



## Phenotypic attributes and production performances of Agonda Goan pig

EAKNATH B CHAKURKAR<sup>1</sup>, AMIYA RANJAN SAHU<sup>2✉</sup>, GOKULDAS P P<sup>2</sup>, SANTANU BANIK<sup>3</sup>  
and SAJAN NAIK<sup>2</sup>

ICAR-Central Coastal Agricultural Research Institute, Goa 403 402 India

Received: 17 January 2023; Accepted: 5 June 2023

### ABSTRACT

The aim of study was to evaluate morphometric traits, growth and reproduction performance of indigenous Agonda Goan pigs reared under coastal climate which supports livelihood development of resource poor farmers. Population size in breeding tract varied depending on farmers' preference for breeding and consumers' demand for pork. Data (n=74) on different parameters were recorded both from farmer's flock and institute pig unit. Body measurements such as body length, height at withers, chest girth and neck girth of both were measured using measuring tape. The body weights at different ages i.e., birth, weaning and monthly interval up to one year of age were recorded using digital weighing balance. The average body length, chest girth, height at withers and neck girth were 102.68±3.22 cm, 99.86±3.64 cm, 58.32±1.19 cm and 73.09±4.18 cm, respectively. The mean bristle yield (g/cutting), bristle length (cm) and bristle diameter (micron) were 38.08±5.85, 4.45±0.04 and 268.21±9.84 in males, and 88.16±16.95, 5.69±0.07 and 270.93±11.07 in female pigs, respectively. The mean weight at birth was 0.59±0.01 kg and at weaning was 3.76±0.12 kg. The yearling weights of adult male and female were 46.58±4.50 and 47.27±6.46 kg, respectively. The average litter size at birth and at weaning was 7.21±0.41 and 5.93±0.28, respectively. Pre-weaning and post-weaning growth rates were 79.25±9.86 and 153.85±13.34 g/day, respectively. This unique germplasm has potential for sustainable production with improved pig breeding programs. However, the breed is under constant threat due to indiscriminate crossbreeding with unbalanced admixture and replacement with exotic breeds for which immediate conservation and improvement programs are essential to save the breed.

**Keywords:** Agonda Goan pig, Bristle characters, Carcass quality, Growth and reproduction, Morphometric traits

Indigenous animal genetic resources are considered as an integral part of diverse ecology that maintains socio-cultural livelihood and balanced ecosystem. The diversity of different breeds reflected in their phenotype through adaptability and productivity in different agroclimatic conditions. Approximately, 20% of livestock breeds are at risk of extinction or already extinct around the globe (Food and Agriculture Organization 2007). The extinction of the animal resources results in disappearance of unique characters, adaptive traits and reliable performance in these feasible production systems (Giuffra *et al.* 2000). Deprivation of feedlot as well as other non-descript meat animals may create a huge loss in terms of food security and environmental imbalance. The total livestock population in India is 535.78 million and pigs represents only 10.29 million (20<sup>th</sup> Livestock Census 2019). The pig population also declined by 12.03% over previous census accounting 7.16 million indigenous/ non-descript and 1.90 million exotic/ crossbred pigs (19<sup>th</sup> Livestock Census

2012). However, the present pig genetic resources are still under-utilized and not being properly conserved.

Total 10 pig breeds have been registered by ICAR-NBAGR, Karnal, which include six from East and North Eastern hilly region, one from East Coast Island, two from Northern dry region and one from West Coast region (<https://nbagr.icar.gov.in/en/registered-pig/>). Among these registered indigenous pig breeds, Agonda Goan pig is the only one found in hot and humid coastal climate. The early onset of oestrus and the success of oestrus synchronization in field condition manifest the reproductive potential of Agonda Goan pigs (Chakurkar 2009). In the present climate change scenario, this unique breed can thrive well because of its adaptive potential to perform better due to small body size in minimizing heat stress effects. It also acts as a potential source of animal protein for the pork eating community as most of the population in Goa prefers pork in their diet. However, this breed is often neglected in the farmers' field due to its comparatively low productivity despite better adaptability in low-input production system. The introduction of exotic germplasm along with un-planned crossbreeding to improve the productivity has become a threat for the indigenous breeds resulting in its genetic dilution (Nidup and Moran 2010). Additionally, there is lack of information on physical

