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Vetrivel D
Department of Animal Husbandry Economics, Madras Veterinary College, Chennai, Tamil Nadu, India

A Serma Saravana Pandian
Department of Animal Husbandry Economics, Madras Veterinary College, Chennai, Tamil Nadu, India

J Shilpa Shree
Department of Animal Husbandry Economics, Madras Veterinary College, Chennai, Tamil Nadu, India

M Boopathy Raja
Department of Animal Husbandry Economics, Madras Veterinary College, Chennai, Tamil Nadu, India

Correspondence
J Shilpa Shree
Department of Animal Husbandry Economics, Madras Veterinary College, Chennai, Tamil Nadu, India

An empirical study on the prevalence of anaplasmosis in north eastern agro-climatic zone of Tamil Nadu, India

Vetrivel D, A Serma Saravana Pandian, J Shilpa Shree and M Boopathy Raja

Abstract
The present study was conducted to assess the prevalence of anaplasmosis in cattle farms. The data were collected from 120 sample cattle owners selected from 6 blocks in 3 districts of North east zone of Tamil Nadu viz. Kancheepuram, Tiruvannamalai and Vellore districts. A total of 60 anaplasmosis affected cattle farms were studied. The results of the study indicated that the overall prevalence of anaplasmosis was 25.10 percent. The prevalence of anaplasmosis was higher among the cattle owned by illiterate farmers than literate farmers. The prevalence of anaplasmosis was high in small herd than medium and large herd size. The mortality rate in anaplasmosis was 3.35 percent whereas the overall case fatality rate in anaplasmosis was 13.33 percent. Thus, the appropriate policy suggestions have to be made to control of anaplasmosis in cattle and minimise the economic losses due to this disease by application of scientific management practices and control over these predisposing factors.

Keywords: Anaplasmosis, prevalence, mortality and case fatality rates

1. Introduction
India has huge livestock population especially cattle (190.90 million), which accounts for 37.28 percent of the total livestock population [1]. Livestock capital is a very important element of the overall capital stock of world agriculture [2]. In India the livestock sector contribution is nearly 3.9 percent of total GDP and 25.85 percent of agriculture and allied activities. On the other hand, the dairy sector has been withstanding the vagaries of weather and has sustained a growth of around 4.51 percent per annum. It is estimated that during the year 2011-12, the gross value of output from livestock sector, at current prices was INR 4,59,051 crores out of which milk and milk products were INR 3,05,484 crores and the meat was INR 83,641 crores [3]. Despite the advantages it offers to vulnerable poor farmers in areas of socio-economic hardships, dairy cattle rearing suffer from inherent constraints. Among the constraints, diseases pose a more serious threat to cattle production. In case of intensive farming system, tick borne diseases are a major threat. An animal disease outbreak would have serious economic impact on producers. The economic loss due to anaplasmosis in different regions of world was explained by Brown [4]. The market chain, gross agricultural income, understanding how animal disease will impact the productivity of the animal product sector and the food chain is a complex multidisciplinary problem. Livestock suffer from innumerable diseases; of which blood parasitic diseases are the most common disease entities in subtropical regions [5]. Anaplasmosis is the common diseases frequently encountered in India resulting greater economic loss [6]. Bilgic *et al*. [7] explained in their study, a number of tick-borne diseases cause important health and management problems, resulting in reduced productivity and economic losses in domestic cattle production systems worldwide. Anaplasmosis is a vector-borne infectious disease in cattle caused by the rickesttsial parasite *Anaplasma* spp. It is also called yellow bag or yellow fever as affected animals can develop jaundice [8]. It causes anaemia, fever, weight loss, breathlessness, abortion, uncoordinated movements, diarrhoea followed by constipation, decreased milk production and fatality in some cases [9]. Bovines are highly prone to tick borne diseases which is indirectly cause huge economic loss to farmers. There are hardly a few studies exist in the research literature focusing on the impact of these diseases in creating an economic loss. It is felt that it is necessary to evaluate the economic impact caused by anaplasmosis. Taking all into account, the present study was undertaken to assess the prevalence of anaplasmosis in north eastern agro-climatic zone of Tamil Nadu, India.

