ICAR-NRCE

ANNUAL REPORT
2017-18

भाकृअनुप
ICAR

भा.कृ.अनु.प.–राष्ट्रीय अश्व अनुसंधान केन्द्र

ICAR-National Research Centre on Equines

ICAR NATIONAL RESEARCH CENTRE ON EQUINES
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The achievements and activities of the Centre from April 2017 to March 2018 are presented in this report. Mention of trademark, proprietary product or firm in the report does not constitute an endorsement or rejection of other suitable products or firms.

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ICAR-National Research Centre on Equines

With best compliments from

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About the Cover

The Kelpies *are 30-metre-high horse-head sculptures, standing next to a new extension to the Forth and Clyde Canal, and near River Carron, in The Helix, a new parkland project built to connect 16 communities in the Falkirk Council Area, Scotland. The sculptures were designed by sculptor Andy Scott. In a monumental feat of engineering, The Kelpies rose from the ground in just 90 days, in October 2013.*

The sculptures form a gateway at the eastern entrance to the Forth and Clyde canal, and the new canal extension built as part of The Helix land transformation project. The Kelpies are a monument to horse powered heritage across Scotland. The Kelpies name reflected the mythological transforming beasts possessing the strength and endurance of 10 horses; a quality that is analogous with the transformational change and endurance of Scotland's inland waterways. The Kelpies represent the lineage of the heavy horse of Scottish industry and economy, pulling the wagons, ploughs, barges and coalships that shaped the geographical layout of the Falkirk area.

Contents

Director's Foreword

After a modest commencement in 1985, NRCE continued in bringing improvements in health and productivity of equines in India. The current report showcases zeal and enthusiasm in all of us at NRCE to work hard for the global competition in generation of commercially viable technologies and demand-driven research for benefit of the farmers. The Centre has projects in the area of vaccinology, diagnostics, therapeutics and equine reproduction. It has attained national and international recognition for quality research on important infectious diseases of equines through its OIE twinning programmes. Efforts towards the improvement in health and productivity of the equines will help in achieving the goal of sustainable development with social justice for the poorest-of-the-poor farmers.

The research ventures of the Centre received major boost during the year through 36 ongoing research projects, including 13 externally funded projects. During the year, scientists published 43 original research articles in international journals and national refereed journals. In addition, 15 book chapters/ technical bulletins/ popular articles and 30 research abstracts were published by the scientists. The scientists of the Centre participated in various Seminars, Conferences & Symposia and presented 29 research papers.

During the year, technology development, assessment and transfer to end-users have been the mainstay activities of the Centre. Rapid diagnostic kit for diagnosis of *Theileria equi* and r-protein-based ELISA kit for differentiation of EHV1/4 infection were released by Hon'ble Minister of Agriculture & Farmers' Welfare, Sh. Radha Mohan Singh. In addition, recombinant protein-based ELISA kits for diagnosis of glanders were provided to diagnostic laboratories of six states. An indirect ELISA for Japanese encephalitis and whole cell lysate antigen-based ELISA for *Trypanosoma evansi* were also provided to Assam Agricultural University, Guwahati to develop diagnostic facilities in north-eastern region. In addition, PCR assays for Vesicular stomatis virus and Venezualan equijne encephalitis virus were developed using synthetic gene technology.

The Centre maintains nationwide vigil on important equine infectious diseases through active surveillance and monitoring programme. During 2017-18, 1446 equine serum samples from 7 states were tested for various diseases like equine infectious anaemia, equine Influenza, equine herpesvirus 1, Japanese encephalitis, trypanosomosis, piroplasmosis, *Salmonella* Abortusequi and brucellosis. Through paid consultancy and diagnostic services for important infectious diseases of equines, the Centre generated revenue of Rs 55.81 lakhs, primarily by testing 3877 equines for

equine infectious anaemia and 4606 for glanders.

During 2017-18 incidence of equine glanders was all time high with 407 cases reported from 10 states of India. A planned surveillance of glanders in Uttar Pradesh led to detection of 253 cases widely spread over 50 districts. Incidence of glanders in Uttar Pradesh and Delhi was alarming, attracting attention of electronic and print media. This calls for a nation wide surveillance and control programme for total eradication of glanders from India.

In our endeavour to develop refined vaccines, EHV1 clone employing bacterial artificial chromosome mediated mutagenesis was developed for its use as vaccine candidate. In addition, recombinant equine influenza virus generated through reverse genetics was evaluated as vaccine candidate in mouse model.

The research on development of herbal drugs for *Theileria equi* and novel drug molecules for *Trypanosoma evansi* treatment made headway during the year. Our scientists also focused on management of colic and interventions against osteoarthritis using nano-delivery vehicles. Our results on exploration of phage cocktails for treatment of mastitis gave encouraging results. The antiviral activity of SERCA inhibitor was also evaluated *in vitro* against PPRV and NDV.

The phenotypic and genetic characterization of donkey breeds, Marwari horses and development of DNA typing for parentage testing has been done. With the standardization of parentage verification in equines using microsatellites, NRCE is working on starting parentage testing for commercial purposes.

During the year 2017-18, NCVTC accessioned a total of 70 bacteria, 27 viruses, 24 bacteriophages, 36 recombinant clones and 8 genomic DNA making the total collection of veterinary microbes to 2497 and cumulative culture collection of microbes to 3403.

The centre extended equine welfare activities in different parts of the country by organizing health camps and interactive farmer meets to educate equine owners on various aspects of disease control and management. Under Mera Gaon Mera Gaurav programme NRCE scientists coordinated agriculture, animal health related activities and social awareness through government officials and village Panchayats. The emphasis was laid on creating awareness about diagnosis and treatment of affected animals, soil conservation, controlled use of chemical fertilizers by the farmers.

The centre has taken initiative for equine tourism at its Bikaner campus, where an equine museum, herbal park, information centre, souvenir shops have been established. In addition, *tonga* riding has been started, which is popular amongst visiting tourists.

The competence of the scientists and technical officers brought laurels to the centre. This year six awards and two fellowships were bestowed on NRCE staff, including ICAR Lal Bahadur Shastri Outstanding Young Scientist award, ICAR Cash Award Scheme 2016 and Women Scientist Award-2017 by ICAR and other scientific societies.

I would like to take this opportunity to record my sincere thanks to the Chairman and the Members of the Publication Committee for bringing out this excellent annual report of the Centre with a new look and substantial improvement in the quality of its publication.

I gratefully acknowledge the whole-hearted support extended to me by Dr Trilochan Mahaptra, Secretary DARE & Director General ICAR; Dr Joykrushna Jena, Deputy Director General (Animal Science), ICAR, New Delhi. My thanks are also due to the Assistant Director Generals Dr Ashok Kumar (Animal health), Dr B.S. Prakash (Animal Nutrition and Physiology) and Dr R.S. Gandhi (Animal Production and Breeding) and Principal Scientists (Dr Rajan Gupta, Dr Vineet Bhasin, Dr Jyoti Misri and Dr Neelam Gupta) at ICAR Head quarters for their continuous support to NRCE.

Btripathi

(B.N. Tripathi)

Executive Summary

कार्यकारी सारांश

The Centre made significant research contributions through 36 research projects, including 13 externally funded projects by DBT, DST, DRDE, ICAR extra mural and OIE during the year. The Research Advisory Committee for guiding the Centre was re-constituted under the chairmanship of Dr M.P. Yadav during the year. The salient achievements of the Centre during 2017-18 are outlined below.

The Centre maintains nationwide vigil on important equine infectious diseases through active surveillance and monitoring programme. During 2017-18, 1446 equine serum samples from 7 states were tested for various diseases like equine infectious anaemia (EIA), equine Influenza (EI), equine herpesvirus 1 (EHV1), Japanese encephalitis (JE), trypanosomosis, piroplasmosis, *Salmonella* Abortusequi and brucellosis. The percent sero-prevalence for various diseases were 60.78% for piroplasmosis, 15.56% for EHV1, 6.98% for trypanosomosis, 2.35% for JE and 0.62% for EI. None of the equines were found positive for EIA, brucellosis and *Salmonella* Abortusequi.

Monitoring of infectious animal diseases in north-eastern states of India is being undertaken by the Centre. Surveillance for influenza A, Japanese encephalitis and trypanosomosis in north-eastern region was undertaken as there is continuous threat of emergence of trans-boundary infectious diseases from neighboring countries. During this year, a highly sensitive indirect ELISA for Japanese encephalitis developed by ICAR-NRCE and whole cell lysate antigen of *Trypanosoma evansi* were supplied to AAU, Guwahati for developing diagnostic competence in this region. Out of 50 cattle and 49 pigs tested for *T. evansi* antibodies, 2 cattle and 3 pigs were found positive by antibody ELISA. This is the first report of *T. evansi* infection in pigs of NER. Out of 98 pig serum samples tested for JEV antibodies, 15 (15.3%) were found positive. None of ducks (23), yaks (30) and bovines (22) tested positive for JEV antibodies. Out of 69 pigs' nasal swabs tested for influenza A viruses by RT-PCR assay

राष्ट्रीय अश्व अनुसंधान केन्द्र ने विगत वर्ष के दौरान डीबीटी, डीएसटी, डीआरडीई, आईसीएआर, एक्स्ट्रामूरल और ओआईई द्वारा 13 बाहरी वित्त पोषित परियोजनाओं सहित 36 शोध परियोजनाओं के माध्यम से महत्वपूर्ण योगदान दिया है। केन्द्र के मार्गदर्शन के लिए अनुसंधान सलाहकार समिति का गठन डॉ एम.पी. यादव की अध्यक्षता में किया गया। वर्ष 2017–18 के दौरान, केन्द्र की मुख्य उपलब्धियों का नीचे संक्षिप्त उल्लेख किया गया है।

केन्द्र, सतत् निरीक्षण और निगरानी कार्यक्रम के माध्यम से महत्वपूर्ण संक्रामक बीमारियों पर राष्ट्रव्यापी सतर्कता बनाए रखता है। वर्ष 2017–18 के दौरान, 1446 अश्वों के रक्त नमूनों का विभिन्न रोगों जैसे इक्वाइन संक्रामक एनीमिया (ईआईए), इक्वाइन इन्फ्लुएंजा (ईआई), इक्वाइन हर्पिस वायरस 1 (ईएचवी 1), जापानी एन्सेफलाइटिस (जेई), ट्रिपैनोसोमा, पायरोप्लास्मोसिस, साल्मोनेल्ला एर्बाटसइक्वाई और ब्रुसेलोसिस के लिए परीक्षण किया गया। इसमें 60.78% पायरोप्लास्मोसिस, 15.56% ईएचवी 1, 6.98% ट्रिपैनोसोमा, 2.35% जेई, 0.62% ईआई पाया गया। ईआईए, ब्रुसेलोसिस और साल्मोनेल्ला के लिए कोई भी अश्व सकारात्मक नहीं पाया गया।

भारत के उत्तर–पूर्वी राज्यों में भी केन्द्र द्वारा पशुओं में संक्रामक रोगों की निगरानी की जा रही है। उत्तर–पूर्वी क्षेत्र में इन्फ्लूएंजा ए, जापानी एन्सेफलाइटिस (मस्तिष्क ज्वर) और ट्रिपैनोसोमा के लिए निगरानी की गई क्योंकि पड़ोसी देशों से सीमा पार संक्रामक बीमारियों के उभरने का लगातार खतरा है। इस वर्ष के दौरान इस क्षेत्र में नैदानिक क्षमता विकसित करने हेतु रा.अ.अनु.के. द्वारा विकसित जापानी एन्सेफलाइटिस की जांच हेतु एक बेहद संवेदनशील एलाईसा और ट्रिपैनोसोमा इवेन्साई के एंटीजन को आसाम कृषि विश्वविद्यालय, गुवाहाटी को प्रदान किया गया । टी. इवेन्साई एंटीबॉडी के लिए 50 मवेशी और 49 सूअरों का परीक्षण किया गया, 2 मवेशी और 3 सूअर सकारात्मक पाए गए। भारत के उत्तर–पूर्वी राज्यों के सूअरों में टी. इवेन्साई संक्रमण की यह

targeting partial matrix gene, 13 samples were detected positive. District-wise JEV sero-prevalence in pigs in Assam was done during the year. On screening 304 pigs, maximum seroprevalence was reported from Kamrup followed by Jorhat district of Assam.

Identification of latently infected horses might help in EHV1 control programs as these animals are responsible for maintenance of virus in the equine population. In this direction, 24 aborted mares were tested after 6 months for the presence of viruses in their nasal and vaginal swabs by EHV1 gB-q PCR. Although, these animals were negative for virus shedding, however we could confirm latent infection by demonstration of expression of LAT in cDNA isolated from PBMCs.

EHV1 is an important, ubiquitous equine viral pathogen that causes significant economic losses to the equine industry. It produces well documented syndromes of respiratory disease, abortion, neonatal foal death and myeloencephalopathy in equine populations. EHV1 glycoproteins especially gB, gD and gM play important role in pathogenesis and generation of protective neutralizing antibodies. These glycoproteins alone or in combination are good target candidate for development of recombinant protein-based or DNA based vaccines against EHV-1. During the year, we evaluated glycoproteins as immunogens in mouse model. On challenge, it was concluded that maximum protection in mice was provided by gB followed by gD and gM.

EHV1 vaccines currently in use in India induce short-lived humoral and cellular immunity. Therefore, development of live attenuated vaccine is priority to boost immune response. The bacterial artificial chromosome (BAC) cloning and mutagenesis approach is being used to develop an effectively attenuated EHV1 virus. In this direction, a recombinant EHV1 has been developed employing bacterial artificial chromosome mediated mutagenesis with a view to develop it as potent modified live vaccine candidate.

For refinement of vaccine for equine influenza, efforts were made for generation of reverse genetics based equine influenza virus and explore its potential as vaccine candidate through challenge studies in mouse model. The inactivated recombinant equine influenza virus vaccine having a backbone of H1N1 and H3N8 from 2008-09 equine outbreak in India adjuvanted with Montanide + CpG provided enhanced protection.

In view of significance of emergency preparedness against exotic equine viral diseases of zoonotic importance, nucleic acid based diagnostic PCR assays were standardized to detect Vesicular stomatitis virus and Venezuelan equine

पहली रिपोर्ट है। जेईवी एंटीबॉडी के लिए निरीक्षण किए गए 98 सूअर सीरम नमूने में से 15 (15.3%) सकारात्मक पाए गए । बत्तखों (23), याक (30) और गायों (22) के नमूने जेइवी एंटीबॉडी के लिए सकारात्मक नहीं पाए गए। आरटी–पीसीआर परख द्वारा आंशिक मैट्रिक्स जीन को लक्षित कर इन्फ्लूएंजा ए वायरस के लिए परीक्षण किए गए, 69 सूअरों के नासिका नमूनों में से 13 नमूने सकारात्मक पाए गए, 304 सूअरों की जांच करने पर आसाम के जोरहाट जिले में अधिकतम जेई संक्रामकता की सूचना मिली ।

गुप्त (लेटेन्ट) ईएचवी 1 संक्रमण की पहचान ईएचवी 1 नियंत्रण कार्यक्रमों में मदद कर सकती है क्योंकि ये घोड़ियों में वायरस के गुप्त रखने के लिए जिम्मेदार हैं। इस दिशा में, ईएचवी 1 जीबी–क्यूपीसीआर द्वारा नासिका और योनि स्वैब्स में वायरस की उपस्थिति के लिए 6 महीने के बाद 24 घोड़ों का परीक्षण किया गया। यद्यपि ये जानवर वायरस शेडिंग के लिए नकारात्मक थे, परन्तु एलएटी (LAT) की अभिव्यक्ति के प्रदर्शन से संक्रमण की पुष्टि की गई।

ईएचवी 1 एक महत्वपूर्ण, सर्वव्यापी अश्व विषाणु रोग है जो अश्व को अत्यधिक नुकसान पहुँचाता है। यह श्वसन रोग, गर्भपात, नवजात शिशु की मृत्यु और अश्वों में माईलोइन्सफैलोपैथी सिंड्रोम पैदा करता है। इएचवी 1 ग्लाईकोप्रोटीन विशेष रूप से जीबी (gB), जीडी (gD) और जीएम (gM) रोगजनकता और सुरक्षात्मक एंटीबॉडी बनाने में महत्वपूर्ण भूमिका निभाते हैं। अकेले या संयोजन में ये ग्लाईकोप्रोटीन ईएचवी –1 के खिलाफ पुनः संयोजक प्रोटीन आधारित या डीएनए आधारित टीकों के विकास के लिए अच्छे उम्मीदवार हैं। वर्ष के दौरान, चूहों में ग्लाईकोप्रोटीन का टीकाकरण किया गया। यह निष्कर्ष निकाला गया कि चूहों में अधिकतम सुरक्षा जीबी और जीएम के पश्चात् जीबी द्वारा प्रदान की गई थी ।

ईएचवी 1 टीका सुधार हेतु एक पुनः संयोजक ईएचवी 1 टीका विकसित किया गया है जो बैक्टीरियल कृत्रिम गुणसूत्र मध्यस्थ उत्परिवर्तन को नियोजित करता है ताकि इसे शक्तिशाली संशोधित सजीव टीका उम्मीदवार के रूप में विकसित किया जा सके ।

अश्व फ्लू के टीके का संशोधित करने हेतु रिवर्स जेनेटिक्स आधारित अश्व इन्फ्लूएंजा वायरस के उत्पादन के लिए प्रयास किए गए और चूहों के मॉडल में अध्ययन के माध्यम से टीके की क्षमता का पता लगाया गया। भारत में 2008–09 के प्रकोप से विलगित विषाणु के साथ रीकॉम्बिनेटेंट अश्व इन्फ्लूएंजा विषाणु द्वारा मॉन्टानाईड+सीपीजी के साथ निष्क्रिय टीके से अधिक सुरक्षा प्रदान की गई।

जूनोटिक महत्व के विदेशी विषाणुजनित रोगों के खिलाफ आपातकालीन तैयारी के महत्व को ध्यान में रखते हुए,

encephalitis virus (VEEV). In addition, an ELISA was standardized using recombinant protein for Vesicular stomatitis virus. Equines were also screened for Rift Valley fever by ELISA.

Neonatal mortality is a significant problem for the equine industry. Since *E. coli* and *Rhodococcus equi* are two important pathogens affecting foals, the study was undertaken to characterize virulence of these two pathogens isolated from the clinical samples. Majority of the *R. equi* of isolates (92-100%) were carrying virulent genes.

Trypanosma evansi and *Theileria equi* are tick borne hemoprotozoan parasites of equines and responsible for considerable economic losses to stakeholders. Available chemotherapeutics are incapable to clear parasitaemia completely from the affected host and entail multiple dosages, which consequently prompt severe multiple organ toxicity to treated host.

During the year, we evaluated cytotoxicity of three drugs viz., Chlorpromazine (CPZ), Indatraline and SC-1. These drugs exhibited significant growth inhibition efficacy against *T.evansi.* The *in vitro* cytotoxicity assays revealed that the drugs were not toxic even up to 5-20 x of effective drug concentration, indicating wide margin of safety. However, these drugs were not effective against *T. evansi* in mouse model.

In order to develop herbal therapeutics against *Theileria equi,* methanolic bark extracts of plants were tested against *T. equi* in MASP culture system. The ethyl acetate elutant fraction of methanolic extract from the bark significantly inhibited the *in vitro* growth of *T. equi.*

The nanoformulations for tissue repair using metal oxides and polymers mimicking the natural environment in the cartilage extra-cellular matrix as carriers were synthesized. Cytotoxicity studies of nanoformulations on horse fibroblast cells revealed a concentration-dependent safety and cytotoxicity.

Colic causes economic losses in the form of morbidity & mortality. To identify risk factors of colic in indigenous horses, a survey of horses of Rajasthan and Punjab was done. Incidence of colic in groundnut straw, wheat straw and wheat straw +groundnut/moth straw fed horses were 4.75, 26.73 and 3.12 %, respectively. Month wise analysis to identify the risk factors of colic incidence at an organized farm revealed the highest incidence of colic in September, coinciding with supply of green fodder (sorghum and pearl millet).

A survey was also done in Rajasthan and Punjab to assess the incidence of reproductive problems in breedable mares and it was observed that incidence of abortion, repeat

न्यूक्लिक एसिड आधारित नैदानिक पीसीआर टैस्ट को वैसीक्युलर स्टोमैटाइटिस विषाणु और वेनेजुएलान अश्व एन्सेफलाइटिस विषाणु (वीईईवी) का पता लगाने के लिए मानकीकृत किया गया। इसके अलावा वैसीक्युलर स्टोमोटाइटिस वायरस के लिए पुनः योगज प्रोटीन का उपयोग कर एलाइसा मानकीकृत किया गया। एलाइसा द्वारा रिफ्ट वैली बुखार के लिए भी अश्वों की जांच की गई।

अश्व पालन में नवजात घोड़ों की मृत्यु एक महत्वपूर्ण समस्या है। ई. कोलाई और रोडोकोकस इक्वाई दो महत्वपूर्ण रोगाणु हैं जो घोड़ों को प्रभावित करते हैं। इसलिए इसका अध्ययन बीमारी से प्रभावित घोड़ों के नमूनों से रोगाणु की विशेषता जानने हेतु किया गया। सबसे अधिक आर. इक्वाई (92–100 प्रतिशत) नमूनों में विषाक्त जीन के रूप में पाया गया।

ट्रिपैनोसोमा इवेंसाई और थाइलोरिया इक्वाई हेमोप्रोटोजोन परजीवी है जो मक्खी व चीचड़ द्वारा फैलते हैं और ये अश्व पालकों को काफी नुकसान पहुंचाते हैं। उपलब्ध दवाएं पूरी तरह से प्रभावित घोड़ों से परजीवी को समाप्त करने में असमर्थ हैं। इन दवाइयों की कई खुराक दी जाती हैं, जिसके परिणामस्वरूप घोड़ों में दवाईयों की विषाक्तता की स्थिति गंभीर हो जाती है।

इस वर्ष के दौरान, तीन दवाओं की विषाक्तता का मूल्यांकन किया गया। क्लोरप्रोमेजिन (सीपीजेड), इंडैट्रालीन और एससी–1 दवाओं का टी. इवेंसाई के विरूद्ध महत्वपूर्ण प्रभाव देखा गया। इन विट्रो साइटोटोक्सिसिटी विधि में पता चला है कि ये दवाएं प्रभावी खुराक से 5–20 गुना तक जहरीली नहीं थी, जो इनके सुरक्षित होने का संकेत देती हैं। हालांकि, ये दवाएं चूहों में टी. इवेंसाई के विरूद्ध प्रभावी नहीं पाई गई।

थाइलोरिया इक्वाई के आयुर्वेदिक उपचार हेतु पौधों की छाल में से मिथैनोल शोधित कुछ रासायनिक पदार्थ निकाले गए उनको 'मास्प' कल्चर के द्वारा परीक्षण किया गया।

कोशिकाओं एवम् उत्तक के सुधार हेतु वाहक के रूप में बाह्य कौशिकीय मैट्रिक्स में उपस्थित प्राकृतिक पर्यावरण से मिलते जुलते पोलीमर एवम् धातु का प्रयोग नैनोफॉर्म्यूलेशन के संश्लेशण के लिए किया गया। घोड़े में फाइब्रोब्लास्ट कोशिकाओं पर नैनोफॉर्म्यूलेशन की विभिन्न खुराकों का विषाक्तता एवम् सुरक्षा के लिए अध्ययन किया गया।

घोड़ों को पेट दर्द (कोलिक) और मृत्यु आर्थिक नुकसान का कारण बनता है। स्वदेशी घोड़ों में कोलिक के इन जोखिम कारकों की पहचान करने हेतु राजस्थान और पंजाब में सर्वेक्षण किया गया, जिसमें पाया गया कि घोड़ों में मूंगफली के भूसे में 4.24%, गेहूं के भूसे में 26.73% और गेंहू के भूसे + मूंगफली/मोठ स्ट्रा में 3.12% से कालिक हुआ। मासिक विश्लेषण के दौरान सितंबर में हरे चारे से कोलिक की सबसे ज्यादा घटनाएँ घटी।

breeding, anestrous and metritis were very frequent.

Parentage testing in horses has become a necessity for breeders to assure horse pedigree integrity. Microsatellite based genotyping for the confirmation of parentage of was standardized. A total of 282 samples were genotyped with 5 multiplex PCR reactions covering total of 21 microsatellite markers.

Genetic characterisation of Marwari breed assists in determination of genetic diversity, relatedness within population and distinction from other breeds. Out of 30 microsatellite markers studied in six multiplexes for genetic characterization of 282 DNA samples, the microsatellite marker TKY 333 was found to be the most contributing marker of genetic diversity.

A mineral mixture specific to an area is more suitable to the livestock of that area as this will supplement the deficit minerals and make a balanced ration. Mineral status in the equine fecal and hoof samples collected from various districts of Rajasthan revealed deficit in calcium, phosphorus and zinc in equines.

National Centre for Veterinary Type Cultures (NCVTC) activities includes isolation, identification, characterization, and preservation of microbial cultures. During the year 2017-18, a total of 70 bacteria, 27 viruses, 24 bacteriophages, 36 recombinant clones and 8 genomic DNA were accessioned making the total collection of 3403 microbes.

Poxvirus infections are endemic in the country. Efforts on isolation, characterization and preservation of the circulating poxvirus strains led to the acquisition of 50 different pox virus isolates from different livestock (cattle, sheep, goat buffalo, pig, camel) and poultry. A study conducted to find out the presence of different fowl adenoviruses (FAdVs) among broilers in different poultry farms of Haryana revealed the circulation of fowl adenovirus belonging to Group E and Group C among broiler chicken.

Investigation on the prevalence of porcine respiratory viruses among swine population from Haryana, Mizoram, Guwahati, Meghalaya & Mumbai revealed the co-circulation of porcine circovirus 2, influenza A viruses (IAVs) and PCMV in various combinations in healthy domestic pigs. Some of the influenza A viruses (IAVs) were very closely related to human influenza viruses (seasonal H1N1 & H3N2 viruses) indicating the possibility of reverse zoonosis. A library of recombinant clones (36) of various genes of these porcine viruses has also been created at NCVTC.

In an attempt to find target for development of novel antiviral therapeutics, sarco/endoplasmic reticulum calcium-ATPase (SERCA) was evaluated. SERCA, a membrane

क्षेत्र के लिए विशिष्ट खनिज मिश्रण उस क्षेत्र के पशुधन के लिए अधिक उपयुक्त है क्योंकि इससे कम खनिजों को पूरक कर एक संतुलित भोजन बनता है। एक अध्ययन में राजस्थान के विभिन्न जिलों से प्राप्त घोड़ों के मल और खुर के नमूनों में उपस्थित कैल्शियम, फास्फोरस और जिंक की कमी का पता चला है।

राजस्थान और पंजाब में प्रजनन संबंधी समस्याओं के आकलन हेतु एक सर्वेक्षण किया गया जिसमें गर्भपात की घटनाएं, पुनःप्रजनन व ताव में न आना मुख्य रूप से पाया गया।

अश्व वंशावली के निर्धारण की तकनीक अश्व प्रजनकों की महत्वपूर्ण आवश्यकता बन गई है। अश्वों में अभिभावक परीक्षण के पुष्टिकरण हेतु माईक्रोसेटेलाइट आधारित जीनोटाइपिंग की तकनीक को मानकीकृत किया गया है। लगभग चार सौ नमूनों में इक्कीस माईक्रोसैटेलाइट मार्कर के पांच मल्टीप्लेकस पीसीआर प्रतिक्रियाओं के आधार पर जीनोटाईपिंग की गई।

अनुवांशिक विविधता व अश्व नस्लों से विभिन्नता के लिए मारवाड़ी नस्ल के अश्वों का जैनेटिक निर्धारण 30 माईक्रोसैटेलाट्स मार्कर के द्वारा किया गया जिसमें 282 डी. एन.ए. नमूनों को छह मल्टीप्लेक्स पीसीआर के आधार पर अध्ययन किया गया। इनमें मार्कर टी.के.वाई. 333 को जैनेटिक विविधता में सबसे अधिक उपयुक्त पाया गया।

राष्ट्रीय पशुचिक्त्सिा प्रारूप संवर्धन केन्द्र (एन.सी.वी.टी.सी.) का लक्ष्य सूक्ष्मजीवों का पृथक्कीकरण, पहचान, लक्षण वर्णन एवं भंडारण है। वर्ष 2017–18 के अन्तर्गत कुल 70 जीवाणु, 27 विषाणु, 24 जीवाणुभोजी, 36 रीकोम्बीनेन्ट क्लोनस एवं 8 जीनोमिक डीएनए परिग्रहण किये गये जिन्हें मिलाकर कुल एकत्रित सूक्ष्म जीवों की संख्या 3403 हो गई है।

भैंसचेचक पूरे देश में फैला हुआ है। फैले हुए भैंसचेचक विषाणु के पृथक्कीकरण, पहचान, लक्षणवर्णन एवं भंडारण के प्रयासों के फलस्वरूप 50 विभिन्न प्रकार के चेचक विषाणुओं का भंडारण किया गया जो कि विभिन्न प्रजातियों जैसे गाय, भैंस, भेड़, बकरी, शुकर, उष्ट्र एवं मुर्गी से थे। मुर्गियों में एडीनोवायरस के लिए एक अनुसंधान किया गया जिसमें पाया कि हरियाणा के विभिन्न मुर्गीपालन केन्द्रों में फाउल एडीनोवायरस का फैलाव ब्रोइलर चिकन में ग्रुप E एवं ग्रुप C का है। पोरसाईन रेसपीरेट्री वायरस के लिए की गई जांच में पाया गया कि हरियाणा, मिजोरम, गुवाहाटी, मेघालय एवं मुम्बई में पोरसाइन सिरको वायरस, इन्फलुएंजा ए एवं पीसीएमवी का मिलाजुला प्रभाव निरोगी घरेलू शूकरों में देखने को मिला। कुछ इन्फलुएंजा ए वायरस हयुमन इंफलुएंजा वायरस (H_3N1 एवं H_3N2 वायरस) से काफी हद तक समानता दर्शा रहे थे जो कि रिवर्स जूनोसिस की तरफ इंगित

bound cytosolic enzyme known to regulate the uptake of calcium into the sarco/endoplasmic reticulum from the cytosol. The study revealed that SERCA can also regulate Peste des petits ruminants virus (PPRV) and Newcastle disease virus (NDV) replication.

