Temporal and Spatial Epidemiological Trend of Emerging Livestock Diseases of Andaman and Nicobar Islands, India

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ABSTRACT

The disease trend of livestock and poultry indicated that very few deadly viral and bacterial diseases are prevalent in the A & N Islands. The prevalence of parasitic diseases is reported to be very high in almost all parts of the Islands. An understanding of the epidemiology of disease is crucial for the development and implementation of effective diagnosis, treatment, control, and managemental practices. Hence, temporal and spatial epidemiological study of the livestock diseases was carried out. Among the parasitic disease, highest number of cases were reported due to ascariasis (34.02%) followed by fascioliasis (29.6%), amphistomiasis (25.5%), and strongyloids (10.9%). The trend showed that parasitic diseases increase during the rainy season (July to December). The secular trend of other diseases indicated that sero-prevalence of *Infectious bovine rhinotracheatis* (IBR) was found to be 20.58%, which is on increasing trend as compared to last 5 years data. The sero-prevalence of *Brucella abortus* was 12.84% during the period 2000 to 2014.However, during the last 4 years the prevalence is found to be nil. The sero-prevalence of *peste des petits* virus (54.93%) and *bluetongue* (77.9%) has been detected for the first time. The high prevalence of PPR and BT in goats is considered to be an alarming situation. The island has become presently free from goat and bovine brucellosis, goat and bovine tuberculosis. However, there is alarming situation of emergence of few bovine and

goat viral and bacterial diseases of FMD, PPR BT, orf and leptospirosis. Considering the changing climatic condition and to improve the health and productivity of the livestock and poultry a strict surveillance, and regular monitoring of the important diseases of livestock and poultry required to be carried out.

INTRODUCTION

The Union Territory of the Andaman and Nicobar Islands, is located about 1,200 km away from the mainland India in Bay of Bengal, situated between 6° and 14° North Latitude and 92° and 94° East Longitude. Andaman group of islands located north of 10° north latitude while Nicobar group of islands located south of 10o north latitude. This archipelago of more than 572 islets and islands with 37 inhabited islands stretches over a length of more than 700 km from North to South. The topography of the islands is hilly with flora and fauna. The total land area of the emerald islands is 8,249 sq km out of which 86 % is covered with lush green tropical rain forests. These islands have a typical maritime climate and are endowed with both southwest and northeast monsoons with an average rainfall of 3,100 mm distributed over 8 months. The climate of the islands can be defined as humid, tropical coastal climate. Humidity ranges between 70% to 90% with a gentle breeze blowing at all times and temperature range of 18ºC - 35ºC. The local human population in these islands is about 3.80 lakhs (Livestock Census 2012) with nearly 55% population living in rural areas. In Andaman, livestock farming is considered to be a profitable complementary enterprise in agriculture and constitutes an important activity for accelerating the rural economy of the union territory (Sunder 2014). The livestock farming is done in the areas that have been cleared from the forest regions of the islands, which have dense vegetation growth of rain forest. The total percentage of lands that are used for livestock is small, yet in some areas of Andaman and Nicobar Islands, livestock thrives despite harsh conditions. Out of 37 islands, 12 islands have no livestock and another 4 islands have a population less than 200. The North, South, and Middle Andaman have major chunk of livestock in Andaman group of islands and Car Nicobar, Katchal, are the centers having more concentration of livestock in Nicobar group of islands. At the same time cattle, buffalo, goat, and poultry are the predominant livestock species in Andaman group of islands, whereas pig and goat are dominant in Nicobar Islands (Kundu *et al.* 2010). As per livestock census 2012, the cattle, buffalo, goat, pig, and poultry population in the islands is 45,625, 7,863, 65,324, 35,921 and 116,5363 respectively. There is a big gap between requirement and availability of milk, meat, and green fodder.

