

Effects of Artificial Insemination (AI) on the Gene Pool of the *Bos* genera Linnaeus (1758): A Study with Reference to Block Mehadwani, Dindori, Madhya Pradesh, India

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Abstract: The objective of this study was to study the effect of artificial insemination (AI) on the gene pool of the genus *Bos* Linnaeus (1758). The training session was carried out on artificial insemination and field investigation. The field survey was conducted during the years 2021–2022 to extract realistic data. We found that the *Bos* race in the area was identified as the local name "Aavnat Nssal." *Bos primigenius* is the wild ancestor of the domesticated "Avnat Nassl" of *Bos*. The local indigenous race has yet to be specifically identified and documented. Random sampling, investigation, interviews, training, and demonstration techniques were used to obtain data. The survey data was analysed using the z-test formula, which yielded a criteria-based p-value. The p-values obtained for the level of awareness of artificial insemination were 0.0000063 and 0.0 for the locations of Sarsdoli, Mehadwani, Khamaria, Sudgaon, and Kathotia, respectively. We found significant results with P<0.10 values. The result indicates that Block Mehadwani currently has a 40% population that breeds calves by artificial insemination (AI) extensively. It is interpreted that the intensive use of AI can result in improved genetic advantage as well as genetic diversity, but deteriorates the pure gene pool. As a result, the data suggest that widespread use of AI may deplete the region's indigenous *Bos* genus gene pool.

Keywords: Mehadwani, Dindori, *Bos*, *Bos indicus*, *Bos primigenius*, artificial insemination, gene pool

1. Introduction: - The Block Mehadwani area is part of the Dindori district, a tribal-dominated territory where many primitive tribes dwell alongside other backward cultures [1]. The Indigenous Breed (IB) of the *Bos* Linnaeus 1758 is the staple livestock of these tribes and others. The IB of the *Bos* is widely found in the Block Mehadwani [2]. It is the primary source of cattle in this region. There is no biological or taxonomic information about the IB *Bos* in reference to Block Mehadwani. IB of the *Bos* generates a very small amount of milk [4]. The government provides AI services to local residents in Block Mehadwani through the Veterinary Hospital and NGEOS. In Madhya Pradesh, about 70 cows are being artificially inseminated at home to improve the indigenous breed of cows. In terms of artificial insemination, Madhya Pradesh is second only to Telangana in the country.[3] AI replaces the indigenous breeds with hybrids in the area. On the other hand, long-term AI breeding techniques should be reinforced to improve returns without wasting indigenous genetic resources [5]. However, we discovered gaps in the study of AI practise and IB of *Bos* in the reference of Block Mehadwani after examining the literature. This research was conducted to determine the long-term effects of artificial insemination (AI) experiments for breed improvement on the Indigenous Breed (IB) of *Bos* Linnaeus, 1758 in Block Mehadwani.

2. Literature Review: - *Bos taurus* (European cow), *Bos indicus* (Indian cow), *Bos grunniens* (Yak), *Bos frontalis* (Gemini), *Bos javanicus* (Banteng), and *Bos Souveli* species are generated from climate variations. With the passage of time, Indian, European, and yak cows have all evolved into distinct species [6]. Artificial insemination is not a novel method of impregnating animals. It has been in use since at least 1700 AD. Spallanzani was the first to use artificial breeding procedures to impregnate dogs in 1780. As early as 1700 AD, Arabs were employing artificial insemination to acquire their horse breeding [7]. In India, artificial insemination began in 1939 at Palace Dairy Farm (Mysore)[8]. After 1942, the Indian Veterinary Research Institute began to focus on developing artificial insemination technologies. AI is currently a common method for increasing livestock output [9].