Mastitis is economically devastating and most important disease of dairy animals. Various bacteria identified in mastitis included *Staphylococcus aureus* ssp. *aureus, Staphylococcus haemolyticus*, *S. agnetis, S. sciuri, S. xylosus, S. chromogene, S. epidermidis, E. coli, Streptococcus dysgalactiae* and *Klebsiella pneumoniae.* Fourteen bacteriophages were isolated from these animal farms and biological activity of the phages indicated that the phage cocktails were active against majority of mastitic pathogens and phage-BPA116 alone was active against various species of Staphylococci.

Mule dung contains microorganisms which may be of public health and environment concern. The mule dung collected from Katra region (Jammu) was subjected to metagenomic analysis. The findings identified bacteria of pathogenic potential including, *Bacteroides fragilis; Orientia tsutsugamushi; Erysipelothrix rhusiopathiae; Erysipelothrix* larvae; *Neisseria perflava,* etc.

During 2017-18, the scientists of the Centre published 43 original research articles in international journals and national refereed journals. In addition, 15 book chapters, technical bulletins, popular articles and 30 research abstracts were published by the scientists. The scientists of the Centre participated and presented 29 research papers in various seminars, conferences and symposia. The scientists of the centre also delivered 24 expert lectures in various workshops and training programmes.

The Centre provides expert trainings to various stakeholders. DBT sponsored training on “Bioinformatics tools & their application in biological research” was organized during 5-7 September 2017. In addition, trainings on artificial insemination, equine health & management and glanders diagnosis were also organized during the year.

The centre extended equine welfare activities in different parts of the country by organizing health camps and interactive farmer meets to educate equine owners on various aspects of disease control and management. Under Mera Gaon Mera Gaurav programme, NRCE scientists coordinated agriculture, animal health related activities and social awareness through government officials village Panchayats. Social campaign on 'save girl child' was also undertaken in this programme.

Infrastructure development and upgradation activities continued at NRCE during 2017-18. Equine eco-tourism

करता है। इन्हीं पोरसाइन विषाणुओं की एक लाइब्रेरी एनसीवीटीसी में विकसित की गई जिनमें 36 रीकोम्बीनेन्ट क्लोन मौजूद हैं।

एक खोज में पाया गया कि सारको एन्डोप्लाजमिक रेटिकुलम कैल्शियम एटीपीएज (सरका) एक वह लक्ष्य है जिसकी मदद से विषाणुनाशक दवाओं का विकास किया जा सकता है। सरका एक झिल्ली से जुड़ा कोशिकीय एन्जाइम है जो कि कैल्शियम को साइटोसोल से सारको एन्डोप्लाजमिक रेटिकुलम में अन्दर आने को संभालता है। इस अध्ययन से ज्ञात हुआ है कि सरका पीपआरवी एवं एनडीवी वायरस की प्रतिकृति को भी रोकता है।

घोड़े की लीद में स्वास्थ्य एवं पर्यावरण के लिए लाभकारी सूक्ष्म जीव पाये गये हैं। कटरा (जम्मू) क्षेत्र से एकत्रित की गई घोड़े की लीद का मेटाजिनोमिक विश्लेषण किया गया है।

वर्ष 2017–18 के दौरान केन्द्र के वैज्ञानिकों ने राष्ट्रीय व अन्तर्राष्ट्रीय पत्रिकाओं में 43 शोध पत्र प्रकाशित किए। इसके अतिरिक्त पुस्तकों में 15 अध्याय व 30 शोध सारांश प्रकाशित किए गए। वैज्ञानिकों द्वारा विभिन्न वैज्ञानिक संगोष्ठियों में 29 शोध पत्र प्रस्तुत किए गए। वैज्ञानिकों द्वारा प्रशिक्षण कार्यक्रमों में 24 व्याख्यान दिए गए।

केन्द्र विभिन्न लाभार्थियों को प्रशिक्षण भी प्रदान करता है। इसी कड़ी में केन्द्र द्वारा बायोइन्फार्मेटिक्स, कृत्रिम गर्भादान, अश्व स्वास्थ्य एवं प्रबंधन व ग्लैंडर्स निदान के प्रशिक्षण आयोजित किए गए।

केंद्र ने स्वास्थ्य शिविरों और किसान बैठकों का आयोजन करके देश के विभिन्न हिस्सों में बीमारी नियंत्रण और प्रबंधन के विभिन्न पहलुओं पर अश्व पालकों को शिक्षित करने के लिए गतिविधिओं को बढ़ाया। मेरा गॉव मेरा गौरव कार्यक्रम के तहत, रा.अ.अनु.के. के वैज्ञानिकों ने सरकारी अधिकारियों और गॉव पंचायत के माध्यम से कृषि, पशु स्वास्थ्य संबंधी गतिविधियों और सामाजिक जागरूकता का संचालन किया। इस कार्यक्रम में 'बेटी बचाओ बेटी पढ़ाओ' पर सामाजिक अभियान भी चलाया गया।

वर्ष 2017–18 के दौरान रा.अ.अनु.के. में बुनियादी ढांचों के विकास हेतु गतिविधियां जारी रहीं। बीकानेर कैंपस में अश्व पर्यावरण–पर्यटन शुरू किया गया। अश्वों की समग्र जानकारी हेतु अश्व मालिकों, पशु चिकित्सा अधिकारियों, पशु स्वास्थ्य विभाग के अधिकारियों, छात्रों और अन्य हितधारकों के लिए मोबाईल एप ''इन्फोइक्वाईन'' विकसित की गई।

केन्द्र द्वारा भारत सरकार के निर्देशों के तहत विभिन्न गतिविधियों का आयोजन किया गया। जिनमें विश्व पशु चिकित्सा दिवस (29 अप्रैल, 2017) स्वच्छता अभियान (29 अप्रैल से 22 मई, 2017), अंतर्राष्ट्रीय योग दिवस (21 जून,

was initiated at Bikaner campus. A user friendly mobile app "Info-equine" was developed for equine owners, veterinary officers, animal husbandry department officials, students and other stakeholders.

The Centre organized various activities under directives from Government of India. World Veterinary Day (April 29, 2017); Cleanliness drive under the Swacchata abhiyan programme (April 29 to May 22, 2017); International Day for Yoga (June 21, 2017); Independence Day (August 15, 2017); Tree plantation on *Van Mahotsav* (August 8, 2017); Agriculture Education Day (December 1, 2017); World Soil Day (December 05, 2017); 69th Republic Day (26 January 2018) were organized. The 29th Foundation Day of the Bikaner campus (September 28, 2017.) and 33rd Foundation Day of Hisar campus (November 26, 2017) were celebrated with great fanfare.

Technology development, assessment and transfer to end-users are the mainstay activities of the Centre. During the year, rapid diagnostic kit for diagnosis of *T. equi* and r-protein-based ELISA kit for differentiation of EHV1/4 infection were released on July 16, 2017 during 89th ICAR Foundation Day by Hon'ble Minister of Agriculture & Farmers' Welfare. In addition, glanders recombinant protein-based ELISA kits for glanders were provided to six states.

The Centre also offers paid consultancy and diagnostic services for important infectious diseases of equines. Under this programme, 9039 equines were tested and a revenue of Rs 55.81 lakh was generated through contractual diagnostic services.

The scientists of the Centre upgraded their skills in the world renowned laboratories. Dr Naveen Kumar attended three months training programme at Division of Infection and Pathway Medicine, University of Edinburgh, UK. Dr Shanmugasundaram completed his PhD from University of Guelph, Guelph, Ontario, Canada. Prestigious awards were also bestowed on NRCE scientists and staff, including Dr Taruna Anand, Dr B.R. Gulati, Dr Nitin Virmani, Dr R.A. Legha, Dr Anuradha Bhardwaj, Dr T.R. Talluri, Dr B.C. Bera and Sh Mukesh Chand.

2017), स्वतंत्रता दिवस (15 अगस्त, 2017), वन महोत्सव (8 अगस्त, 2017), कृषि शिक्षा दिवस (1 दिसंबर, 2017), विश्व मृदा दिवस (05 दिसंबर, 2017), गणतंत्र दिवस (26 जनवरी 2018) सम्मिलित हैं। बीकानेर परिसर के 29वें स्थापना दिवस (28 सितंबर, 2017) और हिसार परिसर के 33वें स्थापना दिवस को उल्लास और हर्ष के साथ मनाया गया।

प्रौद्योगिकी विकास, मूल्यांकन और हस्तांतरण केंद्र की प्रमुख गतिविधियां है। वर्ष के दौरान, ईएचवी 1/4 संक्रमण के भेद के लिए टी. इक्वाई और आर–प्रोटीन आधारित एलाइसा किटें 16 जुलाई, 2017 को कृषि और किसान कल्याण मंत्री द्वारा 89 वें आई.सी.ए.आर. स्थापना दिवस के दौरान जारी की गई। इसके अलावा, ग्लैंडर्स के निदान के लिए एलाइसा किट छह राज्यों को प्रदान किया गया।

केन्द्र महत्वपूर्ण संक्रामक बीमारियों के लिए परामर्श और नैदानिक सेवाएं भी प्रदान करता है। इस कार्यक्रम के तहत, लगभग 39,000 अश्वों के नमूनों का परीक्षण किया गया और नैदानिक सेवाओं के माध्यम से 55.81 लाख रूपये का राजस्व अर्जित किया गया।

इस वर्ष के दौरान वैज्ञानिकों ने विश्वस्तरीय प्रयोगशालाओं में प्रशिक्षण प्राप्त किए। डॉ. नवीन कुमार ने तीन माह के लिए एडिनबर्ग (यूके) में प्रशिक्षण प्राप्त किया व डॉ. शन्मुगासुन्दरम ने गल्फ विश्वविद्यालय कनाडा से पीएच.डी की उपाधि प्राप्त की। इसके अतिरिक्त विभिन्न वैज्ञानिकों एवं अधिकारियों डॉ तरूणा आनंद, डॉ बलदेव राज गुलाटी, डॉ नितिन विरमानी, डॉ राम अवतार लेघा, डॉ अनुराधा भारद्वाज, डॉ टीआर तल्लुरी, डॉ बीसी बेरा एवं मुकेश चंद को गौरवमयी पुरस्कार प्राप्त हुए। डॉ बलदेव आर गुलाटी को 'पशु चिकित्सा इम्यूनोलॉजी एंड बायोटेक्नोलॉजी' के मुख्य संपादक के रूप में नामित किया गया।

Introduction

Horses have been domesticated and used by humans since ancient times. Humans have conquered the world with the aid and sacrifice of the loyal horses. They have played major role in the rise and fall of empires and the conquest of great battles. Horses have played an important role in the human progress including development of transport systems, agriculture and forestry. The importance of horses has decreased due to mechanization. However, they are still being used in hilly and difficult terrains and are an important source of livelihood for marginal farmers and landless laborers. Donkeys are used as pack animals by the poorest of the poor. These are used by shepherds while grazing the herds. At the same time the mules are providing efficient draught power for pulling the carts. Horses, due to their power, agility, gracefulness and speed, are increasingly being used for personal pleasure and in sport competitions.

Considering the importance of equines and cater to the needs of equine health and augment equine productivity, Indian Council of Agricultural Research established National Research Centre on Equines (NRCE) on November 26, 1985 at Hisar (Haryana). The main campus of NRCE has state-of-the art laboratories and facilities for undertaking research in areas of equine virology, bacteriology, parasitology, immunology, pathology, medicine, biochemistry and biotechnology. The research activities are supported by centralized facilities such as animal and agriculture farms, experimental animal facility, microbial containment laboratory, AKMU cell, ATIC, library and Info-equine museum. A regional station of NRCE, named Equine Production Campus (EPC) was established in 1989 at Bikaner to undertake research on equine production, genetics and breeding, reproduction, physiology and nutrition. Bikaner campus has well maintained herd of Marwari, Kathiawari, Zanskari and Manipuri horses and indigenous and exotic donkeys. The National Centre for Veterinary Type Cultures (NCVTC) was established in the year 2005 at NRCE, Hisar, for collection and preservation of microbes of animal origin and veterinary importance. Presently, the Centre is working through 14 network units spread throughout the country.

ICAR-NRCE

MANDATE OF NRCE

- Basic and strategic research on equine health and production.
- To provide advisory and consultancy services and capacity development.

SALIENT ACHIEVEMENTS

During past 32 years, NRCE has contributed significantly in the area of diagnosis and control of equine infectious diseases by providing state-of-the-art diagnostics and biologicals. The Centre is striving hard for conservation and characterization of Indian breeds of equines in the country and even established nucleus herds of representative breeds of equines in its Bikaner campus. Some of the achievements and accolades of the centre are listed below:

Development of diagnostics for equine diseases

The Centre has been recognized as National Referral Centre for diagnosis of important equine infectious diseases by Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture, Government of India. The Centre has developed and refined diagnostics against various equine diseases:

- HERP kit for field diagnosis of equine herpesvirus 1 (EHV1) infection.
- COFEB kit for diagnosis of *Theileria equi.*
- A neutralizing monoclonal antibody-based diagnostic kit 'Equiherpes B-ELISA' for EHV1 antibody detection.
- A type-specific ELISA and real-time PCR for differentiation of EHV1 and EHV4 infections.
- Complement fixation and r-protein-based ELISA for diagnosis of glanders.
- A monoclonal antibody-based sandwich ELISA and RT-PCR for detection of equine rotavirus (ERV) from faecal samples.
- RT-PCR and real-time RT-PCR based assays for typing and diagnosis of equine influenza virus.
- A recombinant antigen based-ELISA for detection of antibodies to *Theileria equi.*
- An indirect ELISA using whole cell lysate antigen and PCR for detection of *Trypanosoma evansi.*
- ELISA and RT-PCR for diagnosis of Japanese encephalitis.
- A recombinant protein-based indirect ELISA for serodiagnosis of equine infectious anemia.

Development of vaccines and immuno-biologicals

- Inactivated EHV1 vaccine "Equiherpabort" using indigenous virus for prevention of abortions in mares.
- Inactivated equine influenza vaccine using indigenous isolate (A/equi-2/Ludhiana/87). The vaccine was updated in 2008-09 incorporating recent virus strain {A/eq/Katra-Jammu.06/08 (H3N8)}.
- Bacterin and outer membrane protein-based vaccine for *Salmonella* Abortusequi.
- Monoclonal antibodies against EHV-1, equine rotavirus, equine influenza, Japanese encephalitis and *Trypanpsoma evansi.*

Surveillance and monitoring of equine diseases in India

ICAR-NRCE is involved in nation-wide monitoring and sero-surveillance of important equine infectious diseases with a view to manage, control and eradicate diseases. Some of the salient achievements under seromonitoring include:

- India has gained OIE disease-free status for African horse sickness (AHS) in 2006 based on sero-monitoring data generated by NRCE,.
- Clinical cases of equine infectious anemia (EIA) have not been reported since 1997. Only two sero-positive cases (one mule from Uttarakhand in 2009 and one horse from Haryana in 2011) were detected and culled. Control of EIA in India was possible due to timely diagnosis and implementing package of practices formulated by NRCE.
- Outbreaks of glanders in equines have been detected since 2006-07 from different states and control measures are being adopted for preventing their further spread.

OBJECTIVES OF NRCE

- Generation of demand-driven technologies for equine health and production management.
- Capacity building for competitive equine power utilization in agricultural operations to serve the under privileged under changing environment & socio-economic scenario.

- Effective control of equine influenza outbreak of 1987 (involving 83000 equines) was done by implementing biosecurity and development of effective vaccine. Similarly, a major outbreak of equine influenza that spread in 13 different states of India during 2008-09 and caused huge mortality and economic losses, was timely diagnosed and controlled in collaboration with state animal husbandry departments.

Characterization of equine pathogens

- Nucleic acid sequencing of HA, M, M1 and M2 genes of equine influenza virus (EIV) isolates from 2008 outbreak (A/eq/Jammu-Katra/08, A/eq/Mysore/08 and A/eq/Ahmedabad/09) revealed clustering of Indian and Chinese isolates in a separate cluster designated as "Asian clade" and vaccine updated accordingly.
- Sequencing of VP7 gene of equine rotavirus isolates indicated circulation of G10, G3 and G6 serotypes in India.
- Whole genome sequence analysis of Japanese encephalitis virus isolated from an equine indicated virulent strain of genotype 3 is causing the disease in equine.
- The *in-vitro* cultivation of *T. evansi* and *Theileria equi* was successfully established.
- Experimental mouse models for equine influenza and equine herpesvirus 1 infections developed.

Phenotypic and genotypic characterization of Indian equine breeds

- Six equine breeds namely, Marwari, Kathiawari, Spiti, Zanskari, Bhutia and Manipuri, have been characterized on the basis of their biometric indices and coat colour.
- High genetic diversity observed between Spiti and Thoroughbred, followed by Spiti and Kathiawari while Zanskari and Manipuri are the least differentiated.
- Indian breeds form three distinctive clusters based on Bayesian analysis: (a) Kathiawari; (b) Zanskari, Spiti & Manipuri and Bhutia ponies.

Establishment of nucleus herd

ICAR-NRCE has initiated *in-vivo* conservation programme in the form of developing an equine sanctuary at EPC, Bikaner where nucleus herds of different Indian horse breeds are being maintained:

- Marwari horses from Rajasthan; Kathiawari horses from Gujarat; Zanskari ponies from Zanskar valley (Jammu & Kashmir) and Manipuri ponies from Imphal (Manipur)

  In addition, herd of indigenous and exotic donkeys is being maintained:

- Small grey and large white donkeys for conservation and improvement of donkeys.
- Poitou donkey herd for improvement of indigenous donkeys and for production of superior mules.

Improvement in production potential of equines

- In order to conserve the germplasm of indigenous equine breeds, cryopreservation of semen of Marwari, Zanskari and Manipur stallions and Poitou donkeys has been done.
- Artificial insemination using frozen semen has been perfected for production of superior quality horses, mules and donkeys.
- An eCG based sandwich ELISA has been developed for pregnancy diagnosis between days 30 to 150 of gestation in mares.
- Pregnancy diagnosis between days 14 and 18 post-insemination has been perfected using ultrasonography in donkey and horse mares.
- Donkey fibre has been used to produce carpets by mixing with sheep fibres (40:60).

Marwari

Kathiawari

Zanskari

Utilization of equine energy in agricultural activities

- Single animal drawn matching plough, seed drill (two furrow) and harness have been designed and developed for donkeys and mules for agricultural operations like ploughing and sowing.
- The mules have been used for chaff cutting operation with average output capacity of 660 kg/hour of chopped bajra straw in rotary mode chaff cutter.
- The technique of vermi-composting of equine dung has been optimized for use in agricultural fields.

Patents granted

- A method for preparation of a diagnostic kit useful for forecasting equine herpesvirus-1 disease (Patent No. 55E4-1891278 dated 25.10.2003).
- A method for preparing complement fixation test based (COFEB) kit for diagnosis of *Babesia equi* infection of equines (Patent No. 196690 dated 31.07.2009)

Patents filed

- A highly sensitive kit for detection of antibodies against *Theileria equi* in serum of equids. Application No. 2763/DEL/2012 dated 06.09.2012
- Nano-drug delivery for quinapyramine sulphate. Application No.2560/DEL/2011, dated 06.09.2011.
- Polynucleotide sequence, processes, composition and methods thereof- Application No. 1575/CHE/2010 and PCT/IB 2011/052475.
- A recombinant haemagglutinin domain-containing protein for the detection and diagnosis of glanders and method of preparation thereof. Application No. 1328/DEL/2010 dated 08.06.2010.
- Recombinant TssA protein for detection of antibodies against *Burkoholderia mallei* and uses thereof. Application No. 3610/DEL/ 2015.
- Recombinant Hcp1 protein for detection of antibodies against *Burkoholderia mallei* in equines. Application No. 4120/DEL/ 2015.

Services

ICAR-NRCE provides following services to the farmers and equine breeders:

- Disease diagnostic services for various infectious and non-infectious diseases to equine owners,

NATIONAL CENTRE FOR VETERINARY TYPE CULTURES

National Centre for Veterinary Type Cultures (NCVTC) initiated its activities in 2005 for conservation of the microbial diversity of animal origin. The activities comprise acquisition, authentication, preservation, documentation, and repository database management system of animal microbes. A network programme was started in 2010 with its 18 units located in 12 different states viz., Haryana, Rajasthan Uttar Pradesh, Himachal Pradesh, Assam, Jammu & Kashmir, Tamil Nadu, Gujarat, Uttarakhand, Karnataka, Arunachal Pradesh and Nagaland. These network units are contributing in conservation of animal microbial diversity in three specialized areas: veterinary microbes at NRCE Hisar, dairy microbes at NDRI, Karnal and rumen microbes at NIANP, Bengaluru.

MANDATE OF NCVTC

- National repository of veterinary, dairy and rumen microorganisms and their identification, characterization and documentation.
- Distribution of microbes for teaching, research and development of new technologies.

OBJECTIVES OF NCVTC

- Exploration and collection of microorganisms of animal origin/significance/relevance;
- Central storage of animal microbes from existing culture collection centres, institutions and universities;
- Characterization, documentation and digitization of microbial database of cultures of animal microbes;
- Development of a National Microbial Gene Bank for conserving the biodiversity of animal microbes;
- Conservation (both short-term and long-term) and utilization of microorganisms.

At present, NCVTC repository is maintaining a total of 3403 accessioned microbes, including veterinary pathogens (n=2497), rumen microbes (n=373) and dairy microbes (n=533). The year-wise progress in culture collection can be seen in Table.

Table : Year-wise accessioning of microbial cultures in NCVTC

Type	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	Total
Vet. Microbes										
Bacteria	-	255	185	187	73	227	110	164	70	1271
Virus	24	68	11	21	11	21	14	28	27	225
Bacteriophage	-	-	-	-	13	19	44	29	24	129
Recombinant clones	34	76	81	76	59	140	45	10	36	557
Phage library	27	-	-	-	-	-		-	-	27
Genomic DNA	-	-	-	138	38	47	57	-	8	288
Total	85	399	277	422	194	454	270	231	165	2497
Rumen microbes										
Anaerobic bacteria	-	-	13	60	28	41	74	23	19	258
Fungi/Yeast	-	-	76	11	17	3	-	-	-	107
Meth. Archae	-	-	-	-	8	-	-	-	-	8
Total	-	-	89	71	53	44	74	23	19	373
Dairy microbes										
Bacteria	40	78	89	100	125	36	39	26	-	533
Grand Total	125	477	455	593	372	534	383	280	184	3403

Some of the salient achievements of NCVTC are listed below:

Veterinary Microbes

- First laboratory confirmed camelpox virus zoonosis.
- First report on isolation and genetic characterization of swinepox virus from India
- Accessioning of vaccine strains of viruses *viz.,* Peste des petits ruminants virus, Sheeppox (Srinagar strain), Goatpox virus (Uttarkashi strain), Orf virus (Mukteswar strain), NDV (R2B strain) and NDV (F strain).
- Complete genome sequencing of two isolates of Classical swine fever virus.
- First isolation and characterization of *Bordetella bronchiseptica*, *Actinobacillus equilli, Staphylococcus hyicus*, *Trueperella pyogenes.*
- Whole genome sequencing of *Pasteurella multocida* sub spp. *multocida* B:2 serotype.
- First isolation and identification of *Moraxella* (*Branhamella) ovis* from ovine keratoconjunctivitis in sheep and methicillin-resistant coagulase negative *Staphylococcus sciuri* from goats.
- Whole genome sequencing of *Trueperella pyogenes, Bordetella bronchiseptica, Pasteurella multocida, Actinobacillus equuli* and *Salmonella* Gallinarum.
- Accessioning of rare strains of bacteria: *Campylobacter* spp., *Bacillus megaterium, Enterococcus casseliflavus, E. cecorum, Barrientosiimonas humi, Corynebacterium amycolatum, Enterococcus devriesei, E. hirae, E. faecium, Nocariopsis alba, Ignatzschineria larvae* and *Escherichia hermanii.*
- Isolation of bacteriophages against a variety of pathogenic bacteria were added to NCVTC repository, including a novel thermotolerant bacteriophage isolated from Ganga river water.

Serratia marcescens

Rumen Microbes

- Isolation and characterization of seven tannin degrading bacteria-*Streptococcus gallolyticus* from goat, fibre degrading bacteria *Ruminococcus flavefaciens, Prevotella* sp. and *Butyrivibrio* sp. from buffaloes and cattle, and nitrate reducing and cellulose degrading *E. coli* from buffalo.
- Isolation of rumen fungi - *Anaeromyces* sp., *Orpinomyces intercalaris* and *Orpinomyces joyonii* from buffaloes; *Piromyces* sp. and *Neocallimastix* sp. from goats.

Dairy Microbes

- Preservation of dairy microbes, viz, *Lactobacillus* spp., *Lactococcus* spp., *Lactococcus lactis* ssp. lactis, *Lactococcus lactis*. ssp. Cremoris, *Lactococcus lactis* ssp. lactis bv. Diacetylactis, *Streptococcus thermophilus*, *Leuconostoc* sp., *Bifidobacterium* sp. *Bifidobacterium dentium*, *Bifidobacterium longum, Micrococcus* sp., *Kluyveromyces lactis* and *Saccharomyces bisporus.*
- Combination of *L. lactis* ssp lactis-C12 and *Leuconostoc mesenteroides* ssp. mesenteroides is very suitable for curd and buttermilk preparation.
- Six *Lactobacillus* sp. having phytase degrading potential and strong antifungal activity have been isolated form milk-cereal fermented products (Rabadi samples).

An amylytic strain of *Pediococcus acidolactici* isolated has potential as starter culture in preparation of milk-cereal fermented products.

SUMMARY OF EXPENDITURE & REVENUE GENERATION

(Rs in Lakh)

Summary of Expenditure		
Non-Plan	**2016-17**	**2017-18**
Establishment charges including LSP/PF, wages, OTA	782.51	0
Traveling allowances	4.00	0
Others charges including equipments & recurring charges	426.96	0
Works	0.00	0
Total Non-Plan Expenditure	**1213.47**	**0**
Plan	**2016-17**	
Establishment charges including LSP/PF, wages, OTA	0.00	908.88
Traveling allowances & HRD	9.48	13.05
Others charges including equipments & recurring charges	486.09	827.81
Works	53.92	54.52
Loans and advances	-	2.50
Total Plan Expenditure	**549.49**	**-**
Total Expenditure (Plan & Non-Plan)	**1762.96**	**1806.76**

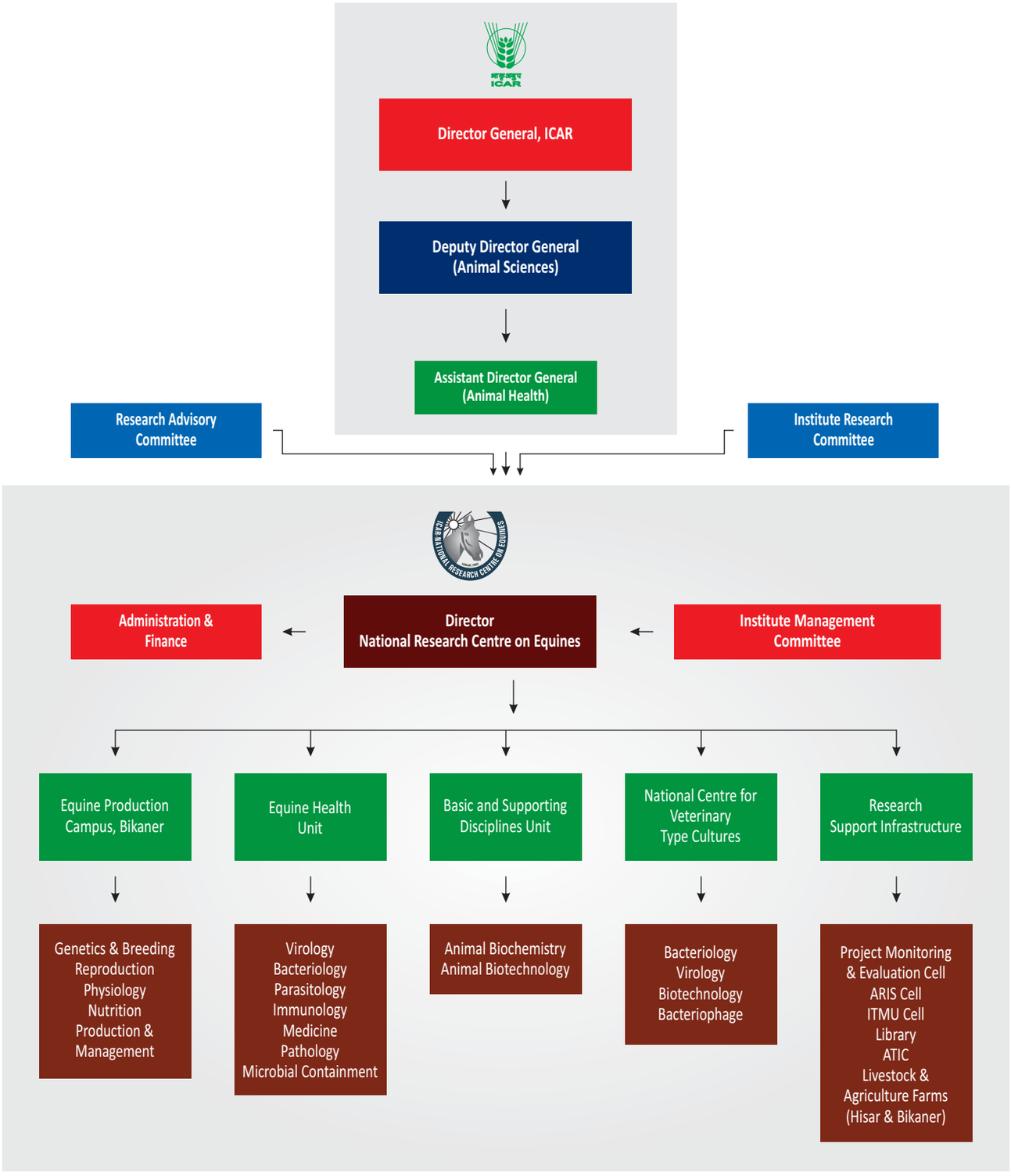
Summary of Revenue Generation		
	2016-17	**2017-18**
Sale of farm produce	7.36	5.29
Sale of livestock	0.78	0.65
Sale of publications and advertisements	0.005	0.18
License fee	1.99	1.47
Interest on loans and advances	2.12	3.94
Interest on short term deposits	22.87	17.24
Income from internal resource generation	48.85	53.97
Receipt from services	3.67	-
Other miscellaneous receipts	20.15	22.37
Ecotourism	-	3.50
Total Revenue	**107.81**	**108.61**

STAFF POSITION AT NRCE AND NCVTC

(As on 31.3.2018)

Name of the Post	NRCE			NCVTC		
	Sanctioned	Filled	Vacant	Sanctioned	Filled	Vacant
Director	1	1	0	-	-	-
Scientific	26	17	9	10	8	2
Technical	24	23	1	1	-	1
Administrative	14	12	2	-	-	-
Supporting	22	20	2	-	-	-

Organizational Structure of NRCE



Research Achievements

Sero-surveillance of equine infectious diseases in India

Surveillance and monitoring of emerging and existing equine diseases has been a regular and continuous activity of the ICAR-NRCE. The Centre is also involved in testing of equine samples destined for export/import as per requirement. During 2017-18, 1446 equine serum samples from 7 states were tested for various diseases like equine infectious anaemia (EIA), equine Influenza (EI), equine herpesvirus 1 (EHV1), Japanese encephalitis (JE), trypanosomosis, piroplasmosis, *Salmonella* Abortusequi and brucellosis (Table). The per cent sero-prevalence for piroplasmosis was 60.78%, 15.56% for EHV1, 6.98% for trypanosomosis, 2.35% for JE and 0.62% for EI. None of the equines were found to be positive for EIA, brucellosis and *Salmonella* Abortusequi.

