Int.J.Curr.Microbiol.App.Sci (2016) *5*(11): 196-204

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 5 Number 11 (2016) pp. 196-204**
Journal homepage: http://www.ijcmas.com

Original Research Article http://dx.doi.org/10.20546/ijcmas.2016.511.022

The Ongole Cattle Germplasm: Corollary Arising out of Regulating Access, Associated Knowledge and Benefit Sharing Post Nagoya Protocol by Brazil from India

Poonam Jayant Singh[1*] and Atul Kumar Tiwari[2]

[1]ICAR-National Bureau of Fish Genetic Resources, Canal Ring Road, P.O.-Dilkusha, Telibagh, Lucknow-226002, Uttar Pradesh, India
[2]Dr. R.M.L. National Law University University, Lucknow, India
**Corresponding author*

Keywords
Convention on Biological Resources, Access and Benefit Sharing, Germplasm, Ongole cattle, National Biodiversity Authority.

Article Info
Accepted:
12 October 2016
Available Online:
10 November 2016

A B S T R A C T

Accessing Genetic Resources has become a complicated concern after implementation of Convention on Biological Resources (CBD, 1992), there after implementation of Nagoya Protocol (NPABS, 2010) and now the Guidelines of 2014 by National Biodiversity Authority of India. Are we prepared to face challenges imposed by the laws and regulations governing access to and Benefit sharing of Biological Resources. Does benefit sharing also include risk sharing. The International Framework structure for access and benefit sharing is complicated. The germplasm exchange between India and Brazil for Ongole post Nagoya Protocol will have implications for sharing of benefits due the usage of germplasm.

Introduction

Accessing Genetic Resources has become a complicated concern after implementation of Convention on Biological Resources (CBD, 1992), there after implementation of Nagoya Protocol (NPABS, 2010) and now the Guidelines of 2014 by National Biodiversity Authority of India. Are we prepared to face challenges imposed by the laws and regulations governing access to and Benefit sharing of Biological Resources. Does benefit sharing also include risk sharing. The International Framework structure for access and benefit sharing is complicated.

The germplasm exchange between India and Brazil for Ongole post Nagoya Protocol will have implications for sharing of benefits due the usage of germplasm.

Access and Benefit Sharing Provisions through CBD, Nagoya and BDA

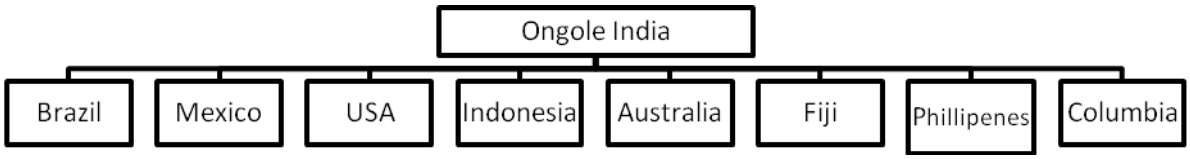
According to Convention on Biological Diversity (CBD, 1992) genetic resources includes, organisms or parts thereof, populations, or any other biotic component of ecosystems with actual or potential use or

value for humanity. In compliance with Convention on Biodiversity, the National Biodiversity Authority (NBA) was established in 2003 to implement India's Biological Diversity Act (BDA, 2002) and Rules 2004. A major achievement of COP 6 was adoption of Bonn Guidelines (http://www.cbd.int/abs/bonn/default.html), developed by CBD to assist in developing Access and Benefit-Sharing (ABS) strategies related to genetic resources, and the fair and equitable sharing of the benefits arising from their utilization. Bonn guidelines was the starting point of taking ABS to a level where countries started to develop guidelines, compatible with national framework. Bonn Guidelines developed by CBD serve as inputs for measures on ABS with particular reference to provisions under Articles 8(j), 10(c), 15, 16 and 19; and contracts and other arrangements under mutually agreed terms for access and benefit-sharing. The Nagoya Protocol on Access and Benefit Sharing (NPABS, 2010) came into force on 12 October 2014, ninety days after the date of deposit of the fiftieth instrument of ratification, has 58 Parties (59 Ratifications and 91 Signatures). NBA through Ministry Of Environment, Forests and Climate Change (MOEF), notified Guidelines on Access to Biological Resources and Associated Knowledge and Benefits Sharing Regulations (GABRAKBSR, 2014) on the 21st November, 2014, in exercise of the powers conferred by section 64 read with sub-section (1) of section 18 and sub-section (4) of section 21 of the BDA, 2002 (18 of 2003) and in pursuance of Nagoya Protocol arising from their utilization to the CBD. Even as the law is set in place, there are always provisions by individuals and researchers to gain access to genetic resources and misappropriate them. The germplasm exchanges between countries post CBD, post Nagoya, and Post India's Guidelines (GABRAKBSR, 2014), will have implications during access of Biological Resources and their benefit sharing.