The Andaman & Nicobar Islands is free from most of the infectious and contagious diseases of livestock. Except for foot and mouth diseases (FMD) and swine fever outbreak, no other outbreak of infectious or contagious disease has been reported so far in livestock of this territory (Sunder *et al.* 2005; Sunder, 2014; Sunder *et al.* 2018; Rai *et al.* 1992). The diseases were introduced long back, probably at the time of settlement when the settlers brought the animals from mainland. In this process, due to unawareness, they introduced most of the diseases. Since then, the diseases have been spread throughout the Islands (Sunder 2014). The disease trend shows that there is sharp increase in the incidence in the recent past mainly after the post tsunami period of 2004. The import of relief materials, unwanted/unauthorized entry of materials, meat, live animals, and products are the major source of the pathogens and diseases into the islands. The island ecosystem is a closed system, and there is very less movement of the materials from island to mainland. Further, the islands are scattered into small islands with the natural protection of large sea barrier which prohibits the transboundary movement of animals. No incidence and outbreak of anthrax, black quarter, enterotoxaemia, haemorrahgic septicaemia, brucellosis, *bluetongue*, IBR, rabies, *pestis des*

petits ruminants, babesiosis, theileriosis, and trypanosomiasis were reported. However, the cases of contagious ecthyma, leptospirosis, fascioliasis, ascariasis, amphistomiasis, strongyloids, stephanofilariasis, mastitis, toxocara, diphylobothridium, paraamphistome, monizia, salmonellosis, erlichiosis, goat pox, coccidia, strongyle, and trichurius were reported from the livestock and poultry (Rai *et al.* 1992; Rai *et al.* 2010; Sunder *et al.* 2005, Sunder 2014; Sunder *et al.* 2018; Varma *et al.* 2000; Varma *et al.* 2001).

Sero-prevalence studies showed that the livestock and poultry of this islands are prevalent to infectious bovine rhinotrcheatis (IBR), brucellosis, PPR, *bluetongue*, trypanosomaisis (Jeyakumar *et al.* 2002; Sunder *et al.* 2005, Rai *et al.* 1992; Shome *et al.* 1998; ICAR-NIVEDI report 2017-18). However, the studies suggested that that the island is free from avian influenza, brucellosis and *bluetongue* in cattle. The outbreak of FMD has been reported in the livestock in the year 2005 and reemergence was reported after a gap of 13 years i.e. in 2018. This outbreak of FMD was due to serotype O which was reported in 2005 also (Hemadri *et al.* 2005; Sunder *et al.* 2008). The prevalence of parasitic diseases has been reported to be very high and have been studied in details (Agrawal *et al.* 2003; Jeyakumar *et al.* 2009; Sunder 2014). Every year almost 25,000 to 27,000 cases of parasitic diseases have been reported from the livestock of these islands (Annual Report ICAR-NIVEDI 2017-18). In the present study, the active and passive disease data has been collected for the last 7 years and cyclical and secular trend analysis has been done to know the trend of the livestock disease pattern in the A & N Islands.

MATERIALS AND METHODS

The information on the monthly disease incidence and prevalence were collected for the last 7 years from the Department of Animal Husbandry & Veterinary Services, A & N Administration. The active data were collected based on the sero-monitoring of the blood samples collected from livestock and poultry periodically. Sera samples were collected from cattle and goats from different parts of the A & N Islands. Sera samples were subjected to serological studies for presence of antibodies for *Brucella abortus*, *Leptospria spp*, *infectious bovine rhinotracheatis* (IBR), *bluetongue*, *peste des petitsruminant virus* (PPRV), swine fever,and tuberculosis. The antibodies against brucella were detected by using protein G based indirect ELISA developed by ICAR-NIVEDI, India. The leptospirosis was detected by using microscopic agglutination test (MAT) as per the standard method. The PPR antibodies were detected by using indirect ELISA method. The bovine tuberculosis was detected by using rapid test card method based on fast immune-chromatography technique which detected the TB antibodies in bovine serum. The IBR was detected by using kit developed by ICAR-NIVEDI based on biotin-avidin ELISA. Datas were analyzed and the sero-surveillance graph on secular trend of diseases was prepared.