Present address: <sup>1</sup>ICAR-Central Island Agricultural Research Institute, Port Blair, Andaman & Nicobar Islands. <sup>2</sup>ICAR-Central Coastal Agricultural Research Institute, Goa. <sup>3</sup>ICAR-National Research Centre on Pig, Guwahati, Assam. ✉Corresponding author email: [dramiyavet@gmail.com](mailto:dramiyavet@gmail.com)

characters, productivity and reproductive attributes of the Agonda Goan pig. In this backdrop, the present research was carried out to assess the phenotypic characteristics, production performance and litter traits of this indigenous breed in the breeding tract.

## MATERIALS AND METHODS

*Distribution pattern of native germplasm:* The indigenous pig breed Agonda Goan was originated and distributed all around the Goa such as Old Goa, Goa Velha, Siridao, Panjim, Parvorim, Aldona, Utorda, Verna, Majorda, Benaolim, Cancona, Cuncolim, Tivim, Mardol, Calangute, etc. This unique population was registered as a breed by National Bureau of Animal Genetic Resources, Karnal, Haryana by the working group of ICAR-Central Coastal Agricultural Research Institute, Goa, India (ICAR-NBAGR 2015).

*Location and climatic variables:* The study was conducted both in the Institute Pig Unit as well as in the farmers' field. The location of breeding tract is in Goa, India with latitude of 15°N and longitude of 73°E (<https://ccari.icar.gov.in/overview.html>). The climate is hot and humid with maximum temperature of 34.5°C and minimum of 23°C, and the relative humidity ranges between 57-90% (Nayak *et al.* 2021). The maximum annual rainfall is 4470 mm and minimum 2432 mm. The local pig breed is highly adapted to the coastal hot and humid climate.

*Management practices:* The pigs are reared predominantly in backyard scavenging and in semi-intensive system. The herd size of local pigs is low which varies from 5 to 20 animals. The animal sheds are primarily made up of wooden planks, galvanized iron wires or laterite stones an emphasis on giving protection from the rain and shelter at night to prevent them from predators. The animals have greater capacity to utilize fibrous and cheap quality feed in comparison to exotic or crossbred pigs. The pigs are usually fed with kitchen/ hotel wastes, bakery products, boiled rice husk or gruels and chicken offals. The farmers are rearing pigs placing different breeds in common shed due to space shortage and improper knowledge of pedigree record which leads to admixture of breeds as a result of crossbreeding. The breeding followed in farmers' field is only by natural mating with mature boars. Generally, no vaccination is followed by the farmers for the local pigs maintained in their backyard. However, some of the experienced farmers strictly vaccinate the stocks with classical swine fever and circovirus vaccines.

*Survivability:* This local breed is very hardy as evolved in their natural environment. The adult pigs hardly need any climatic protection except for continuous rain over several days. Sometimes diarrhoea and other digestive problems appear due to inappropriate feeding practice in extensive rearing system. The incidence of piglet anaemia is very low, even though the piglets not accessed to any concentrate feed. In few cases, piglets suffer from ascites due to protein deficiency in the diet. Although these indigenous pigs are resistant to many diseases, farmers are recommended

to regularly vaccinate against Swine Fever virus as a preventive measure. There is no incidence of diseases like Foot and Mouth Disease, Haemorrhagic Septicaemia, Mycoplasma infections and Porcine Reproductive and Respiratory Syndrome reported in this indigenous breed.

