SYMPOSIUM ON

BUFFALO RESEARCH IN SRI LANKA

7-10 March 1989

Kandy, Sri Lanka

PROGRAMME AND ABSTRACTS

Sponsored by

THE SWEDISH AGENCY FOR RESEARCH COOPERATION WITH DEVELOPING COUNTRIES

Organized by

THE NATURAL RESOURCES, ENERGY & SCIENCE AUTHORITY OF SRI LANKA

Director General
Natural Resources, Energy &
Science Authority of Sri Lanka
47/5, Maitland Place, Colombo 7.

P R O G R A M M E

Tuesday 7th March '89

8.30 - 9.30	-	Registration
9.30 - 10.30	-	OPENING SESSION
		Chairman - Dr R.P. Jayewardene Director-General, NARESA
9.30	-	Lighting of Traditional Oil Lamp
9.30 - 9.40	-	Welcome address by Chairman
		Dr R.P. Jayewardene
9.40 - 9.50	-	Address by H.E. Olof Milton Charge d' Affairs Swedish Embassy in Sri Lanka
9.50 - 10.00	-	Address by Chief Guest H.E. E.L.B. Hurulle, Governor Central Provincial Council
10.00 - 10.20	-	SAREC BUFFALO RESEARCH PROGRAMME; AN OVERVIEW
		Dr S.S.E. Ranawana, Chairman Research & Advisory Committee of the NARESA/SAREC Buffalo Research Programme
10.20 - 11.00	-	**T E A**
11.00 - 12.15	-	**SESSION I - Buffalo Development Programmes**
		Chairman - Dr A. Bandaranayake
11.00 - 11.20	-	ACTIVITIES OF THE DEPARTMENT OF ANIMAL PRODUCTION & HEALTH IN THE FIELD OF BUFFALO DEVELOPMENT
		Dr D.H.A. Subasinghe

11.20 - 11.40	-	ACTIVITIES OF THE NATIONAL LIVESTOCK DEVELOPMENT BOARD IN THE FIELD OF BUFFALO DEVELOPMENT Mr P.B. Molligoda
11.40 - 12.00	-	ACTIVITIES OF THE MAHAWELI AUTHORITY OF SRI LANKA IN THE FIELD OF BUFFALO DEVELOPMENT Dr H.P. Premasiri
12.00 - 12.30	-	Discussion
12.30 - 14.00	-	**L U N C H**
14.00 - 14.15	-	**SESSION II** Chairman - Prof. A.S.B. Rajaguru
14.00 - 14.20	-	FEEDING STRATEGIES IN THE UTILIZATION OF CELLULOSIC WASTES AND OTHER INDUSTRIAL BY-PRODUCTS FOR MEAT AND MILK PRODUCTION IN BUFFALOES S.K. Ranjhan, Philippine Council for Agriculture and Resources Research & Development
14.20 - 14.40	-	A SURVEY TO ASCERTAIN THE PRESENT STATUS OF INDIGENOUS BUFFALOES IN SMALL FARMS IN SRI LANKA E.F.A. Jalatge, D.M. Parañagama, S. de S. Alwis Seneviratne, M.D. Jeyaruban Veterinary Research Institute
14.40 - 15.00	-	MEASUREMENT OF DRAUGHT CAPABILITIES OF BUFFALOES UNDER CONTROLLED CONDITIONS S.K. Seneviratne & A.S. Bulumulla University of Peradeniya

15.00 - 15.30 - Discussion

15.30 - 15.45 - **T E A**

15.45 - 16.45 - **SESSION III - Socio Economic Aspects**

Chairman - Dr A.S. Abeyratne

15.45 - 16.05 - MICROECONOMICS OF RURAL CATTLE AND BUFFALO PRODUCTION, A COMPARATIVE STUDY IN THE KURUNEGALA DISTRICT

C. Bogahawatte &
D.P. Athulathmudali
University of Peradeniya

16.05 - 16.25 - TRENDS IN THE UTILIZATION OF ANIMAL DRAUGHT IN MAHAWELI SYSTEM C

W.I. Siriweera &
P.V.J. Jayesekara

University of Peradeniya

16.25 - 17.00 - Discussion

Wednesday 8th March '89

9.00 - 10.30 - **SESSION IV - Reproduction**

Chairperson - Prof. Viranjanie Gunawardene

9.00 - 9.20 - Invited Paper

9.20 - 9.40 - CLINICAL AND ENDROCRINOLOGICAL STUDIES AND POSTPARTUM OVARIAN ACTIVITY IN INDIGENOUS BUFFALOES OF SRI LANKA

V. Mohan, V.Y. Kuruwita, B.M.O.A. Perera & H. Abegunawardene

University of Peradeniya

9.40 - 10.00 - PHYSIOLOGICAL AND ENDOCRINOLOGICAL CHANGES AT THE TIME OF PUBERTY IN MALE BUFFALO CALVES

V.Y. Kuruwita & A.M. Karunaratne

University of Peradeniya

10.00 - 10.30 - Discussion

10.30 - 11.00 - **T E A**

11.00 - 12.00 - **SESSION IV (Contd)**

Chairman - Dr S. Kumaraswamy

11.00 - 11.20 - EFFECT OF SEASON AND HORMONAL TREATMENT ON FERTILITY IN MURRAH BUFFALOES REARED UNDER DRY ZONE CONDITIONS

A.R. Mohamed, R. Sivakanesan & R. Rajamahendran

Veterinary Research Institute, University of Peradeniya

11.20 - 11.40 - STUDIES ON THE CYTOGENETICS OF INDIGENOUS BUFFALOES

Preeni Abeynayake, I. Gustavsson, V.Y. Kuruwita, B.M.A.O. Perera & N.K. Arambepola

University of Peradeniya

11.40 - 12.00	-	Discussion
12.00 - 13.30	-	**L U N C H**
13.30 - 15.30	-	**SESSION V - Nutrition/Physiology**
		Chairman - Dr J.A. de S. Siriwardene,
13.30 - 13.50	-	EFFECTS OF EXOGENOUS UREA INFUSION ON GLUCOSE METABOLISM IN ACUTE HEAT STRESSED SWAMP BUFFALOES (BABALUS BUBALIS)
		Nárongsak Chaiybutr
		Chulalongkorn University, Thailand
13.50 - 14.10	-	THE MINERAL NUTRITIONAL STATUS OF INDIGENOUS BUFFALOES
		S.S.E. Ranawana, A.A.J. Rajaratne Kumari Gunaratne & E.M.C. Ekanayake,
		Veterinary Research Institute
14.10 - 14.30	-	A STUDY ON COMPOSITION AND PHYSICO CHEMICAL PROPERTIES OF INDIGENOUS BUFFALO MILK
		Chandra Kodikara, Ajantha Horadagoda and S.S.E. Ranawana
		University of Peradeniya
14.30 - 15.00	-	Discussion
15.00 - 15.30	-	**T E A**

