

**STUDIES ON REPRODUCTIVE TRAITS IN PANDHARPURI
BUFFALO UNDER FIELD CONDITION**

By

Sandeep Dharansing Valvi
(Reg. No.02058)

A Thesis submitted to the
MAHATMA PHULE KRISHI VIDYAPEETH,
RAHURI - 413 722, DIST.AHMEDNAGAR,
MAHARASHTRA, INDIA

in partial fulfilment of the requirements for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

ANIMAL SCIENCE

DEPARTMENT OF ANIMAL SCIENCE AND DAIRY SCIENCE

**POST GRADUATE INSTITUTE
MAHATMA PHULE KRISHI VIDYAPEETH,
RAHURI - 413 722**

2005

**STUDIES ON REPRODUCTIVE TRAITS IN PANDHARPURI
BUFFALO UNDER FIELD CONDITION**

By

Sandeep Dharansing Valvi

(Reg.No. 02058)

A Thesis submitted to the
MAHATMA PHULE KRISHI VIDYAPEETH,
RAHURI - 413 722, DIST. AHMEDNAGAR,
MAHARASHTRA, INDIA

in partial fulfilment of the requirements for the degree

of

MASTER OF SCIENCE (AGRICULTURE)


in

ANIMAL SCIENCE


APPROVED BY


Dr. B.R. Ulmek

(Chairman and Research Guide)


Dr. Y.C. Fulpagare
(Committee Member)


Dr. V.S. Lawar
(Committee Member)


Dr. B.P. Kaledhonkar
(Committee Member)

DEPARTMENT OF ANIMAL SCIENCE AND DAIRY SCIENCE

**POST GRADUATE INSTITUTE
MAHATMA PHULE KRISHI VIDYAPEETH,
RAHURI - 413 722**

2005

M.P.K.V. LIBRARY, RAHURI


ACC No. T-5781

Call No. 636 / VAL

CANDIDATE'S DECLARATION

*I hereby declare that this thesis or part
thereof has not been submitted
by me or other person to any
other University or Institute
for a Degree or
Diploma*

Place : MPKV, Rahuri


(S.D. Valvi)

Dated : 12 /05/2005.

Dr. B.R. Ulmek
Head,
Department of Animal Science
and Dairy Science,
Mahatma Phule Krishi Vidyapeeth,
Rahuri - 413 722, Dist. Ahmednagar
Maharashtra State (INDIA).


C E R T I F I C A T E

This is to certify that the thesis entitled, "**STUDIES ON REPRODUCTIVE TRAITS IN PANDHARPURI BUFFALO UNDER FIELD CONDITION**", submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra) in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **ANIMAL SCIENCE**, embodies the results of a piece of *bona fide* research work carried out by **SHRI. SANDEEP DHARANSING VALVI**, under my guidance and supervision and that no part of this thesis has been submitted for any other degree, diploma or publication.

The assistance and help received during the course of this investigation has been duly acknowledged.

Place : M.P.K.V., Rahuri

Dated : 13 / 05 / 2005.


(B.R. Ulmek)
Research Guide

Dr. S.H. Shinde

Associate Dean,
Post Graduate Institute,
Mahatma Phule Krishi Vidyapeeth,
Rahuri - 413 722, Dist. Ahmednagar
Maharashtra State (INDIA).

C E R T I F I C A T E

This is to certify that the thesis entitled, "**STUDIES ON REPRODUCTIVE TRAITS IN PANDHARPURI BUFFALO UNDER FIELD CONDITION**", submitted to the Faculty of Agriculture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra) in partial fulfilment of the requirements for the degree of **MASTER OF SCIENCE (AGRICULTURE)** in **ANIMAL SCIENCE**, embodies the results of a piece of *bona fide* research work carried out by **SHRI. SANDEEP DHARANSING VALVI**, under the guidance and supervision of **Dr. B.R. ULMEK**, Head, Department of Animal Science and Dairy Science, M.P.K.V., Rahuri and that no part of this thesis has been submitted for any other degree, diploma or publication.

Place : M.P.K.V.,Rahuri


(S.H. Shinde)

Dated : 30/06 /2005

ACKNOWLEDGEMENTS

The culmination of research work is a Milestone in the life of any student with research guide patronage. I avail this golden opportunity to express sincere and humble indebtedness and deep sense of gratitude towards Dr. B.R. Ulmek, Head, Department of Animal Science and Dairy Science, M.P.K.V., Rahuri. Research Guide and Chairman of my advisory committee, Whose unquestioned mastery on the subject, talented and versatile advice, scholastic guidance, profound interest in research, inspiring discussion throughout the course of my post graduate studies given me this unique experience of planning, conducting and presenting the research.

It is my proud privilege to record my sincere thanks to the members of advisory committee Dr. Y.G. Fulpagare, Associate Professor, Dr. V.S. Lawar, Assistant Professor, Department of Animal Science and Dairy Science and Dr. D.P. Kaledhonkar, Assistant Professor, Department of Statistics, M.P.K.V., Rahuri for giving helpful suggestions in preparing the manuscript.

I extend my sincere thanks to Dr. D.N. Bhosale, Professor, A.P. Fernandes, Assistant Professor, Dr. U.Y. Bhoite, Associate Professor, Prof. H.S. Yadav, Associate Professor and Dr. D.K. Deokar, Jr. Res. Assistant Department of Animal Science and Dairy Science, M.P.K.V., Rahuri for their valuable help, timely suggestions and cooperation during the course of this investigation.

I am also thankful to staff member of Goat Farm for assisting me in carrying out the research work.

The enthusiastic, cheerful and selfless encouragement of my dear friends through both the bright and dark phases of my work has been invaluable to me. Though inadequate, I would like to thank Ravindra, Sagar, Sandeep, Shashi, Sheetal, Vaiju, Sharad, Ramu, Dadu, Neetin, Manish, Prashant, Gulab, Kundan, Ganesh, Prakash, Madhuri and Rupali for their valuable help whenever I needed.

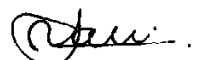
I also express my sincere thanks to ICAR, New Delhi for utilization of research data generated under Ad-hoc Project on Survey of Pandharpuri buffaloes.

Last but never the least I am very much thankful to Shri. Vishwanath Kadam, 'Suyog Computers' Farm Quarter, M.P.K.V., Rahuri for neat, accurate and timely typing of this manuscript.

It would not have been possible for me to reach this destination without the love and blessings of my family members and relatives. The whole credit of this thesis goes to my beloved parents Papa and Aai, brother Yuvraj and Jay for their support and constant source of inspiration to do better than the best.

Place : M.P.K.V., Rahuri

Date : 22 / 05 / 2005.


(S.D. Valvi)

CONTENTS

CANDIDATE'S DECLARATION	ii
CERTIFICATES	
1. Research Guide	iii
2. Associate Dean (PGI)	iv
ACKNOWLEDGEMENTS	v
LIST OF TABLES	xi
LIST OF FIGURES	xii
ABBREVIATIONS	xiii
ABSTRACT	xiv
1. INTRODUCTION	1
2. REVIEW OF LITERATURE	5
2.1 Age at first oestrus	5
2.1.1 Effect of location	5
2.2 Age at first mating	5
2.2.1 Effect of location	6
2.3 Age at first calving	6
2.3.1 Effect of location	6
2.3.2 Correlation	8
2.4 Service period	8
2.4.1 Effect of location	8
2.4.2 Effect of group of age at first calving	10
2.4.3 Correlation	10
2.5 Number of service per conception	10
2.5.1 Effect of location	11

2.5.2	Effect of group of age at first calving	11
2.5.3	Correlation	12
2.6	Calving interval	12
2.6.1	Effect of location	12
2.6.2	Effect of group of age at first calving	14
2.7	Gestation length	14
2.7.1	Effect of location	14
2.8	Reproductive traits of Pandharpuri buffalo bull	15
2.8.1	Age at first training	15
2.8.1.1	Effect of location	15
2.8.2	Age at first ejaculation	15
2.8.2.1	Effect of location	16
2.8.3	Age at first mating	17
2.8.3.1	Effect of location	17
3.	MATERIAL AND METHODS	18
3.1	Source of data	18
3.1.1	Location and climate	18
3.1.2	Housing and feeding	19
3.2	Collection of data	19
3.3	Classification of data	20
3.3.1	Location	20
3.3.2	Age at first calving	20
3.4	Statistical methods	20
3.4.1	Least squares analysis	20
3.4.2	Biometrical models	21
3.4.3	Analysis of variance	21

3.4.4	Comparison method	22
3.4.5	Duncan's multiple range test	22
3.4.6	Correction of data	23
3.6	Correlation coefficient	23
4.	RESULTS AND DISCUSSION	24
4.1	Age at first oestrus	24
4.1.1	Effect of location	24
4.1.2	Correlation	27
4.2	Age at first mating	27
4.2.1	Effect of location	27
4.2.2	Correlation	29
4.3	Age at first calving	29
4.3.1	Effect of location	29
4.3.2	Correlation	30
4.4	Service period	30
4.4.1	Effect of location	31
4.4.2	Effect of group of age at first calving	31
4.4.3	Correlation	32
4.5	Number of service per conception	32
4.5.1	Effect of location	33
4.5.2	Effect of group of age at first calving	33
4.5.3	Correlation	34
4.6	Calving interval	34
4.6.1	Effect of location	34
4.6.2	Effect of group of age at first calving	35
4.6.3	Correlation	35

4.7	Gestation length	36
4.7.1	Effect of location	36
4.7.2	Effect of group of age at first calving	36
4.8	Reproductive traits of Pandharpuri buffalo bull	36
4.8.1	Age at first training	36
4.8.1.1	Effect of location	39
4.8.2	Age at first ejaculation	39
4.8.2.1	Effect of location	39
4.8.3	Age at first mating	39
4.8.3.1	Effect of location	40
5.	SUMMARY AND CONCLUSION	41
A.	Summary	41
B.	Conclusions	43
6.	LITERATURE CITED	44
7.	APPENDIX	56
8.	VITA	57



T-5781

LIST OF TABLES

No.	Title	Page
1.	Average age at first calving in different breeds of buffalo	7
2.	Average service period in different breeds of buffalo	9
3.	Average number of services per conception in different breeds of buffalo	11
4.	Average calving interval in different breeds of buffalo	13
5.	Average Gestation length in different breeds of buffalo	15
6.	Average age at first ejaculation in different breeds of buffalo	16
7.	Least squares means and standard errors for AFO, AFM, AFC, SP, NSPC, CI and GL in Pandharpuri buffalo	25
8.	Least square analysis of variance for AFO, AFM, AFC, SP, NSPC, CI and GL in Pandharpuri buffalo	26
9.	Correlations among reproductive traits of Pandharpuri buffalo	28
10.	Least squares means and standard errors for AFT, AFE and AFM in Pandharpuri buffalo bull	37
11.	Least square analysis of variance for AFT, AFE and AFM in Pandharpuri buffalo bull	38

LIST OF FIGURES

No.	Title	Between pages
1.	Average age at first oestrus in relation to location in Pandharpuri buffalo	27-28
2.	Average age at first mating in relation to location in Pandharpuri buffalo	28-29
3.	Average age at first calving in relation to location in Pandharpuri buffalo	29-30
4.	Average service period in relation to location in Pandharpuri buffalo	31-32
5.	Average service period in relation to group of age at first calving in Pandharpuri buffalo	31-32
6.	Average number of services per conception in relation to location in Pandharpuri buffalo	33-34
7.	Average number of services per conception in relation to group of age at first calving in Pandharpuri buffalo	33-34
8.	Average calving interval in relation to location in Pandharpuri buffalo	35-36
9.	Average calving interval in relation to group of age at first calving in Pandharpuri buffalo	35-36

LIST OF ABBREVIATIONS

AFO	:	Age at first oestrus
AFM	:	Age at first mating
AFC	:	Age at first calving
AFT	:	Age at first training
AFE	:	Age at first ejaculation
CI	:	Calving interval
DMRT	:	Duncan's multiple range test
GL	:	Gestation length
MS	:	Maharashtra
M.S.L.	:	Mean sea level
NSPC	:	Number of services per conception
SP	:	Service period

ABSTRACT

**STUDIES ON REPRODUCTIVE TRAITS IN PANDHARPURI
BUFFALO UNDER FIELD CONDITION**

By

Sandeep Dharansing Valvi

A candidate for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

ANIMAL SCIENCE

2005

Research Guide : Dr. B.R. UlmekDepartment : Animal Science and Dairy Science

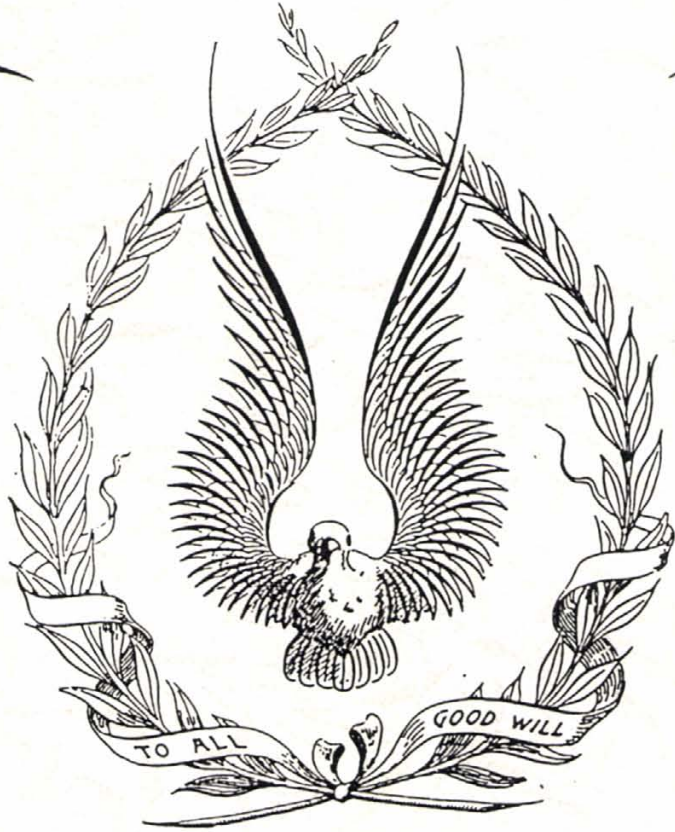
The data pertaining to reproductive traits of 3228 Pandharpuri buffaloes *viz.*, age at first oestrus, age at first mating, age at first calving, service period, number of services per conception, calving interval and gestation length and 96 Pandharpuri buffalo breeding bulls *viz.*, age at first training, age at first ejaculation and age at first mating were collected from Ad-hoc project on "Survey of Pandharpuri buffaloes in Maharashtra." The investigation was undertaken with the objectives to know the effect of location and group of age at first calving on reproductive traits. The data were subjected to least-squares analysis, Duncan's multiple range test and correlation coefficients studies.

Least squares means for the reproductive traits *viz.*, AFO, AFM, AFC, SP, NSPC, CI and GL were 33.62 ± 0.09 , 34.13 ± 0.07 , 44.32 ± 0.06 months and 85.49 ± 0.78 days, 1.18 ± 0.02 , 395.55 ± 0.8 days, 309.99 ± 0.01 days, respectively in Pandharpuri buffalo.

The correlations among most of the reproductive traits were positive and significant ($P < 0.01$) in Pandharpuri buffalo. NSPC were significantly ($P < 0.05$) correlated with GL. The correlations between AFO with NSPC and CI with GL were negative and significant at the level of 1 and 5 per cent, respectively. The correlation coefficients of GL with AFO, AFM, AFC were non-significant.

The overall least squares means for AFT, AFE and AFM in Pandharpuri buffalo bull were 34.05 ± 0.86 , 37.26 ± 0.93 and 39.08 ± 0.90 months, respectively. Location had non-significant effect on reproductive traits in Pandharpuri buffalo bull.

The location and group of age at first calving significantly influenced all reproductive traits under study except gestation length in Pandharpuri buffalo. Service period, number of services per conception and calving interval were showed increase trend from lower group of age at first calving to higher group of age at first calving.