*Data recording and statistical analysis:* Body measurements (n=74) such as body length, height at withers, chest girth and neck girth of both the sexes were recorded following the guidelines of Food and Agricultural Organization (Food and Agricultural Organization 2012). The bristle characteristics viz. bristles yield in each cutting, length and diameter of bristles were recorded. The body weights at different ages i.e. birth, weaning and monthly interval up to one year of age were recorded using digital weighing balance. The litter traits viz. age at first oestrus, age at first breeding and farrowing, litter size at birth, litter weight at birth, litter size at weaning, litter weight at weaning, pre- and post-weaning growth rates, etc. were recorded. The data on mean body weights, litter traits, body measurements, carcass characteristics and bristle characteristics were analysed using SPSS® Statistics software version 20.0.

## RESULTS AND DISCUSSION

*Population trends:* The Agonda Goan pigs are distributed in farmers' field in both the districts of Goa. Population of the pigs in the breeding tract varies depending upon the market demand. Population size in the breeding tract varied from 35,000 to 41,000 depending on farmers' preference for breeding and consumers' demand for pork based on sampling estimate.

*Physical characteristics and body measurements:* The pigs are small with pot belly appearance. The colour of the coat is predominantly black, and some animals have white marks on legs and snout (Fig. 1). The head is elongated with triangle shaped face and short straight snout. Ears are small and erect. The body is covered with rough bristles. The dorsal line of body is slightly concave and straight tail (Fig. 2). The pigs are aggressive in nature, very alert and run faster on approaching them for treatment or sample collection. The sows have strong maternal instinct and protect their piglets from any strangers (Fig. 3). Female pigs have 12-14 functional teats present equidistantly along the mid ventral line. There are some reports which describe the aggressive nature of indigenous pig, but the indigenous pig Burmese Black is docile in nature (Banik *et al.* 2016, Govindasamy *et al.* 2019).

The various traits on body measurement of Agonda Goan pig in both the sexes are presented in Table 1. The average body length, chest girth, height at withers and neck girth were 102.68±3.22, 99.86±3.64, 58.32±1.19 and 73.09±4.18 cm, respectively. The average chest girth and neck girth in female pigs were significantly higher (P<0.05) than male pigs; however, there was no significant difference in body length and height at withers between male and female pigs. The different body measurement traits of Agonda Goan pigs were similar with Doom and



Fig. 1. Adult male of Agonda Goan pig.



Fig. 2. Adult female of Agonda Goan pig.



Fig. 3. Sow with piglets of Agonda Goan pig.

Niang Megha pigs (Khargharia *et al.* 2014), Suwo pig (Zaman *et al.* 2017) and Mizo local pig (Kalita *et al.* 2018). The earlier reports also showed significant differences in chest girth and neck girth in indigenous pig, but the males have high measurements than females in Suwo pigs (Zaman *et al.* 2017), Mizo local pigs (Kalita *et al.* 2018) and Burmese Black pigs (Govindasamy *et al.* 2019).

Agonda Goan pigs have medium sized rough bristles. The average bristle yield (g)/ cutting, bristle length (cm) and bristle diameter (micron) obtained from adult male and female pigs are given in Table 2. Female pigs have comparatively higher average values for different bristle traits than male pigs. The present findings are in accordance with the reports on Burmese Black pigs (Govindasamy *et al.* 2019). However, all the bristle traits studied were lower than high yielding long bristles of Doom pig (Rahman *et al.* 2008) and Hampshire × Ghungroo pig (Mohan *et al.* 2015).

**Growth performance:** The average body weights of Agonda Goan pigs at birth, weaning (40<sup>th</sup> day of age) and on monthly interval up to one year of age are presented in

Table 1. The average weights (kg) at birth, weaning and yearling age were 0.59±0.01, 3.76±0.12 and 46.90±3.70, respectively. The pre- and post-weaning growth rates (g/day) were 79.25±9.86 and 153.85±13.34, respectively (Table 3). The body weights of Agonda Goan pigs were comparable with the reports on indigenous pig breeds viz. Desi pig of Jabalpur, Jharkhand desi pigs, Mali, Doom and Niang Megha, Bareilly desi pigs, Suwo and Mizo local pigs (Pandey *et al.* 1997, Lakhani *et al.* 1991, Dandapat *et al.* 2010, Khargharia *et al.* 2014, Boro *et al.* 2016, Zaman *et al.* 2017, Kalita *et al.* 2018). However, the body weight at different age groups of Agonda Goan pigs was lower than Ghoongroo (birth weight 0.96 kg and 7 months