15.30 - 17.30 - Chairman - Dr S.S.E. Ranawana

Working Session with the Project Applicants on the 1989/1990 Programme

Thursday 9th March '89

9.00 - 10.45 - **SESSION VI - Diseases**

Chairman - Dr S.B. Dhanapala

9.00 - 9.20 - Invited paper - Dr John Roberts

9.20 - 9.40 - IMMUNOLOGICAL RESPONSE OF BUFFALOES, RABBITS, AND MICE TO TOXOCARA VITULORUM INFECTION

S.T. Fernando, V.K. Gunawardene R.P.V.J. Rajapaksa, P. Amarasinghe, B.T. Samarasinghe & M.A. Masood

University of Peradeniya

9.40 - 10.00 - STUDIES ON SOME PROTOZOAN INFECTIONS OF BUFFALOES IN SRI LANKA

D.J. Weilgama, M. Bahirathan & P.S.G. Perera

10.00 - 10.20 - A STUDY OF THE INCIDENCE AND DISTRIBUTION OF BRUCELLOSIS AND LEPTOSPIROSIS IN BUFFALOES IN SRI LANKA

G.S. Pieris & S.B. Karunasena

Veterinary Research Institute

10.20 - 10.45	-	Discussion
10.45 - 11.00	-	**T E A**
11.00 - 12.40	-	**SESSION VI (Contd)**
		Chairman - Dr. D.H.A. Subasinghe
11.00 - 11.20	-	SIGNIFICANCE OF CARRIER ANIMAL IN THE EPIDEMIOLOGY OF HAEMORRHAGIC SEPTICAEMIA
		M.C.L. de Alwis, Thula G. Wijewardene, Anoma I.U. Gomis & A. Vipulasiri
		Veterinary Research Institute
11.20 - 11.40	-	EXPERIMENTAL HAEMMORRHAGIC SEPTICAEMIA; CLINICAL, BACTERIOLOGICAL AND PATHOLOGICAL FINDINGS
		N.U. Horadagoda, M.C.L. de Alwis, Anoma I.U. Gomis, S.C. Molligoda & A Vipulasiri
		Veterinary Research Institute/ University of Peradeniya
11.40 - 12.00	-	PREVALANCE OF MASTITIS AMONG BUFFALOES IN SRI LANKA AND ANTIBIOTIC SENSITIVITY PATTERNS OF BACTERIAL PATHOGENS
		D.D. Wanasinghe, H.A. Maithreepala & M. Somaratne
		Veterinary Research Institute

12.00 - 12.20	-	ROTAVIRUS ASSOCIATED DIARRHOEA IN BUFFALO CALVES
		N.P. Sunil Chandra & S. Mahalingam
		University of Peradeniya
12.20 - 12.40	-	Discussion
12.40 - 14.00	-	L U N C H
14.00 - 16.00	-	**REVIEW SESSION**
		Chairman - Dr C.G. Thornstrom, SAREC
14.00 - 14.30	-	REVIEW OF NARESA/SAREC BUFFALO RESEARCH PROGRAMME 1983-1988
		Prof. M.R. Jainudeen
		Agriculture University of Malaysia
14.30 - 14.40	-	DEVELOPMENT OF THE SAREC/NARESA/ NLDB BUFFALO RESEARCH FARM, NARANGALLA
		D.H.A. Subasinghe,
		Dept. of Animal Production and Health
14.40 - 14.50	-	REPORT ON THE MAWELA BUFFALO RESEARCH FARM
		V.Y. Kuruwita
		University of Peradeniya
14.50 - 15.00	-	Discussion
15.00 - 16.00	-	Closing Session

THE SAREC/NARESA BUFFALO RESEARCH PROGRAMME

Water buffaloes have played an essential role in the cultivation of the Asian staple, rice, for over 5000 years. Despite their importance to the rural economy, little scientific attention was paid to them till very recently. Several research projects in the South and South East Asian region, started during the last 10 years, have begun to generate the information needed for scientific breeding, feeding and disease control in this species.

In Sri Lanka, serious research on the water buffalo began with a workshop sponsored by the Swedish Agency for Research Cooperation with Developing Countries (SAREC), held at Peradeniya in 1980. All scientists who had any information on buffaloes presented papers at this meeting. In addition others who were involved in buffalo production participated in the discusssions. The papers and discussions was later published together with research recommendations as a SAREC report (R3, 1982). This document has since proved to be of great value both in Sri Lanka and elsewhere in the region.

Based on the recommendations, a research programme was commenced in 1983. This programme was generously funded by SAREC and managed by the Natural Resources, Energy and Science Authority (NARESA) of Sri Lanka. Initially, 19 individual projects which planned to study aspects of the physiology, reproduction, nutrition and diseases of indigenous buffaloes were approved. Subsequently, inclusion of projects on Socio-economic aspects made it a well-balanced multidiciplinary programme. SAREC also supported the development of two research farms, a small farm at the University of Peradeniya and a large farm in cooperation with the National Livestock Development Kuliyapitiya.

The research objectives identified by the 1980 workshop could not be fully realised due to several constraints. Chief among these were, lack of suitably qualified scientists in all fields, the departure of many scientists from the island and the disturbed ocnditions in the country during the last two years. Nevertheless, a large and valuable body of information has been generated resulting already in nearly 70 scientific publications. Several research students were trained, techniques established and the research infrastructure built

up, during these 5 years. A monograph designed to disseminate the information gathered to Agriculture teachers, high school students and extension workers has been prepared.

The programme is now 5 years old and most projects have either been completed or are nearing completion. It was felt that this phase of the programme should be reviewed before the next phase is commenced. Accordingly, the idea of this symposium was born. This symposium, therefore, has as its objectives.

1. to present the results of research on the water buffalo since 1980
2. to review this phase of the programme
3. to invite selected scientists from the region to present papers on buffalo research
4. to involve research workers, invited scientists, policy makers and others involved in buffalo development in a discussion of research results
5. To publish the proceedings.

The first session will be devoted to a description of buffalo development activities by the 3 state agéncies involved.

SAREC has indicated their willingness to support a further phase of the programme. For this future programme a total of 34 projects have been tentatively approved. A session of the symposium has been assigned for a discussion of the future research programme. The main thrust of the next phase will be to develop suitable and economically viable buffalo farming systems using the knowledge gained in the first phase. It is hoped, by the end of this phase of the programme, that buffalo productivity will be stimulated and that farmers will be directly benefited - which is the ultimate aim of all agrucultural research.

