



## Indigenous pig genetic resources of India: Distribution, types and their characteristics

RAHUL BEHL<sup>1</sup>, P K VIJ<sup>2</sup>, S K NIRANJAN<sup>3</sup>, JYOTSNA BEHL<sup>4</sup> and R K VIJH<sup>5</sup>

ICAR-National Bureau of Animal Genetic Resources, Karnal, Haryana 132 001 India

Received: 8 February 2019; Accepted: 17 May 2019

### ABSTRACT

In India, the indigenous pigs are traditionally reared either by the poor, weaker and the tribal sections of the society. Although, the growth rates and feed conversion ratio of indigenous pigs are less than those of exotic or crossbred pigs, they have unique features like heat tolerance, disease resistance, early sexual maturity and ability to produce meat with less fat. In India, the total population of indigenous pigs is 78.35 lakhs constituting 76.14% of the total pig population of the country. Uttar Pradesh has the largest population of indigenous pigs (11.52 lakhs), followed by Assam (10.22 lakhs), Jharkhand (9.21 lakhs) and Bihar (6.26 lakhs). In studies conducted at various centres of All India Coordinated Research Project on pigs, the weight of these pigs at birth, weaning (8 weeks) and 32 weeks of age ranged from 0.44±0.01 to 0.83±0.01, 7.00±0.36 to 8.12±0.18 and 31.32±0.45 to 42.91±1.04 kg, respectively. Although, the indigenous pigs were largely clubbed as local or non-descript but in the last few years many population have been characterized. Some of them have been registered by ICAR-NBAGR as new breeds of indigenous pigs, like Ghongroo, Niang Megha, Agondagoan, Tenyi Vo, Nicobari, Doom, Zovawk and Gurrah pigs. This review discusses the population trend, attributes and available breeds of indigenous pigs of India.

**Key words:** Attributes, Breeds, Indigenous pigs

Pig (*Sus scrofa*) is an important livestock species that can survive in diverse agro-ecological environments and relatively poorer management conditions. They are most efficient domestic animals in converting domestic and agricultural wastes into edible meat. Due to their high growth rate, better feed conversion ratio and large litter size, pigs produce the cheapest meat among all meat producing animals that can be afforded by weaker sections of the society, thus providing an affordable source of good quality protein to poorer people.

In India, pigs are traditionally reared by the poor, weaker and tribal sections of the society, rearing mainly indigenous pigs (Gaur 2001, Bhat *et al.* 2010, Naskar *et al.* 2013). Besides indigenous pigs, some exotic breeds like Large White Yorkshire, Landrace and their crosses were also introduced. Although the growth rates and feed conversion ratio of indigenous pigs is less compared to exotic or crossbred pigs (Kumar *et al.* 1990, Gaur *et al.* 1997), they have unique features like heat tolerance, disease resistance, early sexual maturity and ability to produce meat with less fat. Due to their smaller size, their requirement for feed and space is much less than the exotic and crossbred pigs, thus making them suitable for rearing by poor people with meagre resources. They are well adapted to survive under most adverse conditions of nutrition and management (Hetzler and Miller 1973, Chhabra *et al.* 1999, Naskar *et al.*

2013). This article attempts to review the present status of indigenous pigs of India in terms of their population trends, their productive and reproductive attributes, and the breeds or types of these pigs.

### Population trends and distribution

In the past decade, the population of indigenous pigs has declined from 109.39 lakhs in 1992 to 78.37 lakhs in 2012 showing a decline of 28.85%. However, population of exotic and crossbred pigs has increased from 18.49 lakhs (1992) to 24.56 lakhs (2012) during this period. Taking into consideration the trend since 1992, the population of indigenous pigs is estimated to be mere 69.20 lakhs in 2020 and 60.70 lakhs in 2025 (Behl *et al.* 2018).

As per Livestock Census (2012), Uttar Pradesh has the largest population of indigenous pigs (11.52 lakhs), possessing about 14.78% of the total indigenous pig population of the country followed by Assam (10.22 lakhs), Jharkhand (9.21 lakhs) and Bihar (6.26 lakhs). In terms of population density, Delhi has the highest density of 45.664 indigenous pigs per sq. km followed by Meghalaya (18.268), Tripura (14.199) and Assam (13.034). Only 6 states (Delhi, Meghalaya, Tripura, Assam, Jharkhand and Goa) have the indigenous pig population density of more than 10 pigs per km<sup>2</sup>.

Among states with total pig population of at least 10000, Odisha has the highest percentage of indigenous pigs (98.57) followed by Bihar (96.6), Telangana (95.16) and

Present address: <sup>1</sup>Principal Scientist (behl1969@rediffmail.com); <sup>2,3,4</sup>Principal Scientist; <sup>5</sup>Director.

Chhattisgarh (94.9). Sikkim has the lowest proportion of crossbred and exotic pigs (6.9) followed by Kerala (8.93), Mizoram (13.06) and Nagaland (24.40). Four states, viz. Meghalaya, Tripura, Mizoram and Delhi, have shown increase in indigenous pig population during 2003–2012. Sikkim has shown maximum decrease in indigenous pigs with a decline of 89.47% followed by Kerala (80.77), Nagaland (56.54) and Goa (54.76) (Table 1) (Livestock Census 2003, Livestock Census 2012, Behl *et al.* 2018).