Sero-prevalence of important equine diseases

State	Number Tested	Number positive for				
		EI	*T. evansi*	EHV1	Piroplasmosis	JE
Uttarakhand	20	0	1	4	3	0
Meghalaya	12	0	0	0	6	0
Uttar Pradesh	269	0	9	16	166	13
Haryana	18	0	0	3	6	0
J&K	821	7	74	185	462	8
Rajasthan	16	0	0	1	10	0
Delhi	290	2	17	16	226	13
Total	1446	9	101	225	879	34
Positive (%)		0.62	6.98	15.56	60.78	2.35

Investigation of equine infectious disease outbreaks in India

The Centre is regularly monitoring disease outbreaks in equine population of India. In view of the emergence of glanders in the country, 33249 equines were tested for glanders. A total of 407 equines were found positive including (253 from UP, 51 from Delhi, 23 from Rajasthan, 18 from Maharashtra, 16 from Uttarakhand, 12 from Gujarat, 11 from J&K, 8 from Haryana, 14 from Madhya Pradesh and one from Himachal Pradesh. In addition, 70 human serum samples from in-contact equine handlers tested negative for glanders.

A glanders affected horse

Two (0.07%) of 2618 equines were positive for equine influenza H3N8 antibodies and 34 (89.47%) of 38 equines were sero-positive for equine piroplasmosis. None of 383 serum samples tested positive for EIA by Coggins test. For African Horse Sickness (AHS), 127 random samples from 5 states were found negative (Table 1).

Table 1. Samples tested under disease investigation

Disease	No. tested	No. positive
Glanders	33249	407
Equine influenza	2618	2
Equine infectious anemia	383	0
African horse sickness	127	-0
Piroplasmosis	38	34
Trypanosomosis	20	0
Equine herpesvirus 1	22	0
Japanese encephalitis	21	0

Post-mortem and histopathology samples received from the field revealed fatty liver and hepato-toxocity (2), nephro-hepatopathy along with myocardial necrosis (1), necrotic enteritis (1), multiorgan failure due to sepsis (1), portal cirrhosis (1), acute enterocolitis (1), chronic interstitial nephritis and pancreatitis (1) and pulmonary tuberculosis (1).

Analysis on 255 clinical samples including nasal swabs, tissues, abscesses, aborted fetuses, etc. originating from different parts of India yielded 38 isolates (Table 2).

Table 2. Bacteria and parasite isolated from 255 biosamples

Organism	No. of Isolates
Klebsiella spp	13
E.coli	6
Enterococcus spp	7
Streptococcus spp	10
Burkholderia mallei	1
Babesia caballi	1
Total	38

(H.Singha, B. N. Tripathi, S.C.Yadav, B.R. Gulati, Rajender Kumar, Sanjay Kumar, N.Virmani, Sanjay Barua, Rajesh K. Vaid, Ramesh Dedar, Anju Manuja and Balvinder Manuja)

Development of competence for laboratory diagnosis of infectious animal diseases in north-eastern region (NER) of India

Animal population in north-eastern region of India is at continuous threat due to possibility of emergence of trans-boundary and infectious diseases from neighboring countries. With an aim to keep vigil in this region, a DBT-sponsored Advance Animal Diagnostic and Management Consortium (ADMaC) was established to build the diagnostic capabilities and competence in animal disease diagnosis for rigorous surveillance of north-eastern states. NRCE has been actively involved in developing newer diagnostics and transfer of technologies to NER and also involved in active surveillance of animal diseases in the region.

Development of diagnostic competence of NER laboratories: Activities were undertaken to develop diagnostic facilities for influenza A, Japanese encephalitis and trypanosomosis to augment the diagnostic competence of veterinary diagnostic laboratories in north-eastern states.

A highly sensitive indirect ELISA for Japanese encephalitis was developed using a recombinant expressed JEV envelope protein. For developing this assay, JEV E protein immuno dominant epitope of 444 bp size was PCR amplified, cloned, expressed in *E.coli* vector as a protein of 36 kDa (Fig. 1). The recombinantly expressed protein reacted specifically with anti-JEV hyper-immune rabbit serum (Fig. 2). The expressed protein was used for development of an indirect ELISA for detection of JEV antibodies in horse and pig sera. The ELISA was specifically detecting JEV antibodies. The assay has been transferred to AAU, Guwahati (Core Lab-1) and is being used for JEV diagnosis in pig samples.

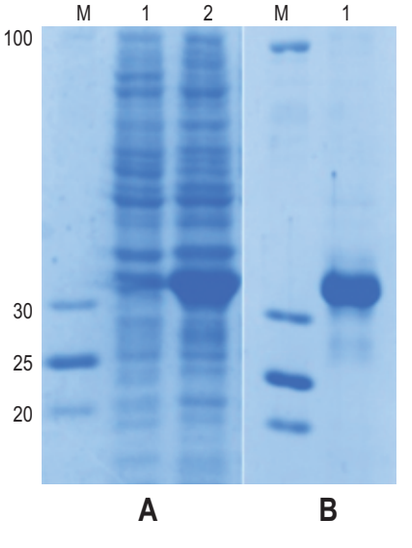


Fig. 1. Cloning, expression and purification of 36 kDa recombinant E-protein

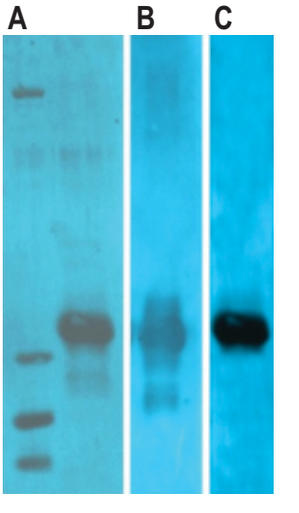


Fig. 2. Immunoblotting of recombinantly expressed E-protein. Protein stained with amido black (A), reaction with anti-His antibody (B) and with JEV-specific hyperimmune rabbit serum (C)

The antigen for ELISA along with positive control serum was supplied to the Core Lab-1 for JEV serology. In addition, the Core Laboratory was provided with reagents and SOPs for the nested RT-PCR for specific detection of Japanese encephalitis infection from clinical samples.

In addition, several batches of whole cell lysate (WCL) antigen of *Trypanosoma evansi* were supplied to the Core Lab-1. The shelf life of the WCL antigen coated ELISA plates at 4°C was tested up to 30 months.

Surveillance of infectious diseases: During the year, surveillance for influenza A, Japanese encephalitis and trypanosomosis was done in animal population of NER.

Influenza A viruses: Pig nasal swabs (n=69) were tested for influenza A viruses by RT-PCR assay targeting partial matrix gene (244 bp) and 13 samples were detected positive. The PCR amplicons (244 bp) were further confirmed by sequence analysis, which revealed 90-99.9% identity to the influenza A viruses. In addition, 168 pig and 34 horse serum samples were tested negative for influenza A antibodies (Table).

Table: Testing of animal population of NER for influenza A

Place (animal)	No. of Isolates	
	Nasal swabs	Serum
Mizoram (pigs)	29 (8)	168 (0)
Guwahati (pigs)	25 (3)	0 (0)
Meghalaya (horses)	15 (2)	15 (0)
Arunachal Pradesh (horses)	0 (0)	19 (0)
Total	69 (13)	202 (0)

Japanese encephalitis: During 2017-18, a total of 211 animal serum samples from north-east were tested for JEV antibodies, including 98 pigs, 30 yaks, 23 ducks, 22 bovines, 19 horses and 19 goats. Out of 98 pigs, 15 (15.3%) were detected positive for JEV antibodies, indicating high JEV seropositivity in pig population of the region. Only one horse sample was JEV positive. All other animals tested negative for JEV antibodies.

***Trypanosoma evansi* infection:** Serum samples from cattle (n=50), yak (n=30), pigs (n=49) and horses (n=8) were tested for *T evansi* antibodies and 2 cattle and 3 pig serum samples were found positive by antibody ELISA. None of the yak and horse serum samples were found positive. It is noteworthy that this is the first report of *T. evansi* infection in pigs of NER.

(B.N. Tripathi, S.C. Yadav, B.R. Gulati, Rajender Kumar and Nitin Virmani)

Prevalence of Japanese encephalitis in pig population in Assam

Assam also has the largest pig population in the country accounting for 17.96% of the country's total pig population and state has witnessed over 6% growth in pig population during 1994-2012. Abundance of rainfall, rice and pig farming makes Assam the most vulnerable state for spread of Japanese encephalitis. Therefore, we attempted to know the prevalence of JEV infection in pig population of Assam in collaboration with ICAR-National Research Centre on Pig, Rani, Guwahati.

Table: District-wise prevalence of JEV in pigs in Assam

District	No. Tested	No. (%) Positive
Kamrup	173	37 (21.38)
Jorhat	57	5 (8.77)
Dhemaji	33	1 (3.03)
Lakhimpur	30	1 (3.33)
Golaghat	11	0 (0.00)
Total	304	44 (14.47)

During 2017-18, serum samples were collected from pig population in Lakhimpur, Kamrup, Dhemaji, Jorhat, Golaghat and Dibrugarh districts of Assam. A total of 304 pig sera samples were screened for sero-prevalence of JEV by virus neutralization and HI test. A total of 44 (14.47%) pigs were positive for JEV antibodies by haemagglutination inhibition and VNT. Maximum JEV seroprevalence in pigs was reported from Kamrup followed by Jorhat district (Table).

In addition, 79 whole blood samples and 48 tissue samples were screened for JEV by RT-PCR. The envelope protein of JE virus was targeted by RT-PCR and 19 blood samples & 5 tissue samples were found to be positive. The sequence analysis of PCR amplicons revealed 100% identity with JEV envelope protein of human and equine from West Bengal, Vellore, Haryana and Lucknow.

(Baldev R. Gulati and Seema Rani Pegu, NRC-Pig)

Establishment of latency following natural abortion outbreak of equine herpesvirus 1 in India

EHV1 is an important, ubiquitous equine viral pathogen that causes significant economic losses to the equine industry. It produces well documented syndromes of respiratory disease, abortion, neonatal foal death and myeloencephalopathy in equine populations. It is estimated that following natural infection, EHV1 produces life-long latent infection in the neurons within the trigeminal ganglia, lymphoid tissues and/or lymphocytes in lymphoreticular tissues in over 50% cases. There is no study on establishment of latent EHV1 infections following natural EHV1 outbreak. Identification of latently infected horses might help in EHV1 control programs as these animals are responsible for maintenance of virus in the equine population.

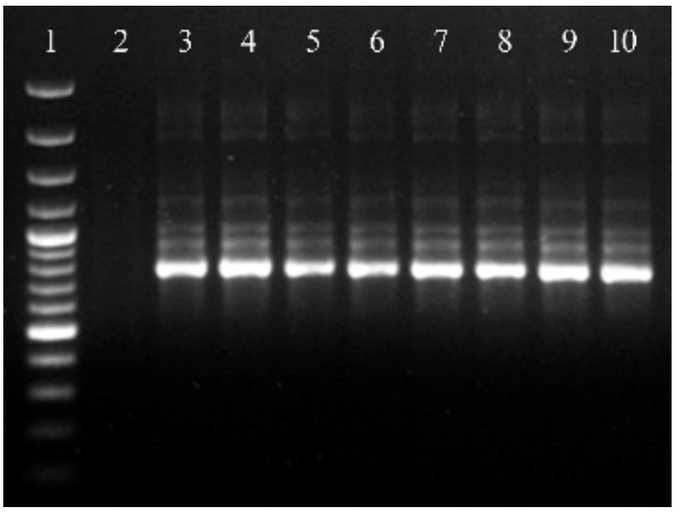


Fig. EHV1 gB-nPCR of vaginal swabs of aborted mares amplifying 770 bp of glycoprotein B.

During January to May 2014, 40 mares aborted in their last trimester of pregnancy. EHV1 was detected in vaginal swabs of 24 mares by nested PCR and further confirmed by virus isolation from 15 mares (Fig.) After 6 months of abortion, none of the aborted mares with laboratory confirmed EHV1 infection (n=24) tested positive for virus shedding in nasal and vaginal swabs by EHV1 gB-qPCR. Viral DNA was detected in gDNA from PBMC in 15 mares by gB-qPCR ($1.38x10^4$-$7.48x10^5$ copies/million cells), whereas, PBMC cDNA in all mares tested negative by EHV1 qPCR, indicating non-transcription of EHV1 late structural gene. These findings suggest conversion of 15 (62.5%) mares from acute to latent EHV1 infection 6 months after abortion. The latent infection was further confirmed by demonstration of expression of LAT in cDNA isolated from PBMCs.

Although establishment of EHV1 latency following experimental infection has been reported previously, to our knowledge, this is the first report describing development of latency following natural outbreak.

(Baldev R. Gulati, Himanshu Sharma and Sanjay Kapoor)

Evaluation of protective immunity of EHV1 glycoproteins in mice

EHV1 glycoproteins especially gB, gD and gM play important role in pathogenesis and generation of protective neutralizing antibodies. These glycoproteins alone or in combination are good target candidate for development of recombinant protein-based or DNA based vaccines against EHV-1.

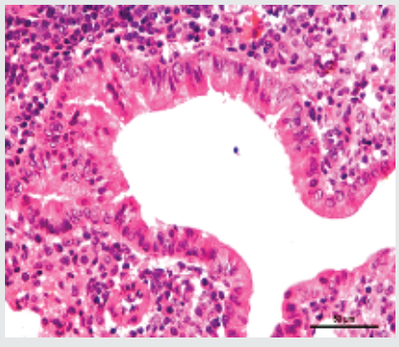
We previously expressed recombinant proteins (gB, gD and gM) in eukaryotic system in Sf9 cells and purified for development of subunit vaccine. During the year, doses of immunogen were prepared in montanide adjuvant. BALB/c mice (n=70) were divided into five groups. Mice from group A, B and C were immunized with 20 µg of each recombinant glycoproteins gB, gD and gM on 0 day followed by a booster on day 21 and 35. After one week of final booster mice were challenged with EHV1 virus intranasally. Mice from group D were kept as positive control (mock immunized, infected) while group E mice worked as negative control (mock immunized and mock infected). After challenge mice were sacrificed at 1, 3, 6 and 13 dpc to monitor immune responses and protective efficacy through histopathology, virus isolation and immune responses. Humoral immune response as observed by indirect ELISA could be seen in all the glycoprotein immunized mice with maximum responses being observed for gB (5333.33±1847.52) followed by gD (3466.66±1222.02) and gM (2266.66±1006.64) at 42 dpi (Table).

Table: Humoral immune response to various glycoproteins in BALB/c mice

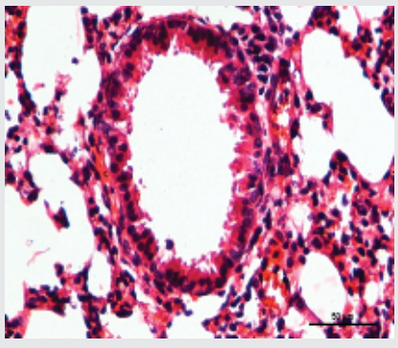
Group	Immunization details	Antibody titres at days post-immunization	
		21	42
Gp I	gB	800±230.94	5333.33±1847.52
Gp II	gD	200±173.20	3466.66±1222.02
Gp III	gM	233.33±152.75	2266.66±1006.64
GpIV	Mock immunized	Nil	Nil
Gp V	No infection	Nil	Nil

Histopathological lesions in group IV (positive control mice) were characterized by wide spread congestion, haemorrhages and mild neutrophilic infiltration at 1 dpc followed by frank necrosis, massive wide spread lymphocytic and macrophage infiltration at 3 dpc. Syncitia formations, bronchiolar necrosis along with perivascular and peribronchial cuffing were charcterstic at 6 dpc and the lesions had nearly resolved by 13 dpc. Comparison of lesions at various intervals has been illustrated in Fig. at 3 dpi. The scoring of histopathological lesions in the lungs on the basis of necrosis of parenchyma and bronchiolar epithelium, infiltration of macrophages and neutrophils, syncytia formation and peribronchial cuffing revealed maximum scoring in group IV followed by group III at 3 dpc while group II and group I animals had nearly same scores. At 6 dpc minimum scores were observed in mice belonging to group I followed by group II and group III while group IV animals continued to show maximum severity of the lesions. At 13 dpc the lesions had nearly same score amongst all the groups. Group V animals did not show any lesions at any of the intervals.

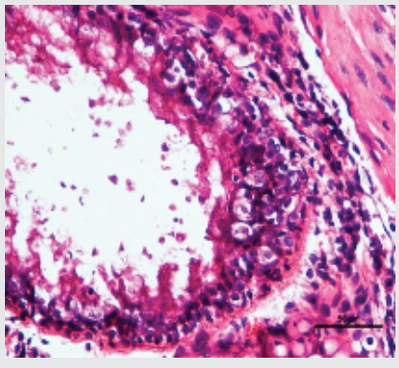
It is concluded on the basis of virus recovery and histopathological scoring of the lesions that maximum reduction of the lesions was observed in mice immunized with gB followed by gD and gM. These findings indicate that gB provides maximum protection against challenge.



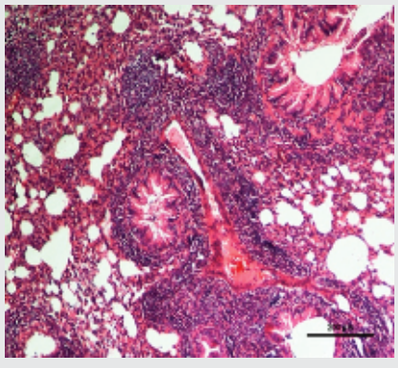
gB Immunized mice showing mild lymphocytic infiltration in alveolar parenchyma while bronchiolar epithelium appears normal (H&E400x)



gD Immunized mice showing necrosis in bronchiolar epithelium, alveolar congestion and lymphocytic infiltration (H&E400x).



gM Immunized mice showing bronchiolar necrosis and lymphocytic infiltration (H&E400x)



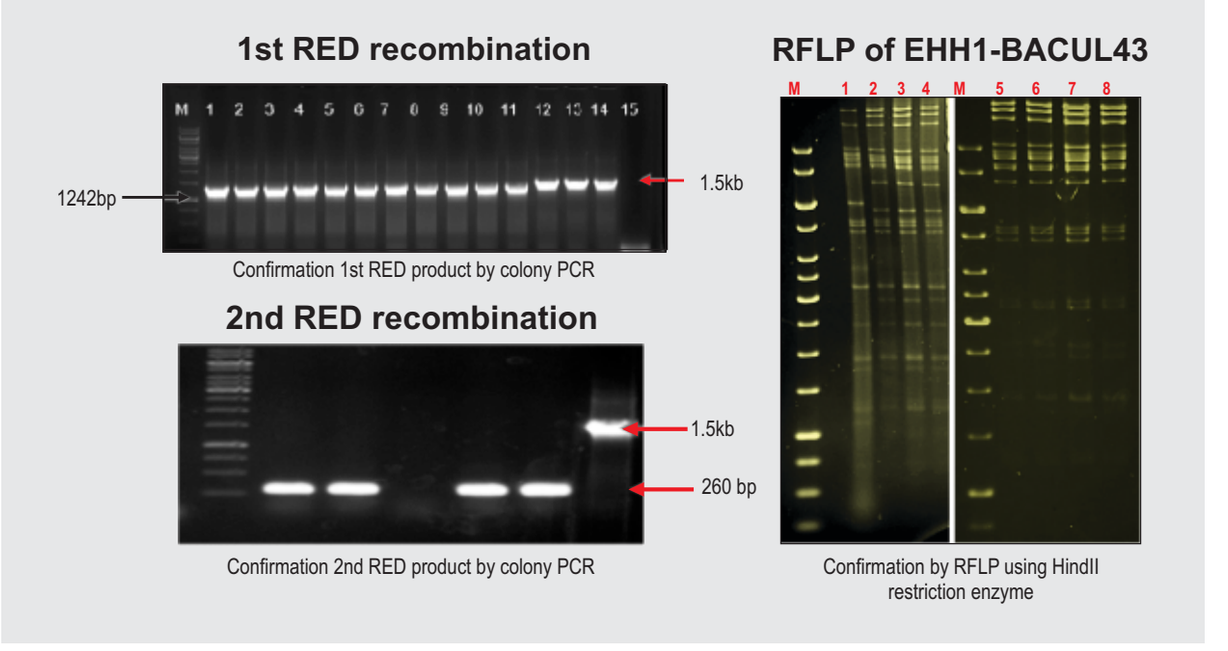
Mock Immunized mice showing massive necrosis in lung parenchyma, wide spread massive lymphocytic infiltration bronchiolar necrosis (H&E100x).

(Nitin Virmani, B.C. Bera and B.R. Gulati)

Development of recombinant EHV1 employing bacterial artificial chromosome mediated mutagenesis

EHV1 infection leads to significant economic losses by inducing abortions in pregnant mares, respiratory disease, neurological disorders and early neonatal death in foals. Currently, inactivated EHV1 vaccines in vogue induce short-lived humoral and cellular immunity. Therefore, development of live attenuated vaccine is priority to boost immune response. The bacterial artificial chromosome (BAC) cloning and mutagenesis approach is being used to develop an effectively attenuated EHV1 virus.

In this study, deletion of gI, IR6 and other genes is being attempted. For the *En Passant* red mediated mutagenesis, primers were designed for the removal of the respective genes by insertion of cassette in Red 1 mutagensis followed by removal of kanamaycin cassette through homologous recombination employing Red 2 recombination and the colonies of *E. coli* were screened through replica plating under influence of kanamycin and chloramphenicol. The colonies growing in chloramphenicol only were selected and removal of respective genes was confirmed through specific PCR and RFLP analysis (Fig.). A pUL43 deletion mutant has already been constructed, while, for deletion of IR6 and gI genes Red1 and Red2 mediated mutagenesis has been carried out successfully. The pUL43 deletion mutant was transfected in RK13 cells and deletion mutant EHV1 virus could be generated.



(Nitin Virmani, B.C. Bera, Taruna Anand and B.N. Tripathi)

Evaluation of reverse genetics-based equine influenza virus as vaccine candidate in mice

Equine influenza is a global problem and rapid globalization and transport of equines has led to frequent incursions of the disease sans boundaries. Recombinant equine influenza virus generated through reverse genetics with backbone of H1N1 (WSN/33 system) and HA and NA segments from H3N8 of EIV isolated from outbreak of 2008-09 in India. The recobminant virus was inactivated with 0.2% formalin and adjuvanted with Montanide, CpG and Montanide + CpG for inoculation in mice. The immune responses were studied in the mice and they were challenged on day 42 of first immunization with wild H3N8 virus to study the comparative protective efficacy of recombinant virus adjuvated in various combinations (Fig 1).

Mice were divided into 5 groups. Groups A to C, were given inactivated recombinant EIV with adjuvants. Group A had Montanide, group B had CpG ODN 2216 while group C mice were given a combination of both. Mice from group D served

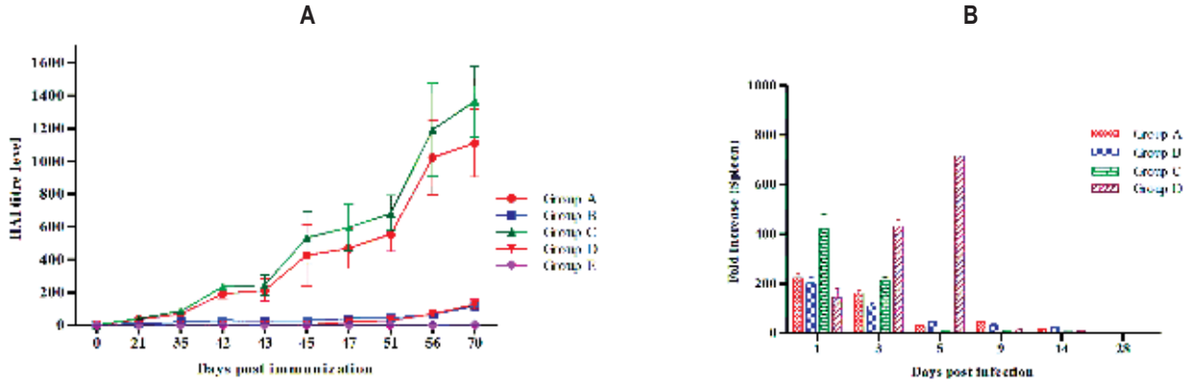


Fig. 1. Immune response in mice following vaccination with EIV: antibody (A) and cellular (B) response

as positive control while group E mice acted as negative control. Recombinant virus (6:2) constructed employing reverse engineering technology and adjuvanted with various adjuvants, proved to be effective in giving protection and reducing pathology of the disease as apparent at various intervals. The histiocytic alveolitis and necrotizing bronchitis were recorded at 3 dpc with peribronchiolar and perivascular pneumonitis at 5 dpc. Proliferation of type II pneumocytes was a characteristic finding, indicating repair and resolution of lung lesions at 9 and 14 dpc with decreased intensity. In immunized mice at 3 dpc, the intensity of the lesions was far less and there appeared to be clear demarcation in lesions amongst the groups, with group B showing moderate infiltration of inflammatory cells, while it was mild in groups A and C (Fig 2).

Bronchiolar degeneration was seen in groups A and B, while the epithelium was intact in group C with goblet cell hyperplasia.The total score of histopathological lesions in the lungs for various lesions depicted maximum scores in unimmunzed mice while immunized mice had drastically reduced scores at 3 and 5 dpc with maximum reduction seen in A and C groups

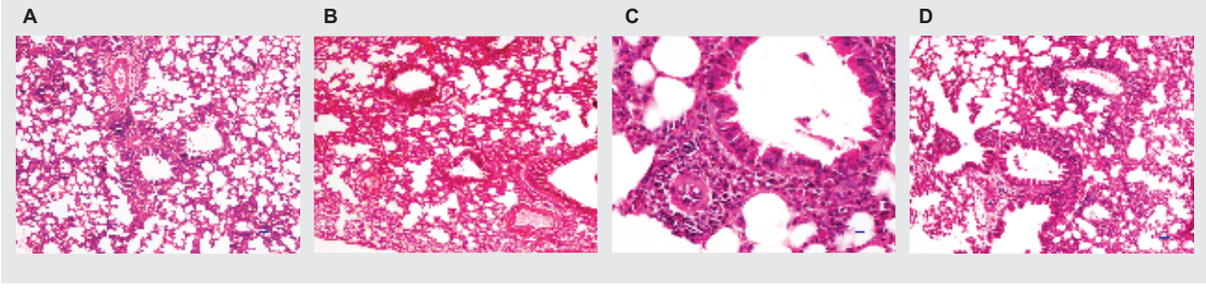


Fig 2. Histopathological lesions in mice following challenge. Group A showing mild lymphocytic infiltrations (a); Group B showing moderate lymphocytic infiltration with oedema and congestion (b); Group C showing lymphocytic infiltration and mild degenerative changes (c); and Group D showing severe lymphocytic infiltration along with extensive consolidation, perivascular and peribronchial cuffing (d)

The cocktail adjuvant mix prepared by us using CpG ODN 2216 and Montanide gave maximum protection due to synergistic effect on both arms of immunity. In comparison - Montanide offered better protection as compared to CpG alone, underlining the importance of humoral immunity towards influenza infections, as CpG 2216 on its own was a poor stimulator of humoral response.

