

Review Article

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## A Review on Production, Reproduction and Disease Resistance Traits on Deoni Cattle

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### ABSTRACT

Deoni is a dual purpose medium sized heavy breed among 50 well established cattle breed of India mostly found in Marathwada region of Maharashtra, Bidar district of Karnataka and some part of Medak district in Telangana state which are mostly drought prone areas. On the basis of morphological characteristics, Deoni breed is classified into three strains *i.e.* Balankya (pure white body colour), Waghya (white and black Spots on the body) and Wannera (animals with black face covering both the side of face and complete white Body). Present work was undertaken to study its production, reproduction and disease resistance traits. On the basis of earlier study it was reported that the average lactation milk yield was recorded as  $910.95 \pm 27.62$  Kg to  $238.86 \pm 76.00$  Kg, Daily milk yield  $2.91 \pm 0.05$  Kg to  $2.17 \pm 0.07$  Kg, Peak milk yield  $4.68 \pm 0.05$  Kg to  $2.28 \pm 0.24$  Kg, Average Fat percentage  $4.3 \pm 0.14$  percent, Lactation length  $293.3 \pm 2.9$  days to  $185.79 \pm 4.35$  days, Dry period  $282.77 \pm 12.85$  days to  $103.66 \pm 19.78$  days, Age at first calving  $1628.4 \pm 0.2$  days to  $1070.80 \pm 17.17$  days, Inter-calving period  $566.10 \pm 13.63$  days to  $395.87 \pm 3.38$  days and Service period  $286.57 \pm 13.38$  days to  $116.04 \pm 3.21$  days respectively. Review was taken on Genetic study conducted by using disease resistance genes like TLR-2, TLR-4 production and reproduction associated genes like CYP11B1 (Cytochrome P45011 beta hydroxylase 1) and PPARGC1A (Peroxisome Proliferator Activated Receptor Gamma Co-activator 1 Alpha) genes and it was observed that there was strong significant association between CRS exon 2-1 of TLR-2 gene and significant association of exon 3.3 of TLR-4 gene with somatic cell count and significant effect of CYP11B1 (p.Val30Ala) and PPARGC1A (c.3359A>C) genes with first lactation milk yield. In contrast exon 1 and exon 2 of TLR-2 gene showed lack of association with somatic cell count. Interferon- stimulated gene 15 (ISG 15) gene expressions is upregulated during 16–18 days of pregnancy and could be useful as an early pregnancy marker. Exon 2, 3 and 14 of Lactoferrin gene showed polymorphism and useful as a strong genetic marker for selecting Deoni cattle for udder health and immunity. Glutathione S-transferase Pi (GSTP1) gene showed effect on Age at first calving, Lactation length and Lactation yield. Study on  $\beta$ -casein gene (CSN2), showed, A2 allele is fixed in Deoni cattle.

#### Keywords

Deoni, Lactoferrin, Milk yield, Marathwada, Polymorphism, TLR-2 gene

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## **Introduction**

In India, cattle population is 193.46 million which consist of crossbred as 51.36 million and indigenous cattle population as 142.11 million which comprises of 36.04 percent of total livestock population of India. The Indigenous cattle contribute 48.51 percent of milk production in total milk production of India from different agro climatic conditions and regions of the nation.

Deoni is an important heavy, hardy dual purpose cattle breed of India among 43 well established, descript cattle breeds and quite popular in farmers of drought prone agro climatic zones of Maharashtra, Karnataka, Andhra Pradesh and Telangana states. Based on work done by previous researchers, this breed was genetically evolved from crossbreeding of Gir cattle of Gujrat with Dangi cattle of Maharashtra and some local desi cattle of Nizam states of Karnataka States from near about 300 years back (Joshi and Phillips 1953). On the basis of morphological characteristics, Deoni breed is classified into three strains *i.e.* Balankya (pure white body colour), Waghya/Shevera (white and black Spots on the body) and Wanera (animals with black face covering both the side of face and complete white Body). The name of the breed is derived from local Deoni taluka of Latur district in Maharashtra state. Based on physical and morphological characteristics this breed is medium to good milk yielder and well adopted for agriculture work for the farmers which able to pull bullock cart and carry the load.