#### Productive and reproductive attributes of indigenous pigs

Studies were conducted at several institutions independently (Gaur 2001) and under the All India Coordinated Research Project on Pigs (AICRPP, Bhatia 1997) to evaluate the attributes of indigenous pigs which were largely clubbed as local or *Desi* pigs.

AICRP on pigs was started with the 3 exotic breeds. However, in the mid 1970s, it was realized that traditional pig keepers with their meagre resources were unable to provide proper healthcare and nutrition required for the exotic breeds. The scavenging model continued to be the

Table 1. Population statistics of the indigenous pigs in India

State	Total population of indigenous pigs (2012)	Density per km <sup>2</sup>	Proportion of indigenous pigs in total pig population of the state	Percent increase or decrease during 2003–2012
Assam	1022354	13.034	62.47	-2.85
Uttar Pradesh	1152441	4.783	86.36	-45.09
Jharkhand	920625	11.549	95.64	-15.50
West Bengal	595964	6.715	91.98	-51.97
Bihar	625531	6.643	96.60	-2.64
Meghalaya	409758	18.269	75.37	4.86
Nagaland	122969	7.417	24.40	-56.54
Chhattisgarh	416916	3.084	94.99	-22.63
Tripura	148891	14.199	41.05	30.70
Arunachal Pradesh	318976	3.809	89.61	-0.93
Maharashtra	288301	0.937	88.62	-30.77
Karnataka	261274	1.362	85.57	-9.69
Odisha	276052	1.773	98.57	-51.24
Manipur	94669	4.240	34.17	-54.11
Telangana	236259	2.108	95.16	*
Mizoram	32286	1.532	13.06	45.45
Rajasthan	216589	0.632	91.17	-30.00
Tamil Nadu	153190	1.178	83.15	-43.54
Madhya Pradesh	161715	0.525	92.05	-50.00
Andhra Pradesh	131752	0.809	90.41	-29.50**
Haryana	77153	1.745	60.63	-9.41
Delhi	67765	45.664	88.31	385.71
Kerala	4965	0.128	8.93	-80.77
Goa	37611	10.160	86.36	-54.76
Punjab	14465	0.287	43.75	-17.65
Sikkim	2451	0.345	6.90	-89.47
Uttarakhand	12685	0.237	65.00	-51.85
India	7837306	2.384	76.14	-30.89

\*Telangana created after 2003; \*\*Undivided Andhra Pradesh.

main system of raising pigs. So, the project was remodelled to incorporate a component to study the performance of indigenous pigs (Bhat *et al.* 2010).

The productive and reproductive characteristics reported by various centres of AICRPP and other such studies on indigenous pigs, before classification into new breeds of indigenous pigs, are summarized in this section.

#### Growth and performance

The body weights of indigenous pigs recorded at birth, 8, 16, 24 and 32 weeks of age, at various centres of AICRPP are given in Table 2 (AICRPP Report 1995, 1997; Mukundan and Usha 2000). The birth weight ranged from 0.44±0.01 to 0.83±0.01 kg. The weight at weaning age (8 weeks) ranged from 7.00±0.36 to 8.12±0.18 kg. The weight at 32 weeks of age was recorded between 31.32±0.45 and 42.91±1.04 kg. Similar observations were also made in other studies that recorded the weight at birth, weaning (8 weeks) and 32 weeks of age to vary from 0.52±0.01 to 0.92±0.01 kg, 5.22±0.28 to 7.44±0.10 kg and 28.70±0.52 to 40.54±0.95 kg, respectively (Kumar *et al.* 1990, Shylla *et al.* 1991, Deo *et al.* 1992, Bhatia *et al.* 1997). Chauhan *et al.* (1994) reported the live weight of indigenous pigs at slaughter to be 51.6±1.8 kg at a mean age of 282±8.5 days.

Mukhopadhyay *et al.* (1991) reported the daily weight gain in *desi* pigs from birth to 8<sup>th</sup> week, 8<sup>th</sup> to 22<sup>nd</sup> week and 22<sup>nd</sup> to 30<sup>th</sup> week to be 96.38, 56.98 and 51.13 g/day, respectively. In another study, total gain and daily gain in weight up to weaning was 5.78 kg and 103 g, respectively (Lakhani and Bhadoria 1990). Kumar *et al.* (1990) has reported average daily weight gain during pre- and post-weaning periods in indigenous pigs to be 53.08±2.25 and 28.83±2.58 g/day. Litter size also has highly significant effect on body weights during pre-weaning period. As the litter size increases, the body weight reduces (Chhabra *et al.* 2005). The mean overall feed efficiency of indigenous pigs reared at various centres of AICRPP was 5.28±0.14 kg feed consumed/kg weight gain. In other studies too, the overall feed efficiency of indigenous pigs ranged between 4.50±0.12 and 5.76±0.53 kg feed/kg gain in body weight (Kumar *et al.* 1990, Lakhani and Jogi 2000a).

The head weight, pluck weight and hot carcass weight of indigenous pigs was reported to be 3.92±0.07, 1.86±0.06 and 35.98±0.67 kg, respectively. The dressing percentage was 68.89±0.96 (Lakhani *et al.* 1997, Chhabra *et al.* 1999). Chhabra *et al.* (1999) reported the back fat thickness, carcass length and loin eye area to be 1.72±0.23, 59.95±0.46 and 22.53±1.16 cm, respectively. Similar observations were made by Lakhani *et al.* (1997), who recorded the average backfat thickness, carcass length and loin eye area to be 2.46±0.7, 57.02±0.44 and 17.92±0.54 cm, respectively. Sex of the animal had no effect on carcass traits.