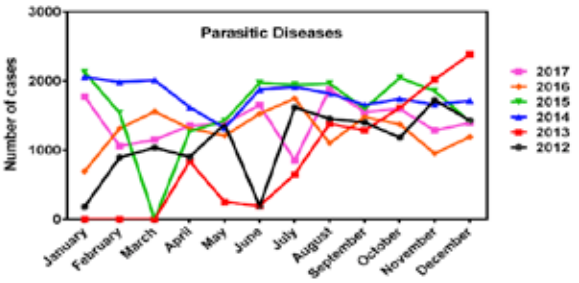
Temporal Analysis

The temporal analysis was done based on the number of cases reported over different period of time. The datas were collected on monthly basis from all the districts of A & N Islands. The data were distributed into two seasons, i.e., dry period (November to April) and rainy period (May to October). The data were analysed using Poisson regression model and graphed.

Spatial Analysis

The data were collected on the basis of geographical distribution and analysed. The data were distributed into North & Middle Andaman, South Andaman, and the Nicobar district and correlated with the weather parameters and number of concentration of livestock population. Patial (District wise) and temporal (year wise) data on the cases of different diseases were collected. This data was transformed into 'rate' as the number of cases per 1,000 animals. This data was plotted on the Geographic Information System (GIS) platform using QGIS software, version 2.18. Maps were created using by dividing the no. of cases into 4-5

Figure 1. *Month wise average number of total parasitic diseases during the period 2012-2017.*



categories, which are represented by different colors for easy and better understanding.

RESULTS

Temporal Trend

The average number of cases per month of the parasitic diseases is displayed in the Figure 1. The temporal trend of parasitic diseases revealed that highest prevalence was reported during the rainy season, i.e., from May – October (Figure 2). However, prevalence was reported throughout the year, irrespective of dry or monsoon season. Peak prevalence of 10.83% was reported in June. The number of cases of fascioliasis on a monthly average was 236 (cattle), 47 (buffaloes), and 136 (caprine). The overall percent prevalence was found to be high in buffalo (7.2%) followed by cattle (4.3%). The trend of facioliasis occurrence was observed erratic during the period among all species. The average number of amphistomiasis cases per month was 89 in cattle, 12 in buffalo and 256 in caprine. The percent prevalence was found to be high in caprine (6.7%), followed by buffalo (1.9%). The frequency trend of amphistomiasis was fluctuated highly among all hosts throughout the period. The average numbers of recorded cases for ascariasis per month were 132 in cattle, 29 in buffalo, and 216 in caprine. The percent prevalence was found to be high in caprine (5.7%) followed by buffalo (4.4%).

Parasitic cases were more in caprine (48%), followed by cattle (41%) and buffaloe (7%). However, in proportion to their respective population, the prevalence was more in buffalo, followed by cattle. Occurrence of parasitic diseases was comparatively more in South Andaman (74%), followed by North & Middle Andaman (21%) and Nicobar (5%), which was calculated on the basis of proportion of livestock population density and distribution. The spatial distribution of parasitic diseases revealed that more prevalence was reported from South Andaman for ascariasis, amphistomiasis and strongyloids. However, fascioliasis was more prevalent in North & Middle Andaman district. The prevalence of all the parasitic infestation was low in Nicobar district, which might be due to the lower number of livestock population. The cluster analysis indicated that the maximum number of parasitic cases have been reported from the South Andaman where the concentration of livestock population of the livestock is more. The prevalence rate per 1,000 livestock population in different district of A &

Figure 2. *Temporal distribution and trend of important parasitic diseases during 2012-2017*

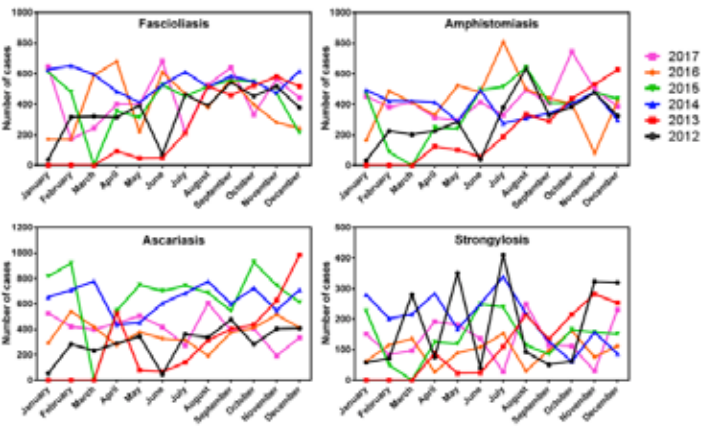


Figure 3. *A & N Islands map showing the spatial distribution of parasitic diseases*