INTRODUCTION



1. INTRODUCTION

An ancient Indian Folk saying goes something like this :

“Come my beloved, let us buy a buffalo,
for then we, too, shall be opulent”.

This may mean many things to many persons, but it definitely has one meaning for all that the buffalo will surely bring economic prosperity. Clearly this is true only if the buffalo is a productive animal.

Buffalo, also known as ‘Asian Animal’, plays an important role in the farmers economic life, being an integral part of the farming system. It is economically important in this region and its meat and milk are rich in nutrients. Buffalo are well know to convert poor quality roughages into milk and meat efficiently. They have 5 per cent higher digestibility of crude fibre and 4-5 per cent higher efficiency of utilization of metabolic energy for milk production than high yielding cows. Buffaloes can gain as much as 1 kg per day on good quality roughages and concentrates (Roy Choudhury, 1988). Buffaloes are more hardy and can be maintained under complete confinement. Buffaloes are not important for milk production but also for drought and meat.

The domestic or water buffalo (*Bubalis bubalis*) belong to the family bovidae, sub-family bovinæ, genus *Bubalus* and species *arni*. Buffaloes are believed to have been domesticated around 5000 years ago in the Indus valley. The domestication of swamp buffalo took place independently in China about 1000 years

latter. The movement of buffaloes to other countries took place from these two countries.

The water buffalo can mainly be classified as river and swamp type. They belong to the same species but have different habitats. Swamp buffalo has 48 chromosomes, the river 50 and they interbreed and produce fertile progeny. The swamp buffalo, mainly a drought-cum-meat animal, is found in eastern half of Asia. The river buffalo usually has curled horns and is found in western half of Asia, Brazil, parts of formerly USSR, Italy and a few east European countries. River buffaloes are docile and have specially been developed for milk production with high fat content in Indo-Pak-sub continent. Both river and swamp type buffaloes are available in India. Swamp buffaloes are found in parts of Assam. The river buffaloes are distributed throughout the country.

The world buffalo population is around 165 million. Of this India has 93.8 million, i.e. above 50 per cent (Anonymous, 2000). Buffalo population increased during the last two decades in Asia (33.2 %) and the world (22.3 %). In India, it is growing at 1.7 per cent annually (Qureshi, 2003). At present India is the largest producer of milk in the world. Of the total milk production of 84.5 million tonnes in India, approximately 55 per cent is from buffalo (Balaraman, 2003).

India is the home of worlds best dairy buffalo breeds, viz., Murrah, Nili-Ravi, Mehsana, Surti and Jaffarabadi. Pandharpuri buffalo is an important milch breed in scarcity and sub-mountain zone of Maharashtra. Almost 3.5 lakh Pandharpuri buffaloes are present in it's breeding tract viz.,

Solapur, Sangli and Kolhapur districts and their adjoining area (Ulmek, 2002).

In spite of its superior dairy merits and good quality meat, buffaloes are known for its low reproductive efficiency through late maturity, seasonality in breeding, weak heat symptoms, anoestrus conditions and long calving interval. The causes of poor reproductive performance in the buffalo have not yet been fully elucidated. This low reproductive efficiency is probably due to an interaction between management and nutrition together with the fact that no selection has been performed in this animal. Moreover, the possible relationships between the heritabilities of some components of reproduction and various environmental conditions, poor nutrition, high ambient temperature, improper management and inadequate schemes of sexual health control has been incriminated as contributing to poor reproductive performance in buffaloes.

Reproduction is a pre-requisite for increasing production and is in itself a biological constraint. In most countries, buffalo development programmes are mainly focused on controlling infectious and parasitic diseases. Although this strategy may have increased buffalo number in some countries, it usually has failed because productivity is, to a considerable extent, dependent upon maximizing reproductive performance. The information on the reproductive performance is very meager.

The approach taken is primarily to look at those aspects of reproduction, which would be of relevance in improving fertility through selective breeding and more efficient

utilization of bulls at the farm and field level. Large genetic variation in reproductive characteristics has been reported in many studies on buffaloes. This points to the lack of selection for desirable traits, and emphasizes the need for more standardized and intensive procedures for selection of breeding bulls.

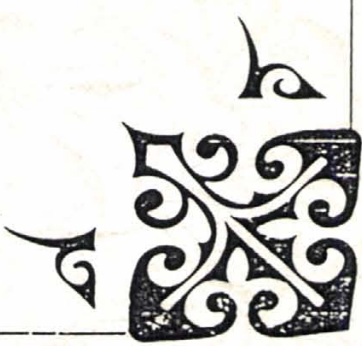
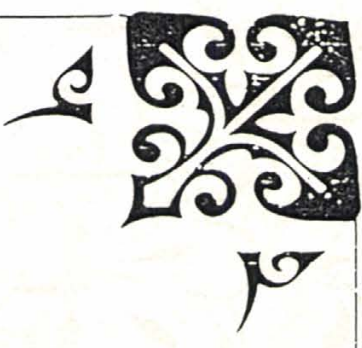
The present investigation is, therefore, undertaken with a view to know, how various traits pertaining to reproduction are influenced by factors like location and group of age at first calving. In order to characterize the Pandharpuri breed of buffalo, an Ad-hoc project on "Survey of Pandharpuri buffaloes in Maharashtra" was sanctioned by ICAR, New Delhi at M.P.K.V., Rahuri. Under the said project survey work has been undertaken in the breeding tract of Pandharpuri buffalo viz., Solapur, Sangli and Kolhapur districts. The data available under above said project on reproductive traits of Pandharpuri buffaloes were utilized for the present investigation. Studies on Pandharpuri buffaloes will be useful for the future planning and genetic improvement of nondescript buffaloes in Maharashtra.

The present investigation entitled "Studies on reproductive traits in Pandharpuri buffalo under field condition" were undertaken with the following objectives :

1. To study the factors affecting reproductive traits in Pandharpuri buffalo.
2. To estimate correlation coefficients among the reproductive traits in Pandharpuri buffaloes.
3. To study the reproductive traits in Pandharpuri buffalo bulls.



REVIEW OF
LITERATURE



2. REVIEW OF LITERATURE

2.1 Age at first oestrus

The average age at first oestrus were 41.28 ± 0.03 , 30.62 ± 0.32 , 30 to 56, 30.59 ± 1.14 , 43.48 ± 0.18 months in Jaffarabadi buffalo in Gujarat (Dutta *et al.*, 2003), Murrah buffalo in Haryana (Basu *et al.*, 1984), rural buffalo in Turkey (Kucukkebabci and Aslan, 2002), Pandharpuri (Ulmek, 2002) and Marathwadi buffalo in Maharashtra (Kulkarni *et al.*, 2003), respectively.

Gajbhiye and Patel (2003), Alam and Ghosh (1991), Sule *et al.*, (2001) reported age at first oestrus as 867.2 ± 11.0 , 1141.5 ± 43.0 , 1365.06 ± 12.85 days in Mehsana buffalo in Gujarat, Bangaldeshi buffalo in Bangladesh and Surti buffalo in Rajasthan, respectively.

2.1.1 Effect of location

Least squares means for age at first oestrus as noticed in Pandharpuri buffalo were 30.70 ± 0.61 , 31.64 ± 0.58 , 29.43 ± 0.61 months in Solapur, Sangli and Kolhapur districts, respectively (Ulmek, 2002).

Location had non-significant effect on age at first oestrus in Jaffarabadi buffalo in Gujarat (Dutta *et al.*, 2003).

2.2 Age at first mating

Dutta *et al.* (2003), Gujar *et al.* (2003) and Ulmek (2002) found average age at first mating in Jaffarabadi, Marathwadi and Pandharpuri buffaloes as 44.23 ± 0.03 , 42.2, 32.44 ± 1.5 months, respectively.

2.2.1 Effect of location

Ulmek (2002) observed overall least squares means for age at first mating in Pandharpuri buffalo as 32.57 ± 0.61 , 33.58 ± 0.59 , 31.19 ± 0.62 months in Solapur, Sangli and Kolhapur districts, respectively.

Effect of location had non-significant effect on age at first mating in Jaffarabadi buffaloes (Dutta *et al.*, 2003).

2.3 Age at first calving

Dutta *et al.* (2003), Patil *et al.* (2003), Ulmek (2002), Gujar *et al.* (2003) and Rane *et al.* (2003) observed age at first calving as 54.51 ± 0.04 , 41.6, 43.82 ± 1.32 , 52.56, 36.12 months in Jaffarabadi, Nili-Ravi, Pandharpuri, Marathwadi and Murrah buffaloes, respectively.

The average age at first calving observed in the literature in different breeds of buffalos have been summarized (Table 1).

2.3.1 Effect of location

Overall least squares means for age at first calving as found in Pandharpuri buffalo were 44.40 ± 0.70 , 45.54 ± 0.67 , 41.53 ± 0.71 months in Solapur, Sangli and Kolhapur districts, respectively (Ulmek, 2002).

Location had non significant effect on age at first calving in Jaffarabadi buffalo in Gujarat (Dutta *et al.*, 2003), murrah buffalo in Uttranchal (Pandey and Singh, 2003) and Madhya Pradesh (Chourasia *et al.*, 1984).

Table 1. Average age at first calving in different breeds of buffalo

Sr. No.	Breed	Age at first calving	Author
1.	Pandharpuri	38.4 to 39.8 months	Patil <i>et al.</i> (1994)
2.	Nagpuri	1893.74 \pm 29.41 days	Ambalkar (1971)
3.	Nagpuri	1627.5 \pm 24.43 days	Deb and Kadu (1977)
4.	Nagpuri	1633.82 \pm 28.01 days	Khire <i>et al.</i> (1977)
5.	Marathwadi	54.21 \pm 0.08 months	Kulkarni <i>et al.</i> (2003)
6.	Berari	1626.32 \pm 32.56 days	Duddalwar (1989)
7.	Purnathadi	6.32 \pm 0.91 Y	Bire <i>et al.</i> (1994)
8.	Mehsana	1406.2 \pm 10.64 days	Gajbhiye and Patel (2003)
9.	Mehsana	1289.01 \pm 12.19 days	Singh <i>et al.</i> (1996)
10.	Surti	1719.84 \pm 13.76 days	Sule <i>et al.</i> (2001)
11.	Murrah	1516.55 \pm 18.94 days	Grewal <i>et al.</i> (2003)
12.	Murrah	44.44 \pm 0.64 months	Singh (2003)
13.	Murrah	43.50 \pm 0.35 months	Basu <i>et al.</i> (1984)
14.	Murrah	39.05 \pm 6.94 months	Vasconcellos <i>et al.</i> (1997)
15.	Murrah	1466.00 \pm 59.88 days	Kadu <i>et al.</i> (1975)
16.	Murrah	1517.86 \pm 52.34 days	Duddalwar (1989)
17.	Nili-Ravi	1290.13 \pm 130.34 days	Singh <i>et al.</i> (1988)
18.	Nili-Ravi	40.22 \pm 0.18 months	Verma <i>et al.</i> (1988)
19.	Indian buffalo	32.4 \pm 0.10 months	Johari and Bhat (1979)
20.	Indian buffalo	42.69 \pm 0.15 months	Kanaujia <i>et al.</i> (1974)
21.	Bangaldeshi	1735.4 \pm 42 days	Alam and Ghosh (1991)
22.	Egyptian	39.9 months	Ahmed (1967)
23.	Egyptian	38 months	Afifi <i>et al.</i> (1992)
24.	Egyptian	25.1 \pm 9.5 months	Soliman <i>et al.</i> (1994)
25.	Egyptian	37.85 \pm 0.08 months	Kotby <i>et al.</i> (1987)
26.	Brazilian	39.05 \pm 6.95 months	Vasconcellos and Tonhati (1998)
27.	Assam swamp buffalo	56.63 \pm 0.47 months	Das <i>et al.</i> , (2003)

Significant ($P < 0.01$) effect of location on age at first calving was noticed in Murrah (Singh, 2003, Dutt and Taneja, 1994 and Gogoi *et al.*, 1985) and Indian buffaloes (Johari and Bhat, 1979 and Kanaujia *et al.*, 1974).

2.3.2 Correlation

Khan *et al.* (1990) noticed positive and significant ($P < 0.01$) correlation between age at first calving and calving interval in Nili-Ravi buffaloes. While, Singh (1957) did not found significantly correlation between age at first calving and calving interval in Tharparkar cattle.

The correlation between age at first calving and service period was observed to be significant ($P < 0.01$) in Holstein Friesian x Hariana half breed (Pyne *et al.*, 1988).

2.4 Service period

The average high value for service period were observed as 202 ± 8 , 201 ± 11.3 and 189.0 ± 5.34 days in Murrah (Venkayya and Ananthakrishnan, 1966 and Kohli and Mallick, 1960) and Mehsana buffalo (Patel and Gajbhiye, 2003), respectively. However, Rane *et al.* (2003), Ulmek (2002) and Dutta *et al.*, (2003) noticed low value for service period as 63.27, 97.92 ± 10.75 , 101.52 ± 0.09 days in Murrah, Pandharpuri and Jaffarabadi buffaloes, respectively.

Average service period in different breeds of buffalo reported by different authors have been presented in Table 2.

2.4.1 Effect of location

Least squares means for service period as noticed in Pandharpuri buffaloes in Solapur, Sangli and Kolhapur districts

Table 2. Average service period in different breeds of buffalo

Sr. No.	Breed	Service period (days)	Author
1.	Marathwadi	162.6 ± 0.77	Kalyankar <i>et al.</i> (2003)
2.	Marathwadi	187.5	Gujar <i>et al.</i> (2003)
3	Marathwadi	179.28 ± 6.00	Patange <i>et al.</i> (2004)
4.	Mehsana	153.8 ± 7.48	Gajbhiye <i>et al.</i> (2003)
6.	Murrah	171.57 ± 3.99	Grewal <i>et al.</i> (2003)
7.	Murrah	133.9 ± 12.6	Prakash <i>et al.</i> (1989)
8.	Nili-Ravi	137 ± 0.9	Patil <i>et al.</i> (2003)
9.	Nili Ravi	115.83 ± 7.73	Dutt and Yadav (1988a)
10.	Indian buffalo	187.53 ± 4.76	Kanaujia <i>et al.</i> (1974)
11.	Indian buffalo	169.3 ± 2.54	Johari and Bhat (1979)
12.	Bangladeshi	179.3 ± 10.3	Alam and Ghosh (1991)
13.	Egyptian	177	Ragab <i>et al.</i> (1956)
14.	Egyptian	165.31 ± 3.20	Ahmed (1967)
15.	Assam swamp buffalo	187.30 ± 4.57	Das <i>et al.</i> (2003)

as 100.85 ± 5.74 , 114.81 ± 5.49 , 78.11 ± 5.80 , respectively (Ulmek, 2002).

Johari and Bhat (1979) and Dutt and Yadav (1988b) reported significant ($P < 0.01$) influence of location on service period in Indian and Murrah buffaloes. Similar results were noticed in Egyptian buffalo (Kotby *et al.*, 1987). However, location had non-significant effect on service period in Murrah (Singh *et al.*, 2003), Mehsana (Patel and Gajbhiye, 2003) and Indian buffaloes (Kanaujia *et al.*, 1974), respectively.

2.4.2 Effect of group of age at first calving

Significant ($P < 0.01$) effect of group of age of first calving on service period was found in Mehsana buffalo (Patel and Gajbhiye, 2003). However, service period was not influenced due to group of age at first calving in Nili-Ravi (Dutt and Yadav, 1988a), Surti buffalo (Tailor *et al.*, 1997), Indian buffaloes (Kanaujia *et al.*, 1974) and Murrah buffalo (El-Arian, 1986).

2.4.3 Correlation

The significant ($P < 0.01$) correlation between service period and calving interval was noticed in Holstein Friesian x Haryana half bred cattle (Pyne *et al.*, 1988).