#### Reproductive performance

The reproductive performance of indigenous pigs recorded at various centres of AICRPP is given in Table 3 (Mukundan and Usha 2000). Age at first farrowing ranged

Table 2. Body weights (kg, mean±SD) at various age groups and efficiency of feed conversion of indigenous pig of India recorded at various centers of All India Coordinated Research Project on Pigs

Center	Age in weeks					Efficiency of feed conversion (kg feed consumed/kg weight gain)
	0 (At birth)	8	16	24	32	
Izatnagar	0.68±0.04	7.32±0.29	14.76±0.82	25.50±1.68	40.43±2.70	5.13
Jabalpur	0.70±0.02	7.59±0.41	13.16±0.54	21.99±0.96	31.78±1.39	5.37
Kattupakkam	0.44±0.01	7.00±0.36	13.43±0.76	22.56±1.06	33.01±1.48	-
Khanapara	0.83±0.01	8.01±0.44	17.39±0.64	28.36±1.05	38.05±1.44	5.21
Mannuthy	0.72±0.01	7.05±0.24	13.53±0.27	21.97±0.40	31.32±0.45	5.21
Tirupati	0.78±0.01	8.12±0.18	15.83±1.03	30.82±1.05	42.91±1.04	5.48

from 375.2 to 423.3 days. Gestation length varied from 109.8 to 112.1 days. Litter size at birth ranged from 4.87 to 6.82 and at weaning from 4.2 to 5.01. Litter weight at birth ranged from 2.13 to 5.21 kg and at weaning from 32.12 to 37.81 kg, respectively (Mukundan and Usha 2000, AICRPP Report 1995, 1997).

Several other studies conducted on indigenous pigs were in agreement with these observations. Mukhopadhyay *et al.* (1992) reported the mean gestation length and farrowing interval of indigenous sows to be 111.78±0.18 and 226.89±6.94 days, respectively. Litter size at birth ranged from 6.2±0.55 to 7.56 and at weaning from 3.89±0.43 to 6.2±0.3 (Mukhopadhyay *et al.* 1992, Chauhan *et al.* 1994, Chhabra *et al.* 1996, Lakhani and Jogi 2000b). Average litter weight at birth (4.44±0.6 to 4.84±0.25 kg) and at weaning (21.38±3.05 to 42.02±0.26 kg) were in the similar range as observed under AICRPP (Mukhopadhyay *et al.* 1992, Chhabra *et al.* 1996, Mishra *et al.* 1990, Lakhani and Jogi 2000b). Mishra *et al.* (1990) reported the average survivability at weaning to be 92.4%.

#### Breeds of indigenous pigs of India

The indigenous pigs were largely grouped as local, *Desi* or non-descript. Only few references were available which grouped them into some population like *Desi* pigs of North India, Ankamali pigs of peninsular India, Gahuri pigs of Assam and Ghoongroo pigs of West Bengal (Bhat *et al.* 1981, Bhat *et al.* 2010). However, new population have been

characterized and documented (Boro *et al.* 2016a). Some of them have been found to be distinct and are registered by ICAR-NBAGR as new breeds of indigenous pigs.

#### Registered breeds of indigenous pigs

Ghoongroo, Niang Megha, Agonda Goan, Tenyi Vo, Nicobari, Doom, Zovawk and Gurrah are the eight registered breeds of indigenous pigs in India.

*Ghoongroo*: The pigs of Ghoongroo breed are black coloured, concave snouted and pendulous eared animals. The height at withers is 84 (66–95) cm in males and 78 (59–92) cm in females. The litter size at farrowing is 12 (8–18). These pigs are distributed in Darjeeling, Jalpaiguri, Cochbehar, North-Dinajpur and South-Dinajpur districts of West Bengal with an estimated population of approximately 15,000 (Breed Descriptor 2013). Sahoo *et al.* (2012) had reported the age at first heat of these pigs to be 190.38±4.38 days. Gokuldas *et al.* (2015) had reported a little higher age of puberty as 7.8±0.41 months for these pigs. Gestation period and age at first farrowing of these pigs is 113.8±0.16 days and 13.1±0.65 months, respectively. Farrowing interval is 213.53±0.4 days. Weight at birth and at weaning is 0.96±0.02 and 7.08±0.25 kg, respectively. Litter size at birth and at weaning is 0.96±0.02 and 8.7±0.25, respectively (Sahoo *et al.* 2012, Gokuldas *et al.* 2015). Hot carcass weight is 85 (63–90) kg in males and 82 (61–90) kg in females (Breed Descriptor 2013). Fatty acid profiling of *musculus longissimus thoracis et lumborum* indicated that

Table 3. Reproductive performance of indigenous pigs of India at various centers of All India Coordinated Research Project on Pigs