Table 1. Body measurements and body weights of Agonda Goan pigs

Parameter	Male	Female	Average
Body length <sup>NS</sup> (cm)	101.39±3.07	103.99±3.37	102.68±3.22 (74)
Chest girth* (cm)	86.47 <sup>b</sup> ±1.92	113.25 <sup>a</sup> ±5.35	99.86±3.64 (74)
Height at withers <sup>NS</sup> (cm)	55.86±0.93	60.78±1.44	58.32±1.19 (74)
Neck girth* (cm)	68.86 <sup>b</sup> ±5.32	77.33 <sup>a</sup> ±3.03	73.09±4.18 (74)
Birth weight <sup>NS</sup> (kg)	0.61±0.01	0.57±0.01	0.59±0.01 (321)
Weaning weight <sup>NS</sup> (kg)	3.73±0.16	3.79±0.17	3.76±0.12 (202)
Two months weight <sup>NS</sup> (kg)	4.64±0.27	4.78±0.26	4.73±0.19 (153)
Three months weight <sup>NS</sup> (kg)	8.06±0.51	9.05±0.44	8.15±0.35 (98)
Four months weight <sup>NS</sup> (kg)	12.25±0.64	14.61±0.87	13.32±0.56 (58)
Five months weight <sup>NS</sup> (kg)	16.61±0.99	19.22±1.38	17.92±0.83 (48)
Six months weight <sup>NS</sup> (kg)	22.18±1.55	24.77±1.07	23.61±0.94 (48)
Seven months weight <sup>NS</sup> (kg)	28.37±2.04	31.55±1.19	30.28±1.11 (48)
Eight months weight <sup>NS</sup> (kg)	31.26±2.28	35.22±3.12	34.53±1.53 (45)
Nine months weight <sup>NS</sup> (kg)	39.40±2.91	37.70±3.87	38.66±2.05 (45)
Ten months weight <sup>NS</sup> (kg)	41.26±3.27	41.37±4.34	41.31±2.55 (45)
Eleven months weight <sup>NS</sup> (kg)	44.22±3.73	43.54±5.70	42.97±3.22 (43)
Twelve months weight <sup>NS</sup> (kg)	46.58±4.50	47.27±6.46	46.90±3.70 (43)

<sup>NS</sup>Not significant; \*significant (P≤0.05); Means with different superscript in a column differ significantly; Figures within parentheses denote number of observations.



Table 2. Bristle characteristics of Agonda Goan pigs (number of observations within parentheses)

Parameter	Male			Female		
	<1 year age	>1 year age	Average	< 1 year age	2-5 years age	Average
Bristle weight (g)/cutting	33.20±5.06 (15)	43.67±11.28 (15)	38.08±5.85 (30)	28.00±2.70 (13)	114.91±18.20 (13)	88.16±16.95 (26)
Bristle length (cm)	3.99±0.05 (700)	4.94±0.05 (800)	4.45±0.04 (1500)	4.13±0.09 (620)	6.38±0.09 (680)	5.69±0.07 (1300)
Bristle diameter (micron)	266.20±8.15 (700)	270.23±11.52 (800)	268.21±9.84 (1500)	263.34±7.45 (620)	278.52±14.68 (680)	270.93±11.07 (1300)

weight 53.13 kg) and Burmese Black (birth weight 0.89 kg, weaning weight 14.67 kg and 8 months weight 66.27 kg) pigs of Eastern and North Eastern sub-Himalayan region (Pan *et al.* 2005, Govindasamy *et al.* 2019).