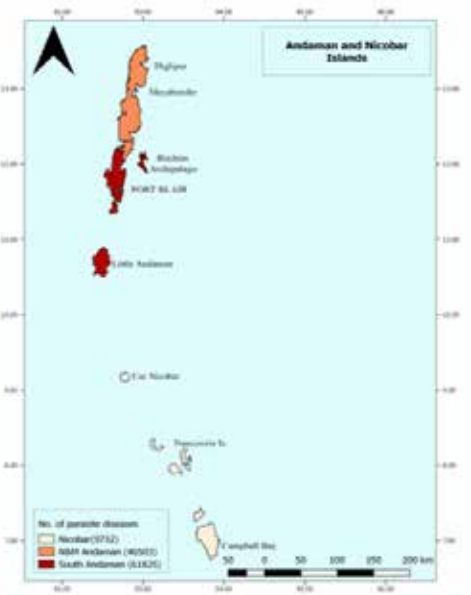
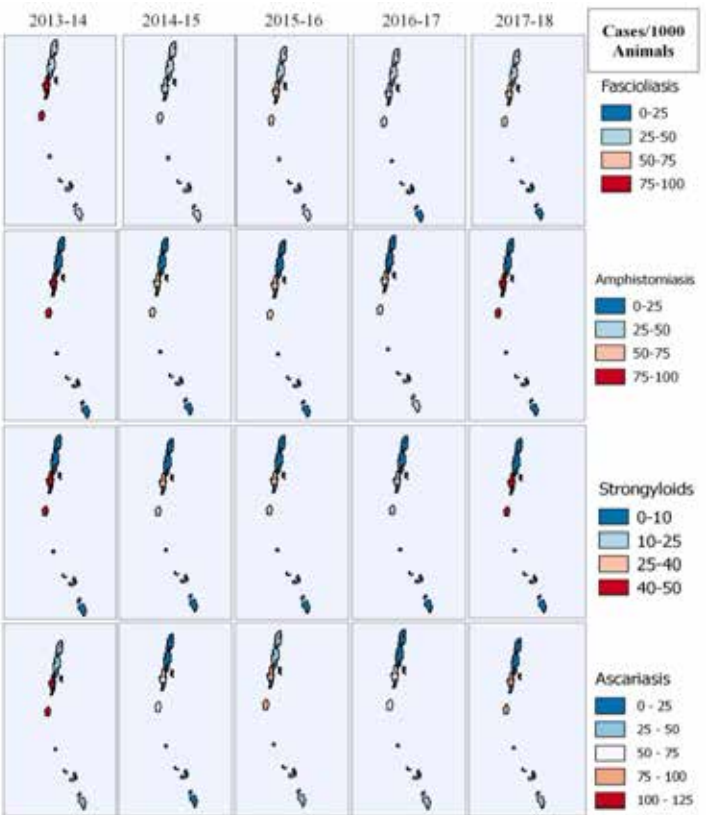
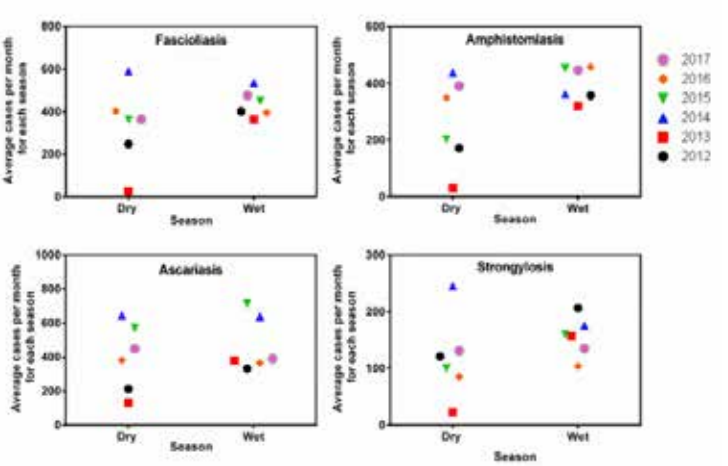


Figure 4. *Spatial distribution of important parasitic cases per 1000 animals in A & N Islands*



N Islands was more in South Andaman (274.1) followed by Nicobar district (91.5), and North and Middle Andaman district (85.0) respectively (Figure 3, 4).