The Distribution of Ongole Cattle and its pre-CBD

The Ongole breed takes its name from the geographical area, Ongole, in which it is reared. It is also called the Nellore breed since the Ongole taluk was earlier included in Nellore district. The Ongole cattle breed (Gaur *et al*., 2002), is the native of the coastal districts Guntur, Prakasham and Nellore of Andhra Pradesh. Ongole Cattle has been used for milk and draught. The breeding tract of Ongole extends all along the coast from Nellore to Vizianagram. Ongole cattle have been exported to several countries. USA imported it for beef; Brazil for beef and milk; Sri Lanka, Fiji and Jamaica for draught; Australia for heat tolerance and beef; and Switzerland for disease resistance. The Nellore or Ongole breed's hardiness, disease resistance and its capacity to thrive on scanty and dry fodder have been quite successfully exploited for improvement and upgrading their local stock by many countries. The Breed of Noble Bloods quotes "Fashions come and go in the cattle business much as they do in clothes. But astute breeders set their goals and stay with them regardless of the rage of the moment" (James and Charle, 1976). Ongole cattle has become an International Cattle breed by virtue of its distribution in different countries like Brazil, United States, West Indies, Mexico, Columbia, Mauritius, Phillipines, Indonesia, Australia and Fiji. Ongole cattle were brought to Brazil in 1868, 1878, 1895 and 1960 form India (Ritchie *et al*., 2009). In 1962, 84 imported Ongole cattle contributed to the foundation of the most influential breeding lines leading to the rapid expansion of the Brazilian cattle population. In 1965, the national herd

consisted of 56 million. By 1995, there were 160 million cattle in Brazil, of which 100 million were Nellore. Nellore cattle were introduced to the U.S. during 1923-25, when 228 cattle of the Guzerat, Gyr, and Nellore breeds were imported to Texas from Brazil. In 1946, eighteen more cattle were imported to the U.S. from Brazil. These cattle were of the Indu-Brazilian breed, which is made up of some Nellore breeding as well as Gyr and Guzerat. Between 1965 and 1995, CBD was enforced, that allowed for Access and Benefit sharing. Today Nagoya Protocol is in force that provides monetary and non monetary benefits for access and commercial use of germplasm.



Materials and Methods

NBA and Ongole

The case of transfer of germplasm of Ongole Cattle to Brazil has made NBA to constitute an expert committee to take a decision (http://timesofindia.indiatimes.com., 2015). After the set up of NBA, taking out the germplasm of the bull is strictly monitored. The Brahmana Bull has been developed by Brazil using germplasm from India. A request of 5,000 units of germplasm has been made to NBA. One unit of germplasm costs $5000 in the International market (Times of India http://goo.gl/6LpwYd., 2015), an amount of $2,50,000,00 economic valuation is at stake. Should NBA allow for as a South-South arrangement for exchange of germplasm, or NBA may impose restriction and enter into a benefit sharing agreement and stop third party transfer of developed germplasm out of Ongole germplasm. The matter will clear the judgemental role NBA is doing with respect to traditional knowledge holders and commercial vendors, whose sole interest is economic gain. The Nellore is among the largest of the purebred Indian breeds. In India, Nellore bulls are used for ploughing. Cows produce an average of about 3525 lbs of milk per lactation, but record yields of over 7,770 lbs indicate excellent dairy potential for the breed in their native land.

History and Development of Zebu Cattle in the United States through Brazil

Most of the Zebu cattle that have entered the United States have been of breeds that originated in India. A large majority of the Zebu cattle that have entered the United States have come from Brazil. Over 6,000 head of Zebu cattle have been imported into Brazil during the last 100 years. Some of the Zebu cattle imported from Brazil have been of the Indu-Brazil breed, a breed developed in Brazil during the 1920's and 1930's.

In addition to several small importations, 33 head of Zebu cattle were imported into the United States from India in 1906; approximately 230 head were imported from Brazil through Mexico in the 1920's, and 18 bulls were imported from Brazil through Mexico in 1946. The Brahman is a Zebu breed developed in the United States from the cattle imported from India and Brazil (Sander., 1980).