**Reproductive performance:** The reproductive traits and average daily weight gain of Agonda Goan pigs are presented in Table 3. The average age at first estrus, age at first conception and age at first farrowing were 172.4±22.95, 206±19.26 and 324.75±28.15 days, respectively. All these reproductive parameters were comparable with Mali pig, Naga local pig and Votho pigs (Dandapat *et al.* 2010, Borkotoky *et al.* 2014, Chusi *et al.* 2016). However, the observed values were lower than the performance of Ghungroo, Niang Megha and Doom pigs (Sahoo *et al.* 2012, Khargharia *et al.* 2014, Gokuldas *et al.* 2015). The average farrowing interval of Agonda Goan pig was 185.35±5.84 days and comparable with other local pig breeds of North Eastern region of India (Zaman *et al.* 2014, Patra *et al.* 2016). But it was found to be shorter than Naga local pig, Votho pig and Mizo local pig (Kumaresan *et al.* 2007, Borkotoky *et al.* 2014, Chusi *et al.* 2016).

Table 3. Reproductive performance and growth rate (g/day) of Agonda Goan pigs (number of observations within parentheses)

Parameter	Overall
Age at first heat (days)	172.4±22.95 (64)
Age at first conception (days)	206±19.26 (59)
Age at first farrowing (day)	324.75±28.15 (59)
Farrowing interval (days)	185.35±5.84 (46)
Litter size at birth (no.)	7.21±0.41 (56)
Litter weight at birth (kg)	3.92±0.14 (56)
Litter size at weaning (no.)	5.93±0.28 (56)
Litter weight at weaning (kg)	21.45±1.48 (56)
Pre-weaning growth rate (g/d)	79.25±9.86 (202)
Post-weaning growth rate (g/d)	153.85±13.34 (45)

The average litter size at birth and weaning were 7.21±0.41 and 5.93±0.28, respectively. The litter weight at birth and weaning were 3.92±0.14 and 21.45±1.48 kg, respectively. The available literatures on reproductive performance with respect to litter size and weight were comparable with the findings of Agonda Goan pigs (Bhowal 1997, Phookan *et al.* 2002, Dandapat *et al.* 2010, Zaman *et al.* 2014, Khargharia *et al.* 2014, Zaman *et al.* 2017). However, some of the large sized indigenous pigs with higher litter size were available in the North Eastern part of India (Pan *et al.* 2005,

Govindasamy *et al.* 2019).

**Carcass traits:** The carcass traits of Agonda Goan pigs are presented in Table 4. The average carcass weight and length of the carcass were 48.46±1.98 kg and 56.89±1.44 cm, respectively at the time of slaughter with body weight of 67.37±2.72 kg. The average dressing percentage was 71.93±0.34%. The back fat thickness was 5.01±0.10 cm with internal loose fat of 2.76±0.19 kg. The average loin weight and ham weight were 4.38±0.20 kg and 6.65±0.39 kg, respectively. The higher demand of pork from this local breed was due to its preference in local sausage making cottage industry and higher back fat thickness which often increase the acceptability among the consumers. Similar findings were observed in the indigenous Ghungroo pigs maintained in intensive system of rearing (Thomas *et al.* 2016). However, there were comparatively lower values in different carcass traits in Assam local pigs under semi scavenging system (Phookan *et al.* 2020).

Table 4. Carcass characteristics of Agonda Goan pigs (n=56)

Carcass characteristic	Male	Female	Average
Slaughter weight <sup>NS</sup> (kg)	67.32±2.12	67.42±3.31	67.37±2.72
Carcass weight <sup>NS</sup> (kg)	48.31±1.47	48.61±2.48	48.46±1.98
Dressing per cent <sup>NS</sup>	71.79±0.28	72.07±0.40	71.93±0.34
Carcass length <sup>NS</sup> (cm)	56.55±1.16	57.22±1.71	56.89±1.44
Back fat thickness (cm)	5.07±0.09	4.94±0.11	5.01±0.10
Internal loose fat <sup>NS</sup> (kg)	2.85±0.15	2.67±0.23	2.76±0.19
Loin weight <sup>NS</sup> (kg)	4.51±0.11	4.24±0.28	4.38±0.20
Ham weight <sup>NS</sup> (kg)	6.59±0.32	6.70±0.46	6.65±0.39

<sup>NS</sup>Not significant, n = number of observations.