ACTIVITIES OF THE NATIONAL LIVESTOCK DEVELOPMENT BOARD IN THE FIELD OF BUFFALO DEVELOPMENT

L.E.A. Fonseka

NLDB, 40, Nawala Road, Narahenpita, Colombo 5

Sri Lanka has a land area of 64,640 sq. km with a human population of 17 million. It is stated that 95% cattle and buffaloes are kept by small-farmers with a farm size of less than 1 hectare and by landless estate labourers. The buffalo population of Sri lanka is approximately 879,200 of which 1% are exotic breeds and their crosses. Of the 25 districts in the country, Kurunegala has the highest buffalo population with 190,000 animals. In the dry zone, the buffalo population is scattered, and in these regions they are used mainly for paddy cultivation. Research indicates that a great potential exists for improving buffaloes in this area.

Intensification of the Dairy Industry is an integral component of Agricultural Development currently underway in Sri Lanka. These programmes concentrate

on improving the existing buffalo herds and the diversification of agricultural activities. The main constraint for buffalo development is the high calf mortality which is more than 10% in all districts and over 35% in the main buffalo districts. At present the total domestic milk production is estimated at 400,000 litres of which 185,000 litres per day are from buffaloes. At present the buffalo cow produces 0.65 to 1.8 litres per day with a calving interval of about 15 to 16 months. The age at first calving is in the region of 40 to 46 months. Other constraints include the non-availability of quality stock, poor fodder and pasture supply, inaduquate training and extension services, high cost of formula feed and low farm-gate price for milk. The indigenous buffalo cow has a low genetic potential for milk production. The aim of the NLDB programme, therefore, is to produce an animal which will give a higher yield and at the same time be suitable for draught.

The NLDB plays a very important role in this respect since adequate resources are available at the Board's disposal to pursue this objective. Of the 11 farms

in the Coconut Triangle, five carry 1500 buffaloes, mainly of the Surti breed with a limited number of upgraded Surti crosses. The average Surti animal weighs around 350-450 kg with a 305 day milk production of 1500 litres.

The Board at present possesses the largest herd of Surti buffaloes in the island. As a policy, all excess quality bull calves suitable for breeding are offered to farmers and different development projects in the country. At the Board's farms, efficient buffalo husbandry practices are being carried out, directed at reducing calf mortality which is a serious problem among buffalo herds in Sri Lanka. It is our experience that even calves that survive diseases do not show the optimum growth rate and produce according to their genetic potential. Mortality rates are increased due to improper husbandry practices and one of our aims is to achieve efficient calf management systems to overcome high mortality.

At present, we are happy to mention that calf mortality at Board farms is less than 5%, as due attention had been given to proper feeding and

management with special emphasis on disease prevention, particularly parasitic infestation, during the early part of life. Calf pens have been provided with adequate ventilation and cover and during hot weather adequate wallowing time has been allowed to prevent skin problems. Bulls and buffalo cows are provided with quality fodder and pasture together with feed, water and mineral mixtures. Feeding of Urea-treated straw to buffaloes showed promising results at the trials conducted at the Board's Melsiripura farm during the period 1981 to 1983. Strengthening of the Extension Services further to disseminate the results of the straw treatment trials should stimulate the farmers to initiate the urea treatment of straw in the Kurunegala district. In 1981, buffalo stud bull services in night paddocks were commenced in the Kurunegala district to upgrade the indigenous buffalo herds to Surti and Murrah breeds. During 1982, under the Intergrated Agricultural Development Project buffalo bull calves of Surti and Murrah breeds from the Board's farms and the Department of Animal Production & Health farms were issued to farmers. During the same period, buffalo stud bull centres were also developed to give further

impetus for the buffalo development programme.

During 1984, a comprehensive programme to improve buffaloes in the district was commenced. The Buffalo Development Project proposal was based on the idea of improving local buffaloes through a closely monitored cross-breeding programme in order to increase the milk production and draught power availability with minimum dependence on concentrate feeding. The Buffalo Development work was directed in this district towards the following objectives -

1. Issue of animals unsuitable for breeding for draught.
2. Salvaging of surplus buffaloes
3. Organization of Dairy Producers Association and farmer training centres.

The farmers were given practical training in veterinary first aid, castration, conservation and management of pastures and other associated management activities. From the initiation of the kurunegala District Buffalo Development Programme approximately 2000 buffalo bull calves had been issued.

The success of this programme depends on a simultaneous castration programme of scrub bulls. The Kurunegala buffalo Development Programme is continuing to progress and increasing numbers of upgraded calves are born every year.

A SURVEY TO ASCERTAIN THE PRESENT STATUS OF INDIGENOUS BUFFALOES ON SMALL FARMS IN SRI LANKA

E.F.A. Jalatge, D.M. Paranagame, S. de Alwis Seneviratne and M.G. Jeyaruban

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Randomly selected buffalo herds from four agro-climatic zones of Sri Lanka were monitored at regular intervals to ascettain the conditions that prevail on small farms. The herd compositon varied in different zones depending on factors such as the length of the cultivation season, availability of feed and the mortality patterns.

The demand for draught power was acute in all the zones studied. The extent to which buffaloes were worked differed with local factors such as the duration of the cultivation season, number of buffaloes available and the feasibility of buffaloes to be driven as herds from place to place.

Farmers in all zones paid little attention to the nutritional requirements of buffaloes. Only 10% of the buffaloes were milked mainly due to the poor lactation yield of the Lanka Buffalo.

Calf mortality was high (average 36%) in all zones, the main causes being roundworm infestation and contagious diseases such as Haemorrhagic Septicaemia and Foot and Mouth diesase. Adult mortality was higher in the dry zone due to a heavy work load and the early impairment of food intake in adult animals due to wasting of teeth.

MICROECONOMICS OF RURAL CATTLE AND BUFFALO PRODUCTION : A COMPARATIVE STUDY IN THE KURUNEGALA DISTRICT OF SRI LANKA

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b. Natural Resources, Energy & Science Authority of Sri Lanka

In recent times the rising demand for milk, meat and energy has resulted in a growing interest in cattle and buffalo production in Sri Lanka. The resurgence of the importance of these animals as a source of milk, meat and draught power has necessitated greater efforts for harnessing this valuable resource. In general, the standard of cattle and buffalo management practices of the rural farmers and relatively poor and this has been partly responsible for the low efficiency of meat and milk production and slow growth rates of the cattle and buffalo population. The objective of this study was to compare the economics of cattle

and buffalo production under rural farming conditions in the Kurunegala district. The field survey carried out in the three Assistant Government Agent's divisions of Kuliyapitiya, Polgahawela and Nikeweratiya using a structured questionnaire with 210 randomly selected cattle and or buffalo farmers in 1987.