2.5 Number of service per conception

Gujar *et al.* (2003), Dutta *et al.* (2003) and Ulmek (2002) noticed average number of services per conception as 1.76, 2.020 ± 0.002 , 1.84 ± 0.26 in Marathwadi, Jaffarabadi and Pandharpuri buffaloes, respectively.

The average number of services per conception observed in the literature in different breeds of buffalo have been summarized (Table 3).

Table 3. Average number of services per conception in different breeds of buffalo

Sr. No.	Breed	Number of service per conception	Author
1.	Murrah	1.33	Rane <i>et al.</i> (2003)
2.	Murrah	2.24 ± 0.22	Prakash <i>et al.</i> (1989)
3.	Surti	2.05 ± 0.11	Tailor <i>et al.</i> (1997)
4.	Indian buffalo	1.25 ± 0.16	Tiwana <i>et al.</i> (1985)
5.	Bangaldeshi	1.86	Alam and Ghosh (1991)
6.	Egyptian	1.4 ± 1.6	Omar (1997)
7.	Egyptian	1.87 ± 0.07	Kotby <i>et al.</i> (1987)

2.5.1 Effect of location

The least squares means for number of services per conception as observed in Pandharpuri buffalo were 2.21 ± 0.14, 2.09 ± 0.13, 1.22 ± 0.14 at Solapur, Sangli and Kolhapur districts, respectively (Ulmek, 2002).

Number of services per conception was non-significantly influenced due to location in Jaffarabadi buffalo (Dutta *et al.*, 2003). However, location had significant ($P < 0.01$) effect on number of services per conception in Egyptian buffalo (Kotby *et al.*, 1987).

2.5.2 Effect of group of age at first calving

The effect of group of age at first calving was noticed to be statistically non-significant on number of services per

conception in Surti buffalo (Tailor *et al.*, 1997). Similar results were observed in Murrah buffalo (El-Arian, 1986 and Dutt and Yadav, 1990).

2.5.3 Correlation

Pyne *et al.* (1988) reported number of services per conception had significant ($P < 0.01$) correlation with age at first calving in Holstein Friesian x Haryana half breeds.

2.6 Calving Interval

Patil *et al.* (2003), Dutta *et al.* (2003), Gajbhiye *et al.* (2003), Ulmek (2002) and Patange *et al.* (2004) found average calving interval in Nili-Ravi, Jaffarabadi, Mehsana, Pandharpuri and Marathwadi buffaloes as 445 ± 0.9 , 415.09 ± 0.37 , 464 ± 7.35 , 407.05 ± 10.32 , 496.25 ± 5.93 days, respectively.

Average calving interval in different breeds of buffalo reported by various authors have been presented in Table 4.

2.6.1 Effect of location

The least squares means for calving interval were 409.44 ± 5.51 , 423.11 ± 5.28 , 388.60 ± 5.57 days at Solapur, Sangli and Kolhapur districts, respectively in Pandharpuri buffalo (Ulmek, 2002).

Significant effect ($P < 0.01$) of location on calving interval was observed in Mehsana (Patel and Gajbhiye, 2003), Indian buffalo (Johari and Bhat, 1979) and Egyptian buffaloes (Kotby *et al.*, 1987). However, Dutt and Yadav (1988a) and Kanaujia *et al.* (1974) found that location did not influence calving interval in Nili-Ravi and Indian buffaloes, respectively.

Table 4. Average calving interval in different breeds of buffalo

Sr. No.	Breed	Calving interval (days)	Author
1.	Nagpuri	305 ± 0.05	Pargaonkar (1969)
2.	Marathwadi	495 ± 1.73	Kalyankar <i>et al.</i> (2003)
3.	Marathwadi	435.05 ± 0.68	Kulkarni <i>et al.</i> (2003)
4.	Mehsana	494.93 ± 5.24	Patel and Gajbhiye (2003)
5.	Surti	462 ± 8	Jain and Tailar (1994)
6.	Surti	486.42 ± 6.96	Tailor <i>et al.</i> (1997)
7.	Murrah	475.27 ± 3.60	Grewal <i>et al.</i> (2003)
8.	Murrah	383	Rane <i>et al.</i> (2003)
9.	Murrah	492.82 ± 5.34	Singh and Singh (2003)
10.	Murrah	385.0 ± 53.45	Vasconcellos <i>et al.</i> (1997)
11.	Murrah	305.74 ± 0.45	Kadu <i>et al.</i> (1975)
12.	Nili-Ravi	422.44 ± 16.08	Dutt and Yadav (1988a)
13.	Nili Ravi	579.99 ± 12.90	Singh <i>et al.</i> (1988)
14.	Bhadawari	525 ± 25.9	Pundir <i>et al.</i> (1996)
15.	Indian buffalo	497.63 ± 4.51	Kanaujia <i>et al.</i> (1974)
16.	Indian buffalo	479.5 ± 2.41	Johari and Bhat (1979)
17.	Indian buffalo	375.5 ± 6.7	Tiwana <i>et al.</i> (1985)
18.	Bangladeshi	544 ± 17.5	Alam and Ghosh (1991)
19.	Egyptian	484.74 ± 2.84	Ahmed (1967)
20.	Egyptian	500	Afifi <i>et al.</i> (1992)
21.	Egyptian	516.47 ± 9.23	Kotby <i>et al.</i> (1987)
22.	Egyptian	403 ± 62	Soliman <i>et al.</i> (1994)
23.	Brazilian	385.0 ± 53.4	Vasconcellos and Tonhati (1998)
24.	Assam swamp buffalo	510.68 ± 4.53	Das <i>et al.</i> (2003)

2.6.2 Effect of group of age at first calving

Age at first calving had significant ($P < 0.01$) effect on calving interval in Nili-Ravi (Dutt and Yadav, 1988a), Murrah buffalo (Dutt and Yadav, 1990) and Haryana cattle (Gehlon and Sekhon, 1966), respectively.

However, Patel and Gajbhiye (2003), Venkayya and Ananthakrishanan (1957) and Tailor *et al.* (1997) noticed non-significant effect of age at first calving on calving interval in Mehsana, Murrah and Surti buffaloes. Similar results were observed in Murrah (El-Arian, 1986) and Egyptian buffaloes (Ahmed, 1967 and Alim, 1953).

2.7 Gestation length

The average gestation length were 310.124 ± 0.192 , 310.02 ± 0.36 , 315.21 ± 0.22 , 309.1 ± 2.81 days in Marathwadi (Patange *et al.*, 2004), Pandharpuri (Ulmek, 2002), Jaffarabadi (Dutta *et al.*, 2003) and Murrah buffaloes (Prakash *et al.*, 1989).

Average gestation length observed in literature have been presented in Table 5.

2.7.1 Effect of location

The least squares means for gestation length in Pandharpuri buffalo were 309.99 ± 0.19 , 310.09 ± 0.19 , 309.99 ± 0.20 days in Solapur, Sangli and Kolhapur districts, respectively (Ulmek, 2002).

Dutta *et al.* (2003) and Johari and Bhat (1979) observed that location had non-significant effect on gestation length in Jaffarabadi and Indian buffaloes, respectively.

Table 5. Average gestation length in different breeds of buffalo

Sr. No.	Breed	Gestation length (days)	Author
1.	Marathwadi	310.32 ± 0.16	Kalyankar <i>et al.</i> (2003)
2.	Marathwadi	309.7	Gujar <i>et al.</i> (2003)
3.	Marathwadi	310.07 ± 0.09	Kulkarni <i>et al.</i> (2003)
4.	Indian buffalo	308.5 ± 0.24	Johari and Bhat (1979)
5.	Indian buffalo	313.7 ± 2.2	Tiwana <i>et al.</i> (1985)
6.	Egyptian	316.68 ± 0.19	Ahmed (1967)
7.	Assam swamp buffalo	323.41 ± 0.10	Dás <i>et al.</i> (2003)

2.8 Reproductive traits of Pandharpuri buffalo bull

2.8.1 Age at first training

Dutta *et al.* (2003) and Ulmek (2002) observed average age at first training as 3.03 ± 0.06 years and 34.28 ± 1.33 months in Jaffarabadi buffalo bull and Pandharpuri buffalo bull, respectively.

2.8.1.1 Effect of location

The least squares means for age at first training at observed in Pandharpuri buffalo bull were 34.53 ± 0.65 , 34.12 ± 0.94 , 34.20 ± 1.14 months at Solapur, Sangli and Kolhapur districts, respectively (Ulmek, 2002).

2.8.2 Age at first ejaculation

Ulmek (2002), Narasimha Rao and Kotayya (1979) and Dutta *et al.* (2003) reported average age at first ejaculation

in Pandharpuri, Murrah and Jaffarabadi bull as 37.66 ± 0.62 , 44.48 ± 1.69 months and 3.70 ± 0.06 years, respectively.

The average age at first ejaculation as observed in the literature in different breeds of buffalo bull have been summarized (Table 6).

2.8.2.1 Effect of location

The least square means for age at first ejaculation were 37.66 ± 0.62 , 37.55 ± 0.90 , 37.88 ± 1.10 months at Solapur, Sangli and Kolhapur district, respectively in Pandharpuri buffalo bull (Ulmek, 2002).

Table 6. Average age at first ejaculation in different breeds of buffalo bulls

Sr. No.	Breed	Age at first ejaculation (months)	Author
1.	Murrah	26.37 ± 1.48	Kotayya <i>et al.</i> (1972)
2.	Nili-Ravi	26.5 ± 0.80	Ahmad <i>et al.</i> (1985)
3.	Nili-Ravi	22.8 ± 1.1	Ahmad <i>et al.</i> (1989)
4.	Nili-Ravi	26.5	Sengupta (1988)
5.	Egyptian	14.2	Sengupta (1988)
6.	Egyptian	14.2	Ali <i>et al.</i> (1981)
7.	Australian swamp buffalo bull	24	McCool and Entwistle (1989)
8.	Ongole bull	35.13 ± 2.00	Kotayya <i>et al.</i> (1972)
9.	Jersey bull	23.73 ± 2.28	Kotayya <i>et al.</i> (1972)

2.8.3 Age at first mating

The average age at first mating were 3.80 ± 0.07 , 2, 4, 3 to 3.5, $2, 3.8 \pm 1.5$, 3.7 years and 40.43 ± 0.66 months in Jaffarabadi buffalo bull (Dutta *et al.*, 2003), Russian buffalo bull (Agabeili, 1956), Local buffalo x Murrah buffalo bull (Gatenby *et al.*, 1989), Indian buffalo bull (Majeed *et al.*, 1961), Italian buffalo bull (Maymone, 1942), Egyptian buffalo bull (Kaschab, 1994 and EI-Itriby and Asker, 1957) and Pandharpuri buffalo bull (Ulmek, 2002), respectively.

2.8.3.1 Effect of location

Overall least squares means for age at first mating in Pandharpuri buffalo bull were 40.43 ± 0.66 , 39.99 ± 0.96 , 42.01 ± 1.17 months in Solapur, Sangli and Kolhapur districts, respectively (Ulmek, 2002).



MATERIAL
AND
METHODS

3. MATERIAL AND METHODS

3.1 Source of data

The data pertaining to reproductive traits of 3228 Pandharpuri buffaloes and 96 Pandharpuri buffalo bulls recorded under the Ad-hoc project on "Survey of Pandharpuri buffaloes in Maharashtra" were utilized for the present investigation.

3.1.1 Location and climate

Solapur, Sangli and Kolhapur districts were considered as 3 locations for the present investigation.

The Solapur is at an elevation of 479 Mts. above M.S.L. on the 17°40' north latitude and 75°54' East longitude. The Sangli and Kolhapur are at an elevation of 549 and 574 Mts. above M.S.L. on the 16°51' and 16°43' North latitude and 74°36' and 74°14' east longitude, respectively.

Average maximum and minimum temperatures were 34.16°C and 19.66°C in Solapur, 29.60°C and 19.44°C in Sangli and 30.19°C and 17.91°C in Kolhapur districts, respectively. The average maximum and minimum humidity per cent were 74.36 and 43.21 in Solapur, 87.09 and 55.38 in Sangli and 82.67 and 46.67 in Kolhapur districts, respectively. The annual rainfall were 511.18, 354.64, 1168.96 mm in Solapur, Sangli and Kolhapur districts, respectively. The rainfall occurs between middle of May to end of October.

3.1.2 Housing and feeding

The animals were confined in byre which was close to farmer's house or sometimes in his own residence.

The green fodder provided to the animals included maize and sugarcane tops. The major dry fodder used for feeding was jowar kadabi and paddy straw. The concentrates viz., groundnut cake, wheat bran, rice bran, grains (jowar, rice and maize) and arhar broken grains etc., were used for feeding buffaloes mostly at the time of milking.

3.2 Collection of data

The observations on 3228 Pandharpuri buffaloes and 96 Pandharpuri buffalo bulls pertaining to reproductive traits were collected from Ad-hoc project on "Survey of Pandharpuri buffaloes in Maharashtra". The following traits were considered for present investigation.

i. Reproductive traits (female)

1. Age at first oestrus (months)
2. Age at first mating (months)
3. Age at first calving (months)
4. Service period (days)
5. Number of services per conception
6. Calving interval (days)
7. Gestation length (days)

ii. Reproductive traits (male)

1. Age at first training (months)
2. Age at first ejaculation (months)
3. Age at first mating (months)

3.3 Classification of data

The data were classified according to the location and group of age of first calving.

3.3.1 Location

Three districts were randomly selected to study the effect of location and coded as follows :

District	Code
Solapur	L ₁
Sangli	L ₂
Kolhapur	L ₃

3.3.2 Age at first calving

According to age at first calving following groups have been made.

Group of age at first calving (months)	Code
Below 41	A ₁
42-44	A ₂
45-47	A ₃
Above 48	A ₄

3.4 Statistical model

3.4.1 Least-squares analysis

The data were analysed by using least squares procedure to avoid non-orthogonality of the data (Harvey, 1991).

3.4.2 Biometrical model

$$Y_{ijk} = \mu + Li + Aj + e_{ijk}$$

Where,

Y_{ijk} = The observations on reproductive trait of k^{th} animal at i^{th} location and j^{th} group of age at first calving

μ = The population mean

Li = Effect of location ($i = 1, 2, 3$)

Aj = Effect of group of age at first calving ($j = 1...4$)

E_{ijk} = Effect at random error NID with mean and variance $(0, \sigma^2)$ respectively.

The standard error of μ will be worked out from the reduced inverse matrix (Harvey, 1991).

$$\text{S.E.}(\mu) = \sqrt{(c_{\mu\mu})\sigma^2e}$$

Where,

μ = Population mean

$c_{\mu\mu}$ = Corresponding diagonal element for that constant

σ^2e = Error mean square

3.4.3 Analysis of variance

Source	d.f.	M.S.	Cal 'F'
Location	$(L - 1) = a$	M.S. (L)	M.S. (L) ----- M.S. (E)
Age at first calving	$(A - 1) = b$	M.S. (A)	M.S. (A) ----- M.S. (E)
Error	$(N-1) - (a + b)$	M.S. (E)	

Where,

- N = Total number of observations
 L = Location
 A = Age at first calving
 M.S. = Mean square
 E = Error

3.4.4 Comparison method

The statistical significance of various fixed effects were studied by F test, whenever the effects are significant, the difference between mean were tested by DMRT (Kramer, 1957).

3.4.5 Dunkan's multiple range test (DMRT)

The test (Kramer, 1957) as used to make pairwise comparison among the least squares means with the use of inverse element and the root mean squares for error.

$$(Y_i - Y_j) = \sqrt{2/C_{ii} + C_{jj}} + 2C_{ij} > \sigma^2e, Z(P, ne)$$

Where,

- $(Y_i - Y_j)$: Differences between the two least squares means
 C_{ii} : Corresponding i^{th} diagonal element of C matrix
 C_{jj} : Corresponding j^{th} diagonal element of C matrix
 C_{ij} : Corresponding off diagonal elements
 $Z(P, ne)$: Standardized range value in Dunkan's table at the chosen level of probability for the error degree of freedom
 P : Number of means involved in the comparison
 σ^2e : Root mean squares for error

Standardized range value for significance of least squares means taken from Gomez and Gomez (1983).