The Agonda Goan pig being an indigenous breed have medium-sized body with high productive and reproductive performance under low-input backyard production system in the coastal ecosystem. The small body size with high maternal instinct and aggressiveness are the unique qualities of this breed. The population of this breed is declining due to unrestricted crossbreeding and high slaughter rate for which conservation of this pig under field condition is highly warranted. The rapid dilution of this indigenous germplasm may face troublesome in near future for which special attention should be given to conserve this breed both in farmers' field as well as through efforts of government agencies and like-minded professional organizations. The present work on Agonda Goan pig may serve as vital information which would be useful to adopt suitable breeding policy and future conservation strategies.

## ACKNOWLEDGEMENTS

Authors are thankful to the Director, ICAR-Central Coastal Agricultural Research Institute, Goa and State Animal Husbandry Department, Goa for providing necessary facility to execute the research programme.

## REFERENCES

- 19<sup>th</sup> Livestock Census. 2012. Department of Animal Husbandry, Dairying & Fisheries Annual Report, Ministry of Agriculture, Govt. of India, New Delhi.
- 20<sup>th</sup> Livestock Census. 2019. Department of Animal Husbandry, Dairying & Fisheries Annual Report, Ministry of Agriculture, Govt. of India, New Delhi.
- Banik S, Naskar S, Zaman G, Sarma D K, Tamuly M K and Gandhi R S. 2016. Doom Pig: An Indigenous Pig Germplasm of Assam. Monograph, published by ICAR-National Research Centre on Pig, Rani, Guwahati.
- Bhowal A. 1997. 'Genetic studies on the performance of indigenous pigs and their crosses with Hampshire.' M.V.Sc. Thesis, Assam Agricultural University, Khanapara, Guwahati, Assam.
- Borkotoky D, Perumal P and Singh R K. 2014. Morphometric attributes of Naga local pigs. *Veterinary Research International* **2**(1): 08–11.
- Boro P, Patel B H M, Sahoo N R, Gaur G K, Dutt T, Singh M, Upadhyay D, Madkar A and Naha B C. 2016. Productive and reproductive performances of local pigs of Bareilly district under scavenging system. *Journal of Animal Research* **6**(6): 1019–23.
- Chakurkar E B. 2009. Synchronization of estrus in local and Large White Yorkshire sows under coastal climatic conditions. *Indian Journal of Animal Reproduction* **30**(2): 39–41.
- Chusi Z, Savino N, Dhali A and Perumal P. 2016. Reproductive attributes of local pig (Votho) of Nagaland, India. *Indian Journal of Animal Research* **50**(6): 862–66.
- Dandapat A, Choudhury K B D, Debbarma C and Das M K. 2010. Phenotypic characterization of Mali pig in Tripura, India. *Livestock Research and Rural Development* **22**(4): 1–3.
- Food and Agricultural Organization. 2007. The State of the World's Animal Genetic Resources for Food and Agriculture, edited by Barbara Rischkowsky and Dafydd Pilling. Rome.
- Food and Agricultural Organization. 2012. Phenotypic characterization of animal genetic resources. FAO Animal Production and Health Guidelines No. 11. Rome.
- Giuffra E J M H, Kijas J M H, Amarger V, Carlborg O, Jeon J T and Andersson L. 2000. The origin of the domestic pig: independent domestication and subsequent introgression. *Genetics* **154**(4): 1785–91.
- Gokuldas P P, Tamuli M K, Mohan N H, Barman K and Sahoo N R. 2015. A comparative analysis of reproductive performance of different pig breeds under intensive management system in sub tropical climate. *Indian Journal of Animal Sciences* **85**: 1042–45.