Trait	Research Center						Mean±SD
	Izatnagar	Jabalpur	Kattupakkam	Khanapara	Mannuthy	Tirupati	
Age at first conception (days)	301.10	280.70	–	311.10	261.80	278.50	286.64±19.53
Age at first farrowing (days)	411.30	395.50	–	423.20	375.20	386.80	398.4±19.12
Gestation length (days)	110.00	110.80	–	112.10	111.60	109.80	110.86±0.99
Litter size at birth	6.82	6.20	4.92	4.87	5.04	5.38	5.54±0.80
Litter size at weaning	5.01	4.26	4.20	4.62	4.52	4.73	4.56±0.30
Litter weight at birth (kg)	4.57	4.02	2.13	4.33	3.73	5.21	4.00±1.05
Litter weight at weaning (kg)	33.77	33.12	36.45	36.80	32.12	37.81	35.01±2.31
Birth weight (kg)-Male	0.70	0.70	0.45	0.85	0.76	0.78	0.71±0.14
Birth weight (kg)-Female	0.66	0.70	0.42	0.81	0.75	0.78	0.69±0.14
Weight at weaning (kg)-male	7.34	7.59	7.19	8.20	6.88	8.20	7.57±0.54
Weight at weaning (kg)-Female	7.30	7.56	6.68	7.80	6.86	8.04	7.37±0.53

the proportion of saturated and unsaturated fatty acids were in the range of 32.17 to 41.19 and 58.98 to 68.15%, respectively. Further,  $\omega$ -3,  $\omega$ -6 and essential fatty acids were 0.88 to 1.73, 19.95 to 27.23 and 14.52 to 23.47%, respectively (Thomas *et al.* 2016). Analysis of subcutaneous fat of these pigs also showed the proportion of saturated and unsaturated fatty acids to be 34.99 and 61.72%, respectively (Nasker *et al.* 2014).

**Niang-Megha:** Pigs of Niang-Megha breed are found in Meghalaya. They are mostly black in colour with short and erect ears, pot bellies and long snouts. The height at withers of these pigs is 51.4 (48–54) cm in males and 48.2 (45–52) cm in females. The estimated population of Niang-Megha pigs is about 3.9 lakhs (Breed Descriptor 2013). Age at first heat is 210.5±2.42 days. Age at first farrowing and farrowing interval is 355.25±2.25 and 207.05±8.16 days, respectively. Gestation period is 111.85±0.14 days. Weight at birth and at weaning is 0.485±0.23 and 4.97±0.21 kg. Litter size at birth and at weaning is 6.34±0.26 and 5.63±0.42 (Sahoo *et al.* 2012, Khargharia *et al.* 2014, Gokuldas *et al.* 2015). Hot carcass weight is 40.60 (30–58) kg in males and 44.10 (32–60) kg in females (Breed Descriptor 2013). Fatty acid profiling of *musculus longissimus thoracis et lumborum* indicated that the saturated and unsaturated fatty acids were in the range of 32.75–38.91 and 54.69–69.28%, respectively (Thomas *et al.* 2018).

**Agonda-Goan:** The Agonda-Goan pigs are mostly black coloured, short and erect eared, short snouted and pot bellied animals. The height at withers of these animals is 55.87 (46–64.5) cm in males and 60.77 (48.2–74.8) cm in females. These pigs are found in Tiswadi, Bardez and Peenem of North Goa district and Marmugoa, Salcete, Canacona and Quepentaluks of South Goa district with an estimated population of 37556. Age at first farrowing and farrowing interval is 334.75±27.32 and 185.35±4.11 days. Litter size at farrowing and at weaning are 7.45±0.51 and 5.9±0.55, respectively. Carcass weight is 48.30±1.48 (males) and 48.60±2.47 kg (females) (Breed Descriptor 2015).

**Tenyi-Vo:** The pigs of Tenyi Vo breed are found in Nagaland. They are mostly black coloured with white patches on bellies. They have long and straight snouts that have white patches around nostrils, short and erect ears, concave top lines and pot bellies. The height at withers of these pigs is 30.48 (28–36) cm in males and 25.4 (23–30) cm in females. They are distributed in Kohima, Peren, Phek and Dimapur districts of Nagaland with an estimated population of 60,000–70,000 (Breed Descriptor 2016). Age at first farrowing and farrowing interval is 298.35±2.03 and 149.99±2.36 days, respectively (Chusi *et al.* 2015). Litter size at birth and at weaning is 5.8±2.3 and 4.2±1.9, respectively (Borkotoky *et al.* 2014). Litter weight at birth and at weaning is 1.91±1.92 and 25.60±2.54 kg, respectively (Chusi *et al.* 2015). Hot carcass weight of these pigs is 38 (35–40) kg in males and 36 (35–40) kg in females (Breed Descriptor 2016). Male animals of this breed have been observed to mature at very early age and are able to

impregnate the sows even before they attain the age of 6 months (Kumarasen *et al.* 2007, Karunakaran *et al.* 2009).

**Nicobari:** The pigs of Nicobari breed are mostly black or brown in colour. Small percentage of animals is creamy white, reddish brown or black and brown mixed. These pigs have short ears, short to medium snout with slight concave conformity, pot bellies of medium size and concave top lines. The height at withers of these pigs is 67.31 (51–86) cm in males and 61.24 (50–82) cm in females. Nicobari pigs are distributed in Nicobar district of Andaman and Nicobar, with an estimated population of 35,000. Age at first farrowing and farrowing interval is 319.19 (260–450) days and 242.4 (180–360) days, respectively. Litter size at farrowing and at weaning is 7.19 (4–12) and 5.42 (3–8), respectively. Dressed weight of these pigs is 52.6 (24–96) kg in males and 58.53 (44–81) kg in females (Breed Descriptor 2016).