3.4.6 Correction of data

Before proceeding for correlation analysis the various physiological and environmental factors influencing the traits were eliminated. The adjusted records were further used to estimate correlation coefficients.

3.5 Correlation coefficients

The correlation coefficients among reproductive traits were computed according to the following formula (Rao, 1983) :

$$r = \frac{\Sigma X_i Y_i - \frac{\Sigma X_i \Sigma Y_i}{N}}{\sqrt{\left(\Sigma X_i^2 - \frac{(\Sigma X_i)^2}{N} \right) \left(\Sigma Y_i^2 - \frac{(\Sigma Y_i)^2}{N} \right)}}$$

Where,

X_i and Y_i are two variables

N = Total number of pairs observations

The significance of correlations were tested (Fisher and Yates, 1963).



RESULTS AND
DISCUSSION

4. RESULTS AND DISCUSSION

The results obtained in the present investigation entitled “Studies on reproductive traits in Pandharpuri buffaloes under field condition”, have been presented and discussed in this chapter.

4.1 Age at first oestrus

The least squares means with standard error for age at first oestrus in Pandharpuri buffalo have been presented in Table 7. The overall age at first oestrus in the present investigation was found to be 33.62 ± 0.09 months. Ulmek (2002) observed almost similar average age at first oestrus in Pandharpuri buffalo as 30.59 ± 1.14 months. Lower value (867.2 ± 11.0 days) was reported by Gajbhiye and Patel (2003) in Mehsana buffalo. However, higher (1365.06 ± 12.85 days) value was found in Surti buffalo (Sule *et al.*, 2001).

4.1.1 Effect of location

The variance analysis revealed that the effect of location on age at first oestrus was significant ($P < 0.01$) in Pandharpuri buffalo (Table 8). DMRT test showed that age at first oestrus significantly differed from each other in L₁, L₂ and L₃. Highest age at first oestrus was noticed (34.00 ± 0.06 months) in Solapur, while lowest in Sangli (33.24 ± 0.05 months). This significant difference in age at first oestrus may be due to climatic and other environmental factors. The



Pandharpuri buffalo

Table 7. Least squares means and standard error for AFO, AFM, AFC, SP, NSPC, CI and GL in

Pandharpuri buffalo

Source of variation	Code	Number of observation	AFO (Months)	AFM (Months)	AFC (Months)	SP (days)	NSPC	CI (days)	GL (days)
Overall mean	μ	3228	33.62 \pm 0.09	34.13 \pm 0.07	44.32 \pm 0.06	85.49 \pm 0.78	1.18 \pm 0.02	395.55 \pm 0.80	309.99 \pm 0.01
Location									
Solapur	L ₁	988	34.00 \pm 0.06 ^c	34.27 \pm 0.05 ^b	44.31 \pm 0.04 ^{ab}	88.56 \pm 0.55 ^b	1.12 \pm 0.01 ^a	398.32 \pm 0.56 ^c	309.98 \pm 0.01
Sangli	L ₂	1281	33.24 \pm 0.05 ^a	33.90 \pm 0.04 ^a	44.24 \pm 0.03 ^a	84.24 \pm 0.48 ^a	1.26 \pm 0.01 ^c	395.32 \pm 0.49 ^b	309.99 \pm 0.01
Kolhapur	L ₃	959	33.62 \pm 0.06 ^b	34.23 \pm 0.05 ^b	44.40 \pm 0.04 ^b	83.67 \pm 0.55 ^a	1.17 \pm 0.01 ^b	393.00 \pm 0.56 ^a	309.99 \pm 0.01
Group of AFC									
Below 41	A ₁	426	—	—	—	76.21 \pm 0.82 ^a	1.11 \pm 0.02 ^a	387.80 \pm 0.83 ^a	309.97 \pm 0.01
42-44	A ₂	1074	—	—	—	83.76 \pm 0.51 ^b	1.12 \pm 0.01 ^a	392.91 \pm 0.52 ^b	309.98 \pm 0.01
45-47	A ₃	1020	—	—	—	86.57 \pm 0.53 ^c	1.14 \pm 0.01 ^a	397.29 \pm 0.54 ^c	310.00 \pm 0.01
Above 48	A ₄	708	—	—	—	95.42 \pm 0.64 ^d	1.37 \pm 0.01 ^b	404.19 \pm 0.65 ^d	309.98 \pm 0.01

Means under each class in the same column with different superscripts differed significantly

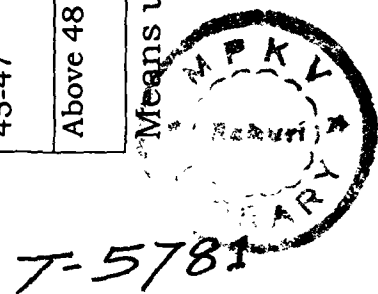


Table 8. Least squares analysis of variance for AFO, AFM, AFC, SP, NSPC, CI and GL in Pandharpuri buffalo

Source of variation	AFO		AFM		AFC		SP		NSPC		CI		GL	
	d.f.	M.S.	d.f.	M.S.	d.f.	M.S.	d.f.	M.S.	d.f.	M.S.	d.f.	M.S.	d.f.	M.S.
Location	2	161.3512**	2	45.5641**	2	7.2389*	2	7167.0332**	2	5.9441**	2	6892.7386**	2	0.0577
Group of AFC	—	—	—	—	—	—	3	36088.5573**	3	11.1741**	3	29097.5469**	3	0.1748
Error	3222	4.2274	3222	2.5206	3222	1.8683	3222	286.4143	3222	0.2667	3222	296.0975	3222	0.1630

* Significant at 5 % level (P < 0.05)

** Significant at 1 % level (P < 0.01)

possibility of decreasing age at first oestrus for buffalo should essentially come through better feeding.

The graphical depiction have been shown (Fig. 1).

4.1.2 Correlations

The correlations of age at first oestrus with AFM (0.9137), AFC (0.8828), SP (0.2924) and CI (0.2639) were positive and significant ($P < 0.01$). Age at first oestrus were significant ($P < 0.01$) and negatively correlated with NSPC (-0.04821). However, correlation of age at first oestrus with GL (0.0119) were non-significant in Pandharpuri buffaloes (Table 9).

4.2 Age at first mating

The least squares means for age at first mating in Pandharpuri buffalo have been presented (Table 7). The overall value for age at first mating in the present investigation was observed to be 34.13 ± 0.07 months. The present value was similar (32.44 ± 1.5 months) to those reported in Pandharpuri buffalo (Ulmek, 2002) and higher value (44.23 ± 0.03 months) in Jaffarabadi buffalo (Dutta *et al.*, 2003).

4.2.1 Effect of location

The analysis of variance revealed that location significantly ($P < 0.01$) influenced age at first mating in Pandharpuri buffalo (Table 8). The graphical presentation have been shown (Fig. 2). However, contradictory results were reported by Dutta *et al* (2003) in Jaffarabadi buffalo.

DMRT indicated that L_2 significantly differed from L_1 and L_3 , which were at par. Age at first mating was higher in L_1 (34.27 ± 0.05 months) while, it was lowest in L_2 (33.90 ± 0.04).

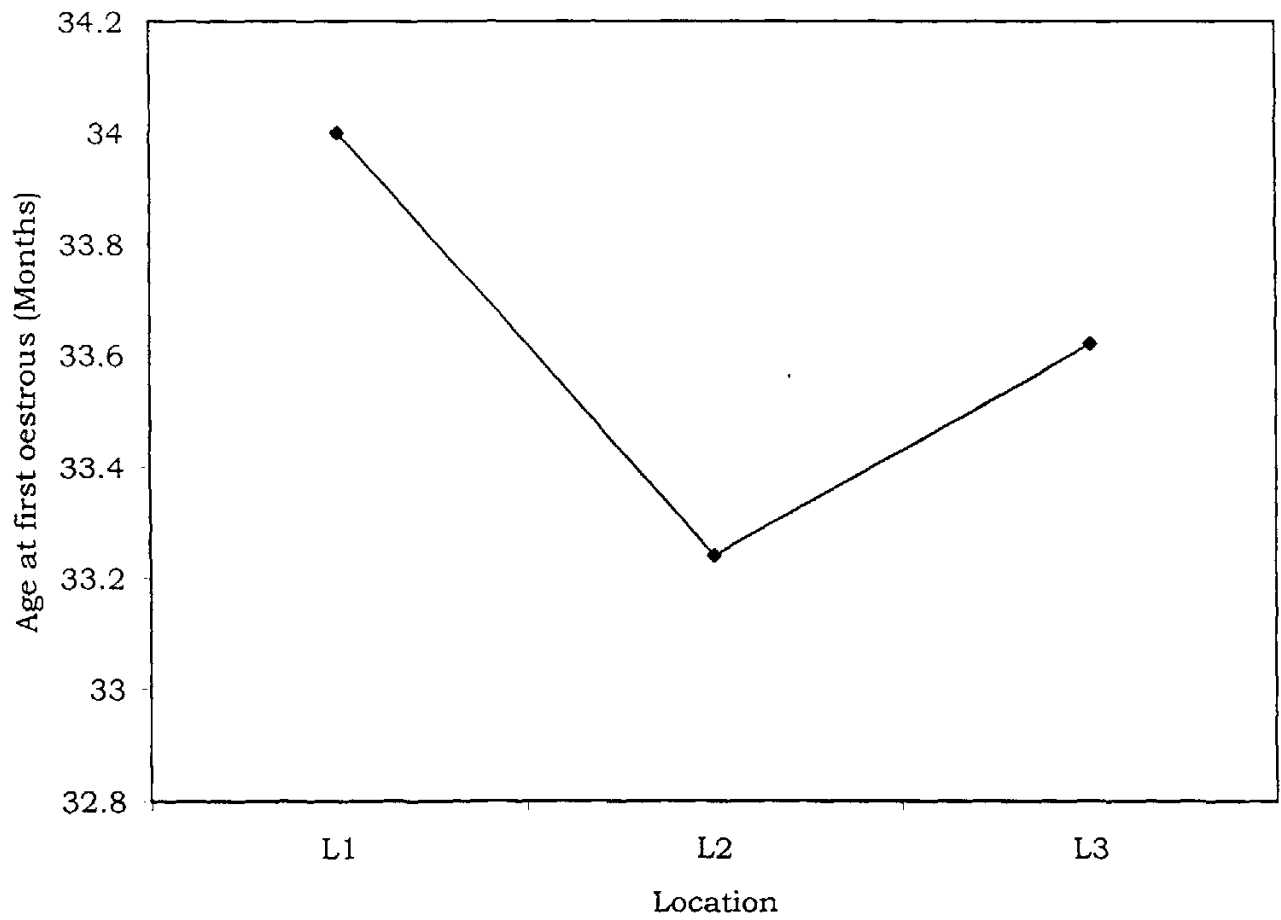


Fig. 1. Average age at first oestrus in relation to location in Pandharpuri buffalo

Table 9. Correlation coefficient different (r) among reproductive traits of Pandharpuri buffalo

Trait	AFO	AFM	AFC	SP	NSPC	CI
AFM	0.9137**					
AFC	0.8828**	0.9687**				
SP	0.2924**	0.3073**	0.3253**			
NSPC	-0.0482**	0.0464**	0.1724**	0.2049**		
CI	0.2639**	0.2750**	0.3014**	0.7747**	0.2295**	
GL	0.0119	0.0041	0.0096	-0.0121	0.0357*	-0.0360*

* Significant at 5 % level (P < 0.05) n = 3228

** Significant at 1 % level (P < 0.01)

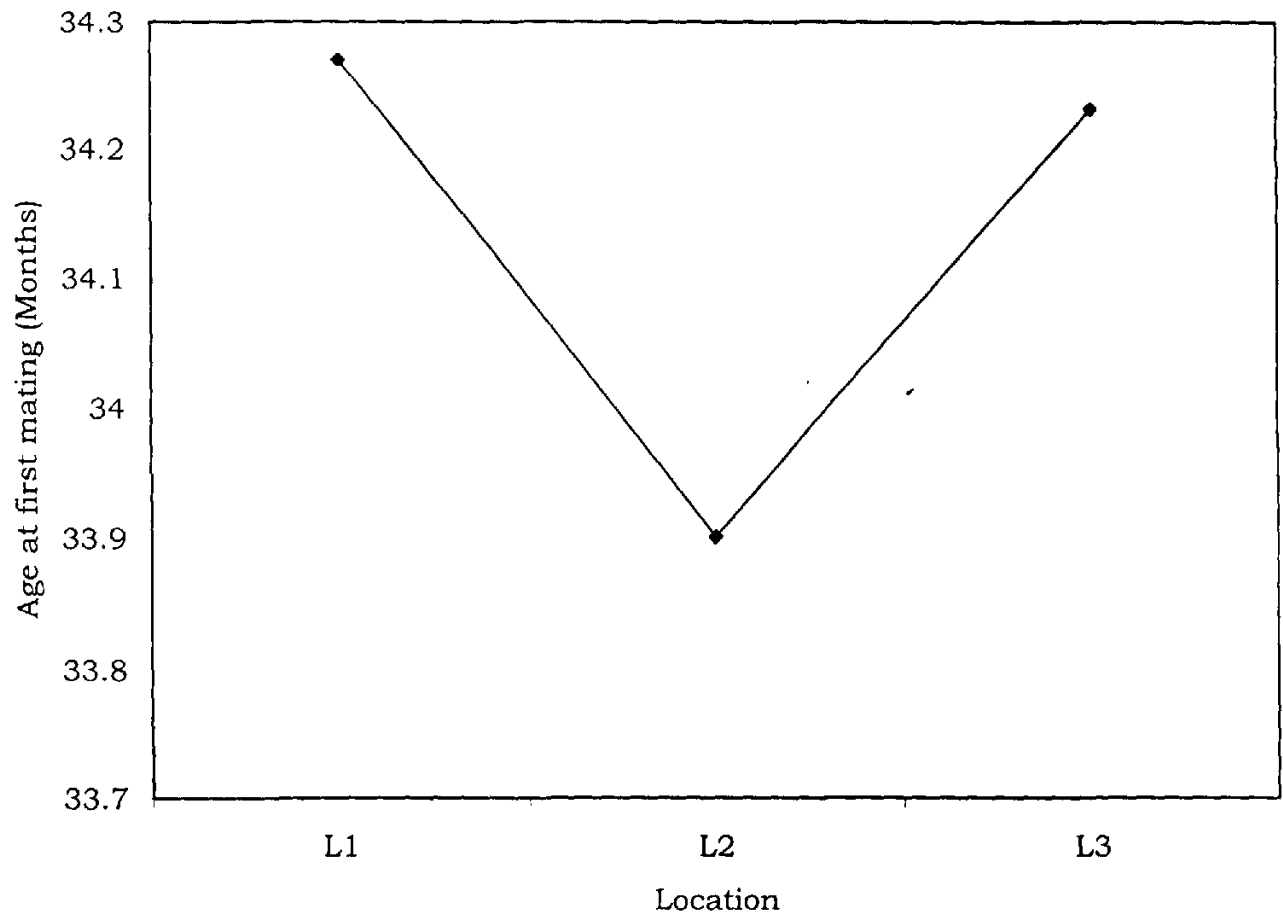


Fig. 2. Average age at first mating in relation to location in Pandharpuri buffalo

The variation in age at first mating might be due to differential management and environmental factors.

4.2.2 Correlations

Age at first mating had positive and significant ($P < 0.01$) correlations with AFC (0.9687), SP (0.3073), NSPC (0.0464) and CI (0.2750) in Pandharpuri buffaloes. However, age at first mating had non-significant correlation with GL (0.0041) Table 9.