(Nitin Virmani, Taruna Anand, B.C. Bera, Manu Mathew and B.N. Tripathi)

Diagnostics for emergency preparedness against emerging equine viral diseases

The country is presently not equipped to test many exotic equine viral diseases of zoonotic importance. The preparedness assumes significance as many of the carriers of such diseases don't exhibit symptoms. Diagnostic facilities are also required for testing the horses and suspected carriers of these diseases crossing international borders. Initially, to develop diagnostic facilities for equine viral diseases like Vesicular stomatitis (VS) and Venezuelan equine encephalitis (VEE), the recombinant proteins having immunogenic potential were cloned, expressed and purified. The expressed proteins were used as antigen to develop immunoassays for emergency preparedness. The multiepitope protein of about 15 KDa was expressed (Fig. 1) in *E. coli* and immunoassay was standardized for Vesicular stomatitis antibody detection (Fig. 2). Nucleic acid based diagnostic PCR assays were also standardized with the potential to detect VSV (NJ) and VSV (Ind) viruses and multiple serotypes of VEEV affecting equines using synthetic gene technology. In addition, serum samples from diverse geographical locations having humid weather were screened for Rift Valley fever by ELISA and were found negative for antibodies.

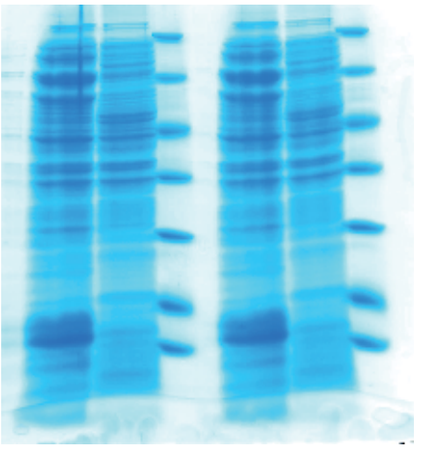


Fig. 1. Western blot of Vesicular stomatitis r-protein

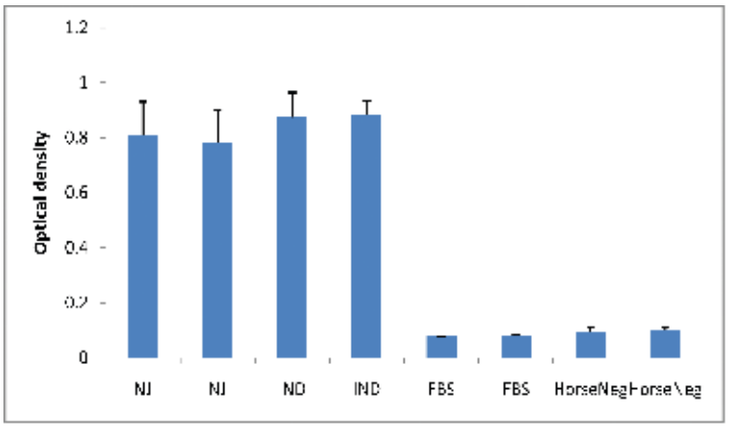


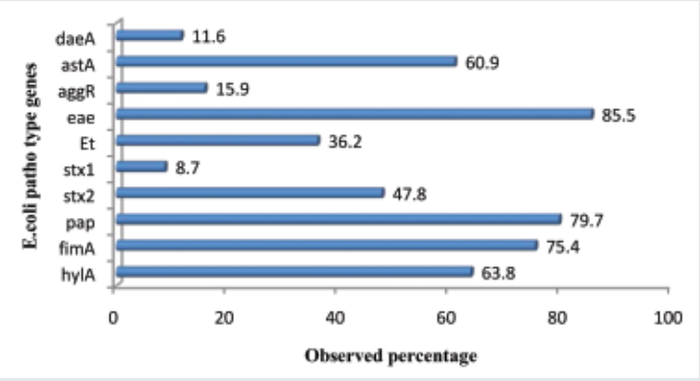
Fig. 2. ELISA OD values using Vesicular stomatitis r-protein with reference sera

(Balvinder K. Manuja, Anju Manuja, Harisankar Singha and Naveen Kumar)

Molecular characterization of *E. coli* and *Rhodococcus equi* from clinically infected foals

E. coli is a Gram-negative, rod shaped, flagellated facultative anaerobe. Some of the *E. coli* strains are capable of causing clinical symptoms leading to septicemia, enteric infections, chronic arthritis, and sudden death in foals. Approximately 25 per cent of all septicemias in foals are caused by *E. coli*. The characterization of *E. coli* isolates was done for presence of virulence genes and serotyping. A total 69 *E. coli* were isolated from foal nasal and faecal samples from equine farms in Haryana and Bikaner. These isolates were processed for amplification of various virulence associated genes. Eae virulence associated gene was amplified in 85% of the samples followed by Pap, FinA, HylA and astA (Fig. 1). Amplification of these genes has confirmed that isolated *E. coli* were pathogenic in nature.

Virulence associated genes of *E.coli*



Virulence Gene description

Gene description	Gene Name
Entero-pathogenic *E. coli*	Eae
Entero-toxigenic *E. coli*	It
Shiga-like toxin or verotoxic	stx1
	stx2
Diffusely Adherant *E. coli*	daaE
entero-aggregative *E. coli*	astA
	aggR
Uro-pathogenic *E. coli*-P-pili	Pap
uro-pathogenic *E. coli* - haemolysis	hylA
Uropathogenic *E. coli*-fimbrial	fimA

Fig. 1. Characterization of *E. coli* isolates for virulence genes by PCR

Further 35 *E. coli* isolates were serotyped and found to belong to 11 serotypes (O2, O7, O8, O34, O83, O86, O88, O101, O118, O119 and O126). Antibiotic sensitivity on these isolates indicated that isolated *E. coli* were mostly sensitive to amikacin, chloramphenicol, norfloxacin, ofloxacin and gentamycin, while resistant to cephalosporin.

Rhodococcus equi is an important cause of a pyogranulomatous pneumonia in foals between 1 and 6 months of age with most cases occurring in foals younger than 4 months. ICAR-NRCE has a repository of 51 isolates of *R. equi,* isolated from clinically infected foals. These isolates were characterized by 16S rRNA PCR amplifying 441 bp amplicons. Further molecular characterization was performed by PCR amplification of various virulence genes – VapA, VapC, VapD, VapE, VapF, and VapG. These genes were amplified in PCR from 92-100% of *R. equi* isolates, indicating virulence of these isolates (Fig. 2). Antibiotic sensitivity on these isolates indicated that rifampicin and erythromycin were the most effective drugs, while one isolate was found resistant to erythromycin, and it will be investigated further.

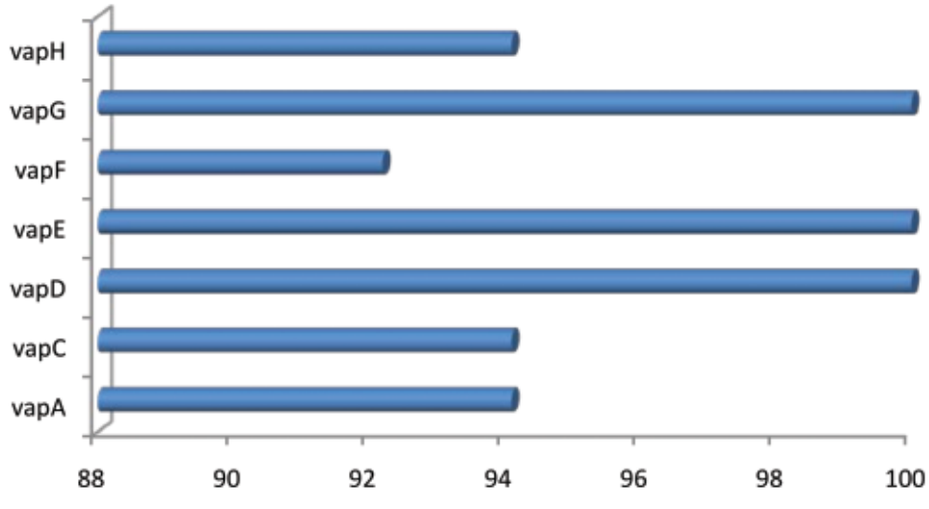


Fig. 2. Virulence gene type analyzed on different *R. equi* isolates

(Sanjay Kumar, Ramesh Dedar, B.R. Gulati, Nitin Virmani and Harisankar Singha)

Validation of assays for glanders diagnosis

World Organisation for Animal Health (OIE), Paris, France has sponsored a project for validation of assays as alternate to routinely used complement fixation test diagnostics. ICAR-NRCE participated in this project as collaborating partner for validation of indirect ELISAs for glanders diagnosis. Other institutes from Germany, France, Brazil and Pakistan also participated as project partners. The validation of glanders diagnostics developed at different laboratories like r-protein based indirect ELISA (NRCE), *B. mallei* purified protein-based ELISA (EURL, France) and Western-blot (OIERL, Germany).

The overall activity of the project was coordinated by OIE-reference laboratory on Glanders, Germany. The glanders true positive and true negative serum samples collected from glanders endemic and glanders free countries were sent to OIE reference laboratory on glanders, Germany. Using these 254 positive and 3000 negative samples serum samples, all the assays were evaluated. Recombinant Hcp1-ELISA developed at NRCE showed 95.28% sensitivity and 99.57% specificity (Table).

Table: Comparison of different glanders diagnostic ELISAs *vis-à-vis* complement fixation test

Assay	Diagnostic Sensitivity	95% CI		Diagnostic Specificity	95% CI	
		Lower	Upper		Lower	Upper
CFT	98.3	95.47	99.36	96.35	95.61	96.97
Hcp1-ELISA	95.28	91.89	97.54	99.56	99.25	99.74
BimA-ELISA	85.43	80.48	89.53	97.43	96.80	97.94
TssA-ELISA	85.07	77.88	87.47	98.99	98.56	99.29
TssB-ELISA	83.07	77.88	87.47	100	99.88	100

(Harisankar Singha and B. N. Tripathi)

In vitro and *in vivo* evaluation of drug molecules against *Trypanosoma evansi* infection

The control of animal trypanosomosis is primarily dependent on chemotherapeutic approach only with limited number of drugs (diminazene aceturate, quinapyramine and isometamedium). These drugs have inherent problem of toxicity and narrow safety index. Further, emergence of drug resistance problem is another threat. Therefore, there is an urgent need to evolve alternate chemotherapeutic agents to combat the situation. Previously, we identified and studied *in vitro* efficacy of nine target specific drugs and out of these, five drugs viz., Chlorpromazine (CPZ), CPA, Indatraline, SC-1 and Thiazolidinedione (TZD) exhibited significant growth inhibition efficacy against *T.evansi.* During this year, *in vitro* cytotoxicity and *in vivo* evaluation of these drugs in mouse model were carried out.

***In vitro* cytotoxicity evaluation:** For *in vitro* cytotoxicity peripheral blood mononuclear cells (PBMC) and vero cell line were used. The PBMC were isolated by density gradient method. The PBMCs at a density of $1x10^5$ cells were cultured in 100µl of culture medium in a 96 well plate. To determine the cytotoxic activity of these drugs, 100 µl of cell suspension (1 x 10^5/ml) was seeded into each well of 96 well plate and treatment with different concentrations of drugs for 72 h. After 72 h of treatment with drugs, 25 µl of resazurin added to all the wells. Absorbance of samples was recorded using spectrophotometer at two wavelengths of 570 nm and 650 nm for calculation of cytotoxicity. *In vitro* cyto-toxicity assays revealed that drugs viz. CPZ, Indatraline & SC-1 were not toxic even up to 5-20 x of effective drug concentration, indicating wide margin of safety.

***In vivo* evaluation:** *In vivo* testing of four drugs viz., Chlorpromazine (CPZ), CPA, Indatraline, SC-1 was carried out in mouse model. Initially, mice were experimentally infected with 10^5parasites (*T. evansi* Hisar pony strain). Drug was administered at different concentration on third day after establishment of infection, confirmed by microscopy. Thereafter, the parasitaemia was checked daily to know the effect of drugs. Quinapyramine sulphate was used as standard drug and administered at rate of 5 mg/kg body weight. None of the drug at different concentrations (0.5-30 mg/kg b.wt.) was able to

cure *T. evansi* infection. However, CPZ at higher concentration (> 5 mg/kg b.wt.) produced sedative effect but did not show any effect on inhibition of growth of trypanosomes. Indatraline was found toxic at 5 mg/kg b.wt. concentration and resulted in mortality of 2 out of 4 mice within 10 min after drug inoculation. These drugs exhibited significant growth inhibition in *in vitro* system but failed in *in vivo* system. To address this issue further pharmacokinetics and pharmacodynamics studies are required to know the bio-availability of these drugs in *in vivo* model.

(Rajender Kumar)

Validation of assays for sero-diagnosis of *Trypanosoma evansi*

The Centre has developed ELISA and lateral flow assay for detection of antibodies to *T. evansi* in equine serum samples. During the year, the shelf life of ELISA coated plates was evaluated. In addition, the sensitivity and specificity of lateral flow assay was evaluated *vis-à-vis* ELISA.

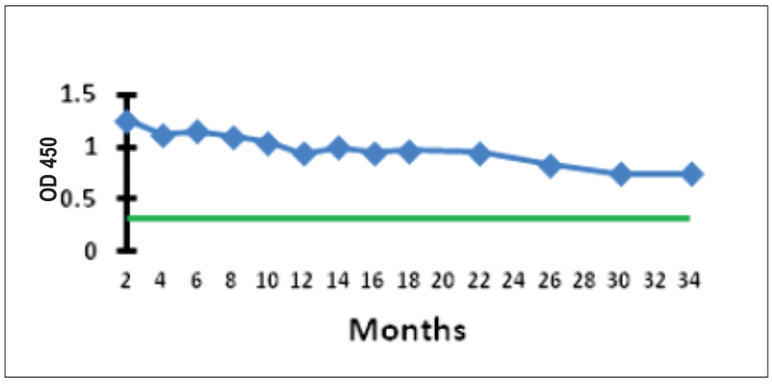


Fig. Shelf life of *T. evansi* WCL coated plates

Shelf life of *T. evansi* antigen-coated ELISA plates: An ELISA has been developed for detection of antibodies to *T. evansi* using whole cell lysate (WCL) antigen. The shelf life of the WCL antigen coated ELISA plates, stored at 4°C was determined for long term use. The antigen coated plates have been found stable up to 34 months, when tested with same set of reference positive and negative serum samples over the period with standard reagents at bi-monthly intervals (Fig.).

These samples were subjected to lateral flow assay (LFA). The sensitivity and specificity of LFA was found to be 87.0 % and 90.9% respectively (Table). Internal validation of LFA in three different laboratories at NRCE, Hisar was completed with high sensitivity and specificity. However, external validation at two different parasitology laboratories showed 95% sensitivity and 100% specificity respectively. The shelf life of LFA-coated strip test line and control line stored at 4 °C when tested with same set of reference positive and negative serum samples were found to be stable upto six months. LFA is easy to perform and can be employed during outbreaks and in the endemic areas to quickly screen the large number of suspected cases.

Table: Comparison of sensitivity and specificity of ELISA *vis-a-vis* Lateral Flow Assay

No. of Samples	ELISA			Leteral Flow Assay			
	Positive	Negative	Positive Rate %	Positive	Negative	Sensitivity	Specificity
92	92		100 %	80	12	86.96%	-
210		210	0.00%	17	193	-	90.90%

(S.C. Yadav)

Development of LFA for rapid sero-diagnosis of *Theileria equi* in equines

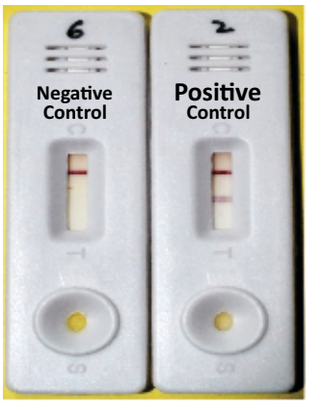


Fig. LFA kit developed by ICAR-NRCE

Theileria equi infection is of major economic importance as significant segment of the Indian equine population (~35%) is latently infected. Diagnosis of sub-clinical *T. equi* infection is of more relevance as these animals aid in spread of the parasite to naive animals. These latently infected animals may become clinically infected in the event of physical/immunological/mental stress. Previously, ICAR-NRCE developed ELISA based diagnostic kit for diagnosis of *T. equi* infection, which can only be handled in laboratory by skilled technician. There is increasing demand from equine owners for development of a user friendly, rapid and specific diagnostic kit which a farmer can apply himself with ease and can plan control measure of the disease condition. Now ICAR-NRCE has further transformed the earlier ELISA kit into the lateral flow assay (LFA) kit format. This LFA kit is simple, rapid and user-friendly obviating the requirement of any skilled technician or laboratory equipments. The equine owner can use this kit himself by applying a drop of the serum/plasma onto the sample applying area and read the colored reaction results (Fig). The kit has been successfully validated in three different laboratories of the ICAR-NRCE. Further the LFA kit has been validated on the field samples with respect to other serological assays – EMA-2 ELISA, IFAT, PCR and MASP *in vitro* culture system. A total 108 samples were collected from different areas and tested individually on above assays and results were compared. A total 46 samples were detected positive for *T. equi* antibodies in EMA-2 ELISA, while 40 and 41 samples were detected positive in LFA and IFAT, respectively. Out of these samples, *T. equi* parasite was demonstrated in 39 samples by MASP culture technique. The kit was released during the ICAR Foundation Day on 16thJuly, 2017 under CRP network project platform. Further field validations studies are in progress.

(Sanjay Kumar and Rejender Kumar)

Growth inhibitory efficacy of herbal plant extracts against *Theileria equi*

Theileria equi and *Babesia caballi* are tick borne apicomplexan hemoprotozoan parasites of equines and responsible for considerable economic losses to stakeholders. Available chemotherapeutics drugs are incapable to clear parasitaemia completely from the affected host and entail multiple dosages, which consequently prompt severe multiple organ toxicity to treated host. In this study, we prepared methanolic extract from the bark of herbal plant (AN/NRCE/MED). This methanolic plant-bark extract was subjected to *T. equi* inhibition efficacy in MASP culture system at different concentrations ranging from 50 µg/ml to 1000 µg/ml. This whole extract was able to inhibit the in vitro growth of *T. equi* with IC_{50} concentration of 155 µg/ml.

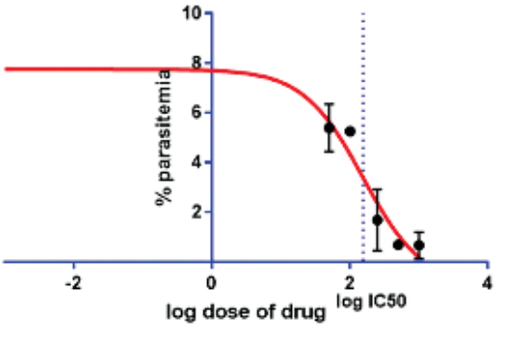


Fig. Dose-response curve of methanolic extract of herbal drug against *Theileria equi*

This methanolic extract was further separated on silica gel (60-200 mesh size) chromatography column and about 200 eluted fractions were collected using different solvent system: n-hexane, n-hexane:chloroform (25:75), chloroform, chloroform:ethyl acetate (75:25), ethyl acetate, ethyl acetate: ethanol (50:50), ethanol, methanol:water (90:10). These elutes were pooled according to thin layer chromatography (TLC) Rf value analysis. TLC analysis showed that there are eight different types of molecular fractions in these elutes, which were pooled accordingly. These eight pooled fractions were further concentrated on rotary evaporation followed by freeze drying. The stock solutions of these freeze-dried fractions were prepared in DMSO or distilled water and individually tested for their *T. equi* inhibition efficacy in MASP culture at different concentrations ranging from 50 µg/ml to 500 µg/ml. The ethyl acetate elutant fraction (as above) derived form methanolic extract from the bark of AN/NRCE/MED significantly inhibited the *in vitro* growth of *T. equi* and IC_{50} concentration was 52 µg/ml. Further GC/MS analysis on this elutant is under progress.

(Sanjay Kumar and Rajender Kumar)

Evaluation of nanoformulations for tissue repair on equine fibroblast cells

The nanoformulations intended for tissue repair using metal oxides and polymers mimicking the natural environment in the cartilage extra-cellular matrix as carriers were synthesized. We have described a simple and rapid method to synthesize nanoformulations via microwave heating method. The size of the synthesized nanoformulation was less than 100 nm. Equine fibroblast cells were cultured for evaluation of nanoformulations. The cytotoxicity assays were performed on cultured equine fibroblast cells by resazurin assay. Metabolically active cells reduced the blue color nonfluorescent resazurin dye into pink color fluorescent resorufin within 4 hr(s) of incubation and percent cytotoxicity was determined. Cytotoxicity studies of nanoformulations on horse fibroblast cells revealed a concentration-dependent safety and cytotoxicity. The nanoformulations were also evaluated on horse erythrocytes, suspension of horse erythrocytes was treated with different concentrations of nanoformulations. Percentage of hemolysis caused by metal oxides and polymeric ZnO NPs was determined. In comparison to metal oxides, Fe-doped and polymeric nanoformulations showed decreased hemolysis on horse erythrocytes. The preliminary results suggest that the synthesized nanoformulations in this study need further evaluation in animal models at non-toxic doses.

(Anju Manuja, Balvinder Kumar and Riyesh T.)

Assessment of risk factors of colic

Colic causes economic losses in the form of morbidity & mortality and creates a sense of insecurity for the life of horses among the horse owners. Risk factors of colic related to management and nutrition vary in different countries, due to variation in climate, fodders, housing pattern and utility of horses. To identify these risk factors of colic in indigenous horses we surveyed horse populated districts of Rajasthan and adjoining Punjab and collected data of 78 horse farms having 924 horses. Out of these, 300 horses belonging to 28 farmers in districts of Hanumangarh, Sriganganagar, Mukatsar, Jhunjhunu, Sikar and Bikaner were regularly monitored for feeding, management and incidence of colic quarterly for one and a half year. We also analyzed data on month-wise incidence of colic in the last 10 years of an organized farm having 80 horses.

Incidence of colic in groundnut straw, wheat straw and wheat straw +groundnut/moth straw fed horses were 4.75, 26.73 and 3.12 %, respectively. Incidences of colic were found significantly higher in the horses, which were being offered wheat straw alone as dry fodder. While the incidences of colic in the groundnut straw fed group and wheat straw+ groundnut straw/moth straw fed group were not significantly different. Another important risk factor identified was keeping the horse's empty stomach for hours. Horses fed with limited quantity of roughage had significantly higher incidence (8%) of colic than those offered ad lib quantity of roughages (1.35%). Change of fodder, especially dry to green fodder was also identified as an important risk factor of colic.

Month wise analysis to identify the risk factors of colic incidence at an organized farm revealed the highest incidence of colic in September, coinciding with supply of green fodder (sorghum and pearl millet) during kharif crop. Colic incidence can be controlled by mixing good quality dry roughages with wheat straw and providing *ad lib* fodder to the horses. Special care must be taken during the time of fodder change especially from dry to green.

(R.K. Dedar, P.A. Bala, S.K. Ravi and S.C. Mehta)

Parentage testing in equines through microsatellite markers

Parentage testing in horses has become a necessity for breeders to assure horse pedigree integrity. In the current study, microsatellite based genotyping for the confirmation of parentage of foal in cases when either of the parent is not known was adopted. Twenty one microsatellite markers (AHT4, AHT5, VHL20, ASB2, HTG10, HMS1, ASB17, CA425, LEX3, HTG7, ASB23, TKY333, TKY374, TKY325, TKY321, UM005, UM011, TKY341, LEX54, TKY344, TKY287) were grouped into five multiplex PCR reaction sets depending on the PCR conditions and size of PCR products. A total of 282 samples were genotyped with 5 multiplex PCR reactions covering total of 21 microsatellite markers. Mean number of alleles per locus was observed to be 33, mean proportion of loci typed was found to be 0.96, mean expected heterozygosity (marker

for polymorphism) was 0.8804 and mean polymorphic information content (PIC) was 0.8678. Eighty five foals belonging to Marwari, Thoroughbred, Spiti, Zanskari and exotic breeds and 4 mules were of confirmed known parentage, which were found correctly matched (100%) to their parents upon genotyping with 21 microsatellite markers. A total of 14 foals were of conflicting (out of 2-3 stallions which is the true father?) or doubtful (whether the foal belongs to the stallion present at the farm?) parentage at the time of sample collection. Upon analysis, the wrong stallions were excluded in 100% cases. A set of 21 microsatellites used in this test are highly polymorphic with heterozygosity and polymorphism information content > 0.8 and are highly suitable for the test. With the standardization of this test for parentage verification in equines, NRC on Equines, Hisar is on the verge of declaring this facility for commercial purpose.

(Mamta Chauhan, A.K. Gupta, Yash Pal, A. Bhardwaj and B.N. Tripathi)

Genetic characterization of Marwari horses

Genetic characterization of Marwari breed not only provides the scientific evidence for the breed but also assists in determination of genetic diversity, relatedness within population and distinction from other breeds. Blood samples were collected from Marwari horses from their home tracts according to their phenotypes and a total of 282 DNA samples were genotyped with 30 microsatellite markers in six multiplexes. The allele size ranged from 4 to 17 with an average of 9.6957±3.2813. The microsatellite marker TKY 333 was the most contributing marker of genetic diversity. The observed heterozygosity estimates was 0.7235. Population structure analysis enables estimation of a hidden structure that is the number of various clusters (K partitions) without using any pre-information about individuals, populations or breeds. The estimation of K value was done using ΔK method based on the rate of change in the log probability of data between successive K values. The ΔK detects the uppermost hierarchical level of structure. The height of the modal value is as an indicator of the strength of signal detected by structure (Fig).

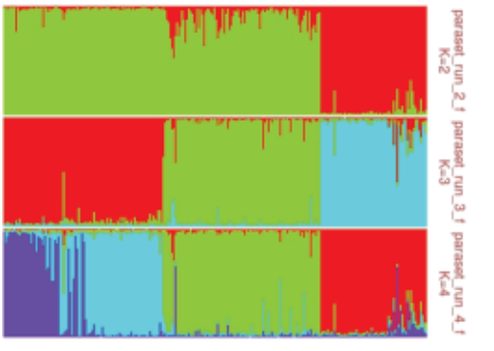


Fig. Admixture and Structure analysis at ΔK 2 to 4.

(Anuradha Bhardwaj, A.K. Gupta, Yash Pal and Mamta Chauhan)

Reproductive performance of indigenous breeds of horses

For any successful accomplishment of the breeding programme, the reproductive cycles and reproductive parameters of breed needs to be ascertained. In this regard, a comparative study was conducted to study the reproductive characteristics of mares of Marwari (4), Manipuri (5) and Zanskari (5) breeds being reared in arid region in an intensive system. All the mares were subjected to daily teasing process and ultrasound examination throughout their estrus period to study the follicular dynamics. The length of estrus cycle ranged between 21 and 27 days and estrus duration ranged between 5 and 11 days. There was significant variation in the size of the pre-ovulatory follicle across the breeds and the size ranged from 35-48 mm (Table).

Table: Reproductive parameters of three indigenous breeds of horses reared in arid region

Breed	No. of Animals (n)	Length of estrus cycle (Days)	Estrus duration (Days)	Pre-ovulatory follicle size (mm)	Conception (%)	No. of Cycles/ Conception	No. of AI/ Conception
Marwari	14	21.45±0.82	8.41±0.17	43.22±1.33	85.71(12/14)	1.83	1.28
Manipuri	5	25.37±1.71	12.24±0.34	37.65±1.85	60 (3/5)	1.88	1.96
Zanskari	5	21.49±1.12	9.78±1.21	38.88±1.62	100 (5/5)	1.72	1.42

(S.C. Mehta, R.A. Legha, R.K. Dedar, P.A. Bala, T.R. Talluri, S.K. Ravi and J. Singh)

ICAR-NRCE

Diagnosis and management of reproductive failure in field and farm mares

A survey was conducted in different districts of Rajasthan and Punjab, and a total of 68 equine breeders were approached to record incidence of reproductive problems in a scattered population of 299 breedable mares. The reproductive problems recorded in 29 mares were abortions (9), repeat breeding (8), anestrus (4), metritis (2), dystocia (2) and one case each of silent heat, anovulation and recto-vaginal tear. The incidence of abortion, repeat breeding, anestrous and uterine infection/metritis were more frequent.

The farm mares were also examined through ultrasonography and uterine cytology to determine presence and severity of uterine infections (Fig.1). A successful treatment was also provided to a field mare with cystic ovary (Fig.2).

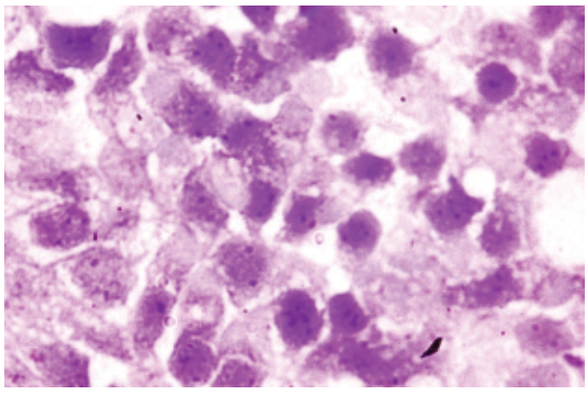


Fig.1. Non inflammatory endometrial cells of the Marwari mare

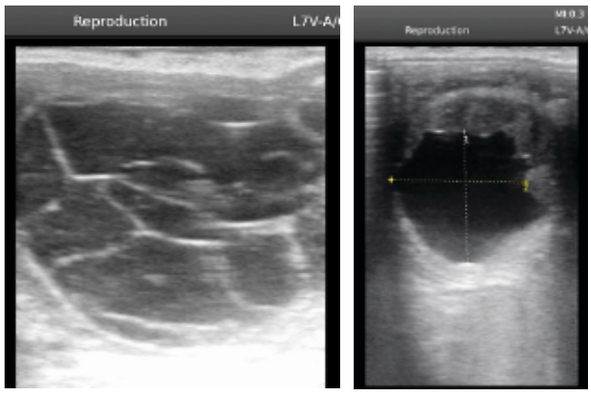


Fig. 2. Ultrasonograph showing cystic ovary (A) and establishment of pregnancy (B)

(S.K. Ravi, T.R. Talluri, R.K. Vaid, R.A. Legha and J. Singh)

Comparative study of the buffalo and mare ovaries in terms of their oocyte retrieval and maturation methods

A comparative study was done to evaluate size and location of oocytes in buffalo and mare ovaries. Due to anatomical differences in ovaries, and different follicular genesis, there were significant differences in the number of oocytes retrieved. The differences observed between both the species were compared and tabulated (Table 1).