2. Materials and methods

For the present study, Kancheepuram (12.8342° N, 79.7036° E), Tiruvannamalai (12.2253° N, 79.0747° E) and Vellore (12.9165° N, 79.1325° E) districts of North eastern zone of Tamil Nadu were purposively selected. Since these districts have a unique blend of milk shed, cattle population and high incidence of tick borne diseases like Anaplasmosis among the cattle. From each of the selected districts, two blocks were selected by simple random sampling and from each block five villages were selected by simple random sampling and from each village; four cattle farms with the incidence of anaplasmosis were selected. Thus a total sample size for the study is 120 farms. The period of the study is from December 2013 to March 2014. The primary data for the study was collected through a well structured pre-tested interview schedule. The collected data were analysed by conventional percentage and average analysis, measure of disease occurrence Prevalence, Mortality rate, Case fatality rate and chi square analysis to achieve the objectives of the study.

2.1 Prevalence

Prevalence refers to number of instances of disease or related attribute in a known population at designated time without distinction between old and new cases. Prevalence is usually expressed in terms of the number of diseased animals in relation to animals in the population, which are on the onset of developing stage of diseases. Prevalence can take the values of 0 and 1 and it is dimensionless. It is expressed as a percentage.

$$\text{Prevalence} = \frac{\text{[Number of individuals having a disease at particular point of time]}}{\text{[Number of individuals in population at risk at that point of time]}}$$

2.2 Mortality rate

Mortality rate possess three essential elements, which are as follows; (a) a specifically defined population group (denominator), (b) the time period, and (c) the number of deaths occurring in population group during that time period (numerator). The numerator comprises the number of deaths and the animals that develop disease are included in the denominator (until they die).

$$\text{Mortality rate} = \frac{\text{[Number of death due to disease that occur in a population during particular point of time]}}{\text{[All animals at risk of dying]}}$$

2.3 Case fatality rate

Case fatality rate is the number of death occurred due to a specified disease in a specified population during a specified time period, divided by the number of cases of that particular disease in that population during that period of time.

$$\text{Case fatality rate} = \frac{\text{[Number of death]}}{\text{[Total number of animals affected with that disease]}}$$

2.4 Statistical analysis: Testing independence of factors

Chi-square analysis (χ^2) was used to test the Hypothesis, H_o: The factors are independent.

$$\chi^2 = \sum \frac{(f_o - f_e)}{f_e}$$

$$\chi^2 = \sum \frac{f_o}{f_e} - N$$

Where,

χ^2 = Chi-square statistic

f_o = Observed frequency

f_e = Observed frequency

N = Number of observation

The decision rule: reject H_o if $\chi^2 > \chi_\alpha^2$ (K-1), where, α is the level of significance and K-1 is the degrees of freedom.

3. Results and Discussion

3.1 Prevalence of anaplasmosis in cattle in the study area

The overall prevalence of anaplasmosis in cattle in the study area is presented in Table 1. The overall prevalence of anaplasmosis was 25.10 percent. The prevalence of anaplasmosis in the present study population was lower than the study (37.50 percent) reported by Ashuma *et al*.,[10], but higher than the study (22.98 percent) reported by Reetha *et al*.,[11]. Similar studies on prevalence of anaplasmosis was conducted by Belal *et al*.,[12] and Khan *et al*.,[13]

Table 1: Prevalence of Anaplasmosis in cattle in the study area (in Numbers)

Diseases	Sample farms	Total number of cattle studied	Number of cattle affected
Anaplasmosis	60	239 (100.00)	60 (25.10)

(Figures in parentheses indicate percentage to respective total)