4.3 Age at first calving

The least squares means with standard errors for age at first calving in Pandharpuri buffalo have been summarized (Table 7). The overall age at first calving in the present study was noticed to be 44.32 ± 0.06 months. Almost similar results were reported by Ulmek (2002) and Singh (2003) in Pandharpuri (43.82 ± 1.32 months) and Murrah (44.44 ± 0.64 months) buffaloes, respectively. However, Ambalkar (1971) observed higher (1893.74 ± 29.41 days) value in Nagpuri buffalo.

4.3.1 Effect of location

The variations in age at first calving were significantly ($P < 0.05$) attributed to location in Pandharpuri buffalo (Table 8) and presented graphically (Fig. 3). These results were in line with the findings of Singh (2003), Dutt and Taneja (1994) and Gogoi *et al.* (1985) in Murrah buffalo and Johari and Bhat (1979), Kanaujia *et al.* (1974) in Indian buffaloes. However, contradictory results were reported by Dutta *et al.* (2003) in Jaffarabadi buffalo and Murrah buffalo (Pandey and Singh, 2003 and Chourasia *et al.*, 1984), respectively.

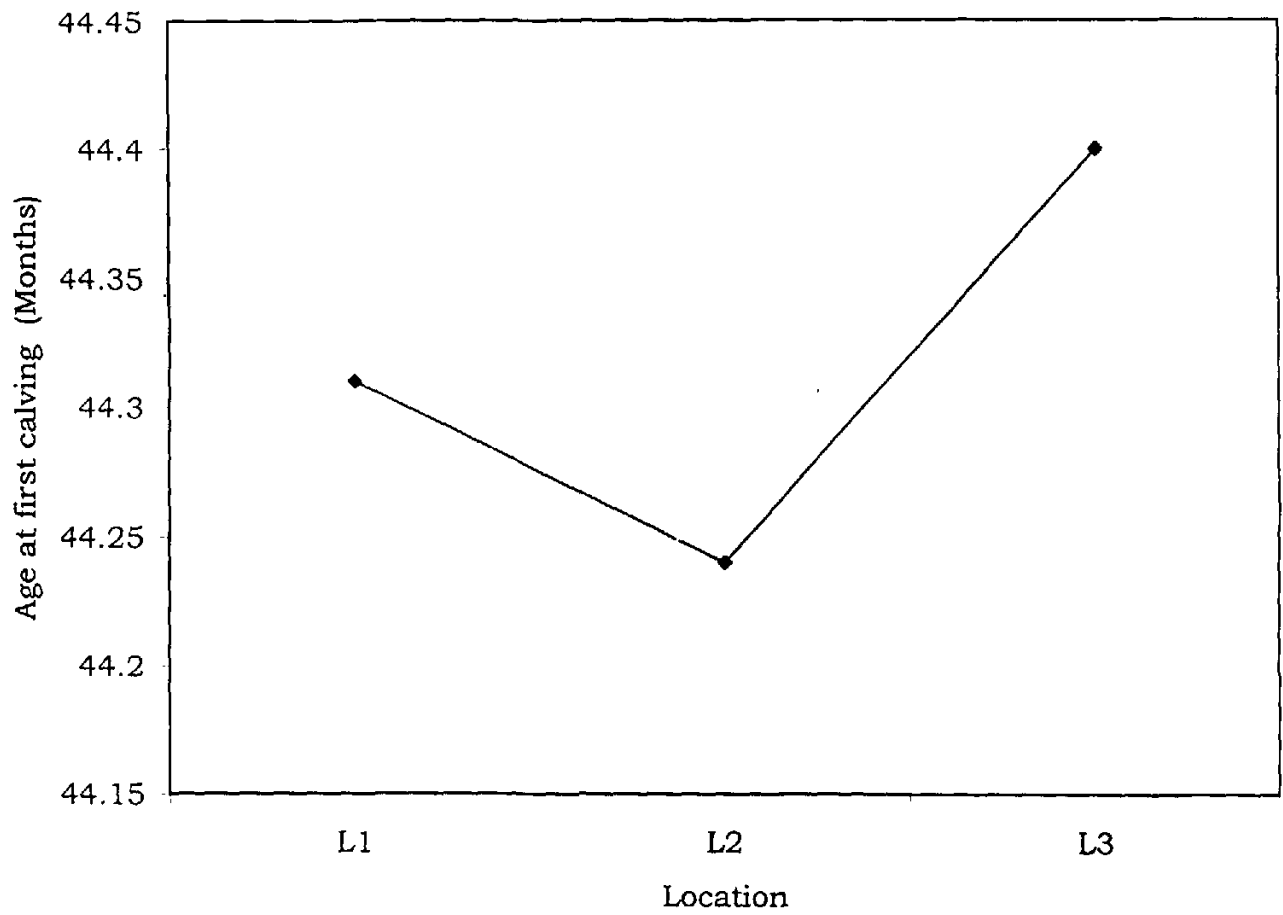


Fig. 3. Average age at first calving in relation to location in Pandharpuri buffalo

It revealed from the DMRT that age at first calving in L₂ and L₃ significantly differed from each other. While L₁ were at par with L₂ and L₃. Higher age at first calving (44.40 ± 0.04 months) in L₃ and lower (44.24 ± 0.03) in L₂. These variation could be due to differential availability of inputs to the buffalo owners at these locations. The location differences could also be genetic in nature due to differences in genetic merit of the sires used.

4.3.2 Correlation study

The correlation coefficients of age at first calving with SP (0.3253), NSPC (0.1724) and CI (0.3014) were positive and significant ($P < 0.01$). However, non-significant correlations of age at first calving with GL (0.0096) were observed in Pandharpuri buffaloes (Table 9).

Khan *et al.* (1990) noticed positive and significant ($P < 0.01$) correlations between age at first calving and calving interval in Nili-Ravi buffalo. However, contrary results were reported by Singh (1957) in Tharparkar cow. Significant ($P < 0.01$) and positive correlation between age at first calving and service period were observed in Holstein Friesian x Haryana half bred (Pyne *et al.*, 1988).

4.4 Service period

The overall least squares means for service period was 85.49 ± 0.78 days in Pandharpuri buffaloes (Table 7). As compared to the present findings, the slightly higher estimates for the trait were recorded by Ulmek (2002) in Pandharpuri

buffalo (97.92 ± 10.75 days) and lower (63.27 days) in Murrah buffalo (Rane *et al.*, 2003).

4.4.1 Effect of location

The least squares analysis of variance showed that location significantly ($P < 0.01$) influenced the service period in Pandharpuri buffalo (Table 8). The results were in agreement with Johari and Bhat (1979), Dutt and Yadav (1988b) and Kotby *et al.* (1987) in Indian, Murrah and Egyptian buffaloes. However, contradictory results were obtained by Singh *et al.* (2003), Patel and Gajbhiye (2003) and Kanaujia *et al.* (1974) in Murrah, Mehsana and Indian buffalo, respectively. The graphical presentation have been shown in Fig. 4.

DMRT showed that L_1 significantly differed from L_2 and L_3 for service period. Service period in L_2 and L_3 were on line with each other. Higher service period (88.56 ± 0.55 days) was observed in L_1 and lower (83.67 ± 0.55 days) in L_3 . Differences between these estimates represented managerial and climatic differences.

4.4.2 Effect of group of age at first calving

Group of age at first calving significantly ($P < 0.01$) influenced the service period (Table 8 and Fig. 5). The results reported by Patel and Gajbhiye (2003) in Mehsana buffalo were affirmative to the present findings. However, non-significant differences were observed in Nili-Ravi buffalo (Dutt and Yadav, 1988a), Surti buffalo (Tailor *et al.*, 1997), Indian buffalo (Kanaujia *et al.*, 1974) and Murrah buffalo (El-Arian, 1986).

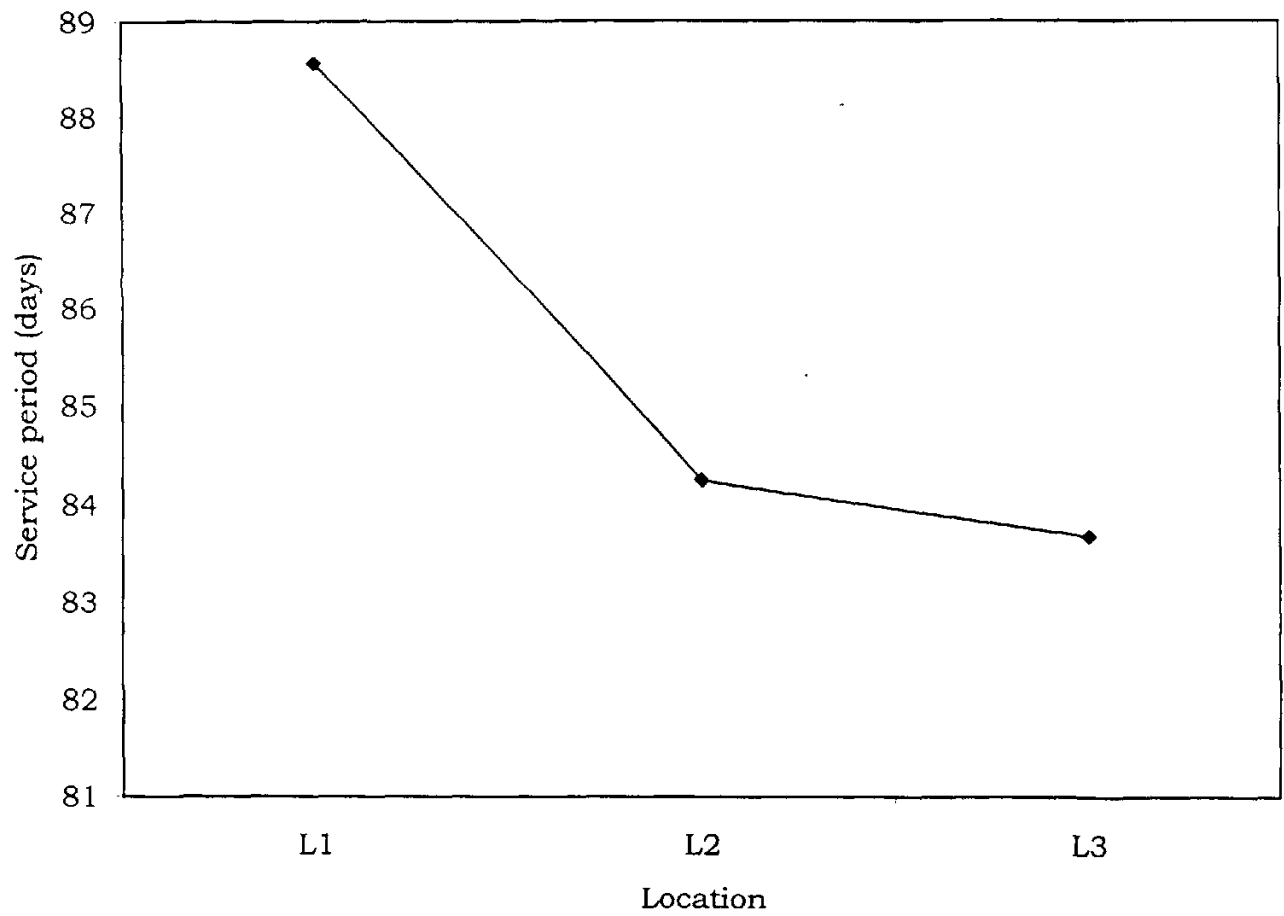


Fig. 4. Average service period in relation to location in Pandharpuri buffalo

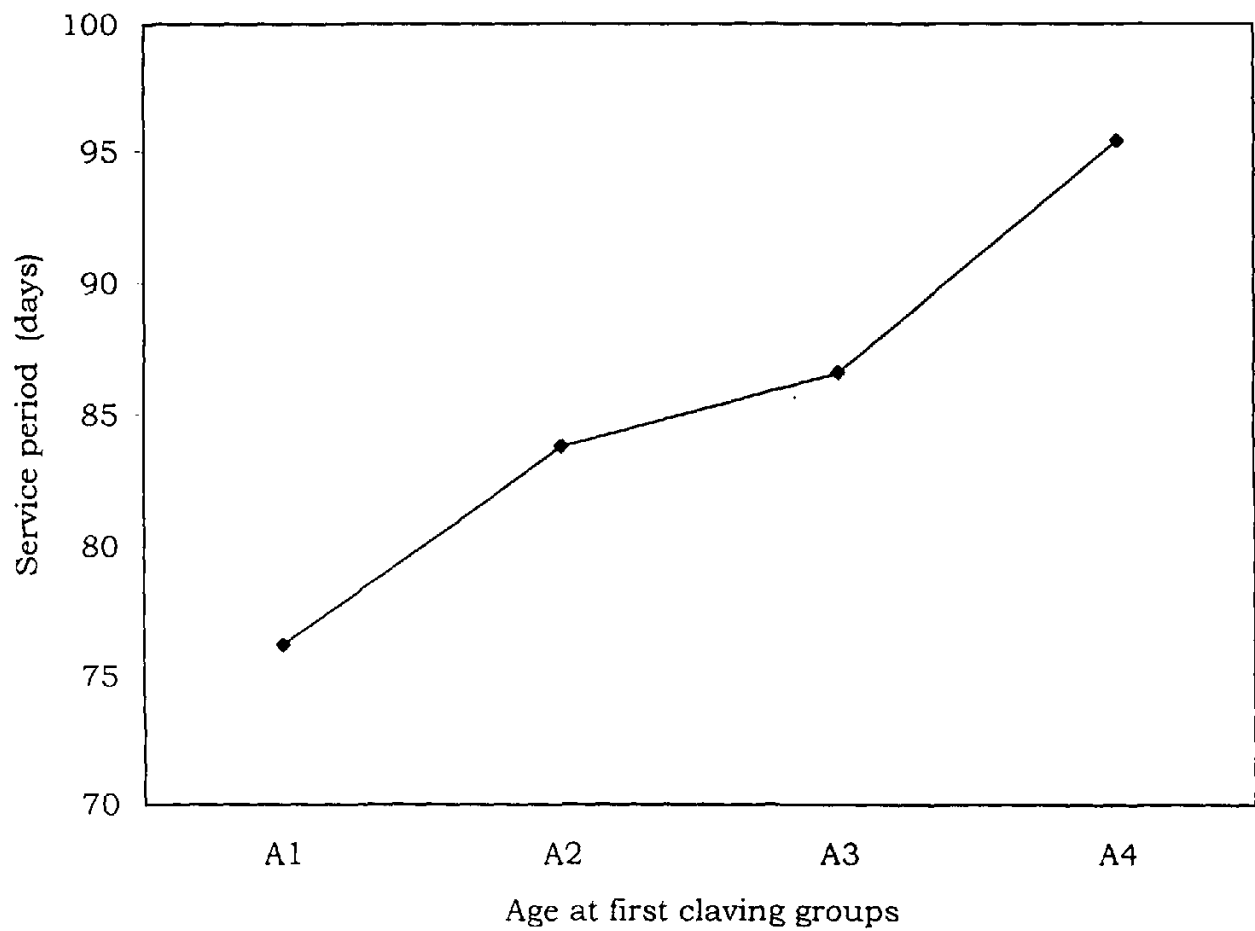


Fig. 5. Average service period in relation to group of age at first calving in Pandharpuri buffalo

DMRT test indicated that service period significantly differed from each other in A₁ to A₄. Higher service period was noticed (95.42 ± 0.64 days) in A₄, while lower in A₁ (76.21 ± 0.82 days). Service period increased gradually with advancement of age at first calving. From the above study it is concluded that the buffalo having lower age at first calving were associated with lower service period.

4.4.3 Correlations

Significant ($P < 0.01$) and positive correlation of service period were observed with NSPC (0.2049) and CI (0.7747). However, service period had non-significant and negative correlation with GL (-0.0121) in Pandharpuri buffalo (Table 9).

Pyne *et al.* (1988) noticed significant ($P < 0.01$) and positive correlation between service period with CI in Holstein Friesian x Haryana half bred cattle.