Table 1. Comparative study of mare and buffalo ovaries

Observation	Horse Ovary	Buffalo Ovary
Follicles localization	Medulla	Cortex
Follicles/ovary	Less	More (>2X)
Ovulation	Medulla only	Cortex any site
Follicular fluid / follicle	More (?5-10X)	Less
Oocyte retrieval rate	1.5 - 2	1.5 2
Method of oocytes isolation	Washing and slicing of follicle	Aspiration
Require hormonal dose for maturation	Very high (10X)	Low

Among different methods used for oocyte isolation from mare ovaries combination of the slicing and scraping proved to yield significant number of oocytes compared to the aspiration of the follicular fluid from the visible follicles. Many oocytes were found stuck between the cortical tissues of the equine ovaries, hence slicing and scraping are necessary for

Table 2. Comparative study of oocyte retrieval from mare and buffalo ovaries

Criteria	Mare	Buffalo
Ovaries used	72	1500
Oocytes recovered	132	3250
Recovery rate per ovary	1.83	2.16

the isolation and retrieval of more number of oocytes (Table 2). A total of 35 oocytes were isolated from the 18 mare ovaries. The isolated oocytes were subjected to *in-vitro* maturation. Five different protocols for maturation of the mare oocytes were followed out of which media containing TCM-199 (3 ml), 10% mare estrus serum, FSH (100 µg/ml), 1% antibiotics, EGF- 3 µl and follicular fluid (10%) was better for maturing the mare oocytes. Estrus mare serum was found to have an effect on the maturation of mare oocytes.

(T.R. Talluri, Naresh Seloker, S.K. Ravi, Dharmendra Kumar, Taruna Anand and P.S. Yadav)

Assessment of equine growth, feeding and breeding performance in arid region

The growth pattern with respect to the breed and age group was evaluated in 44 Marwari & 3 Kathiawari horses, 16 Zanskari & 15 Manipuri ponies, 31 Poitou & 14 indigenous donkeys. The average body weight of adult Marwari males and females were 405 Kg and 408 Kg, respectively. The average adult body weights of Manipuri males and females were 260 and 265 Kg and that of Zanskari males and females were 279 and 317 Kg, respectively. The adult males and females of Poitou weighed 328 and 301 Kg and those of Indigenous donkeys weighed 225 and 220 kg, respectively. The average adult mule body weight was 391 Kg.

(P.A. Bala, R.K. Dedar and Rajesh Nehra)

Use of Agro-industrial byproducts as feed for equines

A comparative feeding trial for 120 days was conducted to evaluate the feed intake and nutrient utilization by the Marwari horses (5), Manipuri (4) and Zanskari (2) ponies. The animals were fed with concentrate mixture, dry fodder (groundnut haulm & wheat straw, 1:1 ratio) and green oats. The results indicated that the dry matter digestibility was good when two agro-industrial by-products were fed and the nutrient digestibility was relatively higher in Marwari animals as compared to the ponies (Table).

Table: Dry matter intake and nutrient digestibility

Parameters	Horses	Ponies
Average body weight (kg)	332	228
Av. feed intake (DM as % B. Wt.)	2.04b±0.03	2.22a±0.02
Av. feed intake (DM in Kg)	6.90a±0.05	5.52b±0.07
Dry matter digestibility (%)	56.17a±0.96	53.62b±0.40
Crude protein digestibility (%)	64.74±1.01	63.63±0.48
Crude fibre digestibility (%)	36.53±1.01	34.94±0.31
Ether extract digestibility (%)	69.75±1.14	67.70±0.60
Nitrogen free extract digestibility (%)	71.61±0.72	72.51±0.56

(P.A. Bala, R.K. Dedar and Rajesh Nehra)

Mineral status of soil and equines of different zones of Rajasthan

A mineral mixture specific to an area is more suitable to the livestock of that area as this will supplement the deficit minerals and make a balanced ration. Hooves and hair give a chronic picture of mineral deficit in animals. With an objective to find out the mineral status, fecal and hoof samples were collected from horses from various districts of Rajasthan and analyzed with ICP-OES analyzer. The study revealed that there was no mineral deficit in soil of different agro-climatic zones. Calcium, phosphorus and zinc were found to be deficit in the animals, in varying degree. Horses for maintenance require very small quantity of minerals to be supplemented externally (other than feed). Though, in horses' deficiency signs are shown rarely, they need extra boost of minerals for better performance and disease resistance.

(P.A. Bala, R.K. Dedar and Rajesh Nehra)

Accessioning of viruses in NCVTC repository

During 2017-18, a total of 36 virus cultures were received from TANUVAS Chennai, LUVAS Hisar and NCVTC Hisar. All these cultures were processed by checking their viability in appropriate cell lines, authentication by PCR amplification and sequencing of virulence genes. A total of 27 viruses were accessioned including Newcastle disease virus (17), Chicken astrovirus (7), Infectious bursal disease virus (1) and Sheeppox virus (2).

Development of repository of poxviruses: Poxvirus infections are endemic in the country. Although majority of the poxviruses don't cause mortality, however, they are the leading cause of production losses in livestock and poultry. Despite vaccines being available, pox outbreaks keep occurring throughout the length and breadth of the country. Several cases of species jumping at the same space and time have also been reported. Pox virus infections due to more than eight species of poxviruses have been reported from different parts of the country. In this endeavour the identification, characterization and preservation of the different field isolates affecting different livestock and poultry assumes enormous significance in view of the requirement of updation of existing vaccines and diagnostics through incorporation of the prevalent field strains. Efforts on isolation, characterization and preservation of the circulating poxvirus strains led to the acquisition of 50 different pox virus isolates from different livestock (cattle, sheep, goat buffalo, pig, camel) and poultry (Table). All these isolates have been authenticated and preserved in the repository and are available to stakeholders for research and development needs.

Development of repository of recombinant clones of influenza A virus and porcine circovirus 2: A library of accessioned recombinant clones of various genes of microbes is being developed in the NCVTC repository for conservation of microbial genetic materials. A total of 36 recombinant clones, including 8 clones of whole genome of PCV2, 14 clones of swine/H1N1 and 14 clones of swine/H3N2 viruses were generated by cloning of the amplicons into pTZ57R/T vector and verified by sequencing and BLAST, NCBI homology analysis of the sequence data. The confirmed clones (36 nos) were preserved and accessioned in the repository. Such state-of- the-art genetic resources will serve as reference material as well as for specific application.

Table: Poxviruses in the repository

Ponies	Numbers
Sheeppox virus	5
Goatpox virus	3
Buffalopox virus	29
Fowlpox virus	1
Swinepox virus	1
Orf virus	2
Pigeonpox virus	1
Camelpox virus	8
Total	50

(Sanjay Barua, Naveen Kumar, Riyesh T, B.C. Bera and Taruna Anand)

Isolation and genetic characterization of Fowl adenovirus from Haryana, India

Fowl adenoviruses (FAdVs) are distributed worldwide in chicken flocks and are responsible for outbreaks of inclusion body hepatitis (IBH), hepatitis-hydropericardium syndrome (HHS), respiratory tract disease and adenoviral gizzard erosions (AGE) in young broiler chicken. The causative agents belong to genus *Aviadenovirus* of the family *Adenoviridae* and have been grouped into five different species (FAdV-A to FAdV-E) with 12 different serotypes. Infections due to all the different species of fowl adenoviruses have been reported from India. In this study, we decided to find out the prevalence of fowl adenovirus in different poultry farms of Hansi and Hisar, Haryana. A total of 98 samples were collected from different farms and slaughter houses and tested for the presence of FAdV by DNA polymerase gene based PCR. A total of 34 samples were found positive for Avian adenovirus. All these positive samples were passaged in chicken embryo liver cells (CEL) and virus could be isolated from 22 of samples (Fig.1A-B).

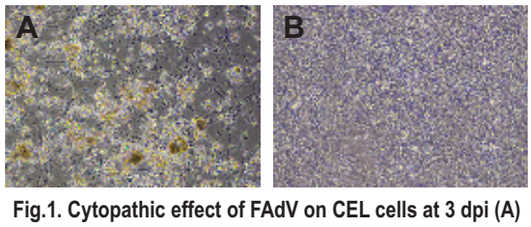


Fig.1. Cytopathic effect of FAdV on CEL cells at 3 dpi (A) and Control cells (B)

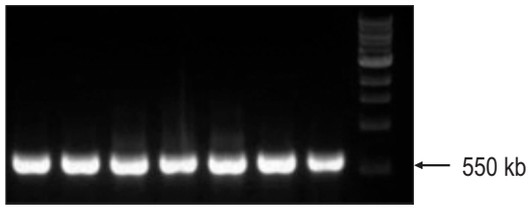


Fig 2: PCR amplification of DNA polymerase gene of Fowl adenoviruses

A total of 14 of these isolated viruses were genetically characterized by amplifying and sequencing of hexon and DNA polymerase genes (Fig.2). Sequence analysis revealed that 12 isolates belong to fowl adenovirus group E and two isolates belong to fowl adenovirus Group C. This study indicated the circulation of fowl adenovirus belonging to Group E and Group C among different poultry farms in Hansi and Hisar, Haryana.

(Riyesh T, Sanjay Barua, Naveen Kumar and Naresh Jindal)

Circulation of human-seasonal flu viruses in healthy swine populations

The human-to-swine transmission of influenza A viruses (IAVs) were reported across a wide range of countries and continents, despite less intensive surveillance studies in swine populations globally. The IAVs circulating in domestic swine populations has a serious impact on the swine industry as well as a threat for humans. In present study, we investigated the circulation of IAVs in apparently healthy domestic pigs from Haryana, Mizoram, Guwahati, Meghalaya & slaughterhouse in Mumbai. The viral RNA was isolated from 243 nasal swabs and subjected to RT-PCR amplification of conserved region (244 bp) of matrix (M) gene of IAVs. A total of 23 nasal swabs (Mumbai-20 nos; Haryana-2 nos & Mizoram-1 no) showed positive amplification for IAVs, which was further confirmed by sequencing and revealed 98-99.9% identity with IAVs.

For sub-typing of the circulating IAVs, the full length haemagglutinin (HA) and neuraminidase (NA) genes were amplified from RNA isolated from nasal swabs using universal primers, cloned the amplicons and sequenced recombinant plasmids. The sequence homology analysis indicated 97-99% homology with the human seasonal- H3N2 and - H1N1 influenza A viruses.

The phylogenetic analysis revealed that Indian SIVs clustered with swine isolates of human (seasonal H1N1 & H3N2 viruses) and showed close grouping of Indian swine/H1N1 virus with swine isolates from USA (A/swine/Illinois/2018 & A/swine/Minnesota/2018), which belonged to recent human seasonal viruses (Fig.). Similarly, the Indian swine/H3N2 virus grouped with the swine/H3N2 isolate from USA (A/swine/Oklahoma/2017) and human isolate from China (A/Shanghai/2017) (Fig.). This indicates the incidences of species jumping of currently circulating human- seasonal flu viruses into pig populations, which is of great concern for both animal and public health aspect.

The co-circulation of p/H1N1/09 with other swine viruses like- triple-reassortant H3N2, human-origin H1N1/H1N2, and classical H1N1 leads to frequent reassortment between lineages. Hence, further understanding of the underlying ecological and epidemiological mechanism of human-to-swine transmission events is vital for the health of both humans and swine.

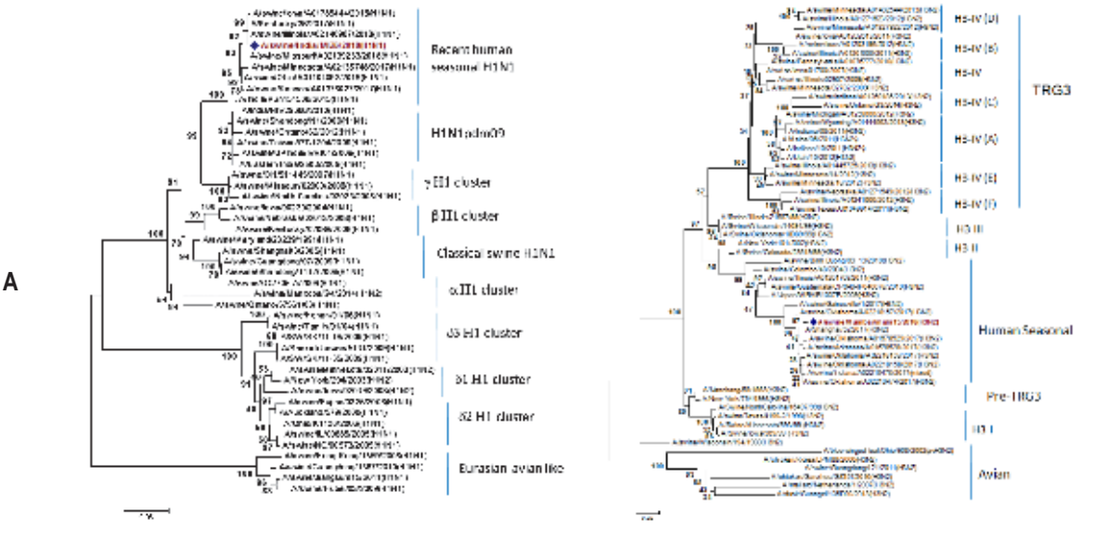


Fig. Phylogenetic analysis of sequence of HA gene of H1N1 virus (A) and H3N2 virus (B) amplified from nasal swab of pig

(B.C. Bera, Sanjay Barua, Taruna Anand and Nitin Virmani)

Co-circulation of influenza A virus, porcine circovirus 2 and porcine cytomegalovirus in pigs

The domestic and wild pigs are susceptible to concurrent infection with several viruses which is a major concern to the swine producing countries globally. Here, we report the co-circulation of PCV2, influenza A viruses (IAVs), and PCMV in various combination in apparently healthy domestic pigs on the basis of molecular detection of pathogens by PCR and RT-PCR assays in nasal swabs (243 nos) collected from five states (Mizoram, Meghalaya, Guwahati, Haryana and Mumbai) of the country. We observed that a total of 79 samples were positive for PCV2 from all places, followed by 34 samples for PCMV and 23 samples for influenza A viruses. The mixed circulation of viruses was found for influenza A virus + PCV2 in 14 samples from Mumbai, and for PCV2 + PCMV in 21 samples collected from Mizoram, Guwahati and Mumbai. The presence of viruses in samples was further confirmed by sequencing of PCR products (ORF2-490 bp of PCV2; M gene-244 bp of influenza A virus and gB gene-413 bp of PCMV). The sequence data subjected to BLAST, NCBI homology analysis and revealed 90-99.9% identity to the respective viruses. Among these three viruses, the IAVs and PCV2 are important respiratory pathogens, as PCMV generally does not cause severe problem.

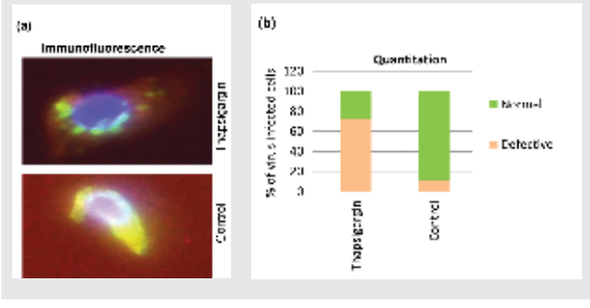
The study revealed that PCV2 infection is a major problem in swine in the country. Further to understand the evolution of this emerging virus, whole genome (~1.7 kb) of four PCV2 viruses were amplified from positive samples collected from Guwahati, Chhattisgarh and Maharashtra. Sequence analysis indicated that the PCV2 sequences from Guwahati, Chhattisgarh and Maharashtra belonged to the cluster 2d. The prevalence of similar cluster of PCV2 was also reported earlier in pigs from Meghalaya and Uttar Pradesh. This suggests that cluster-2d of PCV2 is the major problem in swine population of the country.

(B.C. Bera, Sanjay Barua, Taruna Anand and Nitin Virmani)

SERCA regulates paramyxovirus replication

The control strategies against pathogens have classically relied upon targeting essential proteins of the pathogens. High mutation rate in viral genome allows the virus to become resistant to antiviral drugs and preexisting immunity. Classically antiviral drugs have been developed by directly targeting viral protein (components). Viruses get mutations at the drug targets and become resistant. The rise in incidence of drug resistance has prompted a shift for the development of novel antiviral drugs. Viruses are obligate intracellular parasites that are highly dependent on host. Host responses are equally important in determining actual outcome of the diseases. Upon viral infection, numerous cellular factors are dysregulated (increased or decreased expression); some of these host factors facilitate virus production (proviral) whereas others block the viral replication cycle. Proviral host factors may serve as a target for development of novel antiviral therapeutics.

Sarco/endoplasmic reticulum calcium-ATPase (SERCA) is a membrane bound cytosolic enzyme that is known to regulate the uptake of calcium into the sarco/endoplasmic reticulum from the cytosol. Here, we show for the first time that SERCA can also regulate paramyxovirus [Peste des petits ruminants virus (PPRV) and Newcastle disease virus (NDV)] replication. Treatment of Vero cells with SERCA specific inhibitor (thapsigargin) at a concentration that is nontoxic to the cells significantly reduced virus replication. Conversely, over-expression of SERCA rescued the inhibitory effect of thapsigargin on virus replication. PPRV/NDV infection induced SERCA expression in Vero cells which could be blocked by thapsigargin. With the help of time-of-addition and virus step-specific assays, it was observed that thapsigargin specifically inhibits viral entry and subcellular localization of the viral proteins (Fig.). On long-term sequential cell culture passage (P=70) in presence of thapsigargin, a significant (though partial) resistance to thapsigargin was observed in NDV, though PPRV did not acquire any resistance. To the best of our knowledge, this is the first report describing that SERCA facilitates virus replication and a rare report suggesting virus may acquire resistance even in presence of an inhibitor that



Localization of viral protein in Thapsigargin-treated and untreated cell infected with NDV (a), cells (percent) with or without punctuate structures in Thapsigargin-treated and control (b).

targets cellular factors. The study will contribute in understanding paramyxovirus replication and development of antiviral therapeutics using SERCA (host factor) as a candidate drug target.

(Naveen Kumar and Sanjay Barua)

Accessioning of bacterial cultures in NCVTC repository

The act of isolation, identification, characterization, and *ex situ* preservation of bacterial cultures leads to an appreciable gain in their value as compared to the in situ clone, which is considered to be of negligible monetary value. A total of 70 bacteria were accessioned during the year, making cumulative culture collection of 1271 bacteria of veterinary importance. During this period cultures were obtained from; SKUAST Srinagar, NIBSM Raipur, CIRG Makhdoom; CMVL Meerut; DUVASU Mathura; CVAS Udaipur; NEH Meghalaya; CVSc Nagpur; RKVY Jaipur; CSWRI Avikanagar; TANUVAS Chennai; IVRI Izatnagar; COVS Khanapara, Guwahati; CSKHPKV Palampur; and NCVTC Hisar. Out of 350 cultures received and processed at bacteriology laboratory, 143 cultures are ready to be accessioned. In addition, a total of 184 pathological and environmental samples [small ruminants (38); large ruminants (4); farm water bodies (10); Human (1); poultry (5) equines (113) and dog (8)] were also processed during this period and 291 bacterial isolations were made of which 134 cultures are ready to be accessioned by now. The important bacterial isolates accessioned during this period is given in Table.

Table: Important bacteria isolated and accessioned

Mannheimia hemolytica	*Aeromonas hydrophila*	*Aeromonas taiwanensis*
Aeromonas jandaei	*Aeromonas dhakensis*	*Moraxella lacunata*
Acinetobacter bouveti	*Acinetobacter lwoffi*	*Acinetobacter variabilis*
Acinetobacter harbinensis	*Acinetobacter johnsonii*	*Acinetobacter indicus*
Klebsiella ozaenae	*Klebsiella singaporensis*	*Plesiomonas shigelloides*
Escherichia hermanii	*Escherichia fergusonii*	*Escherichia marmotae*
Enterobacter cloacae	*Pseudomonas putida*	*Pseudomonas protegens*
Streptococcus canis	*Streptococcus suis*	*Streptococcus uberis*
Streptococcus agalactiae	*Streptococcus hyovaginalis*	*Streptococcus minor*
Streptococcus rupicaprae	*Streptococcus ovis*	*Paenibacillus alvei*
Corynebacterium pseudotuberculosis	*Corynebacterium glutamicum*	*Lactococcus lactis ssp. hordniae*
Lactococcus lactis ssp. tructae	*Lactococcus lactis ssp. lactis*	*Lactococcus garviae*
Aerococcus viridans	*Vagococcus fluvialis*	*Aerococcus urinaeequi*
Macrococcus caseolyticus	*Arthrobacter gandavensis*	*Arthrobacter luteolus*

A total of 18 bacterial cultures were distributed to researchers in Gujarat, Rajasthan, Punjab and Haryana.

(R.K. Vaid, Taruna Anand, Riyesh T., B.C.Bera and K. Shanmugasundaram)

Isolation of mastitis causing bacteria from milk and their bacteriophages

Mastitis is economically devastating and most important disease of dairy animals. Bacterial infection results in an initial inflammatory response and finally leading to visibly abnormal milk (eg, color, fibrin clots) and subsequent changes in the udder like swelling, heat, pain and redness. The infection is treated using antibiotics; however, due to the emerging antimicrobial resistance observed at various animal farms, alternatives are being explored. In an order to develop phage cocktails against mastitic pathogens, we first isolated and characterized bacteria from mastitic milk samples collected from mastitic animals. Various bacteria identified by 16s rRNA sequencing included *Staphylococcus aureus* ssp. *aureus, Staphylococcus haemolyticus, S. agnetis, S. sciuri, S. xylosus, S. chromogene, S. epidermidis, E. coli, Streptococcus dysgalactiae* (Fig.1) and *Klebsiella*

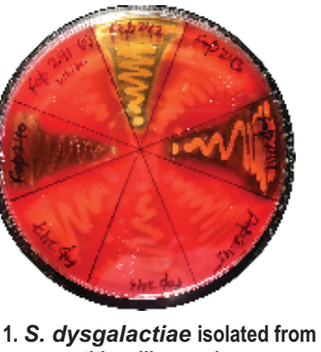


Fig 1. *S. dysgalactiae* isolated from mastitic milk samples

pneumoniae in majority of cases. However, in few cases, *Micrococcus lylae, Kocuria rhizophila, Acinetobacter radiorestens, Acinetobacter baumanii, Corynebacterium sp., Klebsiella sp., Pantoea sp.* and *Bacillus sp.* were also isolated. A methicillin resistant *S. aureus* (MRSA) was also isolated from a case.

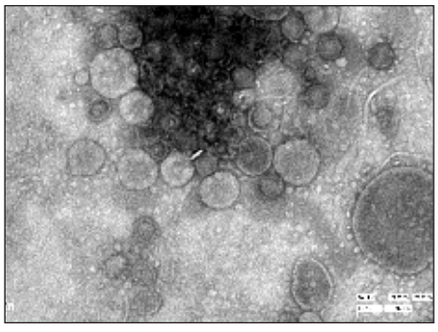


Fig 2. TEM of Bacteriaophage of family *Siphoviridae* from *K. Pneumoniae*

The log phase bacterial cultures were used to enrich bacteriophages from animal farm sewage and soil samples. Fourteen bacteriophages were isolated which were checked for their optimum activity at a range of pH and temperatures and the plaque characteristics were recorded. The bacteriophage VTCCBPA118 against *K. pneumoniae* was visualized by TEM also (Fig 2). The biological activity of the phages indicated that the phage cocktails were active against majority of mastitic pathogens and phage-BPA116 alone was active against various species of Staphylococci isolates including *S. aureus,* MRSA, *Bacillus sp.* and *S. dysgalactiae* and thus proving to be a broad range phage.

(Taruna Anand, Nitin Virmani, R.K. Vaid and B.C. Bera)

Microbial characterization of mule dung from Katra (J&K)

Mules are cheap and easy method of travel for pilgrims in hilly areas of tourism and pilgrimage in Himalayan hills. Although mule owners are benefitted by enhanced livelihood avenues, the use of mules for transport also leads to hygiene issue on account of mule dung scattering on hill tracks. As the mule dung may contain microorganisms which may be of public health and environment concern. This study deals with investigation on evaluation of microbial status of the mule dung in Katra region (Jammu). The dung samples were subjected to metagenomic analysis to understand the taxa level diversity of bacterial microbes in mule dung. From the metagenomic studies, 1484 unique sequences obtained were subjected to bioinformatic analysis by BLASTn analysis up to species level. Although 99.4% of the sequences match were of pathogenically insignificant taxa, a few sequences matched with bacterial taxa which may have some pathogenic potential viz., *Bacteroides fragilis* strain NCTC 9343; *Orientia tsutsugamushi* strain Karp; *Erysipelothrix rhusiopathiae* strain ATCC 19414; *Erysipelothrix larvae* strain LV19; *Neisseria perflava* strain Branham 7078; *Listeria welshimeri* strain NCTC 11857; *Arcobacter lanthieri* strain AF1440; *Helicobacter pylori* strain ATCC 43504; *Vibrio alginolyticus* strain NBRC 15630; *Riemerella columbipharyngis* strain 8151; *Pseudomonas stutzeri* strain ATCC 17588. The process of vermi-composting was also subjected to microbiological analysis to study the microbial trend of the vermi-compost from start to end of vermi-composting process, a period of approximately 3 months. Samples were regularly obtained on weekly basis and bacterial counts were obtained on cfu/gm basis were plotted. Microbial counts showed a declining trend over the course of vermi-composting from 1st week (2.40E+08) to 12th week (7.20E+06), however, the microbial counts were never constant and showed a tendency of rapid flux. The ready vermi-compost samples showed healthy counts of approximately 10^6 cfu/gm (Fig).

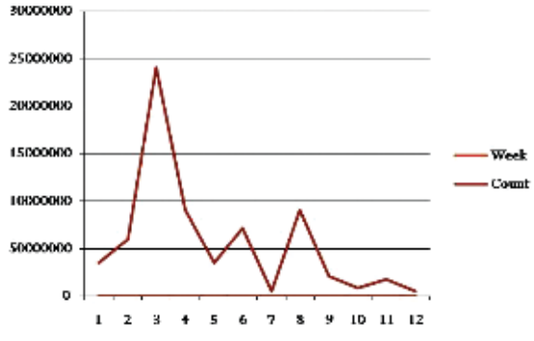


Fig. Vermicomposting microbial counts plotted in cfu/gm of weekly samples

(R.K. Vaid, K. Shanmugasundaram, R.A. Legha and B.N. Tripathi)

Technology Development, Transfer and Commercialization

The major efforts of the Centre are focused on development of technologies for improvement in equine health, production and utilization in the country. The institute is continuously striving for the upliftment of equine sector ever since its inception. Many diagnostic kits, vaccines and biologicals developed by the scientists of ICAR-NRCE are routinely used in the field. Many of the newer technologies are under development, transfer and commercialization.

TECHNOLOGIES FOR COMMERCIALIZATION

- Updated equine influenza vaccine
- Inactivated equine herpesvirus-1 vaccine (Equiherpabort)
- Equiherpes B-ELISA kit for diagnosis of EHV1 infection
- Monoclonal antibody-based ELISA kit for diagnosis of rotavirus infection
- Recombinant antigen ELISA kit for *Theileria equi* diagnosis
- Recombinant protein based ELISA for diagnosis of glanders
- Recombinant protein based ELISA for diagnosis of EIA
- Pregmare kit for pregnancy diagnosis in mares
- Lateral flow assay for rapid diagnosis of equine piroplasmosis.
- Cryopreservation of equine semen
- Recombinant gG-based type-specific ELISA for differentiation of EHV1 & 4 infection

TECHNOLOGIES BEING DEVELOPED

- Recombinant protein based ELISA for diagnosis of trypanosomosis
- Lateral flow assay for diagnosis of trypanosomosis
- Lateral flow assay for pregnancy diagnosis in mares
- Monoclonal antibody-based sandwich ELISA for equine influenza virus

TRANSFER OF TECHNOLOGIES

Transfer of Technology on glanders diagnosis to end-users

The Centre has developed recombinant protein-based ELISA kit for sero-diagnosis of glanders. During the year, the veterinarians and laboratory technicians from six states were provided training on glanders diagnosis. The ELISA kits were provided to diagnostic laboratories of seven states namely Gujarat, Haryana, Himachal Pradesh, Punjab, Rajasthan and Maharashtra. In addition, ELISA reagents have also been supplied to Central Military Veterinary Laboratory, Meerut for screening of Army Horses. During the year, a total of 17563 samples were tested in five state diagnostic laboratories using these kits (Table).

Table: Glanders samples tested in different states

State	No. of Sample Tested
Gujarat	6426
Haryana	3542
Himachal Pradesh	5466
Rajasthan	1529
Maharashtra	600
Total	17563

Release of two NRCE technologies by Union Minister of Agriculture

Two technologies developed by NRCE under Consortium Research Project on Vaccines & Diagnostics were released by Hon'ble Minister of Agriculture & Farmer Welfare, Sh. Radha Mohan Singh and other dignitaries on 16 July 2017 during 89th Foundation Day & Award Ceremony at New Delhi.