Figure 5. *Secular trend of parasitic cases during wet and dry season*



Secular Trend

During the wet season, average fascioliasis and ascariasis cases per month range from 400 to 600 year long, whereas it ranges from 100 to 400 during dry season. Similarly, average amphistomiasis cases per month ranges from 400 to 500 during wet season, while it ranges from 100 to 400 during dry season. Among the major parasitic cases, strongyloides cases are reported less ranging from 100 to 200 during wet season and dry season. Among the major parasitic cases, ascariasis has significant ($p \leq 0.05$ correlation with temperature and highly significant correlation ($p \leq 0.01$) with rainfall (Figure 5 & Table 1).

Trend of Bacterial and Viral Diseases

The trend of bacterial and viral diseases is shown in Figure 6. The trend of the leptospirosis shows that there is constant rise in the percent prevalence of leptospirosis. The prevalence rate of leptospira ranged from 0.9 % (*L. autumnalais*) to as high as 15.7% (*L. icterohaemorrhagiae*). Among the serogroup, which showed highest prevalence rate were *L. hebdomadis* (14.1 %), followed by *L. icterohaemorrhagiae* (12.9%), *L. lai* like (11.9%), *L. australis* (10.8%), *L. grippotyphosa* (5.6%), *L. pomona* (4.9%), *L. hardjo* (4.7%), *L. canicola* (3.5%), *L.pyrogenes* (2.8%), and *L.autumnalis* (0.5%) respectively. The finding of the present study indicate that leptospirosis is highly prevalent among the cattle of South Andaman. The high prevalence rate is due to the topography of the islands, high rainfall pattern, and stagnation of water in low lying areas.

Table 1. *Pearson correlation (PC) between weather parameters with parasitic disease cases*

Parasitic diseases	Temperature	Rainfall
Fascioliasis	0.125	0.146
Amphistomiasis	0.128	0.137
Ascariasis	0.341*	0.980**
Strongylosis	0.101	-0.0479

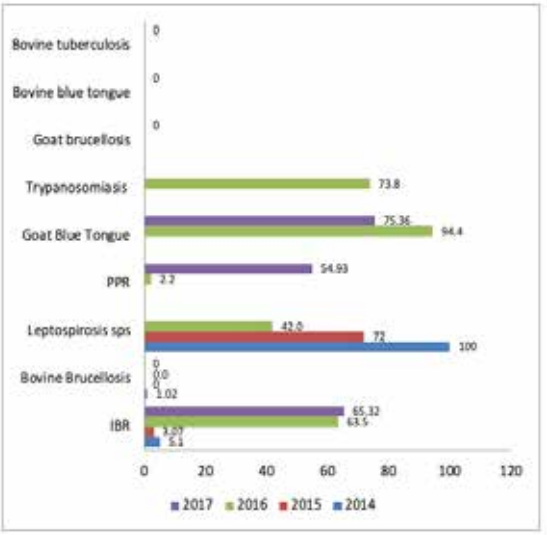
*The values represent Correlation Coefficient (r) * denotes p≤0.05, ** denotes p≤0.01*

The trend of the seroprevalence of brucellosis was found to be declining. The seroprevalence of *Brucella abortus* was 12.84% during the period 2000 to 2014. Car Nicobar tehsil was observed to be free from brucellosis and in Nancowry tehsil only 3.88% sero positivity was observed. However, during the last 4 years, the sero-prevalence of brucellosis in cattle was found to be nil. Similarly, the sero-prevalence of *Br. melitneis* was also found to be nil. The seroprevalence of brucellosis decreased from 1.02% in 2014 to 0 % in 2018. Sero-screening for *infectious bovine rhinotracheatis* revealed the prevalence of 25.06 during the period from 2014 to 2018. No clinical cases of IBR and brucellosis were reported from this island during the year. The prevalence of IBR

decreased from 5.1 % in 2014 to 3.07% in 2015 then again increased to 55.3% 2016-17, and again came down to 12.51%. The prevalence of IBR in the North and Middle Andaman district has been found to be more than the South Andaman district.