The mean herd size of the indigenous cattle and buffalo herds were 9.3 and 16.7 respectively. The sex distribution of the buffalo herd was nearly 1:1. The proportion of females were higher in the cattle herd. Free grazing of animals was common. The mean milk yield of cattle and buffalo herds was found to be 1.53 and 2.01 litre/cow/day respectively. The draught cattle and buffaloes were used for farm work 50-65 days/year. The draught capabilities of these animals were similar. The draught/milk and draught cattle farmers recorded a net herd loss from their enterprises. The dual purpose and milk buffalo herd recorded a net herd profit. In mixed herds, only the dual purpose herd recorded a similar profit. These results indicated the apparent diseconomy of rearing indigenous cattle in the study area.

The estimated production function results showed the importance of concentrate feeding, management

practices such as housing in improving milk productivity of cattle and buffalo herds. The extent of highland and lowland owned, farm gate price of milk, distance of milk transport and availability of credit facilities were some of the major factors affecting animal ownership. The demand for feeds is mainly affected by the availability of concentrates in the farm locality, the farm gate price of milk as compared to the price of feeds and the extent of common property resources in the vicinity of the farms. The demand for animal farm power depended on the daily working hours of the animals, cost difference between tractors and animal power, and the type of soil.

TRENDS IN THE UTILIZATION OF ANIMAL DRAUGHT - MAHAWELI SYSTEM 'C'

W.I. Siriweera and P.V.J. Jayasekera

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Three settlements Hebarawa, Viranagama and Galporuyaya in the Mahaweli System C and a traditional village - Udattawa - outside the Mahaweli system were selected for a field study. The first three study locations were observed as organic units representative of the heterogeneity of system C settlements. For quantitative data, questionnaires were administered at different stages of the cultivation cycle both in Maha and Yala 1986/87. Qualitative data such as the attitude of settlers towards different modes of farm power were obtained through informal interviews, free inter-communication and participant observation methods.

The results obtained from the study confirm that large scale foreign technologies such as tractorisation have a limited role to play in farming in new settlements. Apart from high monetary costs and

operational difficulties faced by the farmers, social costs such as concentration of wealth in the hands of a few and displacement of family labour are some of the problems associated with the use, particularly, of four-wheel tractors. But at the same time the study highlights some of the practical problems faced by farmers in utilizing animal draught especially that of buffaloes.

While buffaloes take pride of place in traditional villages, in Mahaweli system C a new pattern has emerged where the use of neat cattle in field preparation activities is predominant. Even in instances where settlers own both buffaloes and neat cattle the preference is for neat cattle. This development is due to several factors. The most important being that the settler could own and rear a small herd of neat cattle in the homestead of half an acre of land allocated to him whereas buffalo herding requires more extensive grazing and wallowing facilities. In planning Mahaweli C settlement scheme sufficient attention has not been paid to these vital requirements in small peasant farming. Besides, neat cattle could be managed easily in paddy fields and the labour requirement is also relatively less. Another

important factor is that unlike in India and Pakistan buffalo dairy industry has not developed as opposed to that of neat cattle. As there is no prohibition on slaughter for meat there is also a ready market for neat cattle. On top of all these, incentives and advise provided to farmers to keep neat cattle, particularly upgraded varieties are greater than those given for buffalo keeping. These practical considerations have given rise to a situation where neat cattle has become the farmers predominant choice in field preparation in the system C. On the other hand the study reveals that in threshing operations even in small paddy plots of 2½ acres or less, mechanization in the form of four wheel-tractor has come to stay.

The findings of the study highlight the following points.

a. In dry-zone small-farms, utilization of animal draught in the form of both buffaloes and neat cattle should be encouraged for agriculture to be economically viable.

b. In future settlement planning, adequate provision should be made for grazing and wallowing of animals.

c. Experiments on supplementary animal feed should be continued with much greater vigour.

d. Support for tractorization in colonization schemes under facilities for credit purchase should be gradually discontinued.

e. Farmers should be induced to build up their own herds through low interest credit facilities.

f. More government support be given to both buffalo and neat cattle dairy industry by providing necessary infrastructural facilities.

g. Simple and inexpensive technologies should be introduced for cultivation operations other than ploughing, in order to minimize costs, which on the present level of inputs make small farming virtually uneconomic.

CLINICAL AND HORMONAL STUDIES ON POSTPARTUM OVARIAN ACTIVITY OF INDIGENOUS BUFFALOES

V.Mohan [a], V.Y. Kuruwita [b], B.M.O.A. Perera [c] and H. Abeygunawardene [b]

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b. Dept. of Veterinary Clinical Studies, University of Peradeniya
c. International Atomic Energy Agency, Vienna, Austria

Three experiments were conducted to determine the following :

1. reason(s) for the differences in fertility in different locations
2. endocrinological changes during the postpartum (PP) period and
3. effect of suckling on resumption of ovarian activity in Lankan buffaloes

First, sixteen buffalo cows from a 'low fertility' area and a 'high fertility' area (n=8) were brought to a different environment and maintained over a period of 5 years. Postpartum ovarian activity was monitored by clinical and hormonal methods.

Results showed that there were no significant differences in fertility indices between those two groups. Calvings were distributed throughout the year and mean calving interval was similar to what was reported for this area.

Second, the endocrinological changes during PP period were monitored in 14 buffalo cows. On days 7,14,21 and 28 postpartum, sequential blood samples were collected at 15 min. intervals for 8 hours preceding intravenous administration of 2 injections of 12.5 ng GnRH 2 hours apart, which was followed by further 4 hours of blood sampling at the same frequency. Plasma LH concentrations were measured by a heterologus RIA (detection limit 0.45 ng/ml). The LH concentrations remained lower than 0.45 ng/ml and no pulses were observed in these animals.

Third, 12 buffalo cows at calving were assigned either to restricted suckling (Rs. n=7) or a adlibitum suckling (AS, n=5) group. On days 30,45, 60 and 90 PP blood sampling and GnRH administration were performed as in experiment 2. Postpartum ovarian activity was monitored by clinical and hormonal methods. Eighty six percent of the animals in RS group resumed ovarian activity by day 90 PP as opposed by 20 percent in AS group. Mean LH

concentrations in RS group were greater (P 0.05) than that of AS group (1.4 vs. 0.7 ng/ml) on day 30 but similar to that of RS on days 45 and 60 PP. The response to the GnRH as measured by mean LH, maximal LH response and area under LH response curve was also greater (P<0.05) in the RS group than that of AS group on day 30 but similar to that of AS group on days 45 and 60 PP. Animals in RS group resumed the pulsatile LH secretion earlier than (P<0.05) the animals in AS group.

These results suggest that the differences in fertility in Lanka buffaloes in different locations may be due to effects of environment and management on the resumption of PP ovarian activity. Further, suckling appears to prolong the postpartum anestrous period and this may be by delaying the resumption of pulsatile LH secretion postpartum.