**Doom:** The pigs of Doom breed are black in colour with concave snout, erect ears and straight top lines. The height at withers of these pigs is 60.4–66.2 cm in males and 65–71 cm in females. These pigs are found in Agomani, Gauripur, Golakganj blocks and Bilasipara sub-division in Dhubri district and few areas of Bongoigaon and Kokrajhar districts of Assam with an estimated population of approximately 3,000 (Breed Descriptor 2016). Age at first farrowing and farrowing interval of these pigs is 368.0±1.54 and 213.53±0.4 days. The litter size at farrowing and at weaning is 6.25±0.24 and 5.03±0.21, respectively (Khargharia *et al.* 2014). Hot carcass weight is 32.04±1.89 kg in males and 35.10±1.2 kg in females (Breed Descriptor 2016).

**Zovawk:** Zovawk pigs are found in Mizoram. These pigs are black in colour. They are small sized animals having bulging bellies. The ears are short and erect. The snout of these pigs is short and concave. The height at withers is 49.15 (45–54) cm in males and 49.04 (47–50) cm in females. Zovawk pigs are distributed in Mamit, Kolasib, Aizawl, Lunglei, Sahia and Champhai districts of Mizoram with an estimated population of about 40000. The age at first farrowing and farrowing interval is 314.9 (249–350) days and 170 (164–205) days, respectively (Breed Descriptor 2017). Kalita *et al.* (2018) has also reported the average age at first fertile service, average age at first farrowing, gestation period and service periods as 323.75±9.90, 437.75±9.41, 113.63±0.53 and 113.13±7.81 days, respectively. The litter size at farrowing and at weaning is 7.40±0.40 and 5.2±0.66, respectively. Carcass weight is 28.29 (23–33) kg in male animals and 34.2 (25–43) kg in female animals (Breed Descriptor 2017). The male animals of this breed also mature at very early in age and are able to impregnate the sows even before 6 months of age (Kumarasen *et al.* 2006).

**Gurrah:** Gurrah pigs are black in colour. Their legs are white below hock joints. They are medium sized with angular body and flat belly. Head is elongated with triangular face. The snout is long and straight. A thick line of hair is present on neck from head to shoulders. The ears are short, leaf shaped and vertically erect. The weight of

adult animals is about 46 kg in males and 48 kg in females. Litter size at farrowing and at weaning is 6.85 and 5.65, respectively. These pigs are found in Bareilly division and adjoining parts of Lucknow division in Uttar Pradesh (NBAGR 2018). Boro *et al.* (2016b) have also described the phenotypic characteristics of Bareilly *Desi* pigs distributed in Bareilly region which have adult body weight of  $53.1 \pm 0.40$  kg in males and  $53.5 \pm 0.40$  kg in females.

#### *Other population of indigenous pigs of India*

Besides, the above described registered breeds, some other population of indigenous pigs have been described.

*Ankamali:* The Ankamali pigs are black and rusty grey with white patches. The body is small, compact with a little bulge at the belly. The face is long with tapering snout. A distinct bulging can be clearly seen at the joint of the jaws. The back is slightly concave. They attain a body weight of around 37 kg by 8 months. They derive their name from a place of the same name near Ernakulum. These pigs are found predominantly in Kerala and also distributed in Karnataka and Tamil Nadu. The weight at birth, 8 weeks and 32 weeks of age were reported as  $0.86 \pm 0.03$ ,  $8.03 \pm 0.16$  and  $46.37 \pm 0.93$  kg (Gupta *et al.* 2007, Naskar *et al.* 2013).

*Dome:* The Dome pigs are distributed in North and South districts of Tripura. Their colour varies from black to grey with long thick crest of bristles at dorsal line from neck to trunk. Adult body weight is about 50 kg. The litter size varies from 8 to 10 at birth and 5 to 7 at weaning (Naskar *et al.* 2013, Das *et al.* 2018).

*Golla:* These pigs take their name from Golla community of Ganjam district of Odisha that traditionally rear them. They are medium sized with adult weight of 50–80 kg. Litter size is 8–10 with two farrowing per year (Naskar *et al.* 2013).

*Lepchamoun:* The Lepchamoun pigs are reared in the Sikkim. They are medium sized. The ears are drooping type. The weight of adult animals is 80–120 kg. The litter size is about 7–10 at birth (Naskar *et al.* 2013). Nath *et al.* (2013) has reported the litter size at birth and at weaning of these local pigs of Sikkim to be  $4.3 \pm 0.45$  and  $2.79 \pm 0.24$ , respectively. Age at first farrowing and farrowing interval is  $365.39 \pm 7.96$  and  $196.27 \pm 8.37$  days, respectively.

*Mali:* These pigs are found in Dhalai and North districts of Tripura. Colour is black with white patches. Many animals have star on the forehead. Adult body weight is about 50 kg. The litter size varies between 8 to 10 at birth and 7 to 8 at weaning. Age at first farrowing and farrowing interval is  $281.4 \pm 1.6$  and  $178.5 \pm 0.9$  days (Dandapat *et al.* 2010, Naskar *et al.* 2013).

*Manipur Desi:* They are found in Manipur and sometimes also called Burmese pigs by local population. Ears are large sized and drooping. These pigs are medium sized with an adult body weight of 120–150 kg. Litter size is about 8 to 12 (Naskar *et al.* 2013).