There have been several reports in the newspaper about International racket

exporting Ongole Bull germplasm (THE HINDU., 2012). India has a total of 34,135 Biodiversity Management Committees (BMCs) (http://goo.gl/ZpT3mj., 2015). NBA has been in the forefront to process applications since the time of its inception, relating to access to bioresources for research and commercial purposes, transfer of research results, approval for obtaining IPR, and third party transfer of results.

Post CBD 1993, post NBA 2002, post BDA 2002, Post Nagoya 2014, Post NBA Guidelines 2014 Issues

- What will be the route taken by NBA for exporting Ongole Bull germplasm?
- Should NBA study the impact of exchange and claim royalties for exchange of resources?
- Should the provisions be applied post Nagoya retrospectively?
- Will resistance by NBA for germplasm exchange give leeway for the germplasm to be misappropriated?
- Will Brazil share monetary profits with India?

According to Article 6, paragraph 3 (e) of Nagoya Protocol, for access to genetic resources, a country should issue a permit or its equivalent and notify the Access and Benefit-sharing Clearing-House at CBD (www.cbd.int/abs/doc/commonformats/ABS CH-IRCC.doc). The information related to PIC and MAT, according to paragraph 2 (c) of Article 14 is to be provided to ABS Clearing-House. This will help in monitoring the exchange of resources and avoid misappropriation. Under ITC (HS), 2012, Schedule 2, Export Policy, under Tariff Items HS Code (05111000, 05119991, 05119999, 30011091, 30011099, 30012090, 30019099), export policy restricts Exports and are permitted under licence only. Hence Brazil can take the germplasm with an export license. Importer Exporter Code (in short IEC) is a ten digit number granted by Directorate General of Foreign Trade under Ministry of Commerce and Industry, to any bonafide person/company for carrying out export/import (http://dgft.gov.in/dgftcla). The Joint Director General of Foreign Trade Regional Office in coordination with NBA should be proactive in coordination of exchanges ensuring provisions of Access and Benefit Sharing as would be earmarked by NBA. A Certificate of Origin should be issued by Ministry of Finance-DGFT The Foreign Trade (Development and Regulation) Act, 1992 (No.22 of 1992) According to Chapter II Article 5.2.4, ensuring a fair trade for germplasm exchange.

Results and Discussion

Guidelines on Access to Biological Resources and Associated Knowledge and Benefit Sharing Regulation, 2014; Monetary Benefit sharing provisions

The Ministry of Environment, Forests And Climate Change, through National Biodiversity Authority has notified in exercise of powers conferred by section 64 of Biological Diversity Act 2002, regulations called as "Guidelines on Access to Biological Resources and Associated Knowledge and Benefit Sharing Regulations, 2014 notified on 21st November 2014 on ABS. The regulation 3,4,7, 9 and 12 provisions could be used for Monetary gains.

The Science behind Genetic Exchanges

Livestock census started in India in 1919. The livestock census of 2012 was the 19th

census conducted by India (Livestock census 2012). The overall contribution of Livestock sector in total GDP is nearly 4.11% at prices of 2012-2013 (Livestock census 2012). The summarised census is given in Table 1. The most important exotic dairy cattle breeds in India are Jersey and Holstein Friesian (HF). Cross-Bred animals are produced by crossing indigenous animals with exotic breeds or indigenous animals which have exotic inheritance (Livestock census 2012). According to National Dairy Development Board (NDBB), milk production stood at 132.4 million tonnes 2012-13, as per National Dairy Development Board (www.nddb.org).