Head of this breed is massive with black and white colouration, large and massive hump in males and medium size in females. Udder is small compact, round shaped and well attached to the abdomen, teats are black in colour in females. Long and drooping ears, horns are thick with bright and prominent

eyes. Eyebrows are black in colour. Dewlap is masculine, thick and well developed in both the sexes. Tail is long almost reaching to hock joint and sometimes touches to the ground with black and white tail switch. In males scrotum is well developed with black in colour. Skin is loosely attached with the body. Hoofs are strong, well suited for drought purpose with black in colouration. Crossbreeding of Deoni cattle with Holstein Friesian breed gives increased milk production. Traditionally Deoni breed are maintained in semi-intensive housing system. Animals are getting loose during day time for grazing in the bunds of the farm while male are usually stall feed. Some amount of concentrate feed is offered to milking cows and breeding bulls. Average body weight of adult female and male is 340 kg and 590 kg respectively. Deoni cattle are well adapted to tropical drought prone affected areas and can be fed with locally available feed and fodder as well as which is less susceptible to disease conditions hence, a review was undertaken to study the production, reproduction and disease resistance traits.

**Population status:** Deoni cattle are distributed throughout in Maharashtra state and the total population in the state is 73,100. District wise distribution is given in the below mentioned Table no.1.

Deoni cattle are distributed across the Telangana but highest population was found in Sangareddy and Kamareddy districts. The population of Deoni cattle in Telangana state is about 76,436. Breed wise survey (2013) reported that the total Deoni population in India is 3, 51,600 which consist of pure (1, 51,236) and graded Deoni (2, 01,145) respectively (Narsimha, *et al*, 2019).

**Production traits of Deoni cattle:** Production traits are having economic importance in the life of animals. Present

review revealed that highest lactation milk yield was recorded by Kuralkar, *et al.*, 2014 (910.95±27.62 Kg) whereas lowest were reported by (Chakravarthi *et al.*, 2002) (238.86±76.00 Kg) respectively. Highest average Daily milk yield was reported by Kumar *et al.*, 2006 (2.91±0.05 Kg) as compared to (Dhumal *et al.*, 1993) (2.17±0.07 Kg). Highest Peak milk yield was reported by (Narsimha, *et al.*, 2019) (4.68±0.05 Kg) and lowest was (2.28±0.24 Kg) reported by (Chakravarthi *et al.*, 2002.) Average Fat percentage was reported by (Singh *et al.*, 2002) 4.3±0.14 percent as compared with (Kuralkar, *et al.*, 2014) 4.20±0.15 percent given in Table no.4.

#### **Reproduction traits of Deoni cattle:**

Deshpande and Singh 1977b were reported longest Lactation length (293.3±2.9 days) whereas Kumar *et al.*, 2006 reported (185.79±4.35 days) shortest lactation length. Longest Dry period was reported by Kumar *et al.*, 2006 (282.77±12.85 days) and shortest dry period were reported by Chakravarthi *et al.*, 2002 (103.66±19.78 days). Age at first calving (1628.4±0.21 days) was reported by Narsimha, *et al.*, 2019 whereas Chakravarthi *et al.*, 2002 was reported as (1070.80±17.17 days) respectively. Highest Inter-calving period was reported by (566.10±13.63 days) Thombre *et al.*, 2001 in contrast lowest as reported by (395.87±3.38 days) Kuralkar, *et al.*, 2014. Longest Service period was reported by (286.57±13.38 days) Thombre *et al.*, 2001 and Kuralkar, *et al.*, 2014 reported (116.04±3.21 days) shortest Service period in Deoni cattle as given in Table no. 4.

#### **Disease resistance traits in Deoni cattle:**

Various genetic studies were carried out to see the effect of Production, Reproduction and Disease resistance traits in in Deoni cattle by using TLR-2, TLR-4, CYP11B1, PPARGC1A, ISG 15, Lactoferrin and GSTP1 genes respectively.