- Govindasamy K, Rahman M, Singh L A, Singh N M and Kumar R. 2019. Phenotypic characterization and performance evaluation of Burmese black pig: A unique indigenous germplasm of north east region of India. *Indian Journal of Animal Research* **54**: 813–19.
- ICAR-NBAGR. 2015. Registered pig breeds. ICAR-National Bureau of Animal Genetic Resources (NBAGR), Karnal, India. <http://www.nbagr.res.in/repig.html>.
- Kalita G, Sarma K, Rahman S, Talukdar D and Ahmed F. 2018. Morphometric and reproductive attributes of local pigs of Mizoram. *International Journal of Livestock Research* **8**(2): 173–77.
- Khargharia G, Zaman G, Laskar S, Das B, Aziz A, Roychoudhury R and Roy T C. 2014. Phenotypic characterization and performance studies of Niang Megha and Doom pigs of North eastern India. *Asian Academic Research Journal of Multidisciplinary* **1**(27): 667–76.
- Kumaresan A, Bujarbaruah K M, Pathak K A, Chhetri B, Das S K, Das A and Ahmed S K. 2007. Performance of pigs reared under traditional tribal low input production system and chemical composition of non-conventional tropical plants used as pig feed. *Livestock Science* **107**: 294–98.
- Lakhani G P and Bhadouria S S. 1991. Studies on performance of indigenous pigs at Livestock Farm, Jabalpur. *Indian Journal of Animal Research* **26**: 56–58.
- Mohan N H, Debnath S, Sarma D K and Talukdar B. 2015. Physical and microscopic characteristics of fibre obtain from crossbred (Hampshire × Ghungroo) pigs.
- Nayak N, Bhanja S K, Chakurkar E B, Sahu A R and Kumar S. 2021. Effect of mid-embryonic thermal conditioning on zootechnical performance, immune-competence and expression profiling of HSP70 gene in backyard chicken variety. *Indian Journal of Poultry Science* **56**(3): 253–59.
- Nidup K and Moran C. 2010. Biodiversity and rapid loss of indigenous pig population in the Himalayas. In 11<sup>th</sup> APRU Doctoral Student Conf., 12–16 July 2010. Jakarta, Indonesia, University of Indonesia.
- Pan S, Misra S K and Kundu M S. 2005. Ghongroo pig: A new found animal genetic resource of sub-Himalayan West Bengal, India. *Animal Genetic Resources/Resources Genetiques Animales* **37**: 91–96.
- Pandey R N, Singh S K, Singh R L and Dubey C B. 1997. Genetic study of weight at different ages in exotic, desi and their half-bred pigs. *Indian Journal of Animal Sciences* **67**(12): 1086–90.
- Patra M K, Kent Y, Ngullie L, Das R K and Deka B C. 2016. Comparative performance of Ghungroo and Large Black pig at organized institutional farm conditions. *Indian Journal of Animal Research* **50**(5): 776–81.
- Phookan A. 2002. 'Studies on certain growth, reproduction and biochemical traits in indigenous pigs of Assam.' M.V.Sc. Thesis, Assam Agricultural University, Khanapara, Guwahati, Assam.
- Phookan A, Laskar S, Rajbongshi P and Deori S. 2020. Carcass characteristics of indigenous pigs of Assam reared under semi-scavenging system. *Livestock Research International* **8**(2): 56–58.
- Rahman S, Barthakur S and Kalita G. 2008. Pig production and management system in Aizawl District of Mizoram, India. *Healthcare* **95**: 5.
- Sahoo N R, Das A, Naskar S, Banik S, Pan S and Tamuli M K. 2012. A monograph on Ghungroo pig. A new promise in Indian piggery. ICAR-NRC Pig, Rani.
- Thomas R, Banik S, Barman K, Mohan N H and Sarma D K. 2016. Carcass composition and meat quality parameters of Ghungroo pigs. *Indian Journal of Animal Sciences* **86**(8): 925–29.
- Zaman G, Aziz A and Kiba H Z. 2017. Body weights and body measurements of Suwo pigs of Nagaland at different ages. *North-East Veterinarian XVAA*(1): 6–8.
- Zaman G, Aziz A, Laskar S, Phookan A and Akhtar F. 2014. Reproductive performance of indigenous pigs of north-east India. *North-East Veterinarian XAV*(2): 9–10.