4.5 Number of services per conception

The least squares means for number of services per conception in Pandharpuri buffalo have been presented (Table 7). The overall number of services per conception in the present investigation was 1.18 ± 0.02 (Table 7). The present value was closer to those reported by Tiwana *et al.* (1985), Rane *et al.* (2003) and Ulmek (2002) in Indian, Murrah and Pandarpuri buffaloes as 1.25 ± 0.16 , 1.33, 1.84 ± 0.26 , respectively and higher value (2.24 ± 0.22) in Murrah buffalo (Prakash *et al.*, 1989).

4.5.1 Effect of location

Variance analysis revealed that location significantly ($P < 0.01$) influenced number of services per conception in Pandharpuri buffalo (Table 8 and Fig. 6).

Similar results were reported by Kotby *et al.* (1987) in Egyptian buffalo. However, non-significant influence of location was observed by Dutta *et al.* (2003) in Jaffarabadi buffalo.

DMRT revealed that NSPC differed significantly from each other due to location. Higher number of services per conception were observed in L₂ (1.26 ± 0.01), while lower in L₁ (1.12 ± 0.01). Location difference might be the result of differences in climate, management and feeding practices. The results indicate that most of the time Pandharpuri buffalo conceived during first service.

4.5.2 Effect of group of age at first calving

Significant ($P < 0.01$) effect of group of age at first calving on number of services per conception were observed in this study (Table 8 and presented graphically in Fig. 7). However, contradictory results were reported in Surti (Tailor *et al.*, 1997) and Murrah buffalo (Dutt and Yadav, 1990 and El-Arian, 1986).

DMRT showed that number of services per conception during A₄ significantly differed from A₁ to A₃, which were at par with each other. Higher value was observed (1.37 ± 0.01) in A₄. While lower (1.11 ± 0.02) in A₁. The results showed that lower number of services per conception associated with lower age at first calving. While with the advancement of age at first calving, number of services per conception were increased.

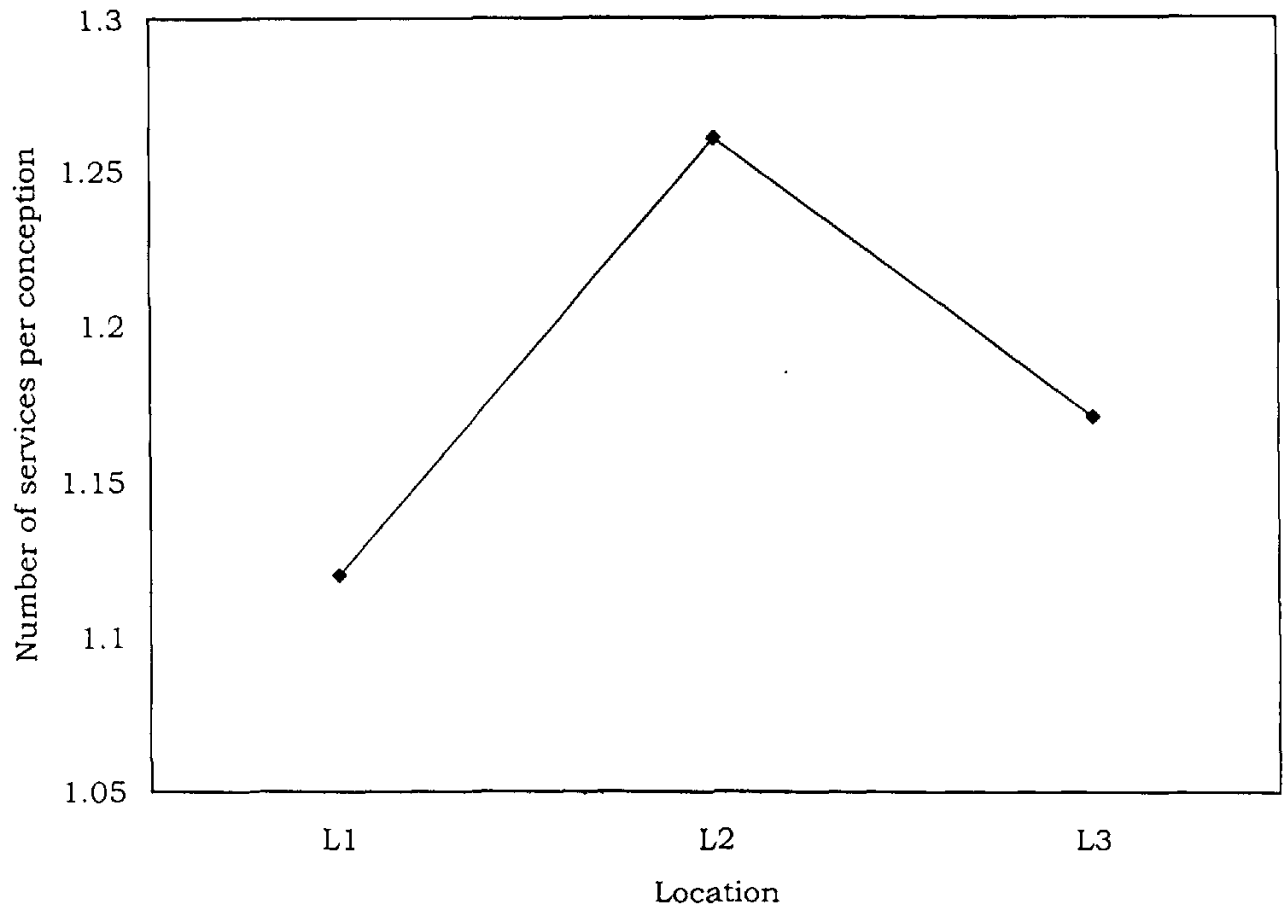


Fig. 6. Average number of services per conception in relation to location in Pandharpuri buffalo

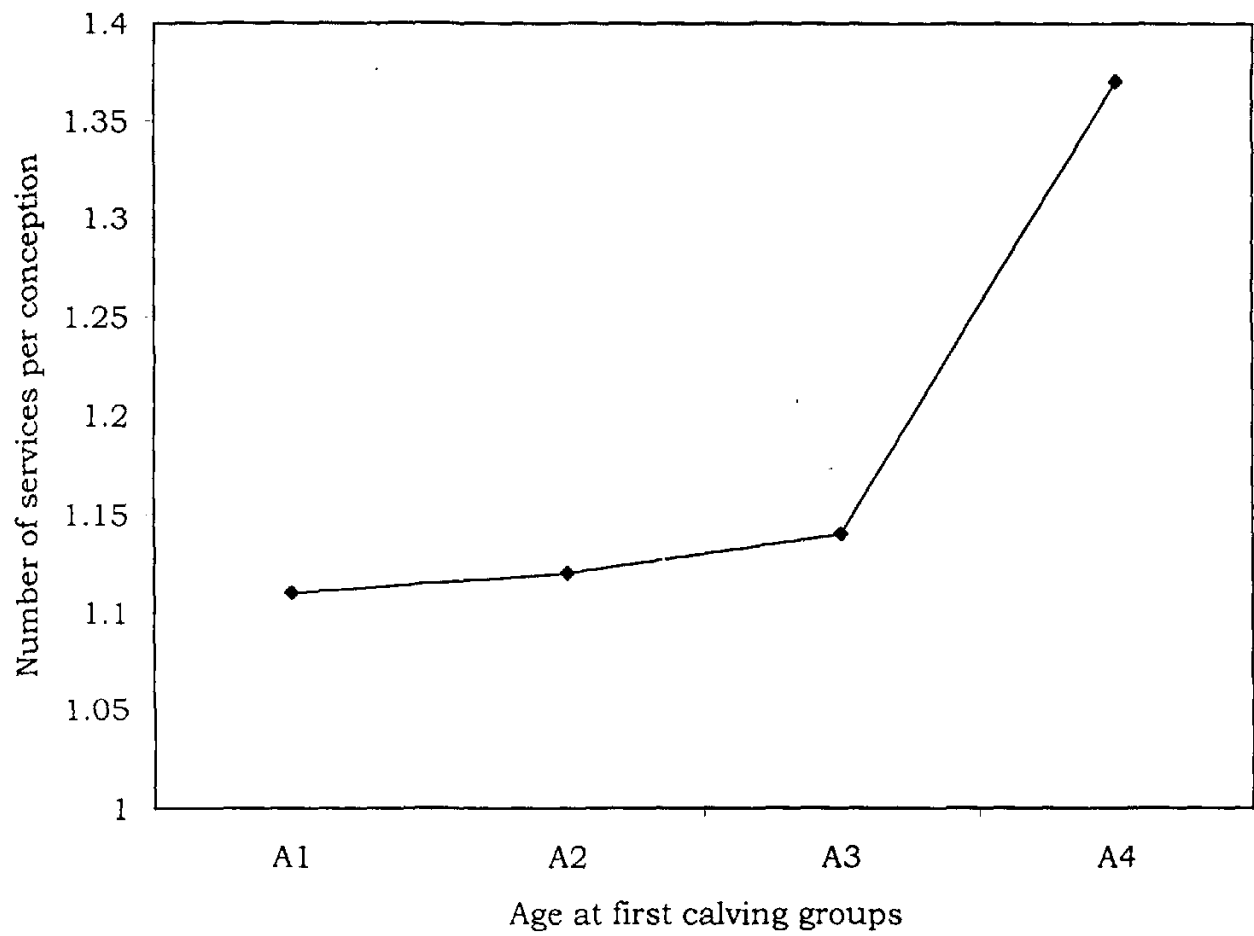


Fig. 7. Average number of services per conception in relation to group of age at first calving in Pandharpuri buffalo

4.5.3 Correlations

The correlation coefficients of number of services per conception with CI were positive and significant ($P < 0.01$). Number of services per conception also significantly ($P < 0.05$) associated with GL (0.0357).

4.6 Calving interval

The least squares means with standard error for calving interval in Pandharpuri buffalo have been summarized (Table 7). The overall calving interval in the present study was 395.55 ± 0.80 days. Almost similar result (407.05 ± 10.32 days) were reported by Ulmek (2002) in Pandharpuri buffalo. Singh *et al.*, (1988) and Alam and Ghosh (1991) noticed higher value in Nili-Ravi (579.99 ± 12.90 days) and Bangladeshi buffaloes (544 ± 17.5 days). Lower values were 305.74 ± 0.45 and 305 ± 0.5 days observed in Murrah (Kadu *et al.*, 1975) and Nagpuri buffaloes (Pargaonkar, 1969), respectively.

4.6.1 Effect of location

Location had significant ($P < 0.01$) effect on calving interval in Pandharpuri buffalo (Table 8 and Fig. 8).

These results corroborated with the findings reported in Mehsana buffalo (Patel and Gajbhiye, 2003), Indian (Johari and Bhat, 1979) and Egyptian buffalo (Kotby *et al.*, 1987). However, non-significant differences were reported by Dutt and Yadav (1998a) and Kanaujia *et al.* (1974) in Nili Ravi and Indian buffalo, respectively.

The DMRT indicated that L_1 , L_2 and L_3 significantly differed from each other. Higher calving interval (398.32 ± 0.56

days) was observed in L₁, while lower (393.00 ± 0.56 days) in L₃. Present study indicated that the variations in calving interval of buffaloes were entirely due to non-genetic causes i.e. environment and management practices. Calving interval were reduced by improving feeding and herd management.

4.6.2 Effect of group of age at first calving

Variations in calving interval attributed to the group of age at first calving were significant ($P < 0.01$) in Pandharpuri buffalo (Table 8 and Fig. 9). These results were in line with the findings of Dutt and Yadav (1988a), Dutt and Yadav (1990) and Gehlon and Sekhon (1966) in Nili-Ravi, Murrah and Hariana cow, respectively.

However, Patel and Gajbhiye (2003), Venkayya and Ananthakrishanan (1986), Tailor *et al.* (1997) and Ahmed (1967) reported the contradictory results in Mehsana, Murrah, Surti, and Egyptian buffaloes, respectively.

The DMRT revealed that A₁, A₂, A₃ and A₄ significantly differed from each other. Higher calving interval was observed in A₄ (404.19 ± 0.65 days). While lower in A₁ (387.80 ± 0.83 days). These results showed that longer calving intervals were associated with longer service period and longer age at first calving. Which was directly related to feeding, management and heat detection.

4.6.3 Correlation

Calving interval was significant ($P < 0.05$) and negatively correlated with GL (-0.0360) in Pandharpuri buffalo (Table 9).