The sero-prevalence of peste des petites virus (PPR) in goat has been detected for the first time (3.36%) in the goat. The recent report of 63.29% in 2018-19 indicates the emergence of PPR in goats. However, no clinical cases are reported. Similarly a very high sero-prevalence (76.36%) of *bluetongue* was reported in goats during the year 2018. Based on the sero-positivity and presence of *bluetongue* virus antigens in the samples, it is inferred that the *bluetongue* virus is in circulation in the goat population of South Andaman. The high prevalence PPR and BT in goats is considered to be an alarming situation. As this Islands have never reported the incidence and prevalence of these diseases earlier.

Figure 6. *Secular trend of bacterial and viral diseases in A & N islands*



DISCUSSION

Parasitic diseases are considered as the major problems that lower the production as well as the health of the livestock. Both ecto-parasites and endoparasites are responsible for heavy economic losses directly as well as indirectly. In Andaman and Nicobar islands, the incidence of both ecto and endoparasites are very high. As per the disease trend, 99% of the total disease/case reported is due to parasitic infestation,followed by bacterial disease and viral disease (1%). Seasonal trends revealed that occurrence of parasitic cases increased during monsoon season. The trend of facioliasis occurrence was observed erratic during the period among all species. Similar results were also reported by Kuchai *et al.* 2011, who reported the high prevalence during rainy season (45.19%) as opposed to the dry season (24.4 %). Rehman *et al.* (2009) also reported the maximum prevalence of parasitic diseases during the month from January to December. The high incidence of fascioliasis during the rainy season could be attributed to the fact that the snail population (Lymnae snail, the intermediate host) during this period is generally very high (Talukdar *et al.* 2010; Abraham and Jude 2014).

Out of total parasitic cases, 47%, 44%, and 9% cases occurred in cattle, buffalo, and caprine respectively. Percent prevalence of parasitic cases was low in caprine (14%), followed by cattle (21%) and buffalo (24%). The overall percent prevalence of fascioliasis was found to be high in buffalo (0.8%), followed by cattle (0.5%). High prevalence in buffalo was also reported by Gupta *et al.* 2008 and Garg *et al.* 2009. The percent prevalence of amphistomiasis was found to be 0.3 % in cattle, 0.2% in buffalo, and 0.4% in goat.

The peak occurrence of amphistomiasis was reported in buffalo in June 2015. Seventy three percent of amphstomiasis cases were recorded in South Andaman, while 25% of cases occurred in N&M Andaman and 2% in Nicobar Islands. The district wise prevalence of the parasitic diseases in A & N islands over different period of time is given in Figures 3 & 4. The present

report is in agreement with the findings of other researchers who also reported the high incidence and prevalence of amphisotmiasis during the rainy season compared to dry season (Azam *et al.* 2011; Singh*et al.* 2009).

The climatic condition of the islands with high rainfall and high humidity favours the prevalence of parasitic and gastrointestinal parasitic diseases in cattle (Pal *et al.* 1987). The incidence of fascioliasis, ascariasis, amphistomiasis, strongylosis, taeniasis, trichuris, and schistosomiasis were also reported in the cattle (Sunder *et al.* 2005). The trend of parasitic diseases indicated that the total number of cases has been reduced. There has been decrease of 20.3 % of total number of cases reported during the year 2016-17 compared to 2015-16. However, there has been no change with respect to the occurrence during the monsoon season. A total of 79,951 number of cases were reported during the last 5 years, i.e., 2012-2016. Of these, the highest number of cases were reported due to Ascariasis (34.02%), followed by fascioliasis (29.6%), amphistomiasis (25.5%), and strongyloids (10.9%). Survey results indicated mostly parasitic diseases as major disease associated with livestock of these islands (Jeyakumar *et al.* 2009, Sunder 2014.). As per the seasonal and temporal trend, cases of parasitic diseases increase during the rainy season from July to December months. However, the total number of parasitic cases has come down. It was due to increased awareness programmes and regular deworming for parasitic diseases.