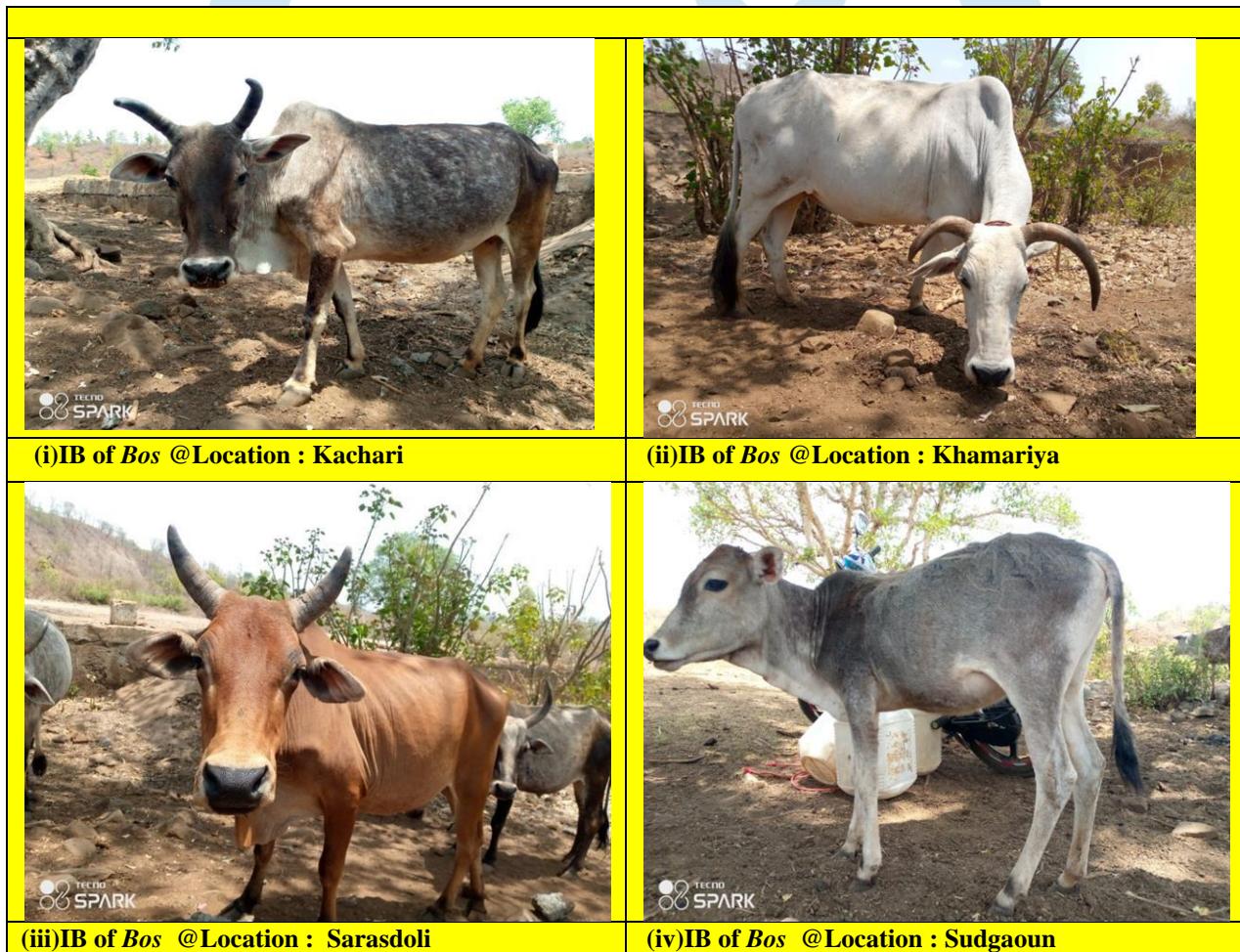
3. Materials and Methods

3.1 Field Survey and Sampling: - The field survey was conducted in Block Mehadwani over the years 2021-2022. The Dindori district includes the Block Mehadwani. The Dindori district spans 3,086.11 square kilometers and is divided into seven blocks, including Block Mehadwani (Fig-3.1). Sarsdoli, Mehadwani, Kathotia, Khamaria, and Sudgaon, all located in Block Mehadwani, were selected for survey and sample .



Fig-3.1, Location Map of study area Block Mehadwani in Dindori district.