Understanding Case in Biochemistry: Milk containing A1 versus A2 beta-casein

There is a correlation existing between Indian Cattle that are A2 A2 homozygous, and the Exotic breeds that have A1 allele providing milk with harmful BMC-7. There emerges a need for studying Casein biochemistry. Milk proteins have a long history of research (McKenzie., 2012). A lot of discussion is occurring in scientific literature regarding the provision of Beta casein and the emerging opionids (Keating *et al*., 2008). Bioactive compounds derived from food are termed "food hormones" or as "formones" (Meisel and Bockelmann., 1999). In 1968, genetic differences in milk proteins between individual cattle and breeds was reported by dairy science review (Aschaffenburg, 1968). Studies have shown some correlation between consumption of A1 β-casein and Type 1 diabetes and Ischemic heart disease (Elli1ott *et al*., 1999; Laugesenn and Elliott, 2003). Milk proteins have the potential to yield opioid-like peptides following proteolysis (Keating *et al*., 2008). These peptides have been termed “food hormones” (Morley, 1982) or "formones" (Meisel, 1998) have been reported to elicit their bioactive effects when released from food constituents. Opioid peptides are opioid receptor ligands with agonistic or antagonistic activities. One of the opioid peptide derived out of milk protein is the β-casomorphins (BCM-7) (Svedberg *et al*., 1985), which is liberated upon digestion of β-casein variant, namely the A1and B variants (Meisel, 1986). The coding gene of β-casein has 12 genetic variants of which A1, A2, A3 and B are universally distributed in almost all *Bos taurus* and *Bos indicus* populations (Farrell *et al*., 2004). Exon VII encodes major part of the mature protein including the base change encoding the amino acid differences between these four variants (Bonsing *et al*., 1988). The β-casein A1and B variants differ from the A2 variant at position 67 where a histidine replaces a proline. In addition, the B variant differs from the A1 variant in a substitution of arginine for serine at position 122. Variants C, F & G have a histidine residue at position 67. Histidine at position 67 results in cleavage during digestion, producing beta-casomorphin (BCM-7) (Damiani *et al*., 1992; Lien *et al*., 1992). In recent years human consumption of β-casein A1and B protein variants has been brought to the public’s attention, in particular in New Zealand, where A2 milk is marketed by the A2 Corporation as being a lower risk factor for disease development (Keating *et al*., 2008). There are scientific concerns to be validated on a large scale about the gastrointestinal effects of A1-type beta-casein protein in cows’ milk compared with the progenitor A2 type (Ho *et al*., 2014). In vitro and animal studies suggest that digestion of A1 but not A2 beta-casein affects gastrointestinal motility and inflammation through the release of beta-casomorphin-7. We aimed to evaluate differences in gastrointestinal effects in a human adult population between milk containing A1 versus A2 beta-casein. Some

individuals may be susceptible to A1 beta-casein, as evidenced by higher faecal calprotectin values and associated intolerance measures. These preliminary results suggest differences in gastrointestinal responses in some adult humans consuming milk containing beta-casein of either the A1 or the A2 beta-casein type, but require confirmation in a larger study of participants with perceived intolerance to ordinary A1 beta-casein-containing milk. A recent paper by NDRI also confirmed that BCM-7 release did not occur from homozygous A2 variant of beta-casein (Haq *et al*., 2015). In another study it was concluded that consumption of A1 "like" variants of β-casein induced inflammatory response in gut by activating Th2 pathway as compared to A2A2 variants; thus supporting the purported deleterious impacts of consumption of A1 "like" variants of β-casein and suggests possible aggravation of inflammatory response for etiology of various health disorders (Haq *et al*., 2014) .The homozygous A2 variant of beta casein did not release BCM-7, hence allows for another option for exchange of Ongole Germplasm for its usage as an A2 milch animal besides its potential for beef export.

Beef Production in Brazil

Brazil is the world's largest beef exporter, the beef cattle industry in Brazil is still based on grass-fed animals in which the Nellore breed predominates, constituting an advantage for Brazilian beef export of natural beef (Danilo *et al*., 2011). Over the last 8 years, till 2012, beef production in Brazil has become one of the most important activities for employment and wealth creation Brazilian beef production is the second largest in the planet (Hugo *et al*., 2012) . It produced 9.7 million ton carcass weigh equivalent (CWE) in 2008, when USA produced a little over 12 million ton, EU-27 around 8.1million ton, Australia and Argentina, between 2 and 3 million ton and India, that did not appear in statistics before, around 2.5 million ton CWE (http://www.abiec.com.br/estatisticas ; Ferraz *et al*., 2010). The strong growth of the Brazilian beef production is based in the tripoid Nellore-Cerrado-Brachiaria, after 1970. The beef breed that has the largest number of animals in Brazil is Nellore (standard/horned and polled), followed by Guzerat and Gir. Indubrasil is, also, a *B. indicus* Brazilian breed originated from crossbreeding among other Zebu breeds, mainly Gyr and Guzerath, with some Ongole (Nellore), decreased sharply in number of animals. Details of those breeds can be seen in the website of the Brazilian Zebu Breeders Association (http://www.ansi.okstate.edu/breeds/ cattle/>; ABCZ:<http://www.abcz.org.br/). A newer Brazilian *B. indicus* breed, that has growing numbers is a pooled breed, Tabapua (http://www.tabapua.org.br).