3.2 District wise prevalence of anaplasmosis

Table 2 presents the overall view the district wise prevalence of anaplasmosis in the study area. The prevalence of anaplasmosis in Kancheepuram, Tiruvannamalai and Vellore districts was 22.47, 26.67and 26.67 percent, respectively. The prevalence of anaplasmosis was equally higher in Tiruvannamalai and Vellore followed by Kancheepuram districts. The prevalence rate in Kancheepuram was found to be higher than the (18.30 percent) observation by Arunkumar and Nagarajan [14]. This might be due to the presence of more number of cross-bred cattle populations in Tiruvannamalai and Vellore districts than Kancheepuram district. The higher prevalence of the anaplasmosis in clinically normal cross-breds of South India indicated subclinical infections or carrier status of these vector borne diseases. *Boophilus microplus* was reported to be the most common tick species infesting cattle in southern region of the country particularly in Tamil Nadu [15]. The abundance of biting flies (*Tabanus* spp.and *Stomoxys*spp.) due to the hot and humid tropical climatic conditions prevailing in the state might also augment the mechanical transmission of the disease to newer animals [16].

Table 2: District wise prevalence of anaplasmosis among the sample farms (in numbers)

Districts	Anaplasmosis		
	Affected	Non-affected	Total
Kancheepuram	20 (22.47)	69 (77.53)	89 (100.00)
Tiruvannamalai	20 (26.67)	55 (73.33)	75 (100.00)
Vellore	20 (26.67)	55 (73.33)	75 (100.00)
Overall	60 (25.10)	179 (74.90)	239 (100.00)

(Figures in parentheses indicate percentage to respective total)

3.3 Prevalence of anaplasmosis in cattle across different land holding categories of the cattle owners

Prevalence of anaplasmosis across different land holding categories of the cattle owners is presented in Table 3. The

farm size of the sample farmers is categorised into four different groups on the basis of land holding size as landless (without land), marginal farmers (with land up to 2.5 acres), small farmers (2.5 to 5 acres) and large farmers (more than 5 acres). The results indicated that the prevalence of anaplasmosis among landless, marginal, small and large farmers was 26.09, 26.80, 24.53 and 15.00 percent, respectively. The results indicated that the prevalence of anaplasmosis was high among the cattle owned by resource poor farmers who maintain their animals under poor management system. However, statistical analysis revealed that the prevalence of anaplasmosis were independent of farm size of the sample farmers (p>0.05).

Table 3: Prevalence of anaplasmosis across different land holding categories of sample farmers (in numbers)

Category	Anaplasmosis	
	Total number of cattle studied	Number of cattle affected
Landless	69 (100.00)	18 (26.09)
Marginal	97 (100.00)	26 (26.80)
Small	53 (100.00)	13 (24.53)
Large	20 (100.00)	3 (15.00)
Overall	239 (100.00)	60 (25.10)

(Figures in parentheses indicate percentages to the respective total)
(Prevalence of Anaplasmosis in cattle is independent of land holding categories of the sample farmers (χ^2=1.33^{NS}; p>0.05)

3.4 Prevalence of anaplasmosis across different educational level of the cattle owners

Prevalence of anaplasmosis across different educational level of the cattle owners is presented in Table 4. The overall results indicated the prevalence of anaplasmosis was higher among the cattle owned by illiterate farmers than literate farmers. The prevalence of anaplasmosis among the cattle owned by illiterate, primary, secondary and collegiate farmers was 36.92, 29.41, 23.73 and 10.94percent, respectively. It could be inferred from the results that with the increase in educational status of the cattle owners, the prevalence of anaplasmosis decreased. Chi square analysis revealed that the prevalence of anaplasmosis were highly associated with the educational status of farmers (P<0.01).