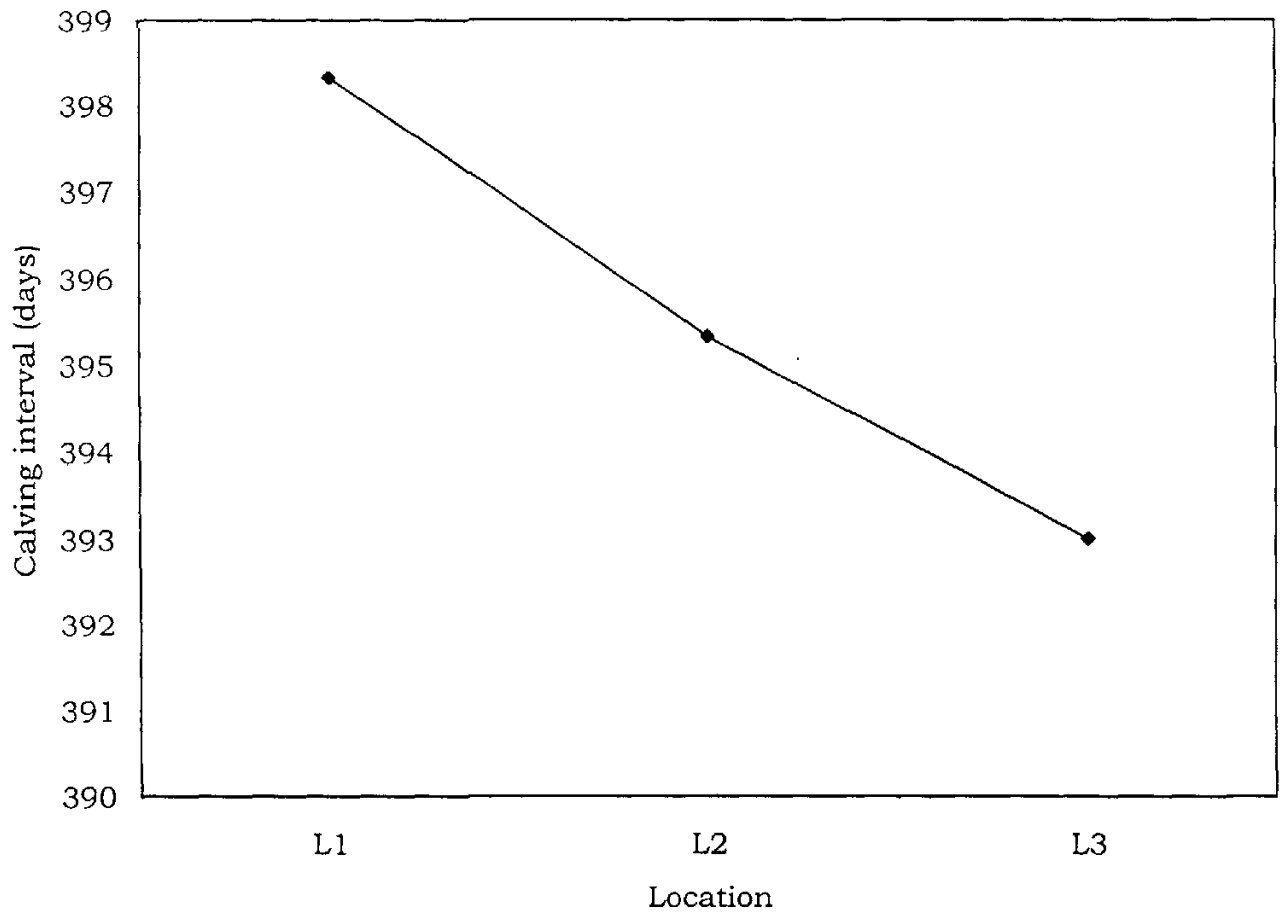


Fig. 8. Average calving interval in relation to location in Pandharpuri buffalo

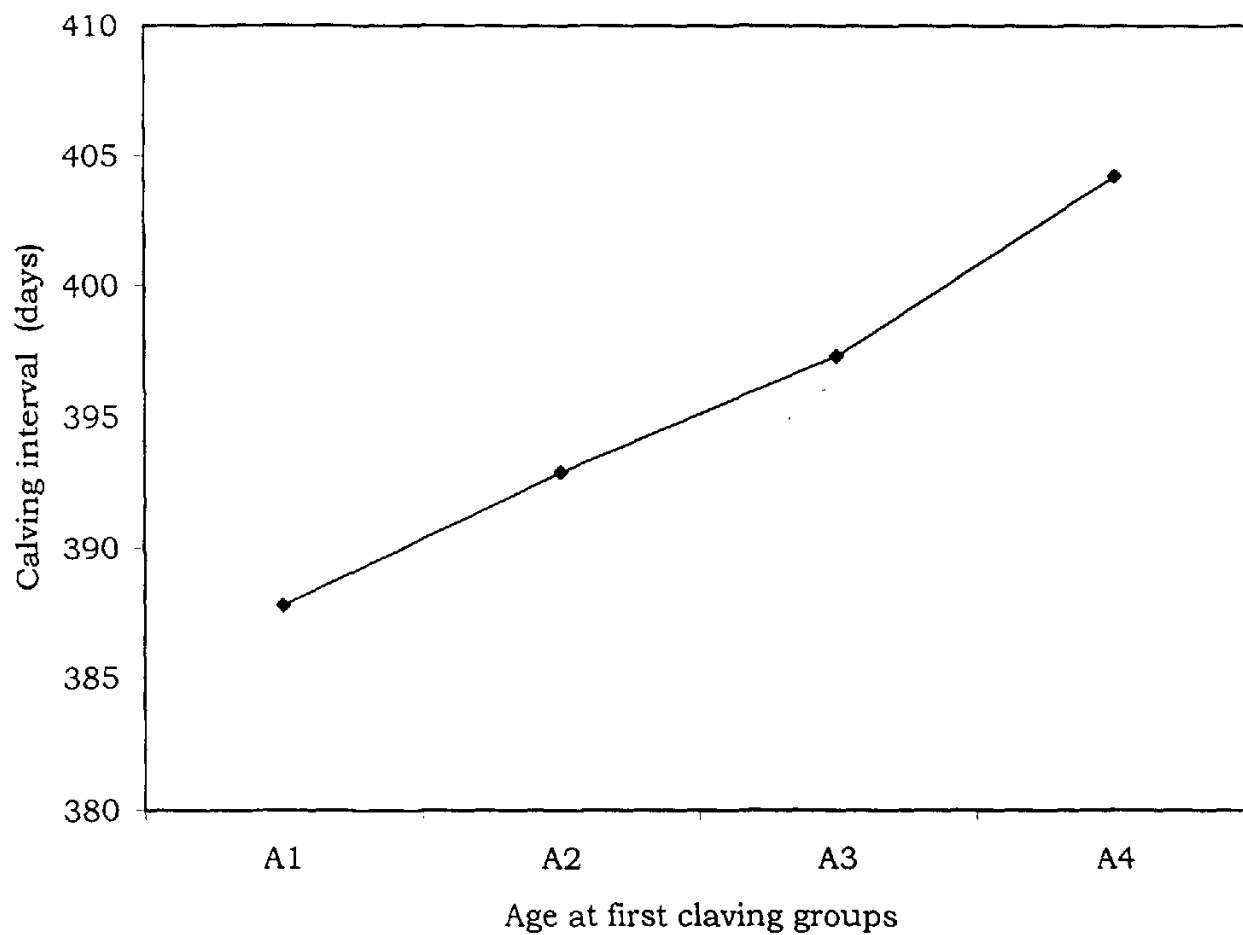


Fig. 9. Average calving interval in relation to group of age at first calving in Pandharpuri buffalo

4.7 Gestation length

The least squares means with standard error for gestation length in Pandharpuri buffalo have been presented in Table 7. The overall gestation length in the present investigation was 309.99 ± 0.01 days (Table 7). The present value was closer (310.02 ± 0.36 days) to reported in Pandharpuri buffalo (Ulmek, 2002). However, higher value as 323.41 ± 0.10 , 316.68 ± 0.19 days reported in Assam Swamp (Das *et al.*, 2003) and Egyptian buffalo (Ahmed, 1967).

4.7.1 Effect of location

The least squares analysis of variance of gestation length observed that location had non significant effect on gestation length in Pandharpuri buffalo (Table 8). The results were in agreement with Johari and Bhat (1979) and Dutta *et al.* (2003) in Indian and Jaffarabadi buffaloes. Non-significant effect which may be attributed to the breed characteristics.

4.7.2 Effect of group of age at first calving

The analysis of variance indicated that group of age at first calving did not influence the gestation length in Pandharpuri buffalo (Table 8).

4.8 Reproductive traits of Pandharpuri buffalo bull

4.8.1 Age at first training

The least squares means for age at first training in Phandharpuri buffalo bull have been presented (Table 10). The overall value for age at first training in the present investigation was observed to be 34.05 ± 0.86 months. Almost similar results (34.28 ± 1.33 months) were reported by Ulmek (2002) in



Pandharpuri buffalo bull

Table 10. Least squares means and standard error for AFT, AFE and AFM in Pandharpuri buffalo bull

Source of variation	Code	Number of observations	AFT (Months)	AFE (Months)	AFM (Months)
Overall mean	μ	96	34.05 \pm 0.86	37.26 \pm 0.93	39.08 \pm 0.90
Location					
Solapur	L ₁	53	34.67 \pm 0.66	37.67 \pm 0.71	40.54 \pm 0.69
Sangli	L ₂	31	33.90 \pm 0.86	36.87 \pm 0.93	38.70 \pm 0.91
Kolhapur	L ₃	12	33.58 \pm 1.39	37.25 \pm 1.51	38.00 \pm 1.46

Table 11. Least square analysis of variance for AFT, AFE and AFM in Pandharpuri buffalo bull

Source of variation	AFT		AFE		AFM	
	d.f.	M.S.	d.f.	M.S.	d.f.	M.S.
Location	2	9.3299	2	6.4793	2	51.3602
Error	93	23.4320	93	27.3901	93	25.8658

Pandharpuri buffalo bull. However, higher value (3.30 ± 0.06 years) was reported in Jaffarabadi buffalo bull (Dutta *et al.*, 2003).

4.8.1.1 Effect of location

Location had non-significant effect on age at first training in Pandharpuri buffalo bull (Table 11).

4.8.2 Age at first ejaculation

The least squares means with standard error for age at first ejaculation in Pandharpuri buffalo bull have been summarized (Table 10). The overall age at first ejaculation in the present study was found to be 37.26 ± 0.93 months. The present value was closer (37.66 ± 0.52 months) to the one reported in Pandharpuri buffalo (Ulmek, 2002). The higher value (44.48 ± 1.69 months) was reported by Narasimha Rao and Kotayya (1979) in Murrah buffalo bull. Sengupta (1988) noticed lower value (14.2 months) in Egyptian buffalo bull and Nili-Ravi (22.8 ± 1.1 months) buffalo bull (Ahmad *et al.*, 1989).

4.8.2.1 Effect of location

Variations in age at first ejaculation attributed to location were non-significant in Pandharpuri buffalo bull (Table 11).

4.8.3 Age at first mating

The least squares means with standard error for age at first mating in Pandharpuri buffalo bull have been presented in Table 10. The overall age at first mating in the present investigation was observed as 39.08 ± 0.90 months. Almost same results (40.43 ± 0.66 months) were reported by Ulmek (2002) in

Pandharpuri buffalo bull. However, higher (3.80 ± 0.07 years) value was reported in Jaffarabadi buffalo bull (Dutta *et al.*, 2003). Agabeili (1956) and Maymone (1942) found lower values (2 years) in Russian and Italian buffalo bull.

4.8.3.1 Effect of location

The analysis of variance indicated that location did not influence the age at first mating in Pandharpuri buffalo bull.



SUMMERY AND
CONCLUSIONS



5. SUMMARY AND CONCLUSIONS

5.1 Summary

The present investigation entitled "Studies on reproductive traits in Pandharpuri buffalo under field condition" was undertaken to study the reproductive performance of Pandharpuri buffalo and Pandharpuri buffalo bull. The data pertaining to 3228 Pandharpuri buffalo and 96 Pandharpuri buffalo bulls available at Ad-hoc project on 'survey of Pandharpuri buffaloes in Maharashtra' were used for the study.

The present investigation was undertaken with the following objectives.

1. To study the factors affecting reproductive traits in Pandharpuri buffalo.
2. To estimate correlation coefficients among the reproductive traits in Pandharpuri buffaloes.
3. To study the reproductive traits in Pandharpuri buffalo bulls.

✓ The data were subjected to least squares analysis. The overall least squares means with standard errors for reproductive traits *viz.*, age at first oestrus, age at first mating, age at first calving, service period, number of services per conception, calving interval and gestation length were 33.62 ± 0.09 , 34.13 ± 0.07 , 44.32 ± 0.06 , months and 85.49 ± 0.78 days, 1.18 ± 0.02 , 395.55 ± 0.8 days, 309.99 ± 0.01 days, respectively in Pandharpuri buffalo.

Least squares analysis of variance for reproductive traits indicated significant effect of location and group of age at first calving except gestation length in Pandharpuri buffalo. Higher values for age at first oestrus, age at first mating, service period and calving interval were observed in Solapur district. However, age at first calving and number of services per conception were higher in Kolhapur and Sangli districts, respectively. Service period, number of services per conception and calving interval were showed increase trend from lower group of age at first calving to higher group of age at first calving.

The correlations among most of reproductive traits were positive and significant ($P < 0.01$). Number of service per conception were significantly ($P < 0.05$) correlated with GL. The correlation of AFO with NSPC and CI with GL were negative and significant at the level of 1 and 5 per cent, respectively. The correlation coefficients of GL with AFO, AFM, AFC were non-significant.

The overall least squares means for age at first training, age at first ejaculation and age at first mating in Pandharpuri buffalo bulls were 34.05 ± 0.86 , 37.26 ± 0.93 and 39.08 ± 0.90 months, respectively. The variations in reproductive traits were non-significantly attributed to location in Pandharpuri buffalo bull.

5.2 Conclusions

Location and group of age at first calving significantly influenced reproductive traits except gestation length in Pandharpuri buffaloes. Thus, the variations in reproductive traits were attributed to non-genetic factors.

There were significant correlations among most of reproductive traits in Pandharpuri buffaloes.



LITERATURE
CITED



6. LITERATURE CITED

- Afifi, E.A., Khalil, M.H., Bedeir, L.H. and Zeidan, S.M. 1992. Genetic analysis of reproductive traits in Egyptian buffaloes. *Egyption J. Ani. Prod.* 29(2) : 139-154.
- Agabeili, A.A. 1956. Uj Vizsgalati eredmenyek a Karakul juh tenyesszkivolasztasahoz. *Magy. Tud. Akad. Agrartud. Oszt. Kozl.* 1956 (1/3) : 299. (*Anim. Breed Abs.* 26 : 234).
- Ahmad, M., Latif, M., Ahmad, M., Ahmad, M. and Ali, A. 1985. Growth pattern in relation to age and sexual maturation in Nili-Ravi buffalo bulls. *Anim. Breed. Abs. Vol. 54* : 2892. pp. 377.
- Ahmad, N., Shahab, M., Khursid, S. and Arsian, M. 1989. Pubertal development in the male buffalo : long tudinal analysis of body growth, testicular size and serum profiles of testosterone and oestradiol. *Anim. Breed. Abs. Vol. 58* : 135, pp. 33.
- Ahmed, S. EL Sheikh, 1967. The reproductive performance of the buffalo in the U.A.R. *Indian J. Dairy Sci.*, 20 : 89-95.
- Alam, M.G. and Ghosh, A. 1991. Reproductive patterns of rural buffaloes in Bangladesh. *Proceedings, Third world buffalo congress, Volume III*, pp. 683-688.
- Ali, H.H., Ahmed, I.A. and Yassen, A.M. 1981. Sexual development and post-pubertal changes in seminal

- characteristics of buffalo bulls. Alexandria. J. Agric. Res. 29(1) : 47.
- Alim, K.A. 1953. Studies on the Egyptian buffaloes. 1. Selection for milk yield. Canadian J. Agric. Sci. 33 : 606.
- Ambalkar, S.S. 1971. A study on the performance of Nagpuri buffaloes under Nagpur climatic conditions. M.V.Sc. Thesis, P.K.V., Akola (M.S.).
- Anonymous, 2000. Agriculture production year book, FAO, Rome, Italy.
- Balaraman, N. 2003. Status and prospectus : Milk production system. Indian Dairyman. 53(3) : 29-33.
- Basu, S.B., Tomar, O.S. and Ghai, A.S. 1984. Genetic studies on sexual maturity traits of buffalo-heifers. Indian J. Anim. Sci. 54(1) : 14-18.
- Bire, P.V., Tombat, R.V. and Ramekar, B.M. 1994. Purnathadi buffalo, a strain of Berari breed potential animal for milk production. Livestock Adviser. 19(12) : 29-37.
- Chourasia, S.K., Dhingra, M.M. and Gurung, B.S. 1984. Studies on age at first calving and it's correlation with some of the reproductive traits in Murrah buffaloes. Indian Vet. J. 61 : 222-226.
- Das, Arpana, Das, D., Goswami, R.N., Das, G.C. and Bhuyan, D. 2003. Performance of swamp buffaloes of Assam with respect to some economically important traits of reproduction under farm condition. IVth Asian buffalo congress, Abstracts, Vol. II : pp. 103.

- Deb, R.N. and Kadu, M.S. 1977. Some observations on production character in Nagpuri buffaloes. *Indian J. Anim. Health.* 16 : 35-38.
- Duddalwar, S.M. 1989. Construction of selection indices based on sex-chromatin frequencies, transferin typing, haemoglobin typing and some economic traits of Murrah and Berari buffaloes. M.V.Sc. Thesis, Dr. P.D.K.V., Akola.
- Dutt, Gautam and Yadav, M.C. 1988a. Factors affecting some reproductive and productive traits in Nili-Buffaloes. *Indian Vet. J.* 65 : 328-331.
- Dutt, Gautam and Yadav, M.C. 1988b. Evaluation of the reproductive performance of Murrah buffaloes. *Indian J. Dairy Sci.* 41 : 8-11.
- Dutt, Gautam and Yadav, M.C. 1990. Factors affecting number of services per conception and calving interval in Murrah buffaloes. *Anim. Breed. Abs.* Vol. 58 : 5166.
- Dutt, T. and Taneja, V.K. 1994. Phenotypic and genetic parameters of age at first calving, first lactation milk yield and some measures of efficiency of production in Murrah buffaloes. *Indian J. Anim. Sci.* 64 : 966-68.
- Dutta, K.S., Tajane, K.R., Murthy, K.S. and Godariya, M.R. 2003. Reproductive performance of Jaffarabadi buffaloes in Field. IVth Asian buffalo congress, Abstracts, Vol. II, pp. 129.

- EI-Arian, M.N.S. 1986. Genetic analysis of murreh buffalo herds. Ph.D. Thesis, Kurukshetra University, Kurukshetra Haryana, India.
- EI-Itriby, A.A. and Asker, A.A. 1957. Buffalo bull in Egypt. *Emp. J. Exp. Agric.* 25 : 126-160. (*Anim. Breed. Abs.* 25 : 1229, pp. 267).
- Fisher, R.A. and Yates, F. 1963. Statistical tables for biological agricultural and medical research sixth Ed. Publishers Longman Group Ltd., England. pp. 63.
- Gajbhiye, P.U. and Patel, V.M. 2003. Age at puberty, conception and first calving in Mehsana buffalo under field condition. IVth Asian buffalo congress, Abstracts, Vol. II, pp. 102.
- Gajbhiye, P.U., Brahmaxatri, K.G., Prajapati, K.B. and Manusri, M.N. 2003. Note on some reproductive traits of Mehsana buffaloes as affected by various factors. *Indian Buffalo. J.* 1(1) : 44-45.
- Gehlon, M.S. and Sekhon, G.S. 1966. Effect of age at first calving on first lactation yield, first lactation length, first dry period and first inter calving period in Haryana Cow. *Indian J. Dairy Sci.* 19 : 128-131.
- Gogoi, P.K., Johar, K.S. and Singh, Ashok. 1985. Factors affecting age at first calving in Murreh buffaloes. *Indian Vet. J.* 62 : 1058-1062.
- Gomez, K.A. and Gomez, A.A. 1983. Statistical procedure for agricultural research. Second ed. pp. 680.