#### *Indigenous pigs of Tamil Nadu*

Kumar *et al.* (2017) has described the local pigs of Tamil

Nadu. These are small sized pigs. The predominant colour is black. The small percentage of animals has white or brown patches. The Legs are white below the hock joint. The ears are leaf like and drooping. The tail is pendulous type with a tuft of hairs at the tip. Belly is mostly flat. These pigs are reared predominantly under scavenging management systems with occasional tethering.

#### *Genetic characterization of indigenous pigs*

In order to develop cost effective approach for conservation, it is necessary to evaluate the genetic structure of indigenous pig breeds of India, so as to identify breeds and genetic lines within breeds for conservation and to preserve the maximum variation available at the minimum cost. The microsatellites are useful polymorphic markers for the analysis of genetic variability between and within population. They are being used in ever increasing number of genetic analysis studies of various pig breeds across the globe.

Among Indian pig population, earlier, it was reported that Ankamali pigs of Kerala are genetically distinct population from *Desi* pigs of North India and Gahuri pigs of Assam. *Desi* pigs and Gahuri pigs were earlier shown to be genetically closely related based on the genotyping studies using 23 FAO recommended microsatellite markers (Behl *et al.* 2002, 2006).

Evaluation of Andaman *Desi* pigs by a set of 23 FAO recommended microsatellite markers revealed that adequate genetic diversity is present in these pigs (De *et al.* 2013). In a similar study, Niang Megha and Tenyi Vo pigs were evaluated for genetic diversity. The mean F values were  $0.15 \pm 0.05$  (Niang Megha) and  $0.05 \pm 0.06$  (Tenyi Vo). No genetic bottlenecks were observed in these two population (Sahoo *et al.* 2016a).

Sahoo *et al.* (2015) evaluated Ghoongroo pigs using 22 FAO-ISAG microsatellite markers. The normal L' shaped curve in mode shift test based on the genotyping data generated in this study pointed to absence of any bottlenecks in this population. Sahoo *et al.* (2016b) evaluated genetic identity/distance between Niang Megha, Tenyi Vo and Ghoongroo breeds using genotyping data generated at 22 microsatellite loci. The Nei's unbiased genetic identity values of 0.291 indicated lower genetic distance between Niang Megha and Tenyi Vo pigs. The Ghoongroo breed was found distinct from these two breeds.

Besides genotyping with microsatellite markers, Ahanthem *et al.* (2015) barcoded the pigs of North-East India using cytochrome C oxidase-1. Pramod *et al.* (2016) has also evaluated erythropoietin receptor gene polymorphism in Ankamali pigs by restriction fragment length polymorphism and found that these pigs are fixed for T allele at this gene.

#### *Conclusion*

In India, pig farming is traditionally associated with people of lowest socio-economic strata. They have little means available with them to adopt to the feeding and

management required for intensive pig farming involving exotic and crossbred pigs. Indigenous pigs, due to their smaller size have much less requirement for feed and space, thus making them suitable for rearing by people with meagre resources. Besides their ability to survive and grow in most adverse conditions of nutrition and management, the indigenous pigs can also withstand hot and humid environments. Although, the feed conversion ratio of indigenous pigs is less than those of exotic pigs, they have the ability to produce meat with less fat as indicated by their lower backfat thickness ( $1.72 \pm 0.23$  cm) compared to exotic breeds like Yorkshire (barrow –  $4.1 \pm 0.22$ , gilt –  $3.7 \pm 0.19$ ), thus wasting less feed resources (Hetzer and Miller 1973, Chhabra *et al.* 1999). However, the population of these pigs have shown a declining trend in the last decade. Although, efforts have been made to characterize and register the breeds of indigenous pigs in India, efforts in scientific breeding strategies can further improve their productive and reproductive attributes.