The analysis of the secular trend of the parasitic disease indicated that during wet season, average fascioliasis and ascariasis cases per month ranged from 400 to 600 in the all years, whereas it ranges from 100 to 400 during dry season. Similarly average amphistomiasis cases per month ranges from 400 to 500 during wet season while, it ranges from 100 to 400 during dry season. Among the major parasitic cases, strongyloides fewer cases are reported, ranging from 100 to 200 during wet season and dry season. Among the major parasitic cases, ascariasis has significant ($p \leq 0.05$ correlation with temperature and highly significant correlation ($p \leq 0.01$) with rainfall. The high prevalence of parasitic diseases in the South Andaman could be attributed to the fact that the population of livestock mainly cattle, buffalo, and goats are more concentrated in this parts of the islands. The spatial trend of the parasitic diseases indicated that South Andaman district reported maximum number of parasitic cases (67%), followed by North & Middle Andaman (28%) and Nicobar district (5%). The trend of the total parasitic diseases has also been declined during the last 7 years.However, there is no change with respect to the percent prevalence of parasitic diseases.

The sero-prevalence of brucellosis and leptospirois are reported in cattle and goat, which may pose a serious threat to humans due to its zoonotic importance. Brucellosis has been reported to be the first among all the zoonotic diseases with total number of more than 5,00,000 cases annually (Pappas *et al.* 2006). The disease has been reported in more than 86 countries worldwide, and cause serious infection in livestock as well as in human (Olsen and Palmer 2014; Khan and Zahoor 2018). In India, brucellosis has been reported from all parts of the country (Singh et al.2015; Renukaradhya *et al.* 2002). As per the estimate, the annual economic loss due to brucellosis in India is approximately Rupees 350 million (Gogoi *et al.* 2017). *Brucella abortus* and *Br melitnesis* has been reported to cause zoonotic infection in humans (Mathur and Amarnath 2008).

In the present, study the sero-prevalence of brucellosis in cattle has been found to be in decreasing trend. During the last 4 years the sero-prevalence has been found to be nil. In other parts of the country various reports suggests the sero-prevalence rate of 17.5 % to 63.9 % (Gogoi *et al.* 2017). The progress report from 2017-18 of ICAR-NIVEDI indicates that the sero-prevalence of *Br melitensis* antibodies across the various

states as 5.8%. The trend indicates the sero-prevalence of 0 to 18.7%.

In Andaman, before the tsunami, i.e., 2004, the sero-prevalence of brucellosis was found to be almost 16 % (Shome *et al.* 1999).However, Sunder *et al.* 2005 recorded high sero-prevalence of *Br abortus* in cattle and *Br melitensis* in goats. No vaccine has been given to livestock of this islands, and the present trend of decline of brucellosis sero-prevalence may be due to fact that the animals are never exposed to the vaccines and the prevalence of antibodies are less. However, there is no clinical case of brucellosis has been reported from this islands during last decade.

Leptospirosis is a zoonotic disease and is very much prevalent in this island. The first report of leptospirosis has been reported from Andaman Islands in 1929 (Taylor and Goyle 1931). Since then, the disease has been reported from other parts of this islands as well as from other parts of the country (Srivastava *et al.* 1983; Srivastava and Kumar 2003, Srivastava 2008; Ratnam 1994; WHO 2000; Sehgal 2000; Vijyachari *et al.* 2008. The leptospirosis trend has been found to be a serious concern in this island. The trend of leptospirosis in cattle decreased during the last 15 years, i.e, 34 % in 2013-14 to 11.6 % in 2015-16. Similarly the trend in goat also decreased from 29 % to 26.6%. However, during the last 3 years, the sero-prevalence of leptospirois has been found to be in the range of 0.65% to 19.61 % (Sunder *et al.* 2018). The high prevalence of leptospirosis is an alarming situation for the island, as the trend has been found to be in the almost same during the last two decades. Being the endemic zone for leptospirosis, high sero-prevalence has also been reported by many workers (Sehegal, 2000; Sharma *et al.* 2006; Jeyakumar *et al.* 2002).