- Gatenby, R.M., Chenjang, P.B. and Pakhrin, B. 1989. Reproduction of buffaloes and cattle in the Koshihills. *Anim. Breed. Abs. Vol. 58* : 1874. pp. 264.
- Grewal, S.S., Saini, M.S., Sangwan, M.L. and Yadav, R.S. 2003. Non-genetic factors affecting the reproduction traits in Murrah Buffaloes. IVth Asian buffalo congress, Abstracts. Vol. II, pp. 194.
- Gujar, B.V., Padghan, P.V. and Karanjkar, L.M. 2003. Herd composition and reproductive performance of Marathwadi buffalo under farmers condition. IVth Asian buffalo congress, Abstract, Vol. II, pp. 191.
- Harvey, W.R. 1991. Least square analysis of data with unequal sub class numbers. United states Department of Agric. ARC. 20 : 8.
- Jain, L.S. and Tailor, S.R. 1994. Inheritance of reproduction traits in surti buffaloes. *Indian Vet. J.* 71 : 684-88.
- Johari, D.C. and Bhat, P.N. 1979. Effect of genetic and non-genetic factors on reproductive traits in Indian buffaloes. *Indian J. Anim. Sci.* 49(1) : 1-6.
- Kadu, M.S., Khire, D.W., Belorkar, P.M. and Kaikini, A.S. 1975. Studies on certain aspects of reproduction in Murrah buffaloes in Nagpur climatic conditions. *Nagpur Vet. Colle. Mag.* 6 : 1-4.
- Kalyankar, S.D., Gujar, B.V., Khedkari, C.D., Patange, D.D. and Hanmante, A.A. 2003. A field study on the effect of season of calving and parity on reproduction traits in

- Marathwadi buffaloes. IVth Asian buffalo congress, Abstract. Vol. II; pp. 137.
- Kanaujia, A.S., Balaine, Dayasingh and Rathi, S.S. 1974. Factors affecting some economic traits of reproduction in Indian buffaloes. *Indian J. Dairy Sci.* 27 : 264-270.
- Kaschab, SEL. 1994. Reproductive efficiency of Egyptian buffalo bulls raised under farmers conditions. *Indian J. Anim. Sci.* 64(10) : 1097-1103.
- Khan, M.A., Ahmed, M.D., Abdullali, M. and Ali, S. 1990. Effect of age at first calving on some reproductive traits in Nili-Ravi buffaloes. *Pakistani Vet. J.* 1 : 25-27.
- Khire, D.M., Kadu, M.S., Belorkar, P.M., Thatte, V.R. and Kaikini, A.S. 1977. Breeding efficiency and producing ability of mil in Nagpuri (Berrari) buffaloes. *Indian J. Anim. Sci.* 47 : 85-87.
- Deshmukh, S.N., Singh, S.N., Thatte, V.R., Amin, M.M. and Desai, R.T. 1983. Some economic characteristics in Nagpuri buffaloes. *Indian J. Anim. Sci.* 53 : 413-414.
- Kohli, M.L. and Mallick, D.D. 1960. Breeding season in Murrah buffaloes. *Indian J. Dairy Sci.* 13 : 157.
- Kotby, E.A., Bedeir, L.H., EL-Sobhy, H.E. and Eid, L.N. 1987. The reproductive performance of Egyptian buffaloes as influenced by some environmental factors. *Ani. Breed. Abs.* Vol. 57 : 7815.
- Kotayya, K., Narasimha Rao, A.V. and Subbaiah, G. 1972. Studies on growth, puberty and semen production in A.I. bulls. *Indian Vet. J.* 49 : 901.

- Kramer, C.V. 1957. Extension of multiple range test to group related adjusted mean *Biometric*. 13 : 20.
- Kucukkebabci, M. and Aslan, S. 2002. Reproductive traits of domestic female buffaloes : A review. *Lalaxhan Hayyancilik Arastirma Enstitusu Dergisi*. 42(2) : 55-63.
- Kulkarni, A.N., Jolgekar, N.V. and Patil, R.A. 2003. Production performance of buffaloes in Nanded district. IVth Asian buffalo congress, Abstracts. Vol. II, pp. 192.
- Majeed, M.A., Carlick, G.K. and Khan, I.R. 1961. Seasonal trend in frequency of oestrous of buffaloes and cows. *Agric. Pakist*. 12 : 181.
- Maymone, B. 1942. Die Buffelzucht in Italian (Buffalo breeding in Italy) *Z. Tierz. Ziicht Biol*. 52 : 1-44 (*Anim. Breed. Abs.* 10 : 217).
- McCool, C.J. and Entwistle, K.W. 1989. The development of puberty and sexual maturity in The Australian Swamp buffalo bull. *Anim. Breed. Abs.* Vol. 58 : 137, pp. 34.
- Narasimha Rao, A.V. and Kotayya, K. 1979. Age of puberty in Murrah buffalo bulls. *Indian Vet. J.* 56 : 252-253.
- Omar, S.S. 1997. Effect of two housing systems on some productive and reproductive traits of buffalo calves. *Egyptian J. Ani. Prod.* 34(2) : 75-88.
- Pandey, A.K. and Singh, Harpal. 2003. Non-genetic factors affecting some economic traits in Murrah buffaloes.



T-5781

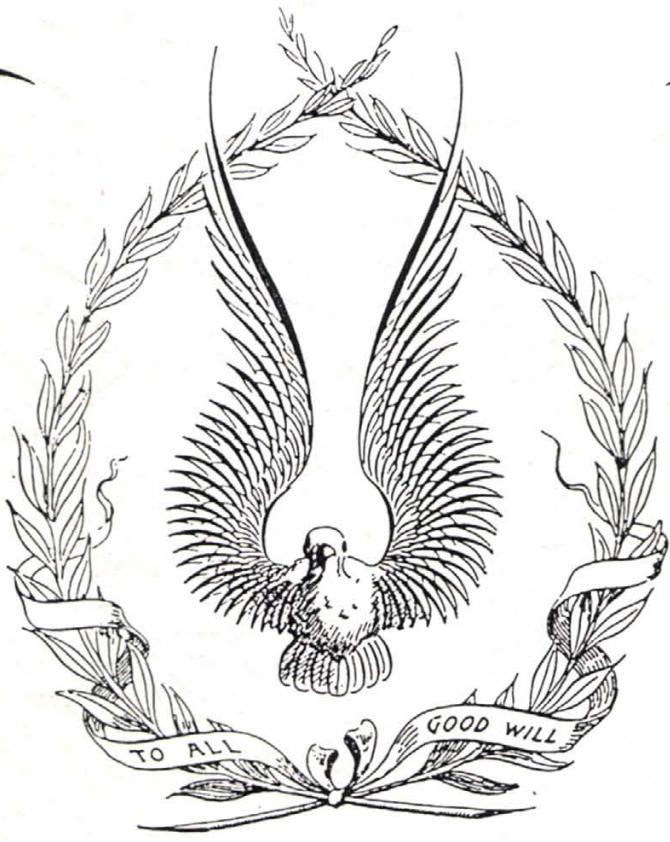
- IVth Asian buffalo congress, Abstracts, Vol. II, pp. 104-105.
- Pargaonkar, D.R. 1969. Study on certain aspects of reproduction in Nagpuri buffaloes. M.V.Sc. Thesis, Maharashtra Krishi Vidyapeeth, Rahuri.
- Patange, D.D., Rajguru, D.N., Kulkarni, A.N. and Kalyankar, S.D. 2004. Studies on some productive and reproductive traits of Marathwada buffaloes. Indian Vet. J. 81 : 86-87.
- Patel, V.M. and Gajbhiye, P.U. 2003. Influence of genetic and non-genetic factors on production traits of Mehsana buffalo in it's breeding tract. IVth Asian buffalo congress, Abstracts, Vol. II, pp. 105.
- Patil, N.V., Singh, Ghanshyam, Mehta, Rajiv and Mehrara, K.L. 2003. Reproductive performance of Nili-Ravi buffaloes under organized farm conditions. IVth Asian buffalo congress, Abstracts. Vol. II, pp. 129.
- Patil, S.S., Mali, S.L., Patil, P.R. and Patil, B.R. 1994. Preliminary studies on productive and reproductive performance of Pandharpuri buffaloes maintained under rural and urban conditions. Proceedings of the first ABA congress, pp. 135-37, Khon Kaen.
- Prakash, Anand, Tripathi, V.N. and Tomer, S.S. 1989. Genetic analysis of reproductive traits of Murrah buffaloes. Indian J. Dairy Sci. 42 : 426-430.
- Pundir, R.K., Vij, R.K., Singh, R.B. and Nivsarkar, A.E. 1996. Bhadwari buffaloes in India. Animal Genetic

- Resources Information, 17, FAO, Rome, Italy, pp. 109-22.
- Pyne, A.K., Misra, S.K., Maitra, D.N., Dattagputa, R. and Roy, S.K. 1988. Reproductive and productive performance of Holstein Friesian x Hariana half breeds in hot humid conditions of West Bengal. *Indian Vet. J.* 65(9) : 797-800.
- Qureshi, S. 2003. Pink revolution via buffalo in the third millennium. *Indian Buffalo J.* 1(1) : 50-53.
- Ragab, M.T., Askar, A.A. and Hilmy. S.S. 1956. The relationship between some fertility aspects and the milk yield in Egyptian cattle and buffaloes. *Indian J. Dairy Sci.* 9 : 53.
- Rane, R.S., Jadhav, R.H., Thorat, R.A., Swami, S.S. and Mazkori, R.C. 2003. Performance of murrah buffaloes under Western Maharashtra condition. IVth Asian buffalo congress, Abstracts. Vol. II, pp. 95.
- Rao, G. Nageswara. 1983. *Statistics for Agricultural Sciences* Oxford and IBH Publishing Co., New Delhi. pp .376.
- Roy Choudhury, P.N. 1988. Planning and Implementation of buffalo development programme in India - NDD'B experiences and projections. II world buffalo congress, Buffalo production and health. pp. 165-170.
- Sengupta, B.P. 1988. Production, preservation and fertility of buffalo semen : problems and prospects. *Indian J. Anim. Prod. Mgnt.* 4 : 307-320.

- Singh, B., Singh, C.V. and Yadav, M.C. 1988. Genetic studies on some economic traits in Nili-Ravi buffaloes. *Indian Vet. J.* 65 : 599-602.
- Singh, C.V. 2003. Genetic association of age at first calving with location components and calving distribution in murrah buffaloes. IVth Asian buffalo congress, Abstracts, Vol. II, pp. 102.
- Singh, D.K. and Singh, B. 2003. Genetic studies on production and reproduction characteristics of buffalo in Jharkhand. IVth Asian buffalo congress, Abstracts, Vol. II, pp. 105.
- Singh, D.V., Dave, A.S., Patel, J.R. and Patel, M.M. 1996. Reproductive events in Mehsana buffalo heifer under field conditions. National convention of ISSAR and National Symposium on Animal Biotechnology, Dec. 4-6, 1996 at GBPU Agri. and Tech. Pantnagar.
- Singh, D.V., Sharma, R.J. and Prasad, T. 2003. Factors affecting service period in rural Murrah graded buffaloes in Tarai region. IVth Asian buffalo congress, Abstracts. Vol. II, pp. 130.
- Singh, O.N. 1957. Age at first calving and its relation to calving interval in dairy cattle. *Indian J. Dairy Sci.* 10 : 63-66.
- Soliman, A.M., Marai, I.F. and El-Menshawly, S.M. 1994. Age at calving, daysopen and lactation length correction factors for total milk yield and repeatability estimates of some productive and reproductive traits in Egyptian buffaloes raised under desert conditions.

- Annals of Agricultural Sci. Moshtohor. 32(3) : 1489-1510.
- Sule, S.R., Taparia, A.L., Jain, L.S. and Tailor, S.P. 2001. Reproductive status of surti buffaloes maintained under sub-humid conditions of Rajasthan. Indian Vet. J. 78(11) : 1049-1051.
- Tailor, S.P., Banerjee, A.K., Singh, Bachchu, Pathodiya, O.P. and Singh, B. 1997. Factors affecting postpartum reproductive performance in surti buffaloes. Indian J. Dairy Sci. 50(5) : 407-409.
- Tiwana, M.S., Bhalaru, S.S. and Bhullar, M.S. 1985. Buffalo No. 857. A wonderful Animal. Indian Dairyman, 37(2) : 67-69.
- Ulmek, B.R. 2002. Final report. Ad-hoc project on survey of Pandharpuri buffaloes in Maharashtra pp. 46-47.
- Vasconcellos, B.F. and Tonhati, H. 1998. Inbreeding and its effects on some productive and reproductive traits in a murrah buffalo herd. J. Ani. Breeding and Genetics. 115(4) : 299-306.
- Vasconcellos, Faria, B.de., Tonnati, Humberto, de-Faria, B., Barghese, A., Failla, S., Barile, V.L. 1997. Inbreeding trends and influence of inbreeding on productive and reproductive traits of Murrah buffaloes in Brazil. Proceedings Vth world buffalo congress, Caserto, Italy. pp. 497-501.

- Venkayya, D. and Ananthakrishanan, C.P. 1957. Influence of age at first calving on the performance of Murrah buffaloes. *Indian J. Dairy Sci.* 10 : 20-24.
- Venkayya, D. and Ananthakrishanan, C.P. 1966. Effect of season of calving on the length of service period in Murrah buffaloes. *Indian J. Dairy Sci.* 19 : 1-3.
- Verma, K., Yadav, M.C. and Jain, V.K. 1988. Age at first calving in Nili buffaloes. *Indian Vet. J.* 65 : 142-144.



APPENDIX



7. APPENDIX

Questionnaire

Ad-hoc project on "Survey of Pandharpuri buffalo in Maharashtra" Mahatma Phule Krishi Vidyapeeth,
Rahuri - 413 722

a. Name :	b. Village :
c. Block :	d. District :
e. Animal No. :	f. Breed :
g. Date of Birth/Age	i. Home breed/purchased :

Reproduction (Female)

1. Age at first oestrus (months)
2. Age at first mating (months)
3. Age at first calving (months)
4. Service period (days)
5. Number of services per conception
6. Calving interval (days)
7. Gestation length (days)

Reproduction (Male)

1. Age at first training (months)
2. Age at first ejaculation (months)
3. Age at first mating (months)



VITA

8. VITA

Sandeep Dharansing Valvi

A candidate for the degree

of

MASTER OF SCIENCE (AGRICULTURE)

in

ANIMAL SCIENCE

Title of thesis : "Studies on reproductives traits in Pandharpuri Buffalo under field condition"

Major field : Animal Science

Biographical information :

* Personal : Born on 17th February, 1981 at Dhanora, Tal./Dist. Nandurbar son of Shri. Dharansing Jalamsing Valvi and Smt. Pramila Dharansing Valvi.

* Education : Passed S.S.C. from Smt. D.R. High School and Junior College, Nandurbar, Dist. Nandurbar in 1996 with First class.

: Passed H.S.C. from Smt. D.R. High School and Junior College, Nandurbar, Dist. Nandurbar in 1998 with Second class.

: Received B.Sc. (Agri.) degree from College of Agriculture, Kolhapur, M.P.K.V., Rahuri in 2002 with Second class.



T-5781