ELISA for differentiation of EHV1 & 4 Infection

A recombinant protein based ELISA kit has been developed by the Centre for differentiation of EHV1 & EHV4 antibodies in the equine serum. This kit is highly sensitive and specific for EHV1/4 diagnosis and has a shelf life of 6 months.

Lateral flow assay for equine piroplasmosis

A lateral flow assay has been developed for detection of antibodies to *Theileria equi* in equine serum samples. This LFA kit is simple, rapid, and user-friendly obviating the requirement of skilled personals and sophisticated laboratory equipments. The assay is easy to perform and highly sensitive and specific.

Union Minister of Agriculture & Farmers' Welfare releasing diagnostic kits

MoU signed for ToT

Mutual non-disclosure agreement & MoU was signed on 12 January 2018 between NRCE and Genomix Molecular Diagnostic Pvt Ltd. & Genomix CARL Pvt Ltd. for collaborative research project submitted under Small Business Innovation Research Programme (SBIRI) scheme of Biotechnology Industry Research Assistance Council (BIRAC), DBT, Ministry of Science & Technology, GoI.

Following two technologies will be transferred for commercialization under MoU:

i. Recombinant antigens (Hcp1, TssA and TssB) and clones thereof for diagnosis of glanders.

ii. Recombinant antigen (p26) and clone thereof for diagnosis of equine infectious anaemia.

Revenue generation under diagnostic services and consultancy

During the year 2017-18, diagnostic services were provided to stakeholders from various states of the country. A total of 9039 samples received from race courses, turf club, stud farm, riding schools and other organized sector were tested on payment basis. Maximum number of samples were tested for EIA (3877) and Glanders (4606). Among others, 162 swab samples from Animal quarantine & Certification services (AQCS) tested for Contagious equine metritis were negative. The other diseases tested include EHV1, *T.evansi,* EI, Dourine, West Nile fever, Piroplasmosis, African horse sickness and equine viral arteritis. During the year revenue of Rs 55.81 lakhs was generated through contractual diagnostic services (Table).

Table: Equine samples tested and income generated during 2017-18

Disease	No. of samples tested	Amount (in Rs.)
EIA	3877	1938500.00
Glanders	4606	2763600.00
EHV1	31	62000.00
T.evansi	45	22500.00
EI	62	31000.00
Dourine	42	42000.00
WNV	27	13500.00
Piroplasmosis	62	259533.50
AHS	44	44000.00
EVA	81	162000.00
CEM	162	243000.00
Total	9039	5581633.50

ICAR-NRCE

LANDMARK ACHIEVEMENTS

Year	Achievement
1985	Foundation of NRCE, Hisar
1987	Detection of first outbreak of equine influenza in northern India
1989	Establishment of Equine Production Campus, Bikaner
1990	Import of Poitou donkey from France
1995	Cryopreservation of Jack semen for AI
1996	Establishment of a herd of Marwari horses
1996	Crystal structure of mare milk lactoferrin
1996	Production of carpet fabric by blending of donkey and sheep hair
1997	Release of inactivated equine influenza vaccine
2003	Award of Indian patent to HERP kit for diagnosis of EHV1 infection
2005	Development of mAb-based sELISA for detection of rotavirus
2005	Establishment of National Centre for Veterinary Type Cultures (NCVTC)
2006	Collection and cryopreservation of stallion semen at farmers' door
2006	Detection of outbreak of Glanders in equines
2008	Detection of second outbreak of equine influenza
2008	Release of 'Equiherpes B-ELISA' kit for EHV1 diagnosis
2008	Release of 'Pregmare kit' for pregnancy diagnosis in mares
2009	Establishment of a herd of Zanskari ponies
2009	First report of Camelpox zoonosis
2010	Re-emergence of a case of equine infectious anemia
2010	Cryopreservation of Zanskari Stallion semen
2011	First report of Buffalopox virus causing concurrent disease in cow, buffalo and human
2011	Whole genome sequencing of Japanese Encephalitis virus isolated from a horse
2011	Whole genome sequencing of *Pasteurella multocida* B:2 strain
2011	Establishment of a herd of Small grey & Large white indigenous donkeys
2012	Organization of SAARC trainings on equine piroplasmosis under OIE Twinning Program
2012	Quinapyramine sulfate nanoformulation developed against *Trypanosoma evansi*
2012	Development of r-protein based ELISA for equine infectious anemia
2012	Whole genome sequencing of *B. bronchiseptica, P. multocida, A. equuli, Salmonella* Gallinarum
2012	Technique for Vermicomposting using equine dung optimized
2013	Establishment of Microbial Containment Laboratory (BSL-3)
2013	Establishment of ATIC and info-Equine Museum
2014	Development of r-protein based ELISA for diagnosis of *Burkholderia mallei*
2014	Development of r-HSP70 based ELISA for *Trypanosoma evansi* infection
2015	NRCE conferred Sardar Patel Outstanding ICAR Institution Award
2015	Release of 'Equiherpabort vaccine' for prevention of EHV1 abortions in mares
2015	Release of r-protein based *Theileria equi* antibody detection kit
2015	Whole genome sequencing of classical swine fever virus
2016	Organization of SAARC trainings on equine influenza and glanders under OIE Twinning Programme
2016	Release of updated equine influenza vaccine
2016	Methodolgy for isolation of RNA virus from mixed infection developed
2017	Establishment of a herd of Kathiawari horses
2018	Ecotourism started at Equine Production Campus, Bikaner
2018	Release of ELISA kits for EHV1/4 and LFA for equine piroplasmosis

Education and Trainings

Training on Artificial Insemination organized at EPC Bikaner

In view of increased demand for training on artificial insemination (AI) in equines at field level, one-week training on “Artificial Insemination in Equines” was organized from 21-27 August 2017 at Equine Production Campus, Bikaner. In this training, eight para veterinarians from Haryana, Rajasthan and Uttar Pradesh participated. A total of 14 theory lectures and 7 practical sessions regarding equine production and management were conducted during the training programme. A hands-on-training for performing AI in equines was provided to the participants.

Hands-on-training on Bioinformatics tools & their application in biological research

A workshop on “Bioinformatics Tools & their Application in Biological Research” was conducted for 3 days from 5-7 September 2017 at National Centre for Veterinary Type Cultures, NRCE, Hisar. The workshop was conducted under the Project “Bioinformatics Instructional Facility for Biology Teaching through Bioinformatics" (BIF-BTBI) sponsored by Department of Biotechnology, Government of India. Speaking on the inaugural session, Dr Tankeshwar Kumar, Vice-Chancellor, Guru Jambheshwar University, Hisar highlighted the role of bioinformatics in agriculture and animal husbandry. In this workshop, 22 trainees from the disciplines of Veterinary Microbiology, Biotechnology and Parasitology participated. Dr K P Singh, Vice-Chancellor, CCS Haryana Agricultural University, Hisar awarded certificate of participation to the successful trainees. The training was organised by Dr R.K. Vaid and Dr Sanjay Kumar under the chairmanship of Dr B.N. Tripathi, Director of the institute.

Training on glanders to Veterinarians and laboratory technicians

To support glanders surveillance programme, 16 veterinary officers and 2 technicians from seven state disease diagnostic laboratories of Uttar Pradesh, Madhya Pradesh, Himachal Pradesh, Punjab, Rajasthan, Maharashtra, and Jammu & Kashmir were provided 3-day trainings in 4 batches on glanders diagnosis during August-September 2017. These trainings were conducted by Dr H.S. Singha under the supervision and guidance of Director, NRCE.

Veterinary students imparted hands-on-training

Training on "Equine Health and Management" was organized at Hisar and Bikaner campus during September 20 to October, 6, 2017. Three veterinary students from Rajiv Gandhi Institute for Veterinary Education and Research, Pondicherry and NDRI, Karnal attended this training programme. The training course consisted of lectures, demonstrations, hands-on-training and discussion on different aspects like equine diseases, lameness, ultrasonography, rectal examination etc. The training was coordinated by Dr Anju Manuja and Dr S.C. Mehta.

Biosafety Workshop at NRCE

A workshop on Biosafety was organized for staff and students at NRCE on October 13, 2017 at NRCE, Hisar. Dr Suresh Kumar Scientist from National Institute of Biologicals, Ministry of Health & Family Welfare, Govt. of India delivered lecture on "New Biomedical Waste Management Rules 2016". In addition, Sh K.K. Gupta chief Technical Officer (Engg), NRCE Hisar delivered a lecture on "Biocontainment in Laboratories". The training program was attended by scientists, technical staff and project staff of NRCE. The workshop was organised by Dr Balvinder Kumar, Member Secretary, IBSC of the institute under the chairmanship of the Director.

Internal Auditors' Training organized at NRCE

For quality management as per ISO9001:2015, one-day Internal Auditors' Training Programme on Quality Management System was organized at NRCE, Hisar on February 26, 2018, in which 10 staff members participated. This training was imparted for QMS9001:2015 implementation at the Centre. The training was provided by Sh Joginder Kumar, Principal Consultant, Quality Growth Services, New Delhi. The training was organised by Dr B.R. Gulati and Dr S. Barua, Nodal Officers for Quality Management of the Institute.

Foreign Visit by Scientists

Dr Naveen Kumar attended one month training programme on "Genome-wide siRNA screens for foot-and-mouth disease virus (FMDV) and herpes simplex virus (HSV)" at Division of Infection and Pathway Medicine, University of Edinburgh, UK under Commonwealth professional fellowship, UK, continue from April 1 to June 1, 2017.

Expert/invited lectures delivered by NRCE scientists in training courses

- Dr Anju Manuja delivered a lecture and imparted hands-on-training on "Resazurin cytotoxicity assays" at 21 days CAFT training in Veterinary Microbiology on "Microbial Genomics and Proteomics in Diagnosis and Control of Diseases of Veterinary Importance" during November 7-27, 2017 in Department of Veterinary Microbiology, LUVAS, Hisar.
- Dr Anju Manuja delivered a lecture on "Applications of Nanoparticles for Therapeutics against Infectious Diseases" at 21 days CAFT training in Veterinary Microbiology on "Microbial Genomics a Proteomics in Diagnosis and Control of Diseases of Veterinary Importance" during November 7-27, 2017 in Department of Veterinary Microbiology, LUVAS, Hisar.
- Dr B.N. Tripathi delivered a lecture on Zoonotic Aspect of Burkholderia mallei (Human glanders) at the National Conference on Scientific Updates on Zoonotic Disease Control at AIIMS, New Delhi on 6 July 2017.
- Dr B.N. Tripathi presented a paper on " Paratuberculosis in Animals:-" at Brainstorming Meeting on Bovine Tuberculosis on invitation of Department of Biotechnology, Ministry of Science and Technology at New Delhi during 18-19 September 2017.
- Dr B.N. Tripathi delivered a lecture on "Equine Glanders – its control and containment" at one day workshop in Bhopal & Indore during 07-09 February 2018.
- Dr B.N. Tripathi delivered lecture on Equine Glanders, at one day seminar on "Molecular Pathology and Diagnosis of Emerging Disease of Livestock and Poultry" at Assam Agricultural University, Guwahati on 25 February 2018.
- Dr BR Gulati delivered a lecture on "Genomic and Proteomic Approaches for the Diagnosis and Control of Equine Herpes Virus Infections" in 21 days CAFT training in Veterinary Microbiology on "Microbial Genomics an Proteomics in Diagnosis and Control of Diseases of Veterinary Importance" during November 7-27, Department of Veterinary Microbiology, LUVAS, Hisar.
- Dr BR Gulati delivered a lecture on "Diagnosis of Equine Herpes Virus 1 infection using Peptide ELISA and real-time PCR. CAFT training in Veterinary Microbiology on 'Microbial Genomics an Proteomics in Diagnosis and Control of Diseases of

Veterinary Importance' during November 7-27, Department of Veterinary Microbiology, LUVAS, Hisar.

- Dr Naveen Kumar delivered a lecture on "Development of Novel Antiviral Therapeutics"in 21 days CAFT training course on "Diagnosis and Control of Emerging and Re-emerging Transboundary Diseases of Poultry" during February 7-28, 2018, LUVAS, Hisar.
- Dr Naveen Kumar delivered a lecture on "Studying virus-host interactions: Development of Novel Antiviral Therapeutics" in training on "Diagnosis of livestock diseases: a molecular approach" from March 7-31, 2018, Department of Animal Biotechnology, LUVAS, Hisar.
- Dr RA Legha delivered a lecture on "Identifying breeds, Characterization and their prioritization for conservation" in ICAR Sponsored winter school on conservation and promotion of indigenous breeds of livestock during October 30-November 19, 2017, Rajasthan University of Veterinary & Animal Sciences, Bikaner.
- Dr T Riyesh delivered a lecture on "Protocols for Identification, Characterization and Preservation of Poultry Viruses with Special Reference to Infectious Bursal Disease Virus" in CAFT training in Veterinary Microbiology on 'Microbial Genomics an Proteomics in Diagnosis and Control of Diseases of Veterinary Importance' during November 7-27, Department of Veterinary Microbiology, LUVAS, Hisar.
- Dr SK Ravi delivered a lecture on "Semen Collection and Cryopreservation in Equines" in ICAR Sponsored winter school on conservation and promotion of indigenous breeds of livestock during October 30-November 19, 2017, Rajasthan University of Veterinary & Animal Sciences, Bikaner.
- Dr SK Ravi delivered a lecture on "Artificial Insemination in Equines" in One week training programme on "Artificial Insemination in Equines" to paraveterinarians from 21-28 August, 2017, EPC, Bikaner.
- Dr SK Ravi delivered a lecture on "Reproductive disorders in Equines and their treatment" in One week training programme on "Artificial Insemination in Equines" to paraveterinarians from 21-28 August, 2017, EPC, Bikaner.
- Dr TR Talluri delivered an invited lecture on "Equine Scenario in India and Measures for the Conservation and Propagation of Indigenous Equines" in ICAR Sponsored winter school on conservation and promotion of indigenous breeds of livestock during October 30-November 19, 2017, Rajasthan University of Veterinary & Animal Sciences, Bikaner.
- Dr TR Talluri delivered an invited lecture on "Application of Emerging Reproductive Biotechnologies in Conservation of Elite and Endangering Livestock" in ICAR Sponsored winter school on conservation and promotion of indigenous breeds of livestock during October 30-November 19, 2017, Rajasthan University of Veterinary & Animal Sciences, Bikaner.
- Dr TR Talluri delivered a lecture on "Anatomy and Physiology the Mare Reproductive System and Estrus Cycle in Mares" in One week training programme on "Artificial Insemination in Equines" to paraveterinarians from 21-28 August, 2017, EPC, Bikaner.
- Dr TR Talluri delivered a lecture on "Quality of the Semen Used for AI" in One week training programme on "Artificial Insemination in Equines" to paraveterinarians from 21-28 August, 2017, EPC, Bikaner.
- Dr Taruna Anand delivered a lecture on "Big-Bang of Database World" during the training programme on "Bioinformatics Tools & their Application in Biological Research" at Bioinformatics Infrastructure Facility-Biology Teaching through Bioinformatics (BIF-BTBI) during September 5-7, 2017, ICAR-NRCE, Hisar.
- Dr Yash Pal delivered a lecture on "Physiology of Pregnancy and Serological Diagnosis of Pregnancy" in training on "Artificial Insemination in Equines" to para-veterinarians during August 21-27, 2017, EPC, Bikaner.
- Dr Yash Pal delivered an invited lecture on "Present Status of Donkeys in India and their Conservation" in ICAR Sponsored winter school on conservation and promotion of indigenous breeds of livestock during October 30-November 19, 2017, Rajasthan University of Veterinary & Animal Sciences, Bikaner.
- Dr Sanjay Barua delivered a lecture on "Development of Repository for Poultry Viruses" in 21 days CAFT training course on "Diagnosis and Control of Emerging and Re-emerging Transboundary Diseases of Poultry" during February 7-28, 2018, LUVAS, Hisar.
- Dr Yash Pal delivered a lecture on "Adaptability of Indian Livestock Production to Climate Change" in Model training course on "Climate Smart Buffalo Husbandry" during November 13-20, 2017, ICAR-CIRB, Hisar.

Dr Manu Mathew awarded IAVP Young Scientist Award

Dr Manu Mathew, M.V.Sc student working in NRCE under the guidance of Dr Nitin Virmani was awarded "Young Scientist Award" for his paper entitled "Immunological and pathological evaluation of protective efficacy of inactivated recombinant equine influenza virus vaccine candidate with different adjuvant formulations in murine model" in Asian Veterinary Pathology Congress-2017, Department of Veterinary Pathology, College of Veterinary Science & A.H., Bengaluru, Karnataka during November 9-11, 2017.

ICAR-NRCE

Post Graduate Students' Research & Guidance

S.No.	Name of the Student	Name of the Guide	Thesis Title
PhD Students			
1.	Alka Galav, RAJUVAS	Dr Naveen Kumar	Epidemiology of PPR in Rajasthan and Role of DUSP1 and KDM6A in PPRV Replication
2.	Ashok Kumar, RAJUVAS	Dr T R Talluri	Evaluation of various parameters affecting semen quality in Marwari stallions
3.	Deepak Kumar Sharma, RAJUVAS	Dr Naveen Kumar	Dynamics of inflammasome activation following exposure to PPR virus
4.	Himanshu Sharma, LUVAS	Dr B R Gulati	Studies on latency in Equine Herpes virus-1 infection among equines in India
5.	Narender Singh Rathore, RAJUVAS	Dr T R Talluri	Isolation, culture and characterisation of stem cells derived from extra embryonic tissues of indigenous equines
6.	Pramod Kumar, RAJUVAS	Dr S K Ravi	Effect of cholesterol-loaded cyclodextrins on semen quality of Marwari Horse and Poitou Donkey.
7.	Ramesh Kumar, LUVAS	Dr Nitin Virmani	Pathological investigation and protective immunity of recombinant vaccine candidates of equine influenza virus in BALB/C mice
8.	Sheetal Saini, CDLU	Dr H S Singha	Expression of recombinant equine cytokines and analysis of their biological activities
9.	V. Balena, IVRI	Dr B N Tripathi	Generation of recombinant equine herpesviruses 1 through BAC mediated deletion mutagenesis and their comparative pathogenicity and immunogenicity in murine model
M.V.Sc. Students			
1.	Ankur Verma, RAJUVAS	Dr R K Dedar	Therapeutic efficacy of aqueous extract of Ocimum sanctum (Tulsi) on oxidative stress in horses
2.	Manish Songara, RAJUVAS	Dr R A Legha	Effect of dietary inclusion of azolla on nutrient utilization and semen quality of Marwari stallions
3.	Manu K Mathew, IVRI	Dr Nitin Virmani	Immunological and pathological evaluation of protective efficacy of inactivated recombinant EIV vaccine candidate with different adjuvant formulations in murine model
4.	Pragya, LUVAS	Dr Sanjay Barua	Detection & experimental studies on astroviruses in broiler chicken
5.	Preeti S., RAJUVAS	Dr R A Legha	Study on the effect of North and south faced housing system, on the performance of growing foals in semi arid
6.	Prerna Yadav, RAJUVAS	Dr R K Dedar	Therapeutic efficacy of aqueous extract of Withania somnifera (AshwaGandha) on oxidative stress in horses
7.	Ram Kumar, RAJUVAS	Dr Naveen Kumar	Role of MNK1 in BPXV replication
8.	Sumitra Panigrahi, LUVAS	Dr Sanjay Barua	Epidemiological studies on chicken astroviruses in gout affected broiler chicken flocks

Workshops, Seminars & Institutional Activites

World Veterinary Day Celebrations

World Veterinary Day was celebrated by ICAR-NRCE, Hisar on April 29, 2017 at Government Sr. Secondary Model School, Muklan, Hisar on the theme "Antimicrobial resistance: Awareness to Action". The awareness among students was generated regarding consequences of irrational use of antibiotics and action to be taken to combat the problem of antimicrobial resistance by NRCE scientists

Scientists interacting with students

Cleanliness of Campus premises under Swacchata Abhiyan

Under the Swacchata abhiyan programme, a fortnight of cleanliness drive was organized from April 29 to May 22, 2017 at NRCE, Hisar and EPC Bikaner. All employees participated daily for one hour in cleaning of offices, laboratories, lawns, and building premises during this drive. NRCE staff also planted trees in the campus premises. At EPC, Bikaner, old garage of the campus was cleaned, renovated and modified into new museum. The area adjacent to the old and new guest house was cleaned and age old material was shifted and aligned properly.

NRCE staff celebrates International Yoga Day

International Day for Yoga was celebrated at NRCE Hisar on June 21, 2017 under the slogan "Yoga for Peace and Harmony". On this occasion,employees of NRCE and their family members practiced Aasnas and Pranayama as per Common Yoga Protocol developed by Ministry of Ayush, GoI. The activity was conducted under the guidance of Dr Balvinder and Miss Reena from Patanjali Yog Samiti, Hisar. In addition, under Mera Gaon and Mera Gaurav, girls and ladies of Kajla village, Hisar also practised Yoga on 20th June, 2017 with NRCE Scientists.

NRCE staff practicing Yoga

Independence Day celebrations at ICAR-NRCE

NRCE celebrated India's Independence Day on August 15, 2017 in the centre. Dr B.N Tripathi, Director, hoisted the National Flag. The staff commemorated the martyrs' struggle for freedom of the nation from the British's rule. While recalling the achievements of the institute for the year, Director congratulated the staff and inspired the staff to accomplish the new horizons in their scientific endeavour. The Institute auditorium reverberated with patriotic fervor and enthusiasm. The children brought the stage alive with their passion and love for the motherland. Dr Hema Tripathi, Principal Scientist, CIRB distributed the prizes to the children participating in the culture programme.

Workshop organized on Foundation Day at EPC, Bikaner

The 29th Foundation Day of the Equine Production Campus, Bikaner was celebrated with great enthusiasm on September 28, 2017. A workshop on "Conservation and propagation of equines through tourism" was organized on this eve. Hon'ble Mayor of Bikaner City, Shri. Narayan Chopra, Chief Guest appreciated the initiative taken up by the campus to start ecotourism. Lt. Col. Ashok Singh Rathore, NCC Raj R & V, Bikaner and Ms. Bharati Naithani, Assistant Director, Rajasthan Tourism, Bikaner graced the occasion as guest of honour. The guests released the Technical bulletin and 2nd issue of the News letter of the Campus. On this occasion a scientist-farmers' interactive meet was also organized. The scientists discussed on various issues related to equine farmers and suitable sustainable solutions were provided.

NRCE Celebrated Foundation Day on 26 November

The 33rd foundation day of the ICAR-NRCE was celebrated on November 26, 2017. Dr Ramesh Kumar Yadav, Chairman of Haryana Kisan Ayog was the Chief Guest and Dr MC Sharma, Former Director of IVRI and Dr Inderjeet Singh, Director, CIRB were the Guests of Honour. They felicitated the progressive equine owners from Haryana who have contributed significantly in conservation of equines. They also released a mobile app "Infoequine" developed by NRCE Scientists and distributed prizes to the winners of drawing competition. Dr BN Tripathi, Director NRCE presided over the function and apprised the dignitaries about the research activities and accomplishment of the Centre in the area of equine production. On this occasion, Mr Rajender Arora delivered a lecture on "Meditation for boosting productivity and stress management".

Chairman, Haryana Kissan Aayog addressing NRCE staff

Drawing Competition organized on Foundation Day

On the eve of NRCE Foundation day, a drawing competition was organized for school children on the theme "Horse as Companion Animal. A total of 55 students from 11 schools of Hisar participated. Mr. Shubham DPS, Hisar and Ms. Polina, Moga Devi Minda Memorial School bagged the first prizes under category VIII - X and XI - XII standard respectively.

Drawing competition winners receiving award

Tree plantation on *Van Mahotsav* at NRCE

Scientists and technical staff of Equine Production Campus, Bikaner participated enthusiastically in the Van mahotsav by planting Indian rosewood, Dalbergia and 200 other plants at the campus on August 8, 2017. Tree plantation was again done on September 19, 2017 in collaboration with Mahavir International, Bikaner when more than 1000 neem plantation was done.

Tree plantation during Van mahotsav

Scientists interact with farmers under '*Mera Gaon Mera Gaurav*' programme

My Village My Pride scheme - Mera Gaon Mera Gaurav - was launched by the Hon'ble Prime Minister on July 25, 2015 with an aim to promote the direct interface of scientists with the farmers to hasten the lab to land process and to provide farmers with required information, knowledge and advisories on regular basis by adopting villages. NRCE has adopted villages through six teams of scientists. During the year, six different scientific groups were formed involving twenty scientists from the Institute. The scientists coordinated agriculture, animal health related activities and social awareness through developing linkages with local government and village Panchayat officials. The emphasis was laid on creating awareness about diagnosis and treatment of affected animals, soil conservation, controlled use of chemical fertilizers and misuse of oxytocin by the dairy farmers. Social campaign on 'save girl child' was also undertaken in this programme.

Summary of activities organized under MGMG

Name of activity	No. of activities	Farmers participated
Visit to village by teams	26	1082
Interface meeting/ Goshthies	20	342
Training organized	-	-
Demonstrations conducted	5	108
Mobile based advisories	11	150
Literature support provided	70	98
Awareness created	21	590
Input support provided (q)	6	93
Total	159	2463

Students apprised of career opportunities in agriculture and allied subjects

The Centre celebrated "Agriculture Education Day" at Government Senior Secondary School, village Kajla (Hisar) on December 1, 2017. Sixty students of class IX and Xth and faculty members of the school participated in the programme. The students were apprised of the career opportunities in Agriculture, Animal husbandry and allied fields through expert lectures. They were also guided about admission procedures and courses being offered by academic institutions. A quiz was organized for students covering general awareness and basic knowledge in Agriculture & Animal Husbandry.

Expert lecture on career opportunities

Controlled use of chemical fertilizers discussed on World Soil Day

On the occasion of "World Soil Day" on December 05, 2017, NRCE organized lecture on controlled use of chemical fertilizers at village Rajli, Hisar to educate farmers regarding importance of soil conservation. About 100 farmers attended the programme in which scientists of NRCE responded to the farmers' queries related to livestock rearing.

Scientists interacting with farmers

Centre celebrated Republic Day with gaiety and patriotic passion

NRCE celebrated India's 69th Republic Day in the Campus premises. After hoisting of the National Flag, Dr B.N Tripathi, Director inspired the staff and families by commemorating a series of incidents in the history of India for the attainment of independence, making India a republic. To mark the day, children of the employees took pride in glorifying and celebrating the spirit of unity. On this occasion appreciation certificates and awards were presented to Dr Taruna Anand (Scientist), Sh. Sita Ram, (Senior Technical Officer), Dr Jitender Singh, (Senior Technical Officer), Sh. Sajjan Kumar, (Technical Officer), Sh. Gopal Nath (T1), Sh. Sunil, Assistant, Sh. Guru Dutt Sharma, (SS Staff), Sh. Ishwar Singh, SS Staff (Agri Section) for their outstanding contribution during the year.