PHYSIOLOGICAL AND ENDOCRINOLOGICAL CHANGES ASSOCIATED WITH PUBERTY IN CROSS-BRED (MURRAH X LANKA) BUFFALO MALES

V.V. Kuruwita [a], *A.M. Karunaratne* [a] *and B.M.O.A. Perera* [b]

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b. *International Atomic Energy Agency Vienna, Austria*

Eight cross-bred (Murrah X Lanka) male calves were used to study the development of physiological and endocrinological parameters during puberty. The calves were reared under identical management systems. Physiological measurements such as body weight, height, chest girth, width of testis, epididymides and scrotal circumference were recorded at monthly intervals. Blood samples were collected by jugular venipuncture every month for determining longitudinal hormone secretory patterns. The longitudinal hormonal data were further supplemented by performing short profiles for four hours at 15 minutes intervals at the ages of 6,12,15,17, and 19 months. The changes in the functional capacity of

the pituitary and testis were determined by administering a constant dose of GnRH (0.5 ug/kg) in the short profile sampling regime. Castrations were done at the ages of 12,15,17 and 19 months and samples to testis and epididymides were taken for histological studies.

The height, body weight, chest girth, scrotal circumference, testicular diameter and eqididymal width were positively correlated with age (r = +0.93, +0.97, + 0.83,+0.93,+0.82 and+0.89 respectively). A transient rise in mean plasma testosterone concentration was detected between 5-6 months, and 12 months. Plasma testosterone concentration at 90 minutes post-GnRH injection was 0.013 ng/ml, 0.32 ng/ml, 0.73 ng/ml and 0.31 ng/ml at 6,12,15, and 17 months of age. Normal spermatozoa appeared in the seminiferous tubules at the age of 17 months.

CYTOGENETIC STUDIES ON LANKA BUFFALOES

Preeni Abeynayake, I. Gustavsson, V.Y. Kuruwita
B.M.O.A. Perera and Niromi Arambepola

Faculty of Veterinary Medicine,
University of Peradeniya

The species Bubalus bubalis has a rather rare cytogenetic status as it includes two cytotypes differing in their habitat. The River type (2n = 50) which prefers clear water for wallowing is found in India and adjacent regions. In contrast, the Swamp type (2n = 48) which wallows in muddy water is indigenous to South East Asia and China.

The indigenous buffalo of Sri Lanka is an exception in that it is reported to have a chromosomal constitution of 2n = 50 although it resembles swamp type in appearance and behaviour. This project was initiated to resolve the currently controversial nature in the taxonomy of both domesticated and wild buffaloes native to Sri Lanka.

For chromosomal analysis, jugular blood was aspectically collected into heparinized vacutainers. Lymphocytes were cultured using the microculture technique.

Samples analysed to date from three Districts in the country all showed a diploid chromosome number of 50. Of these the first four pairs of chromosomes are distinctly submetacentric while the fifth pair is small and metacentric. The remaining autosomes are acrocentric. In the female (XX) the largest pair of acrocentrics are sex chromosomes while in the male (XY) the largest and smallest acrocentrics are the X and Y chromosomes respectively.

Based on chromatid arm-ratios, chromosome size and banding patterns it is now reported that the major difference in the Swamp karyotype is located in the largest pair of metacentric chromosomes. This chromosome pair has resulted from a telomere-centromere tandem fusion between chromosome 4p and 9 of river karyotype thereby reducing the 2n = 50 constitution to 2n = 48. In the case of crossbreds (2n = 49) one member each of chromosome 4 and 9 fuse to produce a single large metacentric chromosome.

More samples from domestic buffaloes in other Districts of Sri Lanka and from wild buffaloes will be analysed in order to confirm the findings discussed above.

EFFECTS OF EXOGENOUS UREA INFUSION ON GLUCOSE METABOLISM IN ACUTE HEAT STRESSED SWAMP BUFFALOES

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The effects of intravenous urea infusion on glucose turnover, glucose carbon recycling, glucose pool size and glucose clearance were studied in buffaloes kept in either normal ambient temperature or acute heat exposure.

Heat stressed animals showed increases in glucose turnover rate, plasma glucose concentration and glucose clearance but decreased glucose carbon recycling.

A marked reduction of glucose turnover and glucose clearance associated with increased plasma glucose concentration in heat stressed animals after urea infusion reflects under utilization of this compound.

Mechanisms involved in glucose metabolism during urea infusion in buffaloes are discussed.

THE MINERAL NUTRITIONAL STATUS OF INDIGENOUS BUFFALOES IN SRI LANKA

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Indigenous buffaloes in Sri Lanka graze on natural pastures and are rarely supplemented. Under such conditions, inadequacies and deficiencies of essential mineral elements can be expected. Indeed, clinical observations and responses to supplementation with minerals indicated that one or more minerals were inadequate in the buffalo population. This paper records two systematic studies designed to investigate the mineral status of buffaloes. The first study was a survey of Lanka buffaloes on small farms. The second examined seasonal effects on Lanka and Indian river type buffaloes kept under typical dry-zone conditions.

The mineral status was determined by measuring Ca, Mg, P, Cu, Zn, and Fe in blood. The activity in blood of the enzyme glutathione peroxidase was used to assess the Se status. Several other blood values

were measured in order to correlate with the mineral status as well as to establish norms for the breed. Several grasses and other forages commonly fed to ruminants in Sri Lanka were analysed for minerals to give an indication of the availability of minerals to grazing ruminants. Altogether 338 indigenous buffaloes from 12 locations covering all the agro ecological zones in which buffaloes are found, were sampled. The sample included 58 calves (less than 12m), 56 Juveniles (12-24m) and 224 adults. The adults comprised 60 males and 164 females of which 40 were lactating.

Calves had significantly lower values for haemoglobin; haematocrit and total protein than adults. Values for mean corpuscular volume indicated that buffaloes have larger erythrocytes than cattle. The range of values for plasma Ca, Mg, P, Cu, Zn, Fe and ceruloplasmin fell within those reported or for cattle. Sodium and potassium values, however, were lower in buffaloes.

Subnormal plasma values were found in the following proportions of buffaloes; Ca-10%, P-29%, Cu-21%, Zn-12% and Se-8%. Subnormal values for P, Cu and Se were more frequent in adult females. Forty percent of adult females and 42% of lactating females had

plasma P less than 4.5mg/dl. For plasma Cu, 25% of adult females and 45% of those in lactation had deficient levels. 15% of adult females appeared deficient in Selenium with a further 22% being marginal. Over 2/3rd of all buffaloes had plasma Na less than 140 M/1. Iron and Mg were normal in all animals.