3.2 Indigenous breed "Avnat Nssal": - During the years 2021–2022, a field survey was done to record the distribution of IB of *Bos* in the Mehadwani area. The breed of *Bos* in this area are known as "Avnat Nssal" by the locals. In the block Mehadwani area, pictures of an "Avnat Nssal" cow are exhibited (fig-3.2). Figures 3.2 (i)-(ii) depict specimen samples of local *Bos* breeds collected from the villages of Kachari, Khamariya, Sarasdoli, Sudgaoun Mehadwani, and Block Mehadwani.



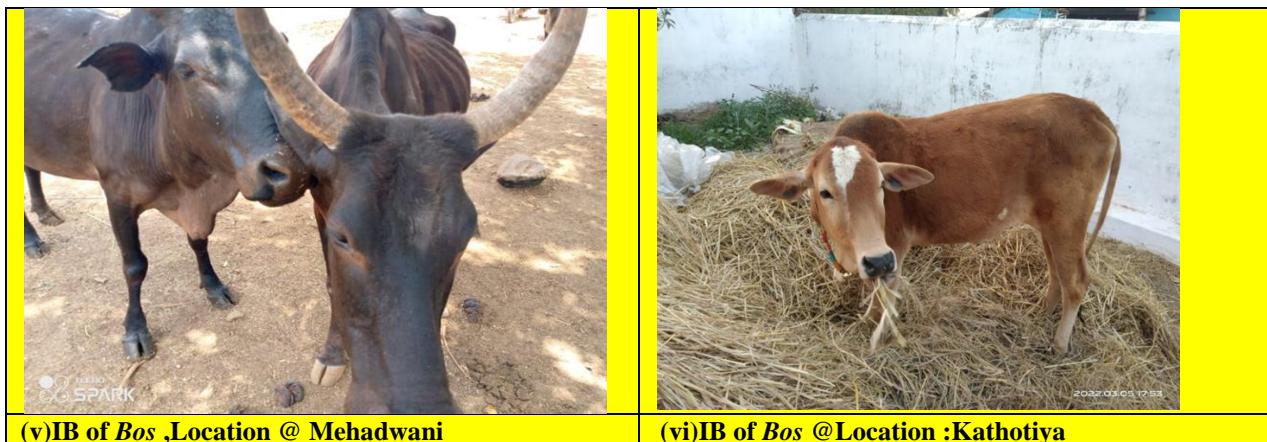


Fig 3.2 (i) - (vi) The local breeds of *Bos* surveyed from the localities- Kachari, Khamariya, Sarasdoli, Sudgaoun Mehadwani from Block Mehadwani.

3.3 Methods of artificial insemination: Artificial insemination is the process of artificially collecting semen from a male animal and placing it in the reproductive tube of a female animal [10]. During the interview, fieldworker and artificial insemination technician Ashok Paraste explained that there are several methods involved in artificial insemination, including semen collection and preservation; deep-frozen semen insemination in animals; liquefaction of semen (thawing of semen); and filling the semen straw in the artificial insemination gun (Fig 3.3).