In TLR-2 gene molecular characterization of exon 2 of TLR2 gene and its association with milk yield and milk quality traits in 104 Deoni cattle using PCR- RFLP technique was carried out. Polymorphism was observed through HaeIII, HhaI and EcoRV restriction enzymes in Created Restriction Site (CRS) exon 2-1, CRS exon 2-5 and exon 2-1 by PCR- RFLP, respectively. In CRS exon 2-1 allelic frequencies were observed as 0.793 for A and 0.206 for B alleles and that of genotypic frequencies were 0.58 and 0.41 for genotypes AA and AB. In CRS exon 2-5, two genotypes viz., AC and CC with corresponding allelic frequencies were observed as 0.221 for A and 0.778 for C allele and that of genotypic frequencies observed were 0.44 and 0.55 for AC and CC genotypes respectively. TLR2 exon 2-1 exhibited two alleles G and T with frequencies of 0.134 and 0.865 and their Corresponding genotypic frequencies were 0.009, 0.25 and 0.74 for GG, GT and TT genotypes respectively. Higher count of somatic cells (SCC) in TT homozygous and TG heterozygous genotypes, and lower in GG homozygous genotypes were observed in exon 2-1. Strongly significant ( $P \leq 0.01$ ) effect for least squares means of Test Day milk yield (TDMY) and Somatic Cell Count of CRS exon 2-1 were observed. Hence polymorphisms were detected through PCR-RFLP in exon 2 of TLR2 gene using Hae III, HhaI and EcoRV restriction enzymes and their association with somatic cell count, test day milk yield, fat and solid not fat percentage in Deoni indigenous cows (Mundhe *et al.*, 2018).

In TLR-4 gene study conducted in Deoni cows (20) with the aim of identification of genetic polymorphism by using Alu I PCR-RFLP technique in exon 3.3 of TLR 4 gene. The entire TLR 4 exon 3 sequence was amplified using primer sets. In the studied population, digestion of amplified product with Alu I restriction enzyme exhibited two

alleles viz., A and B and three genotypes AA, AB and BB respectively. In present study, an allele A (0.55) was predominant over allele B (0.45). Genotypes frequency of heterozygote AB (0.7) was found more than both homozygotes AA (0.2) and BB (0.1), The PCR amplified product of 511 bp from representative samples was sequenced and the sequencing results were further analysed by Clustal W alignment software which revealed the transition of thymine to cytosine at position of 9423 in BB genotype in Deoni breeds. The influence of bovine TLR 4 gene exon 3.3 allelic variations on somatic cell count showed significant effect ( $p < 0.05$ ) in Deoni cows (*Bos indicus*) which revealed significantly higher somatic cell count in cows with AA genotype as compared to BB genotype. Chi- square test revealed that the Deoni breed was under HW equilibrium and was stable (Chauhan *et al*, 2016).

Further genetic study was carried out by using CYP11B1 and PPARGC1A genes in Deoni cattle. Molecular characterization of the putative exon 1 of CYP11B1 and putative

intron 9 and 3'UTR of PPARGC1A genes was carried out in 146 animals using the PCR-RFLP technique. Three restriction enzymes, namely PstI, HaeIII and NheI, were used, respectively. In the putative exon 1 of the CYP11B1 gene, two genotypes, VV and VA, were detected with frequencies of 0.23 and 0.77, respectively. The frequencies of allele V and A in the population were found to be 0.62 and 0.38, respectively. The allelic frequencies of C and T types were observed as 0.63 and 0.37, with frequencies of CC, TC and TT genotypes as 0.38, 0.51 and 0.11 in the putative intron 9 of the PPARGC1A gene, respectively. Three genotypes, namely AA, AC and CC were detected in 3'UTR of the PPARGC1A gene, with respective frequencies of 0.75, 0.21 and 0.04. The allelic frequencies of A and C types were 0.86 and 0.14, respectively. The locus (c.1892+19T>C) in the putative intron 9 of the PPARGC1A gene was found to be significant (PC) genes. No significant ( $P < 0.10$ ) association was observed between the loci of the genes and breeding value of FLMY in the studied cattle population (Basak *et al*, 2019).

**Table.1** Distribution of Deoni cattle in various districts in Maharashtra state (Dairying in Maharashtra, A Statistical Profile 2015)

District	Number of Deoni cattle in Thousands	District	Number of Deoni cattle in Thousands
Ahmadnagar	0.3	Latur	52.6
Akola	0.1	Nanded	0.3
Amravati	0.2	Nashik	0.5
Aurangabad	3.4	Osmanabad	3.7
Bid	6.8	Parbhani	1.5
Buldhana	0.6	Pune	0.1
Chandrapur	0.2	Solapur	0.3
Dhule	0.2	Thane	0.2
Hingoli	0.2	Wardha	0.2
Jalgaon	0.3	Washim	0.9
Jalna	0.1		