Table 4: Prevalence of anaplasmosis across different educational level of sample farmers (in numbers)

Educational status	Anaplasmosis	
	Total number of cattle studied	Number of cattle affected
Illiterate	65 (100.00)	24 (36.92)
Primary	51 (100.00)	15 (29.41)
Secondary	59 (100.00)	14 (23.73)
Collegiate	64 (100.00)	7 (10.94)
Overall	239 (100.00)	60 (25.10)

(Figures in parentheses indicate percentages to the respective total)
(Prevalence of Anaplasmosis in cattle is highly associated with educational status of the of farmers (χ^2=12.22**; p≤0.01)

3.5 Prevalence of anaplasmosis across different herd size

The prevalence rate of anaplasmosis across different herd size groups is presented in Table 5. Herd size of the sample farmers were classified into three different groups as small farm (1-2 adult dairy animals), medium farm (3 to 5 adult dairy animals) and large farm (more than 5 adult dairy animals). It could be seen from the table that the prevalence of anaplasmosis revealed that 50.00, 26.52 and 14.81 percent, respectively for small, medium and large farms. In large herds, the farmers might have given more care and good management practices to control tick and flies. As a result the prevalence of anaplasmosis might be lower among large herds when compared to small herds. Chi square analysis revealed that the prevalence of anaplasmosis were highly associated with herd size (P<0.01).

Table 5: Prevalence of anaplasmosis across different herd size groups (in numbers)

Herd size groups	Anaplasmosis	
	Total number of cattle studied	Number of cattle affected
Small (1-2 cattle)	26 (100.00)	13 (50.00)
Medium (3-5 cattle)	132 (100.00)	35 (26.52)
Large(Above 5 cattle)	81 (100.00)	12 (14.81)
Overall	239 (100.00)	60 (25.10)

(Figures in parentheses indicate percentages to the respective total)
(Prevalence of Anaplasmosis in cattle is highly associated with animal size of the sample farmers (χ^2=13.27**; (p<0.01))

3.6 Mortality and case fatality rate due to anaplasmosis

Table 6 presents the mortality rate due to anaplasmosis affected animals in the study area. The mortality rate in anaplasmosis was found to be 3.85 percent, 3.76 percent and 2.50 percent in small, medium and large farms respectively, with the overall rate being 3.35 percent. These mortality rates appeared slightly higher (2.43 percent) than the study reported by Coetzee *et al*., [17]. The details of case fatality rates due to anaplasmosis among affected cattle are presented in Table 7. The case fatality rate due to anaplasmosis was 7.69, 14.29 and 16.67 percent in small, medium and large farms respectively, with an overall rate of 13.33 percent. The case fatality rate was lesser than that were reported by Radostits *et al.*, [18].

Table 6: Mortality rate due to anaplasmosis in the study area (in numbers)

Farm size	Anaplasmosis	
	Total Number of cattle	Number of cattle died
Small	26 (100.00)	1 (3.85)
Medium	133 (100.00)	5 (3.76)
Large	80 (100.00)	2 (2.50)
Overall	239 (100.00)	8 (3.35)

(Figures in parentheses indicate percentages to the respective total)

Table 7: Case fatality ratedue to anaplasmosis in the sample farms

of the study area (in numbers)

Size of farms	Anaplasmosis	
	Number of cattle affected	Number of cattle died
Small	13 (100.00)	1 (7.69)
Medium	35 (100.00)	5 (14.29)
Large	12 (100.00)	2 (16.67)
Overall	60 (100.00)	8 (13.33)

(Figures in parentheses indicate percentages to the respective total)

4. Conclusion

The economic losses caused by anaplasmosis were worked out in the present study. The study indicated that these diseases remain as the most serious problem to cattle farmers. The study concluded that mortality and case fatality rates were minimum but the economic loss was so high. Hence, care should be taken on the affected animal instantly to avoid these losses. Thus, the losses due to these diseases in cattle could be prevented by application of scientific management practices and control over these predisposing factors. Prevalence of anaplasmosis is more in farms held by illiterate farmers, who lack the knowledge and awareness about the various scientific management practices. Hence, extension activities need to be strengthened to educate the illiterate farmers on the economic importance of the diseases and the ways to reduce the incidence of these diseases. Thus, the appropriate policy suggestions have to be made to control of anaplasmosis in cattle and minimise the economic losses due to this disease.

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