The recent trend of PPR and BT in Andaman Islands is a serious concern as these diseases have never been reported from these lands. The high sero-prevalence of BT and PPR is mainly reported from the goats of South Andamans. In a recent study, the high sero-prevalence of *bluetongue* virus antibodies (78.49%) and presence of *bluetongue* virus antigens (72.5%) was detected (Sophia et. al. 2019). The trend shows that during the year 2016- 2018, there has been sharp increase in the sero-prevalence rate of PPR from 3.15 to 63.29 % in goats. The sero-prevalence of PPR shows that the goats of North & Middle Andaman and South Andaman districts were found to be positive. However, none of the animals of the Nicobar were found to be positive. This might be due to the geographical isolation and separation of the Nicobar district separated by 10o channel and also the restricted movement of the animals to Nicobar district. However, no clinical case of the PPR has been reported from the islands.

In India, the disease has been first reported in 1987.After that, it has been spread to other parts of the country, and now the disease is endemic in India (Mahajan *et al.* 2017). Similar to the trend in Andaman, Hota *et al.* 2018 also reported high sero-prevalence of PPR in goat (51.21%). The high sero-prevalence in the islands shows that the virus is in circulation, and the goats are in the carrier states without showing any clinical symptoms of the disease. The prevalence of PPR in the other coastal parts of the India also suggests the possible entry of the pathogens though fomites, infected materials, water, etc In India the estimated loss due to PPR is 5477.48 crores (Singh *et al.* 2014). The report suggests that there is no carrier state in case of PPR.However, in the present study, the goats have been found to have sero-prevalence without any clinical symptoms.

The trend of BT also shows very high sero-prevalence rate in goat. During the last 2 years the trend has been increased to 76.36%,with a very high sero-positivity. Unlike the other diseases, the sero-prevalence of BT has been found to be equally high in the Nicobar district. However, the rate of sero-prevalence was lower (41.1%). The high concentration of the sero-positivity of BT in the South Andaman district might

be due to the fact that the movement of the animals in the South Andaman and North and Middle Andaman is quite high, which correlates with the concentration of population density in this region.

In India the disease is mainly endemic in southern parts mainly Tamil Nadu, Kerala, Karnataka, Andhra Pradesh (Mann *et al.* 2017). The disease is transmitted through culicoides vector. Similar to our study a high prevalence of 75 % was detected in Haryana (Sushila *et al.* 2017). Studies indicated that the sero-prevalence ranged from 31- 50 % in goats.A very high prevalence of BT in goats of Andaman is a serious concern as this disease is reported for the first time in Andaman.

CONCLUSION

In conclusion, the overall disease scenario of the islands livestock indicated that the island is no more a disease free zone, as in the recent years, the incidences of FMD, Contagious ecthyma, high sero-prevalence of BT, PPR, IBR, has been reported from livestock of this islands. The disease profile of A&N Islands is getting transformed. The diseases are being introduced when Islanders bring the animals from mainland due to unawareness the changing climatic scenario of A&N Islands, which has caused the emergence of livestock diseases in these virgin disease free Islands. The diseases have been at present have spread throughout the Islands. During the last decade, the tourist inflow has been increased to manifold, and presently almost every year approximately 4.50 lakhs tourists visits to this islands. The carrying capacity of the island as such is not sufficient to meet out the demand of meat, milk, and other requirements of the resident population, as well as the floating population. The recent emergence of the transboundary diseases such as BT and PPR in this islands are the examples of such pressure on the requirements of the meat and other commodity.

The present studies on the trend of diseases in livestock indicate the need to formulate strategies for effective control and prevention to make the island disease free. Regular surveillance and monitoring of the diseases are of paramount importance due to its geographical isolation and location of the Islands from mainland, India. An understanding is crucial for the development and implementation of effective diagnosis, treatment, control, and management practices. This requires sound epidemiological data of the prevailing diseases. These epidemiological data will be the base on which control programmes can be planned by Department of Animal Husbandry. Continuous monitoring and surveillance is a need of the hour to formulate control programmes for the emergence of various livestock diseases at appropriate time in these pristine Islands.

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