**Table.2** Distribution of Deoni cattle in various districts in Karnataka state (Dairying in Karnataka, A Statistical Profile 2015)

District	Number of Deoni cattle in Thousands
Bellary	01
Bidar	38
Chitradurga	04
Gulbarga	24

**Table.3** Distribution of Deoni cattle in various districts in Andhra Pradesh state (Dairying in Andhra Pradesh, A Statistical Profile 2018)

District	Number of Deoni cattle in Thousands
Anantapur	0.9
East Godavari	2.2
Guntur	1.9
Kadapa	1.7
Kurnool	01
Prakasam	0.4
Visakhapatnam	1.5
West Godavari	17.6

**Table.4** Production performance of Deoni cattle

Name of the Traits	Parameters	Observations (n)	References
Lactation milk yields (Kg)	818.1	340	Deshpande and Singh 1977a
	605±25.0	171	Dhumal <i>et al.</i> 1993
	518.223±22.44	141	Thombre <i>et al.</i> 2001
	868.24±49.56	1212	Singh <i>et al.</i> 2002
	238.86±76.00	30	Chakravarthi <i>et al.</i> 2002
	544.06±15.53	163	Kumar <i>et al.</i> 2006
	796.31±8.14	150	Narsimha, <i>et al.</i> 2019
	910.95±27.62	204	Kuralkar, <i>et al.</i> 2014
	714.26 ±69.72	57	Dongre, <i>et al.</i> 2017
Average daily milk yield (Kg)	2.17±0.07	171	Dhumal <i>et al.</i> 1993
	2.91±0.05	163	Kumar <i>et al.</i> 2006
Peak milk yield (Kg)	4.3 and 4.58	340 and 427	Deshpande and Singh 1977a
	2.28±0.24	30	Chakravarthi <i>et al.</i> 2002
	4.68±0.05	150	Narsimha, <i>et al.</i> 2019
Average fat (%)	4.3±0.14	1212	Singh <i>et al.</i> 2002
	4.20±0.15	86	Kuralkar, <i>et al.</i> 2014

**Table.5** Reproduction performance of Deoni cattle

Name of the Traits	Parameters	Observations (n)	References
<b>Lactation Length (Days)</b>	293.3±2.9	770	Deshpande and Singh 1977b
	277.0±9.23	171	Dhumal <i>et al.</i> 1993
	149.43±33.52	30	Chakravarthi <i>et al.</i> 2002
	185.79±4.35	163	Kumar <i>et al.</i> 2006
	228.60±1.55	150	Narsimha, <i>et al.</i> 2019
	246.12±1.77	204	Kuralkar, <i>et al.</i> 2014
	284.89±31.92	57	Dongre, <i>et al.</i> 2017
<b>Dry Period (Days)</b>	177.0±4.2	340	Deshpande and Singh 1977b
	103.66±19.78	30	Chakravarthi <i>et al.</i> 2002
	282.77±12.85	163	Kumar <i>et al.</i> 2006
	256.87±7.34	140	Das <i>et al.</i> 2011
	158.1±0.05	150	Narsimha, <i>et al.</i> 2019
	204.77±32.86	57	Dongre, <i>et al.</i> 2017
<b>Age at first calving (days)</b>	1533	340	Deshpande and Singh 1977c
	1451±36.45	101	Kakde <i>et al.</i> 1976
	1371	1212	Singh <i>et al.</i> 2002
	1070.80±17.17	30	Chakravarthi <i>et al.</i> 2002
	1335±0.30	160	Kuralkar, <i>et al.</i> 2014
	1628.4±0.21	150	Narsimha, <i>et al.</i> 2019
<b>Inter-calving period (Days)</b>	566.109±13.63	141	Thombre <i>et al.</i> 2001
	447.0±8.0	1212	Singh <i>et al.</i> 2002
	452.55±19.88	30	Chakravarthi <i>et al.</i> 2002
	465.90±12.52	163	Kumar <i>et al.</i> 2006
	447.22±6.64	140	Das <i>et al.</i> 2011
	395.87±3.38	85	Kuralkar, <i>et al.</i> 2014
	462.3±0.10	150	Narsimha, <i>et al.</i> 2019
	489.23±36.83	57	Dongre, <i>et al.</i> 2017
<b>Service period (Days)</b>	286.57±13.38	141	Thombre <i>et al.</i> 2001
	152.14±15.08	30	Chakravarthi <i>et al.</i> 2002
	170.0±7.0	1212	Singh <i>et al.</i> 2002
	116.04±3.21	97	Kuralkar, <i>et al.</i> 2014
	153.6±0.09	150	Narsimha, <i>et al.</i> 2019
	214.52±43.25	57	Dongre, <i>et al.</i> 2017

