for Bali are for 1989–1990. In one animal, seroconversions were observed to Kimberley virus in March and to both Berimah virus and BEF virus in April. In December another animal seroconverted to BEF virus alone. In February individual calves seroconverted to either Kimberley virus or Adelaide River virus, and in March calves seroconverted to Kimberley virus and Adelaide River virus. It seems probable that several different BEF group viruses were circulating in the study area during the mid to late wet season. Not all animals seroconverted which may indicate inefficient vector transmission.

Seroconversions were recorded in two groups of calves at Kupang and Jayapura in 1990–1991. Patterns were similar to those in Bali. In Kupang one calf seroconverted to BEF virus, Berrimah virus and Kimberley virus in the same month, while another calf seroconverted to BEF virus and Berrimah virus at the same time. Several animals seroconverted to Berrimah virus at the end of the wet season, and one seroconverted to Adelaide River virus in July in the early dry season.

In Jayapura, with its much wetter climate, seroconversions were again in the period March to July, the end of the wet season. Most animals in the group seroconverted to Berrimah virus in June and July, with only four seroconverting to BEF virus. Also, during the observation period, most calves in the group seroconverted to Adelaide River virus, but over a longer period, January to September. In spite of the problem of virus cross-reactions complicating serological interpretations, at least two different patterns of seroconversions to different viruses were observed, which again suggests that more than one BEF group virus was circulating in the district, and also that the viruses may be preferentially spread by two different vectors.

In Bali and Kupang, separated from each other by over 1000 km, seroconversions to BEF virus and Berrimah virus occurred first in December, and then in March, April and May. In Jayapura the seroconversions to these antigens were again in December, then in April and May, reaching a peak in June and July.

Discussion

Serological surveys have demonstrated that infection with BEF virus is widespread in Indonesia. No clinical disease has been reported in the sentinel animals monitored to date. Although earlier reports were of disease in *Bos taurus* cattle, (Merkens 1919), with *Bos taurus* being more severely affected than *Bos indicus* (Burggraaf 1932), subsequent reports (Soeharsono et al. 1982, Ronohardjo et al. 1982) described clinical disease in local *Bos indicus*. Recent outbreaks of ephemeral fever-like disease in South Kalimantan involved many Bali cattle (*Bos javanicus*).

It is not clear whether BEF virus causes disease in water buffaloes (*Bubalus bubalis*) (Young 1979). None of the published reports from Indonesia mention this species, although a high prevalence of serological reactors has been found (see Soleha et al. these proceedings).

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