In a separate study, 5 each of 2 year old Lanka, Murrah and Surti heifers were grazed on natural pasture without any supplementation for a period of 13 months; the feeding and management were similar to those practised by farmers in the Dry Zone of Sri Lanka. The mineral status was monitored at approximately monthly intervals. Haematological values remained within normal limits throughout the year. Ca levels were below 8mg/dl in 15 (8%) of the samples and were lowest during the rainy period. Plasma P was subnormal in 14%, but no relationship with season was evident. Plasma Cu levels were below 50ug/dl in all animals in all seasons. Zn was low at the end of the dry period and normal at other times. The Se status was generally satisfactory and was highest during the monsoon. There were no significant differences between breeds in any of these measurements.

Grasses and forages analysed were generally inadequate in Na, P, Cu, Zn, marginal in Ca and adequate or even excessive in K, Fe and Mn. Se, Co and I were not measured.

Results suggest that inadequacies of the minerals P, Na, Cu, Zn and Se are widespread among indigenous buffaloes. Adult females are chiefly affected no doubt due to the added nutritional burden of pregnancy and lactation. The availability and status can change with season although the factors involved are as yet not clear. Indigenous buffaloes can be expected to benefit by supplementation. A relatively cheap and easily prepared mineral brick that uses cement as a hardener and contains the minerals likely to be deficient has been developed. Preliminary field tests of this brick with buffaloes has given promising results.

STUDY ON THE COMPOSITION AND PHYSICO-CHEMICAL PROPERTIES OF INDIGENOUS BUFFALO MILK

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The chemical composition of buffalo milk can vary with the breed. Information on the composition and properties of milk of the indigenous buffalo in Sri Lanka is not available. In the present study, therefore, the composition, physico-chemical properties, variation of composition due to different factors and the yield of the indigenous buffalo milk were investigated.

Five hundred and fifty six milk samples from 46 indigenous buffaloes in the Puttalam District and six from Mawela SAREC Farm were collected fortnightly over a complete lactation. The samples were analysed for fat by the Gerber method, protein by the Kjeldahl method, lactose by estimation of glucose released by hydrolysis of lactose, total solids by evaporation at 100°C and sodium and potassium using a flame photometer. Physico-chemical properties such as

specific gravity, pH, ethanol stability and percentage acidity of the samples were also measured. The milk yield of suckled cows in early lactation was estimated by measuring the daily turnover of body water in the calves.

The mean percentage by weight of fat, casein, total protein, lactose, solids-non-fat, ash and total solids were 7.2, 4.6, 5.16, 4.24, 9.49, 0.095 and 16.69 respectively. The mean sodium, potassium, phosphorus and phosphate in milk were 612 mg/litre, 931 mg/litre, 1.5 g/litre and 1 g/litre respectively. The mean specific gravity of milk, percentage acidity and pH were 1.0333, 0.202 and 6.42 respectively. The ethanol stability of 96.8% of the samples were found to be less than 68 percent. The changes in milk composition due to other factors include an increase in fat percentage with advancing lactation and a 2 percent increase in fat in the evening milk. Estimates of the yield of milk of 12 suckled indigenous buffaloes gave an average value of 3.58 litres/day for the first month.

The results of this study indicate that the composition of indigenous buffalo in Sri Lanka is similar to that of the Indian Murrah buffalo which is a medium testing breed. The variation in

composition due to the factors under study show a similar pattern to that of neat cattle milk. The range of variation of the indigenous buffalo milk found in this study is of value in establishing norms. The results of the ethanol stability test, which is a routine test performed at milk collecting centres, show that the percentage volume of alcohol used in quality control of cow's milk cannot be used in estimating the quality of buffalo milk.

IMMUNOLOGICAL RESPONSE OF BUFFALOES RABBITS AND MICE TO TOXOCARA VITULORUM INFECTION

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Toxocara vitulorum is an important helminth parasite of buffaloes in Sri Lanka and the Far East and has also been recorded in some European countries. The infection with adult worms occurs in calves about 3-4 weeks of birth. The helminth is a proflic egg layer. During the patent period of this infection, faecal T. vitulorum egg counts per gramme of faeces (epg) ranged from 500-208,000. The eggs which reach the infective stage are ingested by older animals (buffaloes & cattle) of all ages. Thus an infection of this nature stimulates an antibody response in the hosts.

Therefore, from the beginning of this study the immune response of pregnant buffalo cows and of the calves from birth were studied. Serum samples from

animals were examined for antibodies by the enzyme linked immunosorbent assay (ELISA), gel-diffusion precipitin (GPT) and the in vitro larval precipitin tests (IVP). The ELISA trends were compared with the epg. The clinical signs at different stages of the infection were noted. Manifestations of resistance to experimental infections in naturally infected calves after they had cleansed themselves of the natural infections were studied. Hypersensitivity type of reinfections (if any) shown in animals at different stages of the infection were examined. The immunoglobulin classes of buffalo sera and the distribution of antibodies in them were studied.

In 17 calves born to the cows reared under field conditions, the infection became patent by days 18-24 of birth. Thereafter the worm egg counts in the faeces reached their peak in 4-6 weeks of patency. During the peak period of epg, six calves died with severe diarrhoea while 7 showed diarrhoea followed by constipation about 3 days after the commencement of diarrhoea. Four animals did not show any clinical signs. The faecal work egg counts in the animals which were able to resist the pathological effects of a natural infection showed a sudden fall and during this period several live works were eliminated in the faeces. Thus a strong

'self-cure' reaction was noted.

On experimental infection, animals showed an increase in the antibody response as evident from the ELISA reactions. The reinfection is followed also by a marked precipitin (GPT & IVP) response in most calves. Three calves however succumbed to the reinfections and in those animals, the reinfection developed to the third and fourth stages. In the resistant animals, the reinfective larvae migrated to the liver and lungs by seven days after reinfection, but did not develop beyond the infective stage.

Thus, in the resistant animals killed days 7, 14, 35, & 42 after reinfection the larvae progressively disappeared from these organs. Studies on migratory behaviour of the parasite on buffaloes are warranted to elucidate its biology.

There was an inverse relationship between antibody response determined by the ELISA and the worm egg counts in the faeces. A very high level of reaginic antibodies were detected by the passive cutaneous anaphylactic (PCA) tests with the sera collected during the patent period of the infection. The PCA antibodies were of the homocytotropic type. There was less PCA activity in the sera during the post

patent phase.

Sera at different stages of the infection were fractionated by Sephadex G-2000 filteration and DEAE-A-25 'Sephadex' ion exchange chromatography. It was found that PCA activity of homocytotropic type is mostly confined to the IgG2. An analysis of the antigen was carried out by fractionation in 'Sephadex' G-150 filtration and the fractions showing maximum antigenicity were isolated. The adult work antigen in particular showed a marked acetyl cholin esterase activity. It was possible to neutralize this enzyme activity with sera of calves which resisted the infection. Further studies are being carried out to determine the nature of the antibody response. In particular it is proposed to determine if the antibody response is of an antienzymatic type.