हिन्दी प्रसार हेतु आयोजित विभिन्न गतिविधियां

भारत सरकार की राजभाषा की कार्यन्वयन समिति के तत्वावधान में हिन्दी पखवाडे का आयोजन 14 से 28 सितम्बर, 2017 को किया गया। इस कार्यक्रम में स्थानीय दयानन्द महाविद्यालय, हिसार के डॉ. सुरेन्द्र कुमार बिश्नोई, सहायक प्रोफेसर (हिन्दी विभाग) विशिष्ट अतिथि ने हिन्दी भाषा में प्रयुक्त होने वाले विभिन्न शब्दों व उनके समुचित अर्थों के बारे में भी विस्तृत जानकारी प्रदान की। कार्यक्रम के अध्यक्ष व केन्द्र के निदेशक डॉ. भूपेन्द्र नाथ त्रिपाठी ने अपने संबोधन में सभी हिन्दी प्रेमियों से कहा कि अनेकता में एकता का स्वर हिन्दी के माध्यम से गूंजता है। इस दौरान विभिन्न ज्ञानवर्धक एवं रूचिपूर्ण हिन्दी प्रतियोगिताओं क्रमशः निबंध प्रतियोगिता, हिन्दी परिच्छेद अनुवाद प्रतियोगिता, हिन्दी श्रुत लेख प्रतियोगिता (अहिन्दी भाषियों के लिए), हिन्दी आशुभाषण प्रतियोगिता, हिन्दी प्रश्नोत्तरी प्रतियोगिता, हिन्दी कविता पाठ एवं सुलेख प्रतियोगिता, हिन्दी टंकण प्रतियोगिता आदि का आयोजन किया गया। निदेशक महोद्य ने हिन्दी पखवाड़ा में बच्चों की प्रतिभागिता की सराहना की और उन्हें पुरस्कार देकर प्रोत्साहित किया।

केन्द्रीय कार्यालयों के कर्मचारियों के बच्चों की कविता पाठ प्रतियोगिता

समापन समारोह के दिन केन्द्रीय कर्मचारियों के लिए कविता पाठ प्रतियोगिता करवाई गई एवं विजेताओं को पुरस्कार दिए गए। मुख्य अतिथि डॉ प्रमोद बत्रा, कमांडेंट ईबीएस ने हिन्दी के उत्थान एवं हिन्दी की महत्ता पर संबोधन दिया। श्री महेन्द्र पाल कुलश्रेष्ठ, निदेशक राष्ट्रीय सूचना केन्द्र, हिसार विशिष्ट अतिथि ने अपनी मधुर आवाज में गज़ल प्रस्तुत कर श्रोताओं को मंत्रमुग्ध कर दिया। केन्द्र के निदेशक ने संस्थान के कर्मियों को अधिकाधिक हिन्दी में कार्य करने के लिए प्रेरित किया। बीकानेर में भी जून 22, 2017, अक्टूबर 20, 2017, दिसम्बर 29, 2017 एवं मार्च 28, 2018 को बैठकें की गई।

हिन्दी कार्यशालाओं का आयोजन

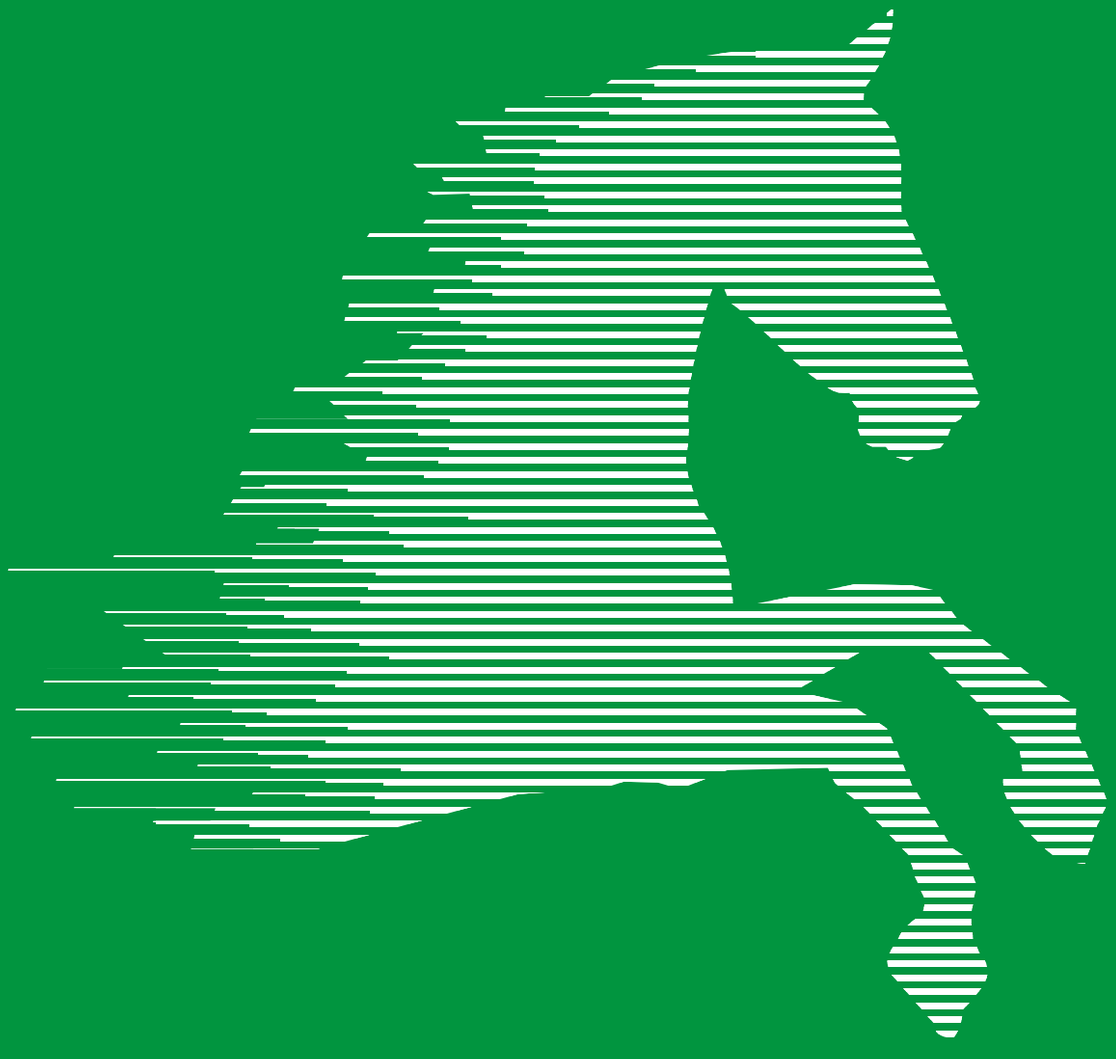
समय-समय पर हिन्दी के उत्थान और विकास हेतु एवं वैज्ञानिकों व कर्मचारियों को अधिकाधिक कार्य हिन्दी में करने के लिए केन्द्र में कार्यशालाओं का आयोजन मई 17, 2017, दिसम्बर 29, 2017 एवं मार्च 17, 2018 को किया गया। इसके अतिरिक्त केन्द्र की राजभाषा कार्यान्वयन समिति के निर्णयों पर क्रियान्वन व अनुपालन के लिए मई 16, 2017, सितम्बर 5, 2017, 26 दिसम्बर, 2017 एवं मार्च 20, 2018 को बैठकें आयोजित की गई।

DD Kisan Broadcasts discussion on glanders

Dr B.N. Tripathi, Director, NRCE, Dr Ashok Kumar, ADG, Animal Health, ICAR & Dr Harisankar Singha participated in a discussion on DD Kishan channel on equine glanders. Main objective of the programme was to make the equine farmers aware of glanders disease. The programme was broadcasted on 19th January, 2018 at 10 PM.

NRCE upgraded to ISO 9001 : 2015

In an effort to continuous quality improvement, NRCE has been awarded ISO9001:2015 certification in recognition of its Quality Management System in the area of '*Research and Development for Improving Equine Productivity, Disease Diagnosis and Microbial Conservation*'. This certificate is valid till 10 March 2019.



IRC, RAC and Research Review Meetings

Annual Institute Research Committee (IRC) Meeting

The annual meeting of Institute Research Committee (IRC) was held under the chairmanship of Dr B.N. Tripathi, Director, ICAR-NRCE during 26-29 May, 2017 for appraisal of the research achievements of the ongoing research projects and also to consider new research project proposals. A total of 37 research projects (24 institutional and 13 externally funded) and 5 new concept notes were discussed in the meeting. The chairman expressed satisfaction on quality of the research and publications by the Centre. He urged the scientists to continue the hard work and concentrate more on the output oriented research so that the institute can be self-sustained. He emphasized that the technologies generated by the institute like lateral flow assays for glanders and trypanosomiasis should be transferred to field at the earliest for benefit of the farmers. He advised the scientist that while doing inter-institutional collaborations in research, the interests of the institute should be protected and cost & benefit ratio should be properly analyzed.

IRC in progress

Half Yearly Institute Research Committee (IRC) Meeting

Half yearly IRC meeting of ICAR-NRCE was held on 10 October, 2017 under the chairmanship of Director, NRCE, Hisar. In this meeting, 34 research projects operational at the Centre including 22 institutional and 12 externally funded projects were discussed. The Chairman motivated all the scientists for submitting proposals for external funding. He also invited suggestions from all the scientists for new initiative to optimize resource use to boost research activities. A plan to develop equine tourism at EPC Bikaner campus was also discussed in the meeting. In the meeting it was also suggested to develop Central Instrumentation Laboratory for optimal use of resources.

Director interacting with scientists during IRC

Project Monitoring Committee Meeting at EPC Bikaner

The 2nd Project Report Monitoring Committee on Inter-institutional Project "Feasibility studies on biogas and compost production from mule dung in hilly regions" was held at Equine Production campus, Bikaner on October 30, 2017 under the chairmanship of Dr Anjan K. Kalia, President Biogas Forum, India. The meeting was attended by Dr H. Rahman,

Regional Representative South Asia, ILRI and Dr B.N. Tripathi, Director, NRCE. The Chairman said that to meet environmental challenges like straw burning composting and vermicomposting are good alternatives. He also emphasized to produce technologies, which are economically viable and has broad application in animal husbandry.

New Research Advisory Committee (RAC) of NRCE

ICAR has constituted new Research Advisory Committee for ICAR-NRCE under the provision of Rule 71A (a) 5 of the Rules and Byelaws of the ICAR Society for a period of 3 years w.e.f. 16 March 2018.

S.No.	Name and Address	Status
1	**Prof. M.P. Yadav** Former Vice-Chancellor I.V.R.I., Izatnagar and SVPUAT, Meerut	Chairman
2	**Dr Lal Krishna** Former ADG (AH), ICAR, New Delhi	Member
3	**Brig. (Dr) S. S. Kashyap** Commandant RVC, Eastern Region, Kolkata	Member
4	**Dr Devender Swarup** Former Director- CIRG, Makhdoom	Member
5	**Dr M. S. Oberoi** Former Animal Health Expert, FAO for SAARC	Member
6	**Dr S. N. Singh** MD, Biovet Pvt Ltd , Bengaluru	Member
7	**Dr Ashok Kumar** ADG (AH), ICAR, New Delhi	Member
8	**Dr B. N. Tripathi** Director, ICAR- NRC on Equines, Hisar	Member
9	**Dr Yash Pal** Pr. Scientist & I/c PME Cell, ICAR-NRC on Equines, Hisar	Member Secretary

Research Advisory Committee reviews research progress

The 21st meeting of RAC to review the research progress during 2017-18 was held under the chairmanship of Prof. M.P. Yadav on 7 April 2018 at ICAR-NRCE, Hisar. Director ICAR-NRCE welcomed the members of new Research Advisory Committee and presented research achievements of the Centre during 2017-18. The RAC reviewed various institute funded and externally funded research projects of the institute in the areas of equine production, equine health and Veterinary Type Cultures. While appreciating the research work at the Centre, the Chairman emphasized the importance of dissemination of the research findings to stakeholders. The RAC advised scientists to work on non-infectious (gastrointestinal and metabolic) diseases, antimicrobial resistance and equine behaviour.

RAC members discussing research priorities of the Centre

Visit of Dignitaries

Sh. Roul applauds the research activities at NRCE, Hisar

Sh. Chhabilendra Roul, Hon'ble Additional Secretary, DARE & Secretary, ICAR, visited NRCE on May 04, 2017. Dr B.N Tripathi, Director, NRCE appraised about the various ongoing research activities and achievements of the Centre. Sh. Roul applauded the efforts of the Centre and its pace in research pertaining to the equines. He assured full support to NRCE from ICAR and congratulated all the scientists for their future endeavors.

Secretary ICAR visiting Equine Info-Museum

Director General, ILRI appreciates NRCE research activities

Dr Jimmy Smith, DG, ILRI, visited NRCE on June 23, 2017. During his visit, he was very much impressed to witness the excellent research accomplishments in the area of equine health. He congratulated NRCE staff for the brilliant work and expressed his desire to collaborate with NRCE in future.

Plantation at NRCE by Dr Jimmy Smith
DG, ILRI, Kenya

Prof. K.P. Singh, visits NCVTC and BSL-3

Prof. K.P. Singh, Vice Chancellor, CCSHAU, Hisar visited NRCE on June 28, 2017. He was impressed with the diagnostic laboratories and excellent BSL-3 facility. Dr Singh desired active collaboration and sharing of infrastructure between NRCE and CCSHAU.

Prof. K.P. Singh during his visit to laboratory

Commandant, Equine Breeding Stud, Hisar visits NRCE

Brig. S.S. Kashyap, Commandant EBS, Hisar visited NRCE on August 14, 2017. He shared his experiences on diverse topics including equine management, feeding and reproduction. He also discussed different health problems encountered by organized equine farms. He emphasized the need for more collaborative efforts between EBS and NRCE. He thanked Director, NRCE for whole hearted support in managing health issues at EBS.

Commandant EBS interacting with NRCE staff

VC GJUS&T appreciates R&D activities at NRCE

Prof. Tankeshwar Kumar, Vice-chancellor Guru Jambheshwar University Science and Technology visited NRCE on September 5, 2017. He was Chief Guest on the occasion of inaugural ceremony of Bioinformatics Training Programme being conducted at NCVTC. He applauded the activities and infrastructure at NRCE and NCVTC, Hisar. He expressed desire to share resources of with NRCE.

VC, GJUS&T during his visit to NCVTC

Dr Ramesh Kumar Yadav applauds contributions of NRCE

Dr Ramesh Kumar Yadav, Chairman, Kisan Ayog, Government of Haryana and Dr M.C. Sharma, former Director and Vice chancellor, IVRI Izatnagar, Bareilly visited NRCE on November 26, 2017. They applauded the research work being undertaken by the scientists and were impressed with the technologies being generated by the NRCE team.

Chairman Kisan Aayog at NRCE

Dr J.K. Jena, DDG (AS) motivates the scientists for team work

Dr J.K. Jena, Deputy Director General (AS) visited NRCE on December 21, 2017. He interacted with the scientists and staff of the Centre and offered all help from the ICAR headquarters to carry on the good work. Dr Jena motivated scientists to work in team mode to achieve new horizons in science. He also stressed upon increased resource generation by the centre.

Dr J.K. Jena visiting Equine Info-Museum

Dr R.K. Singh, Director IVRI visits NRCE

Dr R.K. Singh, Director & Vice-Chancellor, Indian Veterinary Research Institute, Izatnagar visited NRCE on December 22, 2017. He was satisfied to see the good work being done by scientists and efforts being taken in conservation of microbial diversity at NCVTC. He encourages scientists to carry out cutting edge research in equine health and management.

Dr R.K. Singh visiting NRCE

Dr Madan appreciates AI programme in equines

Dr M L Madan, Ex DDG (Animal Sciences) visited Equine Production Campus, Bikaner on October 27, 2017. Dr S C Mehta, In-charge, EPC briefed him activities of the Centre in equine conservation. Dr Madan showed keen interest in the semen cryopreservation and artificial insemination technique in equines

Dr Madan interacting with the scientists at EPC Bikaner

Prof. M P Yadav stressed on commercialization of technologies

Prof. M P Yadav, former Vice-chancellor, SVPUAT, Meerut and IVRI, Izatnagar visited NRCE on December 27, 2017. He interacted with the scientists and enquired about the progress of research activities in their laboratories. He stressed the need for commercialization of vaccines & diagnostics developed by the Centre for the benefit of the stakeholders

Prof. M P Yadav during his visit to NRCE laboratories

Dr Jena encourages the scientist at EPC, Bikaner

Dr Joykrushna Jena, Deputy Director General (Animal Science), ICAR, New Delhi visited Equine Production Campus, Bikaner on January 20, 2018. Dr B N Tripathi, Director and Dr S.C. Mehta briefed him about the mandate and achievements of the Bikaner Campus. DDG interacted with the scientists and staff of the campus at Bikaner and encouraged the scientists to undertake developmental projects for the benefit of people of arid region.

Dr J K Jena visiting at Bikaner

Sh R.P. Singh Visits both campuses

Sh. R.P. Singh, Member of Governing Body, ICAR Visited NRCE, Hisar and Bikaner Campuses during 24-26 March 2018. He was apprised about the activities of the Centre by Director, NRCE. During his visit at Bikaner campus, he took keen interest in equine eco-tourism activities and appreciated the Marwari horse conservation efforts of the Campus. During his address to the staff, he emphasized to understand the needs of the stakeholders and develop farmer friendly technologies to enhance their income.

Sh RP Singh during his visit at the Centre

Visitors from Abroad

Dr Vivek Kapur interacted with the scientists of NRCE

Dr Vivek Kapur, Associate Director for Strategic Initiatives, Huck Institutes of the Life Sciences, Penn State, USA visited NRCE on July 3, 2017 for exploring inter-institutional collaboration for poultry viruses. He expressed happiness to witness the excellent infrastructure facilities and enthusiasm of NRCE staff in research pursuits. He also visited BSL-3 and NCVTC laboratories and applauded the visionary approach of ICAR authorities.

Dr Vivek Kapur deliberating with scientists

Dr Sagar Goyal, University of Minnesota, St. Paul, USA along with a team including Robert Emerson Trite, Christopher Ronda Lewis, and Valerie Anne Deacon, from Defense Threat Reduction Agency (DTRA), Cooperative Biological Engagement Programe (CBEP), USA visited NRCE on 5th Feb., 2018. They were very impressed with the activities of the centre and expressed the desire to explore collaborations with NRCE.

Dr Caitlin Holley, OIE (Asia & Pacific), John Weaver, WCI, Hong Kong, OIE, Susanne Munsterman, Animal Helath Consultant OIE visited NRCE on 21stFeb., 2018. They were impressed by the research being carried out at NRCE and shown keen interest in the activities.

OIE team deliberating with NRCE scientists

Dr Yisehak Tseqaje Redda appreciates R&D activities at NRCE Campus

Dr Yisehak Tseqaje Redda from Mekelle University, Ethiopia visited NRCE on April 20, 2017. During his visit, he was impressed with the unique and exemplary work in the area of equine health at NRCE, Hisar. He also appreciated the efforts of NRCE to get OIE reference status for diagnosis of glanders, piroplasmosis and equine influenza.

Infrastructure and Developmental Activities

Horse statue unveiled by Sh. Roul at Hisar Campus

Sh. Chhabilendra Roul, Additional Secretary, Department of Agricultural Research & Education visited NRCE, Hisar on June 6, 2017 and unveiled the statue of the horse in the campus. Sh. Roul applauded the accomplishments of the centre in the field of equine health and production.

Equine eco-tourism Initiated at Bikaner campus

The Centre is committed for conservation and propagation of the elite equines in the country. For this, equine eco-tourism has been initiated at Bikaner campus. Under this, an equine information centre has been developed to display technical details of indigenous equine breeds and husbandry practices. In addition, a museum showcasing equine harnessing implements and other accessories used for equine operations has been started. Souvenir Shops have also been opened for popularizing handicrafts, leather items and other accessories used for horse rearing.

The activity was inaugurated on October 29, 2017 in a function chaired by Dr Vishwanath, Parliamentary Secretary, GoI. In this function, a horse show involving tent pegging and horse jumping was organized by NCC wing of Bikaner.

A mobile app "Info-equine" developed for stakeholders

A user friendly mobile app "Info-equine" was developed by ICAR-National Research Centre on Equines, Hisar. It is a bilingual mobile app in Hindi and English language useful for equine owners, veterinary officers, animal health department officials, students and other stakeholders. This app provides general information about the equine breeds, diseases, nutrition, breeding and management and allows users to know about the diagnostic services, artificial insemination services being provided by the Centre. This App may be downloaded directly from the Google Play Store. Releasing the App on 26 November 2017, Dr Ramesh Yadav, Chairman Kissan Aayog appreciated the efforts of Drs Anju Manuja, Hema Tripathi, Rajender Kumar under guidance of Director NRCE in developing very useful App.

Herbal Park developed at EPC Bikaner

A herbal park developed at EPC, Bikaner. Dr M.C. Sharma, Chairman, Veterinary Hospital Planning & Surgical Instruments Sectional Committee, Bureau of Indian Standards planted a *Tulsi* plant on December, 14, 2017. This park is being developed in one acre of arid land by planting twenty different herbal plants.

Addressing the scientists, Dr Sharma emphasized on use of herbal medicine in the treatment of animal diseases. The Director NRCE deliberated on doubling farmers' income through herbal plant cultivation.

Livestock Strength

At present, 147 equines of various breeds are being maintained at Hisar and Bikaner, including 57 horses, 32 ponies, 49 donkeys and 6 mules. At Bikaner campus, there are 123 equines, including Marwari (42) & Kathiawari (3) horses; Zanskari (16) & Manipuri (14) ponies; Poitou (29) & indigenous donkeys (14) and mules (5).

Equine herd strength at Hisar Campus

Category	Horses		Ponies		Donkeys		Mules		Total
	M	F	M	F	M	F	M	F	
Stock as on 1.4.2017	3	11	2	0	3	4	1	0	24
Births	1	0	0	0	0	0	0	0	1
Deaths	0	0	0	0	0	1	0	0	1
Balance as on 31.3.2018	**4**	**11**	**2**	**0**	**3**	**3**	**1**	**0**	**24**

Equine herd strength at EPC, Bikaner

Category	Horses				Ponies				Donkeys				Mules		Total
	Marwari		Kathiawari		Zanskari		Manipuri		Exotic		Indigenous				
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
Stock as on 01.04.2017	11	26	0	02	06	09	06	08	11	16	05	07	04	01	112
Birth	06	01	0	01	0	01	01	0	02	02	01	01	0	0	16
Death	02	0	0	0	0	0	0	01	0	01	0	0	0	0	04
Auctioned / sold	0	0	0	0	0	0	0	0	01	0	0	0	0	0	01
Balance as on 31.03.2018	15	27	0	03	06	10	07	07	12	17	06	08	04	01	123
G. Total	**42**		**03**		**16**		**14**		**29**		**14**		**05**		**123**

Agriculture Production

During 2017-18, 220 acres of land was cultivated (140 acre at Hisar and 80 acres at Bikaner). The land was rotationally used for cultivating green fodder, dry fodder and grains for feeding equines at our farms. During the year, total farm production was 5792.27 quintals, including 3670.8 quintals of green fodder, 1080.1 quintals of dry fodder and 1041.37 quintals of grains.

Agriculture production at NRCE (2017-18)

Type of Crop	Production (in Quintals)	
	Hisar	Bikaner
Green Fodder		
Oats	244	876.95
Berseem	85.5	0
Lucerne	133.5	565.25
Sorghum, Sudan grass+Cowpea	266	0
Sorghum Sudan grass	366	1043.70
Bajra	0	89.90
Total	1095	2575.8
Dry Fodder		
Oats, Bajra, Wheat straw etc	593.40	486.7
Grains		
Oats	107.34	333.15
Gram	7.10	0
Bajra	8.00	0
Guar	0	54.00
Barley	420.46	0
Moth	0	12.39
Paddy	98.93	0
Total	**641.83**	**399.54**

Awards, Recognitions & Personal Milestones

ISVIB fellowship to Dr Gulati

Dr Baldev R Gulati, Principal Scientist was conferred the Fellowship of Indian Society for Veterinary Immunology & Biotechnology (FISVIB-2016) in 23rd Annual Convention of ISVIB held at KNP College of Veterinary Science, Shirwal, Maharashtra, during April 17-19, 2017. He was also nominated as Chief Editor of the "Veterinary Immunology & Biotechnology" by Indian Society for Veterinary Immunology & Biotechnology.

NAVS (India) Fellowship to Dr Virmani

Dr Nitin Virmani, Principal Scientist was awarded the Fellowship of National Academy of Veterinary Sciences (FNAVS) in the National Convention of Veterinary Sciences held at College of Veterinary Sciences, Tirupati, Andhra Pradesh during November 4-5, 2017.

Lal Bahadur Shastri award to Dr Taruna Anand

Dr Taruna Anand was awarded "Lal Bahadur Shastri Outstanding Young Scientist award- 2016" in Animal and Fisheries Sciences Category during ICAR Foundation Day and Annual Award Ceremony on July 16, 2017 at NASC auditorium, New Delhi by the Hon'ble Agricultural Minister Sh. Radha Mohan Singh. The award consisted of a cash prize of Rs. 1 lakh and a project on bacteriophages for a period of 3 years.

ICAR Cash Award 2016 to Sh Mukesh Chand

Sh Mukesh Chand, Senior Technical Assistant was awarded "ICAR Cash Award Scheme 2016" (Technical Category) during ICAR foundation day and annual award ceremony on July 16, 2017 at NAAS auditorium, New Delhi. The award consisted of Rs. 25500/ and a certificate of appreciation.

Outstanding Achievement award to Dr Legha

Dr R.A. Legha, Principal Scientist was bestowed with "Outstanding Achievement Award-2017" by the All India Agricultural Students Association for his outstanding contribution and recognition in the field of Livestock Production and Management on October 07, 2017 at RAJUVAS, Bikaner, Rajasthan.

Dr Anuradha Bhardwaj gets SBSS Women Scientist Award

Dr Anuradha Bhardwaj, Scientist was awarded the "Women Scientist Award-2017" by the Society for Bioinformatics and Biological Sciences (SBBS) during the International Conference on "Recent Trends in Bioinformatics and Biotechnology for Sustainable Development" held at Faculty of Veterinary Sciences & Animal Husbandry, SKUAST-J, R.S. Pura, Jammu J&K during October 12-13, 2017.

Young Scientist Award to Dr Talluri

Dr Thirumala R Talluri, Scientist was awarded the prestigious Prof. S.S. Guraya Young Scientist Award by Indian Society for Society Reproduction and Fertility (ISSRF) during February 23-25, 2018 at Indian Institute of Chemical Technology, Hyderabad, Telangana.

Best Oral Presentation Award to Dr Bera

Dr B.C Bera, Scientist was awarded "Best Oral Presentation Award" for his paper entitled "Codon usage preference and evolution of haemagglutinin genes of equine influenza (H3N8) virus" in the International Conference on Bio and Nano Technologies for Sustainable Agriculture, Food, Health, Energy and Industry by Society for Sustainable Agriculture & Resource Management, held at Guru Jambheshwar University of Science & Technology, Hisar, Haryana during February 21-23, 2018.

Skill upgradation

- Dr Yash Pal, Principal Scientist completed LLB (Professional) 3 year degree from Kurukshetra University, Kurukshetra in May 2017.
- Dr Shanmugasundaram Karuppusamy, Scientist completed his PhD from University of Guelph, Guelph, Ontario, Canada and joined back on June 12, 2017. He was deputed to pursue his PhD program under ICAR International Fellowship program in the month of January 2012. During his PhD research, he worked on "Proteomic approaches to early diagnosis of Johne's disease in dairy cows" under the guidance of Dr Gordon M. Kirby.

Joining, Transfers, Retirements

- Dr S.C. Mehta, Principal Scientist (Animal Genetics and Breeding) joined at Equine Production Campus, Bikaner on July 4, 2017 subsequent to his transfer from National Research Centre on Camel, Bikaner.
- Dr Ashok Kumar Gupta, Principal Scientist retired on October 31, 2017 after successful completion of 39 years 10 months of service in ICAR.

Nomination of Dr BN Tripathi, Director NRCE in different committees

1. Member, Task Force of DBT on "Translational Research and Product Development in Veterinary Vaccines and Diagnostics" for a period of 3 years *w.e.f* 23 June 2017.
2. Technical Advisor (Member), Board of Management of Lala Lajpat Rai University of Veterinary and Animal Sciences (LUVAS), Hisar, 2014-17.
3. Member, Research Advisory Committee of ICAR-NRCE, Hisar from 2014.
4. Member, Research advisory committee of Lala Lajpat Rai University of Veterinary and Animal Sciences (LUVAS), Hisar.

Promotions

1. Sh. Sanjeev Kumar, Technical Officer has been promoted to Sr Technical officer w.e.f. January 1, 2016.
2. Sh. Joginder Singh, Sr Technical Assistant has been promoted to Technical officer w.e.f. November 10, 2015.
3. Sh. Mukesh Chand, Sr Technical Assistant has been promoted to Technical officer w.e.f. January 1, 2017.
4. Dr R.A. Pachouri, Technical Officer has been promoted to Sr Technical officer w.e.f. January 1, 2012.
5. Sh. Narender Chauhan, Technical Officer has been promoted to Sr Technical officer w.e.f September 13, 2015.
6. Sh. S.N Paswan, Technical Assistant has been promoted to Sr Technical Assistant w.e.f. May 31, 2016.
7. Sh. Ashok Kumar, Personal Assistant has been financially upgraded to a Grade Pay of 4800 w.e.f. October 1, 2017.
8. Sh. Pratap Singh, U.D.C has been financially upgraded to a Grade Pay of 2800 w.e.f. February 29, 2012.
9. Sh. Ishwar Singh, Skilled Supporting Staff has been financially upgraded to a Grade Pay of 2400 w.e.f. September 21, 2017.
10. Sh Guru Dutt, Skilled Supporting Staff has been financially upgraded to a Grade Pay of 2400 w.e.f. September 21, 2017.
11. Sh Jai Singh Skilled Supporting Staff has been financially upgraded to a Grade Pay of 2400 w.e.f. September 21, 2017.
12. Sh. Sant Ram Skilled Supporting Staff has been financially upgraded to a Grade Pay of 1900 w.e.f. November 17, 2017.

A Painting by ***Monalisa***,
Class IX Student
Army Public School, Hisar
On the occasion of NRCE Foundation Day

Publications

RESEARCH PAPERS

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24. Rathore NS, Thirumala TR, Kumar P, Deora A, Nathawat P and Gahlot K. 2017. Protein characterization analysis and identification by MALDI-TOF Mass Spectrometry. In: National Symposium on "Innovative and Emerging Biochemical and Biotechnological Tools to Augment Animal Health and Production" and Second Annual Convention of Society of Veterinary Biochemists and Biotechnologists of India-2017, Veterinary College, Hebbal, Bangalore, Karnataka, June 2-3.

25. Rathore NS, Talluri TR, Kumar P, Kashyap SK. Isolation culture and characterisation of mesenchymal stem cells isolated from wharton's jelly and umblical cord of marwari mares. In: National Symposium on "Innovative and Emerging Biochemical and Biotechnological Tools to Augment Animal Health and Production" and Second Annual Convention of Society of Veterinary Biochemists and Biotechnologists of India-2017, Veterinary College, Hebbal, Bangalore, Karnataka, June 2-3.

26. Ravi SK, Talluri TR, Vaid RK, Legha RA, Singh J, Pal J and Tripathi BN. 2018. Incidence of reproductive disorders in mares and their management. In XXXIII Annual Convention and National Symposium of ISSAR on "Use of reproductive technologies and production improvement in livestock species aiming to socio-economic development of rural mass", West Bengal University of Animal & Fishery Sciences, Kolkata, February 9-11.

27. Selokar NL, Talluri TR, Kumar C, Krishna A, Ravi SK, Kumar D, Yadav PS and Tripathi BN. 2018. Comparative study of oocyte retrieval from mare and buffalo ovaries. In XXXIII Annual Convention and National Symposium of ISSAR on "Use of reproductive technologies and production improvement in livestock species aiming to socio-economic development of rural mass", West Bengal University of Animal & Fishery Sciences, Kolkata, February 9-11.

28. Talluri TR, Ravi SK, Singh C, Legha RA, Mehta SC and Tripathi BN. 2018. Cryoprotective effect of two different cryoprotectants on exotic stallion and donkey semen. In XXXIII Annual Convention and National Symposium of ISSAR on "Use of reproductive technologies and production improvement in livestock species aiming to socio-economic development of rural mass", West Bengal University of Animal & Fishery Sciences, Kolkata, February 9-11.

29. Talluri TR and Kues WA. 2018. Application of non-viral methods in production of iPS cells and genetic engineering technologies in livestock. In: The world Congress on Reproductive Health with Emphasis on Family Planning and Assisted Reproductive Technology and 28th Annual Meeting of the ISSRF,

Hyderabad, February 23-25.