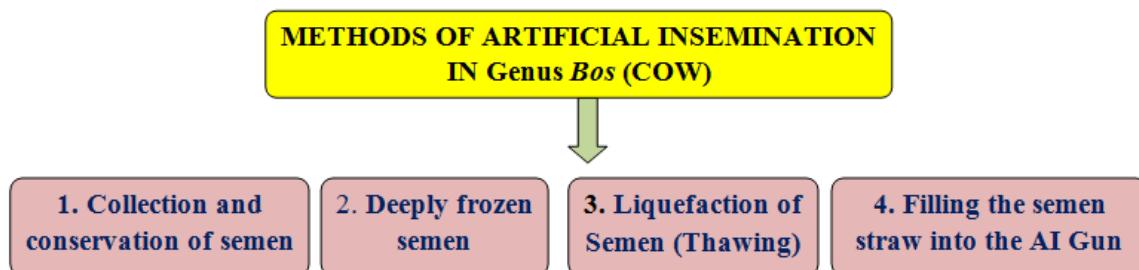


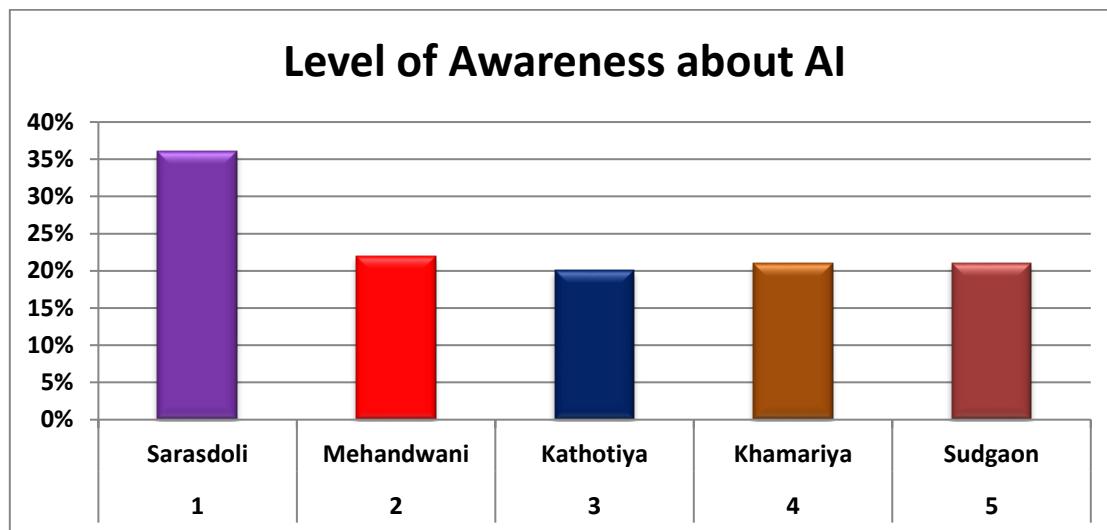
Fig-3.3- Methods of artificial insemination in genus *Bos*

3.4 Procedure for Artificial Insemination: - While we were in the field at Block Mehadwani, technician Ashok Paraste demonstrated the Recto-Vagina Techniques to us (Fig. 3.4). The technician lubricates his left hand with soap-pie, oil, or other lubricant before inserting it into the anus of the animal that came for the worm and holding the cervix in his hand. The second hand then reaches the cervix by inserting the artificial insemination pistol into the vagina and guiding it through the outer door of the cervix with the thumb of the hand in the anus. The gun's tip is then passed down the length of the cervix and into the uterus. Then, using the right hand, unleash the pistol (Fig. 3.4).



Fig:-3.4, Recto-Vagina Techniques procedure in *Bos* at the Sarasdoli locality of Block Mehadwani

3.5 Level of awareness of artificial insemination for the breed improvement in the Block Mehadwani area: - During the years 2021–2022, surveys were conducted in the villages of Block Mehadwani, Sarsdoli, Mehadwani, Kathotiya, Sudgaon, and Khamaria. The purpose of the survey was to gather information on public awareness of artificial insemination procedures. According to the survey, the level of awareness regarding artificial insemination for indigenous breed *Bos* among the villagers of the Block Mehadwani region was 36% in Sarsdoli, 22% in Mehadwani, 40% in Kathoutia, 20% in Khamaria, and 21% in Sudgaon (Graph-3.1).



Graph-3.1:-Level of Awareness about Artificial Insemination for Breed Improvement in the villagers living in Block Mehadwani area.

Data Analysis:- The work of data analysis was done by using the Z-test formula given below[11].

$$Z \text{ Test} = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

Here,

\bar{x} = Mean of Sample

μ = Mean of Population

σ = Standard Deviation of Population

n = Number of Observation

The p-value of the z-score is obtained from the p-value-online calculator (www.calculator.net/p-value-calculator). The p-values obtained with respect to the level of awareness about artificial insemination (Table-1) are 0.0000063 and 0.0 with respect to the location of Sarsdoli, Mehadwani, Khamaria, Sudgaon and Kathotiya, respectively which are significant results at P<0.10 values.