Further genetic study was carried out by using Interferon- stimulated gene 15 (ISG 15) gene. Interferon- stimulated gene 15 (ISG 15) is one of the major gene stimulated by interferon tau, the maternal recognition of pregnancy signal in ruminants. In this study qRT- PCR

analysis revealed constitutive expression of the ISG 15 mRNA in peripheral blood mononuclear cells of Deoni heifers and multiparous cows during early pregnancy. Fourteen Deoni heifers and fifteen multiparous Deoni cows were synchronized

for timed AI by CIDR- Ovsynch protocol, and six animals were kept as cyclic control in each group. Blood samples were collected on days 7, 14, 16, 18, 21, 30 and 45 from the day of AI. Pregnancy was confirmed by plasma progesterone level through ELISA. A significantly higher expression of ISG 15 mRNA was found on day 16 ( $p < .05$ ) and day 18 ( $p < .05$ ) of pregnancy in nulliparous heifers.

Although in multiparous Deoni cows ISG 15 expression was greater in pregnant cows, difference was statistically non- significant. The result of this study indicates that ISG 15 gene expression is up regulated during 16–18 days of pregnancy and could be used as an early pregnancy marker in dairy cows especially in heifers (Soumya *et al*, 2016).

Another study was conducted by using Lactoferrin gene in Deoni cattle which revealed that Amplicons of exons 4, 5 and 16 showed monomorphic patterns. PCR-SSCP analysis revealed a total of eight different variants in three investigated regions of the lactoferrin gene. The locus LtfE2 revealed four different variants, viz. LtfE2-A, LtfE2-B, LtfE2-C and LtfE2-D with the frequency of 0.42, 0.26, 0.22 and 0.10, respectively. Analysis of exon 3 and 14 revealed two unique SSCP patterns with the frequencies of 0.54 and 0.46, 0.86 and 0.14 respectively. Comparison of nucleotide sequences of lactoferrin gene of the Deoni cattle with taurine cattle revealed a total of 12 point mutations, 11 of which were found to be in coding region with 10 transitions. Conceptualized translation of nucleotide sequence revealed 5 amino acid changes. The SNPs identified in the coding region of lactoferrin gene may serve as potential genetic marker (s) in cattle for disease resistance (Singh *et al*, 2015).

Rao and co-workers in 2013 found that two unique SSCP patterns were observed in

fragment 1, 3, 5 and 6 of GSTP1 gene. Sequence analysis with reference to GenBank Acc. no AC\_000186.1 revealed polymorphisms at position 210, 746, 2438, 2439, 2443, 2507, 2695 and insertions between positions 707 and 708, 2700-2701 and 2775-2776. All the observed variations in coding regions were silent mutations.

The cows with SSCP pattern B of fragment-5 had higher age at first calving while the cows with pattern A had higher lactation length and lactation yield as compared to pattern B ( $P \leq 0.05$ ). The animals with pattern A of fragment 6 in GSTP1 gene had higher lactation length and lactation yield as compared to animals with pattern B. It was observed that there was no significant difference in enzyme activity and calving interval in 70 studied Deoni cattle with different patterns in different SSCP fragments. Another study revealed that  $\beta$ -casein gene (CSN2), showed, allele A2 was fixed in 40 Deoni cattle population (Ramesha *et al*, 2016).

In conclusion the study on genetic analysis of animals will help in association of genotype of an animal with phenotype or trait of interest or economical important traits which helps in meet out the production demand from the livestock in terms of milk production. We can concentrate on these traits and improve the milk production to a great extent. Genetic association study also helps in selecting the animals those are having shorter generation interval and having superior breeding value. Therefore in coming future there is a need of replacing the traditionally breeding system with genomic selection which leads to improvement in animal health through improvement in disease resistance. Hence present review focused on selection of the animals by using molecular markers associated with Production, Reproduction and Disease resistance traits.

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