The Brazilian Beef Market

The Brazilian domestic market absorbs close to 7.03 million ton CWE, with a per capita consumption of 37 kg CWE/person/year. 72.5% of total production is absorbed by the internal market. Brazil is the largest beef exporter in the world. Brazilian beef business is responsible by around 1/3 of beef trades in the world. The number of beef processing plants and abattoirs is around 750. Some huge plants, that processes more than 2000 animals/day, with very modern equipment are in operation, mainly in mid-western part of country. In last years, branded meat market is starting to grow.

Table.1 Number of Livestock as per Livestock Census of 2012

S. No.	Livestock	Number of Livestock
1	Total livestock (cattle, buffaloes, sheep, goat , pig, horses & ponies, mules, donkeys, camels ,mithun and yak)	512.05 million
2	Total Bovine (Cattle, buffalo, mithun and yak) population	299.9 million
3	Female cattle (Cows)	122.9 million
4	Female buffaloes	92.5 million
5	Milch buffaloes	51.05 million
6	Exotic/Crossbred milch cattle	19.42 million
7	Indigenous milch cattle	48.12 million

Programs like Angus Beef, Nelore Natural, Hereford beef, Bonsmara beef and several other brands try to commercialize special cuts, in Brazil and other countries, adding value to products. According to USDA (1999), the world's beef consumption grew from close to 20,000,000 t CWE early 1960's decade to around 60,000,000 t at the end of the first decade of the 21st century, an increase of 175% in less than 50 years. In the same period, Brazil's production increased from roughly 1.2 million t CWE to close 10 million t, while domestic consumption enlarged from 1.2 to 7.5 million t. When considering only the last15 years, the countries' beef production increased around 60%, while the internal consumption, only 30%. The surplus of beef in Brazil is, currently, larger than 2000 t/year (Ferraz *et al*., 2010). The potential for export is also based on the Nellore Brand adding value. Will the percent benefit due to the Nellore breed be shared by NBA?

The Stake of Brazil

With the changed scene for access and benefit sharing post Nagoya Protocol, NBA needs to take a stand by analysing the potential benefits accruing and the implications on genetic resources of our country. The NBA should work as a guardian and custodian for conservation, sustainable utilisation for genetic resources of the country providing due share due to its appropriation.

References

ABIEC. 2009. http://www.abiec.com. br/estatisticas.

Aschaffenburg, R. 1968. Reviews of the progress of dairy science. Section G. Genetics. Genetic variants of milk proteins: their breed distribution. *J Dairy Res.*, 35:447–60.

Bid to smuggle Ongole bulls, THE HINDU, March 11, 2012 available at http://goo.gl/igKHxw.

Bonn Guidelines available at http://www.cbd.int/abs/bonn/default.html.

Bonsing, J., Ring, J.M., Stewart, A.F. and MacKinlay, A.G. 1988. Complete nucleotide sequence of the bovine β-casein gene. *Australian J. Biol. Sci.*, 41:527–537.

Damiani G., Pilla F., Leone P. and Caccio S. 1992. Direct sequencing and bidirectional allele specific polymerase chain reaction of the bovine β-casein B variant. *Animal Genetics*, 23: 561–566.

Danilo, D. and Millen. 2011. Current outlook and future perspectives of beef production in Brazil. *Animal frontiers*, 1:46–52.

Director General of Foreign Trade (DGFT) is the nodal organisation for export promotion, trade control & regulation. http://dgft.gov.in/dgftcla/see under Importer Exporter Code.

Elliott, R.B., Harris, D.P. and Hill, J.P. 1999. Type I (insulin-dependent) diabetes mellitus and cow milk: casein variant consumption. *Diabetologia*, 42:292–6.

Farrell, H.M., Jimenez, F.R., Bleck, G.T., Brown, E.M., Butler, J.E., Creamer, L.K., Hicks, C.L., Hollar, C.M., Ng-Kwai-Hang K.F. and Swaisgood H.E. 2004. Nomenclature of the proteins of cows' milk – sixth revision. *J. Dairy Sci.*, 87: 1641–1674.

Ferraz, José, B.S. and Pedro Eduardo de Felício.2010. Production systems–an example from Brazil. *Meat Sci*., 84(2):238-243.

Gaur, G.K., Kaushik, S.N. and Garg, R.C. 2002. Ongole cattle status in India. *Animal Genetic Res. Information*, 32: 27-34.