Table-1: Data Analysis -Level of Awareness about Artificial Insemination					
S.N	Localities	Mean	SD	z-Value	p-Value
1	Sarsdoli	10.71	6.5	4.0	0.0000063*
2	Mehadwani	10.71	6.5	4.0	0.0000063*
3	Kathotiya	16.71	11.4	7.1	0.0*
4	Khamariya	10.50	6.4	4.0	0.0000063*
5	Sudgaon	10.45	6.3	4.0	0.0000063*

Note:- *- Significant

Result: - The results indicated that a native breed of *Bos* genera is widely distributed within the Block Mehadwani. The identification of this indigenous *Bos* race has never been studied, and there is no data available concerning the Block Mehadwani. The people of this region refer to this race as "Avnat Nssal". The race produces a small amount of milk. This breed is an important draught animal for the tribes who live here. Approximately 40% of Block Mehadwani's population raises calves by artificial insemination. The widespread practice of AI has the potential to decrease the genetic pool of indigenous *Bos* breeds in the Block Mehadwani area. Nevertheless, more studies and research are required with respect to breed identification and the effect of AI on the native race of the *Bos* genus in the Block Mehadwani region.

Discussion:- Current research has also successfully evaluated that about 1.5 million years ago, the present-day cow evolved into a wild animal on the earth, which comes under the genus *Bos*. The 'Aurochs' (*Bos primigenius*) are the wild ancestors of all

domesticated *Bos* genera [12]. The geographic distribution of the aurochs (*Bos primigenius*) was very wide, from East Asia to Europe and North Africa. Both the species, *Bos indicus* and *Bos taurus*, domestication events in the Indian subcontinent are well indicated and completely interbred [13]. Cattle were domesticated about 10,000 years ago, spread beyond domestication centers in Europe, Asia, and Africa during the next few thousand years, and many populations have adapted locally [14]. The *Bos indicus* species is an Indian domesticated cow. There are 30 types of cattle breeds found in Madhya Pradesh. These breeds share the same number of chromosomes, their size, shape, quantity, and similar breeding behavior [15]. The main four breeds have been identified so far in Madhya Pradesh: Nimari, Malvi, Gaolao, and Kenkatha. In cattle, intensive use of AI (RT) results in an improved genetic advantage [16]. But on the other hand; it also causes genetic diversity to deteriorate [17]. The aurochs (*Bos primigenius*), the wild ancestor of all domesticated animals, has become extinct. In the present scenario, widespread use of artificial insemination may create the possibility of extinction of the indigenous breed (IB) of *Bos* genera and loss of its gene pool from the Block Mehdwani area.

Conclusion and suggestion: - In conclusion, the *Bos primigenius* (aurochs) is the wild ancestor of all domesticated animals. Both the *Bos indicus* and the *Bos taurus* have been domesticated in India for a long time. An indigenous breed of the *Bos* genus that can be found in the Block of Mahendwani. Nimari, Malvi, Gaolao, and Kenkatha cows are the four main indigenous breeds found in Madhya Pradesh. When AI is used extensively, it improves genetic advantage while simultaneously causing genetic variety to decrease and the loss of the original gene pool.

Current research has only been able to demonstrate the effects of artificial insemination (AI) on the gene pool of the *Bos* genus Linnaeus (1758), a study conducted in Block Mehdwani, Dindori, Madhya Pradesh, India. As a result, future studies should focus on artificial insemination, legitimate breed identification, population dynamics, biodiversity, and genetic diversity of pure and hybrid breeds concerning the genus *Bos*.

Acknowledgments:- The authors are grateful to Ms. Chetna Patil, the Janpad Panchayat Block Mehdwani CEO, and Mr. Pankaj Kumar Singh, the NIWCYD Block Coordinator, for allowing the team to begin the project work and training in the working region. Dr. Rakesh Kumar Tiwari, the extension officer of the Govt. Veterinary Hospital Mehdwani, offered valuable information on artificial insemination techniques. Shri Ashok Paraste, an artificial insemination technician, offered instruction and technical information on artificial insemination. Er. Taj Bisen, a member of the NIWCYD Office, also assisted in the project's completion.

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