#### REFERENCES

- Ahanthem M, Miranda-Devi K S H and Ghosh S K. 2013. DNA barcoding of indigenous pig in northeast India. *Indian Journal of Animal Sciences* **83**: 428–30.
- Behl R, Kaul R, Sheoran N, Behl J, Tantia M S and Vijn R K. 2002. Genetic identity of two Indian pig types using microsatellite markers. *Animal Genetics* **33**: 158–59.
- Behl R, Sheoran N, Behl J and Vijn R K. 2006. Genetic analysis of Ankamali pigs of India using microsatellite markers and their comparison with other domesticated Indian pig types. *Journal of Animal Breeding and Genetics* **123**: 131–35.
- Behl R, Vij P K, Niranjana S K, Behl J and Sharma A. 2018. Population trends and distribution of indigenous pigs in India. *Journal of Livestock Biodiversity* **8**: 48–57.
- Bhat P N, Batt P P, Khan B U, Goswami O B and Singh B. 1981. Animal Genetic Resources of India. National Dairy Research Institute, Karnal. pp 75–83.
- Bhat P N, Mohan N H and Deo S. 2010. *Pig production*. Studium Press (India) Pvt. Ltd., Darya Ganj, New Delhi. Pp 21.
- Bhatia S S. 1997. Status paper on All India Coordinated Research Project on Pigs (*vide* Mukundan and Usha 2000).
- Bhatia S S, Gaur G K and Pal S. 1997. Genetic Studies on post weaning weights in *desi* pigs. *Indian Veterinary Journal* **74**: 943–46.
- AICRPP Report. 1995. *Annual Progress Report (1994–95)*. AICRP on Pigs.
- AICRPP Report. 1997. *Annual Progress Report (1996–97)*. AICRP on Pigs.
- Borkotoky D, Perumal P and Singh R K. 2014. Morphometric attributes of Naga local pigs. *Veterinary Research International* **2**: 8–11.
- Boro P, Patel B H M, Naha B C, Sahoo N R, Gaur G K, Dutt T, Singh M and Madkar A. 2016a. Productive and reproductive performances of *desi* pigs: A review. *Agricultural Reviews* **37**(3): 228–33.
- Boro P, Patel B H M, Sahoo N R, Naha B C, Madkar A, Gaur G K, Singh M, Dutt T, Verma M R, Upadhyay D and Singh A K. 2016b. Phenotypic attributes of Bareilly *desi* pig. *International Journal of Advanced Biological Research* **6**: 390–93.
- Breed Descriptor. 2013. New breeds of indigenous livestock: Khoongroo and NiangMegha pigs. *Indian Journal of Animal Sciences* **83**: 453–55.
- Breed Descriptor. 2015. New breeds of indigenous livestock and poultry: AgondaGoan pigs. *Indian Journal of Animal Sciences* **85**: 546–48.
- Breed Descriptor. 2016. New breeds of indigenous livestock: TenyiVo, Nicobari and Doom pigs. *Indian Journal of Animal Sciences* **86**: 1221–25.
- Breed Descriptor. 2017. New breeds of indigenous livestock: Zovawk pigs. *Indian Journal of Animal Sciences* **87**: 1427–28.
- Chauhan V P S, Deo S, Chhabra A K, Arora R L and Bhat P N. 1994. Production and reproduction traits and their inheritance in indigenous pigs. *Indian Veterinary Journal* **71**: 452–55.
- Chhabra G K, Gaur G K, Ahlawat S P S and Paul S. 1999. Inheritance of carcass traits in *desi* pigs. *Indian Veterinary Journal* **76**: 403–07.
- Chhabra G K, Gaur G K, Bhatia S S, Raheja K L and Pal S. 1996. Studies on litter traits in *desi* and crossbred pigs. *Indian Journal of Animal Research* **30**: 134–36.
- Chhabra A K, Tiwari C R and Bisht G. 2005. Genetic studies on pre weaning body weight in *desi* and different grades of crossbreds with Landrace pig. *Indian Journal of Animal Sciences* **75**: 442–44.
- Chusi Z, Savino N, Dhali A and Perumal P. 2015. Phenotypic morphometric parameters of indigenous pig of Nagaland. *Indian Journal of Animal Sciences* **85**: 1334–37.
- Dandapat A, Dev C K B, Debbarma C and Das M K. 2010. Phenotypic characterization of Mali pig in Tripura, India. *Livestock Research for Rural Development* **22**: article 83.
- Das S, Naha B C and Saini B L. 2018. Adopted way of pig rearing practices in Tripura. *Journal of Entomology and Zoology Studies* **6**(4): 1673–78.
- De A K, Jeyakumar S, Kundu A, Kundu M S, Sunder J and Ramachandran M. 2013. Genetic characterization of Andaman *Desi* pig, an indigenous pig germplasm of Andaman and Nicobar group of islands, India by microsatellite markers. *Veterinary World* **6**(10): 750–53.
- Deo S, Chhabra A K, Arora R L, Pal S and Bisht G S. 1992. Genetic and non-genetic factors affecting growth performance in *Desi* pigs and its crosses. *Indian Journal of Animal Sciences* **62**: 1107–08.
- Gaur G K. 2001. Conservation and management of indigenous pig genetic resources. Compendium of summer school on 'Recent advances in characterization and conservation of animal genetic resources' held at NBAGR, Karnal during 16 July–6 August, 2001. pp 50–56.
- Gaur G K, Chhabra A K and Pal S. 1997. Growth intensity of indigenous pigs from birth to slaughter age. *Indian Journal of Animal Sciences* **67**: 344–46.
- 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.
- Gupta N, Ahlawat S P S, Behl R, Behl J, Vijn R K, Singh G and Gupta S C. 2007. Pig genetic resources of India: Ankamali – A Pig breed of Indian Peninsula. National Bureau of Animal Genetic Resources, Karnal. Monogram 44/2007.
- Hetzer O H and Miller L R. 1973. Selection for high and low fatness in swine: correlated response of various carcass traits. *Journal of Animal Science* **37**: 1289–301.
- Kalita G, Sarma K, Rahman S, Talukdar D and Ahmed F A. 2018.