Haq Mohammad Raies, U.l., Rajeev, K. and Suman, K. 2015. Release of β-casomorphin-7/5 during simulated gastrointestinal digestion of milk β-casein variants from Indian crossbred cattle (Karan Fries). *Food chem.,* 168: 70-79.

Haq Mohammad Raies, U.l., Rajeev, K., Sharma, R., Vamshi, S. and Suman, K. 2014. Comparative evaluation of cow β-casein variants (A1/A2) consumption on Th2-mediated inflammatory response in mouse gut. *European J. Nutri*., 53(4):1039-1049.

Harlan Ritchie. 2009. Breeds of Beef and Multi-Purpose Cattle Acknowledgements, page 76-77.

Ho, S.K., Woodford, S., Kukuljan and Sebely Pal. 2014. Comparative effects of A1 versus A2 beta-casein on gastrointestinal measures: a blinded randomised cross-over pilot study. *European J. Clin. Nutri.,* 68(9): 994-1000.

Hugo, H. and Montaldo. 2012. Opportunities and challenges from the use of genomic selection for beef cattle breeding in Latin America.

ITC. 2012. (HS) codes are known as Indian Trade Clarification (ITC) and are based on Harmonized System (HS) of Coding. It was adopted in India for import-export operations. Indian custom uses an eight digit ITC (HS) code to suit the national trade requirements according to Import Export Classification, ITC (HS) Code and Import Policy.

James, B.L. and Charles, R.K. 1976. breed of noble bloods, http://www.fao.org/docrep/v0600t/v0600t04

James, O., Sander. 1980. History and Development of Zebu Cattle in the United States, *J. Ani. Sci.*, 50: 1188-1200.

Keating, A.F., Smith, T.J., Paul, R.R. and Cairns, M.T. 2008. A note on the evaluation of a beta-casein variant in bovine breeds by allele-specific PCR and relevance to β-casomorphin. *Irish J. Agri. Food Res.*, 99-104.

Laugesen, M. and Elliott, R.B. 2003. Ischaemic heart disease, Type 1 diabetes, and cow milk A1 β-casein.

19th Livestock Census. 2012. All India Report, Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries, Government of India.

Lien, S., Alestrom, P., Klungland, H. and Rogne, S. 1992. Detection of multiple β-casein alleles by amplification

created restriction sites (ACRS). *Animal Genetics*, 23:333–338.

McKenzie H. 2012. Milk Proteins V1: Chemistry and molecular biology. *Elsevier*, Vol. 1.

Meisel, H. 1986. Chemical characterisation and opioid activity of an exorphin isolated from in vivo digests of casein. *FEBS Letters*, 196:223–227.

Meisel, H. 1998. Overview on milk protein-derived peptides. *Int. Dairy J.*, 8(5):363-373.

Meisel, H. and Bockelmann, W. 1999. Bioactive peptides encrypted in milk proteins: proteolytic activation and thropho-functional properties. *Antonie van Leeuwenhoek*, 76: 207-215.

Morley, J.E. 1982. Food peptides: A new class of hormones. *Jama*, 247(17): 2379-2380.

Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (ABS) adopted on 29 October 2010 in Nagoya, Japan and entered into force on 12 October 2014. www.cbd.int/abs/doc/commonformats/ABSCH-IRCC.doc.

National Biodiversity Authority, available at http://goo.gl/ZpT3mj, 2015.

National Dairy Development Board available at http://www.nddb.org/English/Statistics/Pages/Milk-Production.aspx.

Sribala Vadlapatla, Iconic Ongole bull, now a cash cow for Brazil, 15 April 2015, Times of India http://goo.gl/6LpwYd.

Svedberg, J., de Haas, J., Leimenstoll, G., Paul, F. and Teschemacher, H. 1985. Demonstration of b-casomorphin immunoreactive materials in in vitro digests of bovine milk and in small intestine contents after bovine milk ingestion in adult humans. *Peptides*, 6:825-830.

Times of India. 2015. available online at http://timesofindia.indiatimes.com/city/hyderabad/Iconic-Ongole-bull-now-a-cash-cow-for Brazil/articleshow/46925770.cms.

How to cite this article:

Poonam Jayant Singh and Atul Kumar Tiwari. 2016. The Ongole Cattle Germplasm: Corollary Arising out of Regulating Access, Associated Knowledge and Benefit Sharing Post Nagoya Protocol by Brazil from India. *Int.J.Curr.Microbiol.App.Sci.* 5(11): 196-204.
doi: http://dx.doi.org/10.20546/ijcmas.2016.511.022