A marked antibody response (Gel precipitin and ELISA) was noted in pregnant and non-pregnant cows but these animals did not show a patent infection as judged by the presence of Toxocara vitulorum eggs in the faeces. This abtibody response showed a considerable depression at the time of parturition and for a short period after calving, T.vitulorum larvae in the 3rd stage were excreted in the milk. Studies on in vitro

action of immune serum from cows on the larvae excreted with the milk did not show any visible effect whereas the second-stage larvae developed oral, excretory and body precipitates in the presence of immune serum. Transmission of maternal antibodies through the colostrum to the calves was demonstrated. These antibodies did not have any noticeable effect on the development of a naturally acquired infection. Colostrum on the other hand showed a marked protective action in mice infected with embroyonated eggs.

It was possible to compare protectivity of infective larval extracts, excretions and secretions (ES) and immunization schedules with sublethal doses of embryonated eggs in mice. The ES antigens induced a very strong protection even superior to that induced by a sublethal infection. The ES antigens also stimulated a marked lymphocyte transformation.

STUDIES ON SOME PROTOZOAN INFECTIONS OF BUFFALOES IN SRI LANKA

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In the tropics, parasites can cause large economic losses to the animal industry. Buffaloes, however, are less affected by both internal and external parasites. The present study was undertaken to obtain data on the Protozoan infections affecting buffaloes. These observations were carried out in large state farms and in small farmer units in the mid-country and in the dry zone. Blood smears, sera, lymph node biopsy smears and faecal samples were collected from buffaloes for microscopy and serology. Two haemoprotozoa, Theileria and Trypanasoma, and one intestinal protozoan Eimeria, were detected in buffaloes.

Two species of Theileri namely T. annulata and Theileria sp. and two species of Trypanasomes, T. theileri and T.evansi were identified. Theileria

was the most common parasites seen, with the infection rates been 100% in certain areas. Ticks belonging to seven species, namely, Boophilus annulatus (sensu lato), Haemaphysalis bispinosa, Rhipicephalus sanguineus, - R. haemaphysaloides, Amblyomma integrum; Hyalomma marginatum and Hy-brevipunctata were collected off buffaloes, in this survey. Of these only H. bispinosa was found to transmit Theileria Sp under experimental conditions. The other ticks tested, R.haemaphysaloides and Hy:m;isaaci, failed to transmit the disease. Buffalo calves infected with Theileria SP. organisms showed a transient rise in temperature with enlarged lymph nodes. There was marked anaemia and an increase in leucocytes, mainly lymphocytes, and a corresponding decrease in neutrophils. Two species of trypanosomes namely T.evansi and T. theileri were encountered in the survey. T.theileri is non pathogenic whilst T.evensi is known to cause abortions and even death among buffaloes. In the present study T.evansi organisms were detected in only a few smears but fifty percent of buffaloes sampled in the Dambulla region were positive for T.evansi on the indirect fluorescent antibody test.

Faecal samples examined from buffaloes revealed nine species of coccidia, namely, Eimeria subspherica, E. barreillyi, E. Zurnii, E. cylindrica, E. ellipsoidalis, E.bovis, E. canadensis, E. auburnensis and E. ankarensis. Clinical coccidiosis was common in calves raised under intensive systems of management. Coccidial oocysts could be detected in calves as young as 15 days. Diarrhoea was seen mainly in calves between 20 to 30 days of age, with oocyst counts of over 8×10^6 per gram of faeces. E. barreillyi and E. subspherica appeared early in life whilst other species of coccidia were encountered more frequently between the 40th and 130th day of age. E. barreillyi was the most important and the most numerous species in calves between 15 to 40 days of age.

A STUDY OF THE INCIDENCE AND DISTRIBUTION OF TWO DISEASES OF REPRODUCTION OF BUFFALOES IN SRI LANKA

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The objectives of the study were to determine whether the two diseases of reproduction, Brucellosis and Leptospirosis, were present in buffaloes in Sri Lanka and to what extent they were prevalent in the country. Samples were obtained from State Sector Buffalo Farms and Private Sector herds located in different areas of the country. Milk and serum samples were collected and serological tests were carried out for the detection of Brucellosis and Leptospirosis.

There was an incidence of brucellosis in 5 state farms and 10 Veterinary Surgeon ranges on the results obtained with the milk samples. Serum samples from aborted animals showed the presence of Brucella infection in 4 state farms and 8 veterinary surgeon ranges.

Leptospira antibody reactors were detected in 4 state farms and 4 veterinary surgeon ranges in serum from aborted animals. The distribution of Brucellosis in the country was mainly in the Eastern Province, North Central Province, North Western Province and the Hambantota district in the Southern Province. The presence of serological reactors to Leptospirosis indicated that abortion in buffalo cows in 4 farms and 4 veterinary surgeon ranges may have been due to Leptospirosis.

EXPERIMENTAL HAEMORRHAGIC SEPTICAEMIA: CLINICAL, BACTERIOLOGICAL AND PATHOLOGICAL FINDINGS

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Six non-immune Lanka buffalo calves (7-12m) were experimentally infected with Haemorrhagic Septicaemia (HS) by intranasal innoculation of a streptomycin-resistant strain of Pasteurella multocia type 6:B. Clinical examinations were performed and rectal temperatures were monitored weekly for 3 weeks prior to innoculation, daily for 7 days after innoculation (pi), and thereafter, every week for two weeks. On each occasion, nasopharyngeal swabs were examined, and blood samples collected for serology and bacterial culture.

Three of the infected animals died of HS and the others survived to become carriers. The clinical course varied from 48 to 110 hrs in the animals that succumbed to the infection. Rectal temperature increased to 104-106°F within 12-16 hrs of innoculation, and remained elevated until a few hours before death when they became subnormal (97-98°F). Respiratory distress was present; in the early phase it was associated with a clear, watery nasal discharge and as the disease progressed the secretion became whitish, opaque and mucoid. Other clinical signs included anorexia, lacrimation and excessive salivation.

At post-mortem gross pathologic changes consisted of a generalised congestion of the lungs with irregular consolidation of the anteroventral region. The pleura overlying the pneumonic lobes were prominent and roughened by gelatinous thickening. Interlobular septae were conspicuous. In the heart, extensive petechial and ecchymotic subepicardial haemorrhages were present, particularly, around the base.

Subendocardial haemorrhages were observed in both

ventricles. The pleural and pericardial cavities contained excessive straw coloured fluid with strands of fibrin. In the abdominal cavity, haemorrhages were noted in the abomasal and intestinal mucosae. Histologic examinations revealed an acute lobular fibrinopurulent bronchopneumonia with fibrinous pleuritis.