- Morphometric and reproductive attributes of Local Pig of Mizoram. *International Journal of Livestock Research* **8**: 173–7.
- Karunakaran M, Mondal M, Rajarajan K, Karmakar H D, Bhat B P, Das J, Bora B, Baruah K K and Rajkhowa C. 2009. Early puberty of local Naga boar of India: Assessment through epididymal spermogram and *in vivo* pregnancy. *Animal Reproduction Science* **111**: 112–19.
- Khargharia G, Zaman G, Laskar S, Das B, Aziz A, Roychoudhary R and Roy T. 2014. Phenotypic characterization and phenotypic studies of NiangMegha and Doom pigs of North Eastern India. *Asian Academic Research Journal of Multidisciplinary* **1**(27): 667–76.
- Kumar S, Singh S K, Singh R L, Sharma B D, Dubey C B and Verma S S. 1990. Effect of genetic and nongenetic factors on body weight, efficiency of feed utilization, reproductive performance and survivability in Landrace, *desi* and their halfbreds. *Indian Journal of Animal Sciences* **60**: 1219–23.
- Kumar K S V, Balasubramanyam D, Sivaselvam S N and Gnanaraj P T. 2017. Phenotypic attributes of indigenous pigs in Tamil Nadu. *Journal of Entomology and Zoology Studies* **5**: 1437–40.
- 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.
- Kumaresan A, Hussain J, Ahmed S K, Pathak K A, Das A and Bujarbaruah K M. 2006. Growth performance of Hampshire, Large White Yorkshire and Mizo local pigs under Mizoram field conditions. *Indian Journal of Animal Sciences* **76**: 148–50.
- Lakhani G P and Bhadoria S S. 1990. Studies on the pre-weaned economic traits in indigenous pigs. *Indian Journal of Animal Research* **24**: 25–28.
- Lakhani G P and Jogi S. 2000a. Studies on efficiency of feed utilization in indigenous pigs and their Large White Yorkshire grades. *Indian Veterinary Journal* **77**: 910–11.
- Lakhani G P and Jogi S. 2000b. Reproductive performance of indigenous pigs and their Large White Yorkshire grades. *Indian Veterinary Journal* **77**: 1109–10.
- Lakhani G P, Jogi S and Kahlon B S. 1997. Effect of weight group and sex state on carcass traits in *desi* pigs. *Indian Journal of Animal Research* **31**: 18–20.
- Livestock Census. 2003. 17<sup>th</sup> Livestock census-2003. Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture.
- Livestock Census. 2012. 19<sup>th</sup> Livestock census-2012. Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture.
- Mishra R R, Lal K, Sharma G C and Prasad S. 1990. Studies on litter weight at weaning of local pigs maintained in India. *Indian Veterinary Journal* **67**: 552–53.
- Mukhopadhyay A, Singh R L and Singh S K. 1992. A comparative study on effect of genetic and non genetic factors of Landrace, Tamworth and *desi* pigs and their crosses on some reproductive characters. *Indian Journal of Animal Sciences* **62**: 482–84.
- Mukhopadhyay A, Singh R L, Singh S K and Sharma B D. 1991. Factors effecting performance of pigs. *Indian Journal of Animal Sciences* **61**: 438–42.
- Mukundan G and Usha P. 2000. Conservation and management of pigs in India. *Indian Journal of Animal Breeding and Genetics* **22**: 216–22.
- Naskar S, Mandal G P, Borah S, Vashi Y, Thomas R and Dhara S K. 2014. Evaluation of fatty acid profile in subcutaneous adipose tissue of indigenous and crossbred pigs. *Indian Journal of Animal Sciences* **84**: 88–90.
- Naskar S, Niranjana S K and Banik S. 2013. Utilization of pig genetic resources in India. *Sustainable Utilization of Indigenous Animal Genetic Resources*. (Eds) Pundir R K, Niranjana S K and Behl R. NBAGR, Karnal. pp 120–25.
- Nath B G, Pathak P K, Ngachan S V, Tripathy A K and Mohanty A K. 2013. Characterization of small holder pig production system: productive and reproductive performance of local and crossbred pigs in Sikkim Himalayan region. *Tropical Animal Health and Production* **45**: 1513–18.
- NBAGR. 2018. New breeds registered. National Bureau of Animal Genetic Resources. Available at: <http://www.nbagr.res.in/registered-breeds.html>.
- Pramod S, Usha A P and Venkatachalapathy R T. 2016. Erythropoietin receptor gene polymorphism in Indian pig lines. *Indian Journal of Animal Sciences* **86**: 564–67.
- Sahoo N R, Das A, Naskar S, Banik S and Tamuli M K. 2012. *Niang-Megha: the nature's gift for food and fiber*. ICAR-National Research Center on Pigs, Rani, Guwahati. Pp 1–30.
- Sahoo N R, Naskar S, Banik S and Pankaj P K. 2016a. Microsatellite based diversity analysis of native pigs of North-Eastern India. *Indian Journal of Animal Research* **50**: 831–38.
- Sahoo N R, Nesa N, Naskar S, Banik S and Pankaj P K. 2015. Genetic diversity analysis of Ghongroo pig based on microsatellite markers. *Indian Journal of Animal Sciences* **85**: 1215–19.
- Sahoo N R, Nesa N, Naskar S, Pankaj P K and Monalisa. 2016b. Microsatellite and mitochondrial diversity analysis of native pigs of Indo-Burma biodiversity hotspots. *Animal Biotechnology* **27**: 52–59.
- Shylla B, Bardoloi T, Das D and Goswami R N. 1991. Growth rate of indigenous pigs of Assam as effected by some non-genetic factors. *Indian Veterinary Journal* **68**: 232–34.
- Thomas R, Banik S, Barman K, Mohan N H and Sharma D K. 2016. Profiles of colour, minerals, amino acids and fatty acids of *musculus longissimus thoracis et lumborum* of Ghungroo pigs. *Indian Journal of Animal Sciences* **86**: 1176–80.
- Thomas R, Banik S, Barman K, Mohan N H and Sharma D K. 2018. Selected meat quality parameters and nutritional profiles of *M. musculus longissimus thoracis et lumborum* of Niang-Megha pigs. *Indian Journal of Animal Sciences* **88**: 955–60.