P. multocida was consistently recovered from the nasopharynx following inoculation. The organism was successively isolated from venous blood 24 hrs p.i., and from heart blood at necropsy.

In animals that survived, the duration of the clinical course varied from 72 to 120 hrs. The signs were essentially similar but less pronounced. Swelling of the submandibular and brisket region was observed in all animals. Two calves had a diarrhoea upto 72 hrs p.i. P. multocida was recovered from the nasopharynx only upto 36 hrs p.i. In one animal the organism was isolated from blood between 24-48 hrs p.i. All animals had rising haemagglutination titres to HS from day 5 p.i.

ROTAVIRUS ASSOCIATED DIARRHOEA IN BUFFALO CALVES

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Diarrhoeas are one of the more important causes of morbidity and motality in infants, calves and piglets. The buffalo calf is no exception. Amongst the viral aetiologies of diarrhoea, rotavirus are considered the most important. Apart from reports from India and Bulgaria no information was available on the association of rotaviruses with diarrhoea in buffalo calves.

Faecal samples collected from 150 buffalo calves, 1 to 150 days old, were examined for the presence of group A rotavirus antigen. 27.3 percent of these calves exhibited diarrhoea at the time of sampling. In another study, 146 single serum samples were collected from buffalo calves of the same age group as before located in four districts in Sri Lanka, and examined for antirotaviral antibodies.

The techniques used for antigen detection was the ELISA test and for antibodies, the blocking ELISA test. The criterion for positivity of these sera was the blocking effect, 50 percent of more, when tested at a single dilution of 1:20, against 8 units of viral antigen. Virus isolation was in MA 104 monolayer cell cultures, rolled at 37°.

Antigen was detected in 36.6 percent of diarrhoeic animals, and in 11.9 percent of non-diarrhoeic ones. The association between the presence of antigen, and diarrhoea was significant (P .001). In 63.4 percent of diarrhoeic calves, no ratavirus was detected, indicating that other enteropathogens may have been responsible.

Three buffalo rotavirus strains were isolated from five diarrhoeic animals. The incidence of positivity of sera having antibodies was between 33 to 100 percent (in the 1 to 90 days age group) in the different farms visited. Although these antibodies may have been of maternal origin, they reflect the widespread distribution of virus in the dams.

Maternally derived antirotaviral antibodies declined to negativity by the 33rd to 56th day. Virus excretion in infected calves occurred in spite of high circulating antibody. Virus excretion in infected calves occurred for not more than 7 days.

This establishes the presence of rotavirus in buffalo calves in Sri Lanka, and demonstrates its association with diarrhoea in these animals. The only earlier report of the isolation of buffalo rotavirus strains is from Bulgaria.

PERSISTENCE OF THE CARRIER STATUS IN HAEMORRHAGIC SEPTICAEMIA IN BUFFALOES

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Haemorrhagic septicaemia (HS) is a primary pasteurellosis caused in buffaloes and cattle, by specific serotypes of Pasteurella multocida. The disease in characterised by high case fatality, and is therefore of considerable economic importance in Asia. Earlier it was believed that in a given cattle and buffalo population, a small percentage of animals were 'carriers' of the causative organism, and that the organixm survived between outbreaks of the disease in such animals.. Epidemiological studies carried out in the field in herds of cattle and buffaloes located in HS endemic areas, appeared to indicate that a considerably larger proportion of animals than were hitherto known were carriers of the organixm, and that the organism was shed into the nasopharynx only by a few of these animals at more frequent intervals, over a longer period of

time was necessary to elucidate further the nature of the carrier status. Such investigations were not possible in the field.

In the present study, 'carrier' animals were produced by controlled exposure of buffalo calves to infection with a virulent streptomycin-resistant strain of the HS organism. The character of Streptomycin resistance served as a marker to trace the infecting organism.

Fifty seven buffaloes were subjected to direct experimental infection, or naturally exposed to infection by placing in contact with experimentally infected animals. Thirty two of these animals became immune carriers while among the others some developed clinical HS and died whilst a few showed no response at all. The animals that became immune carriers were monitored for their antibody status, and for the presence of the infecting organism in the nasopharynx for varying periods of time. Some animals were slaughtered and attempts were made to isolate the organism from other sites.

In most surviving animals, pasteurellae appeared

in the nesopharynx for short transient periods initially and disappeared thereafter. The organism reappeared intermittently, and the longest observed period of reappearance was 215 days after exposure. All animals showed rising antibody titres with a peak lasting for 150-180 days and declining thereafter. Slaughtered animals showed the presence of the organism in lymphoid tissue associated with the respiratory tract. The most consistent site of isolation was the tonsil from which tissue isolations were made from 20 out of 27 animals slaughtered. The longest period period after initial exposure, when isolations were made from the tonsils, was 229 days. The organism lodged in the tonsils was unaffected by antibacterial therapy using drugs to which the organism was sessitive in vitro.

It was concluded that in HS, a large proportion of animals that develop high antibody titres following non-fatal exposure to disease were also 'Carriers'. These animals displayed a 'Latent Carrier' state, when the organism persisted in the tonsil and intermittently an 'active carrier' state when the organism was shed into the

Nasopharynx. It appears that the tonsil serves as a long-term reservoir, where the organism survives in between outbreask of disease.

DEVELOPMENT OF THE SAREC-NARESA BUFFALO RESEARCH FARM-NARANGALLA

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At the inception of the SAREC-NARESA Cordinated Buffalo Research Project, a decision was taken to establish a central facility for research on indigenous buffaloes were conducted in herd belonging to small farm holdings. A coconut estate located in the intermediate zone of Sri Lanka about 60 miles from Kandy was selected for this purpose. This property is owned and managed by the National Livestock Development Board (NLDB)

and consists of 200 acres of coconut, a limited acerage of improved pasture and a small reservoir. A memorandum of understanding to establish and maintain a research facility on this property, signed by the Director General NARESA and the Chairman NLDB, became effective on September 30, 1985.

The planned research facility at its completion will consist of 200 acres of improved pasture, a circuit bungalow cum research laboratory, cattle shed, calving pens, cattle yeard, race, crush and hay barn. The construction work on the circuit bungalow cum research laboratory has been completed. We are grateful to the Australian Centre for International Agricultural Research (ACIAR) for generously donating the furniture and some equipment for this unit. A 'worm free' cattle shed was also constructed through ACIAR funding.

The farm now has 200 buffaloes (mature cows 80, stud bulls 2, bull calves 30, heifers 35, male calves 30 and female calves 30). It has so far provided facilities for 10 research projects. (reproduction 6, nutrition 3 and parasitology 1).

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