30. Talluri TR, Selokar NL, Kumar C, Krishna A and Kumar D. 2018. Comparative study of oocyte retrieval from mare and buffalo ovaries. In: The world Congress on Reproductive Health with Emphasis on Family Planning and Assisted Reproductive Technology and 28th Annual Meeting of the ISSRF, Hyderabad, February 23-25.

BOOKS, BOOK CHAPTERS, TECHNICAL BULLETINS, POPULAR ARTICLES

1. Gulati BR, Soman R, Punia S and Tripathi BN. 2017. Current status of Japanese encephalitis virus infection among animals in India and role of pigs in its transmission. Compendium of Lead Papers of Satellite Seminar on "Emerging and re-emerging infectious diseases and their impact on pig health and productivity", ICAR National Research Centre on Pig, Rani, Guwahati, December 20.
2. Legha RA and Talluri TR. 2017. Identifying breeds, characterization and their prioritization for conservation. In: Training manual published under ICAR Sponsored Winter School by the Department of Livestock production Management, RAJUVAS, Bikaner. pp 84-89.
3. Manuja A, Kumar B. 2017. Applications of nanoparticles for therapeutics against infectious diseases. In: Compendium of ICAR-CAFT on "Microbial Genomics and Proteomics in Diagnosis and Control of Diseases of Veterinary Importance, Department of Biotechnology, LUVAS, Hisar, pp 50-53.
4. Manuja A, Kumar B. 2017. Resazurin cytotoxicity assays. In: Compendium of ICAR-CAFT on "Microbial Genomics and Proteomics in Diagnosis and Control of Diseases of Veterinary Importance, Department of Biotechnology, LUVAS, Hisar, pp 118.
5. Mehta SC. 2018. Strategies for enhancing farmer's income through livestock and poultry diversity. In: National Symposium on Sustainable Management of Livestock and Poultry Diversity for Enhancing the Farmers' Income, College of Veterinary and Animal Sciences, RAJUVAS, Bikaner, February 8-10.
6. Nayan V, Panghal S, Bhardwaj A., Balhara AK, Phulia SK and Sharma RK. 2017. Genomic technologies for climate resilient livestock production. In Climate Smart Buffalo Husbandry Published by ICAR-CIRB, Hisar, pp 68-71.
7. Pal Y. 2017. Present status of donkeys in India and their conservation. In: Training manual published under ICAR Sponsored Winter School, Department of Livestock Production Management, RAJUVAS, Bikaner, pp 31-35.
8. Shakya J and Pal Y. 2017. Adaptability of Indian livestock production to climate change. In Climate Smart Buffalo Husbandry Published by ICAR-CIRB, Hisar, pp 73-76.
9. Talluri TR, Ravi SK, Singh J, Legha RA, Pal Y and Tripathi BN. 2017. Artificial insemination and pregnancy diagnosis in equines. Technical Bulletin, ICAR-NRCE, Hisar.
10. Talluri TR, Singh J and Ravi SK. 2017. Application of Ultrasonography in equine reproduction. Indian Farmer, 4: 546-555.
11. Talluri TR. 2017. Application of emerging reproductive biotechnologies in conservation of elite and endangering livestock. In: Training manual published under ICAR Sponsored Winter School, Department of Livestock Production Management, RAJUVAS, Bikaner, pp 173-180.
12. Talluri TR. 2017. Equine scenario in India and measures for the conservation and propagation of indigenous equines. In: Training manual published under ICAR Sponsored Winter School, Department of Livestock Production Management, RAJUVAS, Bikaner, pp 157-163.
13. Talluri TR. 2018. Mare as an animal model for the study of reproduction in women. Issue 21, pp 34-36.
14. Tripathi BN, Mehta SC and Talluri TR. 2017. Information Bulletin on Equine Ecotourism. NRCE Publications, pp 1-4.
15. Virmani N. 2017. Dissecting pathogenesis and mechanisms involved in equine influenza virus infection. In: Proceedings Asian Veterinary Pathology Congress-2017, Department of Veterinary Pathology, College of Veterinary Science & A.H., Hebbal, Bengaluru, November 9-11.

Participation, Presentation in Seminars, Conferences & Symposia

1. Dr Anju Manuja presented an invited paper on "Evaluation of ZnO nanoparticles and ZnO nanohydrogel on horse peripheral blood mononuclear cells" in National Conference on Recent Innovations in Science, Engineering, and Technology, Goa, 24 September 2017.
2. Dr Anuradha Bhardwaj participated in International Conference on "Recent Trends in Bioinformatics and Biotechnology for Sustainable Development" organized by Society for Bioinformatics and Biological Sciences (SBBS)-2017 at Faculty of Veterinary Sciences & Animal Husbandry, SKUAST, Jammu, 12-13 October 2017.
3. Dr Anuradha Bhardwaj participated in 9th Asian Buffalo Congress at ICAR-Central Institute for Research on Buffaloes Hisar - Haryana (India) from 1-4 February 2018.
4. Dr Anuradha Bhardwaj participated in XV Annual Convention of Society for Conservation of Domestic Animal Biodiversity (SOCDAB) and National Symposium on "Sustainable Management of Livestock and Poultry Diversity for enhancing the Farmers' Income" at RAJUVAS, Bikaner, Rajasthan, 8-10 February 2018.
5. Dr Baldev R Gulati presented an invited paper on "Current status of Japanese encephalitis virus infection among animals in India and role of pigs in its transmission" in IAVMI Satellite Seminar on 'Emerging and Re-emerging Infectious Diseases and their Impact on Pig Health and Productivity' at ICAR-National Research Centre on Pig, Rani, Guwahati, Assam, 20 November 2017.
6. Dr Baldev R Gulati presented a lead paper on "Changing epidemiological patterns of Japanese encephalitis infection and impact on animal health in India" in XXIV Annual Convention and National Conference of Indian Society for Veterinary Immunology and Biotechnology (VIBCON-2017) on "Recent Trends in Veterinary Immunology and Biotechnology for Doubling Farmers' Income through Livestock Health and Production" at College of Veterinary and Animal Sciences, Parbhani, Maharashtra, 5-7 December 2017.
7. Dr Baldev R. Gulati presented a lead paper on "Biotechnological Approaches for Meeting Challenges in Diagnosis and Control of Equine Herpes virus Infections". In: 23rd Annual Convention of Indian Society for Veterinary Immunology and Biotechnology and International Conference on "Challenges in Livestock and Poultry Production - Solution with Biotechnology" at KNP College of Veterinary Science, Shirwal, Maharashtra, 17-19 April 2017.
8. Dr Balvinder Kumar participated in 9th Asian Buffalo Congress, at ICAR-Central Institute for Research on Buffaloes Hisar - Haryana (India) from 1-4 February 2018.
9. Dr Bidhan Chandra Bera presented a paper on "Codon usage preference and evolution of haemagglutinin genes of equine influenza (H3N8) virus" in International conference on Bio and Nano Technologies for Sustainable Agriculture, Food, Health, Energy and Industry, Society for Sustainable Agriculture & Resource Management, Guru Jambheshwar University of Science & Technology, Hisar, 21-23 February 2018.
10. Dr Bhupendra N. Tripathi participated in 17th Indian Veterinary Congress & National Symposium on

"New Generation Vaccines, Diagnostics for improvement of Animal Health & productivity vis-à-vis Genomic Interventions in Animal Health & production for the societal benefit" at ICAR-IVRI, Izatnagar, 8-9 April 2017.

11. Dr Bhupendra N. Tripathi presented an invited paper on "Therapeutic role of bacteriophages in animal husbandry" in International Conference on Bacteriophages at Institute of Medical Sciences, Banaras Hindu University, Varanasi, 22-23 August 2017.
12. Dr Bhupendra N. Tripathi presented an invited paper on "Equine Glanders" in Asian Veterinary Pathology Congress-2017, Department of Veterinary Pathology, College of Veterinary Science &A.H., Hebbal, Bengaluru, 9-11 November 2017.
13. Dr Bhupendra N. Tripathi presented a lead paper on "Diagnosis, Control and Eradication of Equine Glanders" in National Sympsosium on Innovations in Animal Health – Current Challenges and Future Prospectives and XXXI Annual convention of Indian Association of Veterinary Microbiologists, Immunologists and Specialists in Infectious Diseases, Sri Venkateswara Veterinary University, Tirupati, 29-31 January, 2018.
14. Dr H Singha presented a paper on 'Glanders in India: Epidemiology and Control Strategies' in 9th Workshops of the European Union Reference Laboratory (EURL) for Equine Diseases on Glanders, ANSES-Maisons-Alfort, Paris, France, 28 June 2017.
15. Dr H Singha delivered a lecture on 'Glanders in India: Present Status and Control Strategies' in Emerging & Re-emerging Diseases of Livestock, their Prevention & Control in Workshop organized by Department of Animal Husbandry, Madhya Pradesh, Gwalior, 13-15 February 2018.
16. Dr Naveen Kumar presented a paper on "SERCA regulates paramyxovirus replication" in 26th Annual Conference of the Indian Virological Society (VIROCON-2017), Nitte University, Mangalore, 7-9 December 2017
17. Dr Naveen Kumar presented a poster on "MNK1 signaling regulates buffalopox virus replication" in International Conference on Microbial Health and Wealth, Maharshi Dayanand University, Rohtak, Haryana, 14 November 2017.
18. Dr Naveen Kumar participated in Microbiology Society Annual Conference 2017, Edinburgh, UK, 2-6 April 2017.
19. Dr Nitin Virmani presented a paper on "Dissecting pathogenesis and mechanisms involved in equine influenza virus infection" in Asian Veterinary Pathology Congress-2017, Department of Veterinary Pathology, College of Veterinary Science &A.H., Hebbal, Bengaluru, 9-11 November 2017.
20. Dr Prokasananda Bala presented a paper on "Concentrate mixture for equines of Rajasthan" in XVII Biennial Animal Nutrition Conference, Junagadh Agricultural University, Junagadh, Gujarat, 1-3 February 2018.
21. Dr RA Legha participated in Third International Conference on Bioresource and Stress Management (ICBSM), SIAM Institute, Jaipur, Rajasthan, 8-11 November 2017.
22. Dr RA Legha participated in Annual Workshop of All India Coordinated Research Project on Utilization of Animal Energy at VNMKV, Parbhani, Maharashtra, 30-31 January 2018.
23. Dr Riyesh T participated in International Conference on Microbes for Health and Wealth, Department of Microbiology, Maharshi Dayanand University, Rohtak, Haryana, 14 November 2017.
24. Dr RK Dedar presented a paper on "An epidemiological study of risk factors of equine colic" in 36th Annual Convention of Indian Society for Veterinary Medicine & National Symposium on "Animal Health Service Delivery - The Priorities of the Professionals for Enhancing Farmers' Income", College of Veterinary Science and Animal Husbandry, OUAT, Bhubaneswar, Odisha, 1-3 February 2018.
25. Dr RK Dedar presented a paper on "Oxidative stress biomarkers in horses showing high serum gamma-glutamyltransferases (GGT) levels" in 36th Annual Convention of Indian Society for Veterinary Medicine & National Symposium on "Animal Health Service Delivery - The Priorities of the Professionals

for Enhancing Farmers' Income", College of Veterinary Science and Animal Husbandry, OUAT, Bhubaneswar, Odisha, 1-3 February 2018.

26. Dr SC Yadav presented a lead paper on "Lateral Flow Immunoassay Assay: A New Approach for Diagnosis of Trypanosoma evansi Infection in Equines" in XXVII National Congress of Veterinary Parasitology and National Symposium, College of Veterinary and Animal science, Navania, Udaipur, 12-14 February 2018.
27. Dr SC Mehta presented a theme paper on "Strategies for Enhancing Farmers' Income through Livestock and Poultry Diversity" in XV Annual Convention of Society for Conservation of Domestic Animal Biodiversity (SOCDAB) and National Symposium on "Sustainable Management of Livestock and Poultry Diversity for Enhancing the Farmers' Income", RAJUVAS, Bikaner, Rajasthan, 8-10 February 2018.
28. Dr Sanjay Ravi presented a paper on "Incidence of reproductive disorders in mares and their management" in XXXIII Annual Convention and National Symposium of ISSAR on "Use of Reproductive Technologies and Production Improvement in Livestock Species Aiming to Socio-Economic Development of Rural Masses", West Bengal University of Animal & Fishery Sciences, Kolkata, 9-11 February 2018.
29. Dr Sanjay Barua and Dr BN Tripathi presented "NCVTC profile for designation as a National Repository" in 43rd National Biodiversity Authority (NBA) Meeting, Chennai organized by the National Biodiversity Authority (NBA), Ministry of Environment and Forests, Government of India, Chennai, 28 November 2017.
30. Dr Shanmugasundaram K presented a poster on "Diagnosis of Johne's Disease using antigenically distinct proteins from the cell envelope of Mycobacterium avium ss paratuberculosis" in Asian Veterinary Pathology Congress-2017, Department of Veterinary Pathology, College of Veterinary Science & A.H., Hebbal, Bengaluru, 9-11 November 2017.
31. Dr TR Talluri delivered an invited talk on "Application of non-viral methods in production of iPS cells and genetic engineering technologies in livestock" in 28th Annual Meeting of the ISSRF and World Congress on Reproductive Health with Emphasis on Family Planning and Assisted Reproductive Technology, Hyderabad, 23-25 February 2018.
32. Dr Yash Pal presented a paper on "Composition of equine milk in comparison to different milk species" in XV Annual Convention of Society for Conservation of Domestic Animal Biodiversity (SOCDAB) and National Symposium on "Sustainable Management of Livestock and Poultry Diversity for enhancing the Farmers' Income", RAJUVAS, Bikaner, Rajasthan, 8-10 February 2018.

Meetings attended by Dr B. N. Tripathi, Director, NRCE

1. National Academy of Veterinary Sciences meeting at New Delhi on 22 April 2017.
2. ICAR Review Committee interactive meeting of Animal Science and Fisheries Divisions at NIAP, New Delhi and presented work done by NRCE and its relevance in the country on 24 April 2017.
3. First meeting of Haryana State Committee organized at ICAR- NDRI, Karnal under the Chairmanship of Vice- Chancellor, CCS HAU, Hisar to develop strategies for doubling of farmers' income by March, 2022 on 29 April 2017
4. A meeting under the Chairmanship of AHC, Department of DADF, Govt. of India at Krishi Bhavan, New Delhi to review Glanders disease situation in the country and control & containment measures to check the spread of the disease in equines on 19 June 2017.
5. Meeting with HD, Pathology, about ORW of Ph.D. student and interaction with scientists and students of pathology during 08-09 July 2017.
6. 34th Meeting of the Board of Management of GADVASU, Ludhiana in the Committee Room of

PAU Camp Office, Sec-70, Mohali, Chandigarh on 13 July, 2017.

7. ICAR Foundation Day, Award Ceremony 2017 and Directors Conference at AP Shinde Auditorium NASC, New Delhi during 16-17 July 2017.
8. Meeting at Krishi Bhavan, New Delhi in Committee Room under the Chairmanship of the AHC regarding Glanders situation and related matters on 19 July 2017.
9. An Interactive Workshop on Para-vet Regulation in India at ICAR Pusa Complex, Delhi organized by National Academy of Veterinary Sciences (India) on 11 August 2017.
10. Departmental Promotion Committee Meeting of scientist at IVRI, Izatnagar (UP) on 26 August 2017.
11. Arranged a meeting at Agri-Innovate office at NASC, New Delhi to discuss issues related to commercialization of technology developed by NRCE and issues related with public-private partnership on 08 September 2017.
12. Task Force meeting of DBT on Translational Research and Product Development on Vaccines and Diagnostics at New Delhi on 05 October 2017.
13. 8th meeting of Standing Committee on Zoonoses at DGHS Conference Room, Nirman Bhavan, New Delhi on 11 December 2017.
14. Mid Term Review meeting on the follow up of Action Taken Report of the 24th Meeting of the ICAR Regional Committee No. V at ICAR- CSSRI, Karnal on 12 December 2017.
15. A meeting of Bureau of Indian Standard (BIS) organized at RAJUVAS Bikaner on 15 December 2017.
16. Meeting of all stakeholders to chalk out the strategies for control and containment of Glanders in country held under the Chairmanship of Animal Husbandry Commissioner in the Committee Room, Krishi Bhavan, New Delhi on 28 December 2017.
17. Meeting at NASC, New Delhi regarding implementation of OIE minimum standards for welfare of equine in India organized by NAVS under the Chairmanship of AHC, Govt of India on 08 January 2018.
18. Breed Registration Certificate Distribution Ceremony organized by the ICAR at Krishi Bhawan, New Delhi in Acharya Jagadish Chandra Boss Hall on 10 January 2018.
19. Meeting of stakeholders to take stock of the situation towards control and containment of Glanders in Delhi held under the Chairmanship of Secretary, Department of Animal Husbandry, DADF, MoA, Govt of India in Committee Room, Krishi Bhavan, New Delhi on 16 January 2018.
20. Meeting under the Chairmanship of Dr. T. Mohapatra, Secretary (DARE) &b DG, ICAR in DG's Committee Room for discussing the issue of reported incidence of glanders in Delhi and other regions on 18 January 2018.
21. Meeting to review the project on conservation of Manipuri horses at CAU, Imphal during 22-23 February 2018.
22. Meeting at Committee Room, Krishi Bhavan, New Delhi under the Chairmanship of Animal Husbandry Commissioner, Department of Animal Husbandry Dairying and Fisheries, Govt. of India to review Glanders disease situation in the country and movement of horses in and out of Delhi on 28 February 2018.

On-going Research Projects

Sr. No.	Title	Team
EQUINE HEALTH		
1.	Surveillance, Monitoring and Control of Emerging and Existing Diseases of Equines (Continuous Service Project since 1995)	H.S. Singha*, S.C. Yadav, B.R. Gulati, Rajender Kumar, Sanjay Kumar, Nitin Virmani, Sanjay Barua, Rajesh Vaid, Ramesh Dedar, Anju Manuja, Balvinder Kumar and B. N. Tripathi
2.	Pathology of EHV-1 infection in BALB/c mice post- immunization with glycoprotein (gB, gD & gM) and bacterial artificial chromosome construct of EHV-1 (Oct 2013-Sept. 2017)	Nitin Virmani*, B. R. Gulati and B. C. Bera
3.	Development of diagnostics for emergency preparedness and monitoring of emerging equine viral diseases (April 2014- Sept. 2017)	Balvinder Kumar*, H.S. Singha and Anju Manuja
4.	Generation of reverse genetics based equine influenza virus and explore its potential as vaccine candidate through challenge studies in mice model (April 2015-March 2018)	Nitin Virmani & B.C. Bera and Sandeep Bhatia & Richa (NIHSAD, Bhopal)
5.	Nanobased therapeutic interventions against osteoarthritis (April 2016- March 2019)	Anju Manuja*, Balvinder Kumar and Riyesh T.
6.	Development of recombinant EHV1 viruses employing bacterial artificial chromosome mediated mutagenesis and their pathological evaluation in murine model (April 2017- March 2020)	Nitin Virmani*, B.C.Bera, Taruna Anand and B.N.Tripathi
7.	In vitro growth inhibitory efficacy of different herbal plant extracts against Theileria equi and identification of principal drug molecule(s) there-of (Oct. 2017- Sept. 2019)	Sanjay Kumar,* Rajender Kumar and Sushil (CCSHAU)
EQUINE PRODUCTION		
1.	Development of rapid diagnostic test for pregnancy diagnosis in horse mares (Jan. 2015- Dec. 2017)	A.K. Gupta (upto 31 Oct., 2017), Yash Pal*, Sanjay Kumar and S.K. Ravi
2.	Genetic characterization of Marwari horses for selection of true to breed animals (July 2015- June 2018)	Anuradha Bhardwaj*, A.K.Gupta (upto 31 Oct., 2017), Yash Pal and Mamta Chauhan
3.	Development of DNA typing facility for parentage testing in horses (Oct. 2015-March 2018)	Mamta Chauhan* Anuradha Bhardwaj, Yash Pal, B.N. Tripathi and A.K. Gupta (upto 31 Oct., 2017)
4.	Optimization of inter/intra species somatic cell nuclear transfer technique for production of horse (Equus caballus) cloned embryos (Nov. 2015- Feb. 2018)	T.R. Talluri*, Sanjay Kumar Ravi & Taruna Anand; N. Seloker*, D. Kumar & P.S.Yadav (CIRB) and Chandan Singh and S.S. Kashyap (EBS)
5.	Approaches to the diagnosis and management of reproductive failure in equines (May 2016- March 2019)	S.K. Ravi*, T.R. Talluri, J. Singh, R.K. Vaid and R.A. Legha
6.	Assessment and optimization of equine management in an intensive system (Continuous Service Project since June 2016)	S.C. Mehta* R. A. Legha, Yash Pal, R K Dedar, P A Bala, T R Talluri, S K Ravi and J Singh
7.	Area specific mineral mixture for equines of Rajasthan (June 2016- May 2018)	P.A. Bala*, R. K. Dedar and R. Nehra (RAJUVAS)
8.	Enduracne and fertility analysis in indigenous horses using SNP (single nucleotide polymorphisms) markers (Aug. 2017- Sept. 2020)	S.C. Mehta*, R.K. Dedar, T.R. Talluri and S.K. Ravi
9.	Assessment of risk factors of equine laminitis and colic (Sept. 2016- Aug. 2019)	R.K. Dedar*, P.A. Bala andSakar Palecha (RAJUVAS)

Sr. No.	Title	Team
NATIONAL CENTRE FOR VETERINARY TYPE CULTURES		
1.	Authentication and accessioning of viruses of animal origin (Continuous Service Project since May 2015)	Sanjay Barua,* Naveen Kumar, B.C. Bera, Riyesh T. and Taruna Anand
2.	Isolation, characterization and Development of repository of poxviruses of bovine, caprine, and ovine origin (May 2015- April 2018)	Sanjay Barua,* Naveen Kumar, B.C. Bera and Riyesh T.
3.	Phenotypic and genotypic authentication and preservation of network bacterial isolates (June 2015- March 2018)	R.K. Vaid*, Taruna Anand, B.C. Bera and Riyesh T.
4.	Prevalence studies for porcine respiratory viruses and development of their repository (Jan. 2016- Dec. 2018)	B.C. Bera,*, Sanjay Barua, Taruna Anand and Nitin Virmani
5.	Development of bacteriophage repository and exploring the therapeutic potential of phages and their encoded endolysin (April 2017- March 2020)	Taruna Anand*, Nitin Virmani, R.K. Vaid and B.C. Bera
6.	Isolation, characterization and reposition of enteric viruses of poultry (June 2017- May 2020)	Riyesh T.*, Naveen Kumar, Sanjay Barua andNaresh Jindal (LUVAS)
7.	Isolation, characterization and generation of repository of Mycobacterium species (Oct. 2017- Sept. 2020)	Shanmugasundaram K.*, R.K. Vaid, B.C. Bera and B.N. Tripathi
EXTERNALLY FUNDED PROJECTS		
1.	All India Coordinated Research Project on Utilization of Animal Energy with enhanced system efficiency (July 2009- March 2018)	R A Legha* and Yash Pal
2.	National Fellow Scheme-Development of sensitive and specific diagnostic assays for detection of Trypanosoma evansi infection in animals using modern molecular tools (April 2011- April 2019)	Rajender Kumar*
3.	DBT-NER Advanced Animal Diagnostics and Management Consortium (AdMAC) (Sept. 2013- April, 2019)	B.N. Tripathi*, Sanjay Barua, Nitin Virmani, S.C. Yadav, B.R. Gulati, Rajender Kumar, R.K. Vaid, B.C. Bera, Taruna Anand & Riyesh T.
4.	All India Network Programme on Neonatal Mortality in Farm Animals (Jan. 2015- March 2020)	Sanjay Kumar*, Ramesh Dedar, B.R. Gulati and Nitin Virmani
5.	CRP on Vaccines and Diagnostics (May 2015- March 2020)	B.R. Gulati & Nitin Virmani (Component-I)Nitin Virmani, B.R. Gulati & B.C. Bera (Component-II) Sanjay Kumar & Rajender Kumar (Component-III) Nitin Virmani, B.C. Bera & Taruna Anand (Component-IV)
6.	Validation study of a western blot (WB) technique and ELISAs for serological diagnosis of glanders in equids for the purpose of certifying freedom from infection in individual animals for trade or movement (Dec. 2015-Dec. 2017)	H.S. Singha* and B.N. Tripathi
7.	Seroproteome analysis of recombinant secretory proteins of Burkholderia mallei towards development of multiple antigen immunoassay for improved diagnosis of glanders (July 2017- July 2020)	H.S. Singha* & K. Shanmugasundaram
8.	Targetting a host cell protein kinase for development of antiviral therapeutics against PPR virus (Aug. 2015- March 2018)	Naveen Kumar* and Sanjay Barua
9.	Feasibility studies on biogas and compost production from mule dung in hilly regions in India (Nov. 2015- March 2018)	B.N. Tripathi*, R.K. Vaid and R.A. Legha
10.	Molecular epidemiology of Japanese encephalitis virus in pigs and mosquitoes in Assam (Jan. 2017-Dec. 2019)	B.R. Gulati and Seema Pegu (NRCP)
11.	Scheduling equines from fatal Zoonotic disease-Glanders and equine infectious anemia (EIA) in India using point of care diagnostic (POCD) (March 2018- March 2020)	H.S. Singha* and B.N. Tripathi
12.	Generation of induced pluripotent stem (iPS) cells from buffalo fetal fibroblasts through non-viral approaches (DBT) (February 2016-July 2017)	Dharmendra Kumar*, Naresh Selokar, P.S. Yadav (CIRB) and Taruna Anand
13.	Establishment of international diagnostic methods for piroplasmosis by a ring trail (April 2016-March 2019)	Sanjay Kumar* and Rajender Kumar

*Principal Investigator

Staff at NRCE

Director : Dr B. N. Tripathi

SCIENTIFIC STAFF

Main campus, Hisar

1. Dr Ashok Kumar Gupta, Principal Scientist (till 31.10.2017)
2. Dr Suresh Chander Yadav, Principal Scientist
3. Dr Yash Pal, Principal Scientist
4. Dr Baldev Raj Gulati, Principal Scientist
5. Dr Rajender Kumar, Principal Scientist & National Fellow
6. Dr Sanjay Kumar, Principal Scientist
7. Dr Nitin Virmani, Principal Scientist
8. Dr Anju Manuja, Principal Scientist
9. Dr Balvinder Kumar, Principal Scientist
10. Dr Mamta Chauhan, Sr Scientist
11. Dr Anuradha Bhardwaj, Scientist
12. Dr Harishankar Singha, Scientist

Equine Production Campus, Bikaner

1. Dr S.C. Mehta, Principal Scientist (from 04.07.2017)
2. Dr Ram Avatar Legha, Principal Scientist
3. Dr Ramesh.Kumar Dedar, Scientist
4. Dr Prokasananda Bala, Scientist
5. Dr Thirumala Rao Talluri, Scientist
6. Dr Sanjay Kumar Ravi, Scientist

NCVTC, Hisar

1. Dr Praveen Malik, Principal Scientist (on deputation)
2. Dr Sanjay Barua, Principal Scientist
3. Dr Rajesh Kumar Vaid, Principal Scientist
4. Dr Naveen Kumar, Sr. Scientist
5. Dr Taruna Anand, Scientist
6. Dr Bidhan Chandra Bera, Scientist
7. Dr Shanmugasundaram Karuppusamy, Scientist
8. Dr Riyesh Thachamvally, Scientist

ADMINISTRATIVE STAFF

Main campus, Hisar

1. Sh. A.G. Barapatre, Administrative Officer
2. Smt. Shammi Tyagi, Assistant Finance & Accounts Officer
3. Sh. Ram Pal, Assistant Administrative Officer
4. Sh. Surender Pal Kaushik, Assistant Administrative Officer
5. Sh. Ashok Kumar, Personal Assistant
6. Sh. Subhash Chander, Assistant
7. Sh. Sunil Sharma, Assistant
8. Sh. Pratap Singh, Upper Division Clerk
9. Sh. Dinesh Datt Sharma, Upper Division Clerk
10. Sh. Om Parkash, Upper Division Clerk
11. Sh. Deepak Kumar, Lower Division Clerk

Equine Production Campus, Bikaner

1. Sh. Mahender Singh, Lower Division Clerk

TECHNICAL STAFF

Main campus, Hisar

1. Sh. Krishan Kumar Gupta, Chief Technical Officer
2. Sh. Kirpa Shankar Meena, Senior Technical Officer
3. Sh. Partha Pritam Chaudhary, Senior Technical Officer
4. Sh. Diger Dev Pandey, Senior Technical Officer
5. Sh. Sita Ram, Senior Technical Officer
6. Sh. Ajmer Singh, Technical Officer
7. Sh. Sanjeev Kumar, Technical Officer
8. Sh. Sajjan Kumar, Technical Officer
9. Sh. Suresh Kumar, Technical Officer
10. Sh. Joginder Singh, Senior Technical Assistant
11. Sh. Mukesh Chand, Senior Technical Assistant
12. Sh. Raj Kumar Dayal, Senior Technical Assistant.
13. Sh. Arun Chand, Senior Technician
14. Sh. Raghbir Singh, Senior Technician

Equine Production Campus, Bikaner

1. Dr Jitender Singh, Senior Technical Officer
2. Sh. Kamal Kumar Singh, Senior Technical Officer
3. Sh. Brij Lal, Technical Officer
4. Sh. Narender Chauhan, Technical Officer
5. Sh. R.A. Pachori, Technical Officer
6. Sh. S.N. Paswan, Senior Technical Assistant
7. Sh. Om Parkash, Senior Technical Assistant
8. Sh. Rajender Singh, Technical Assistant
9. Sh. Gopal Nath, Technician

SKILLED SUPPORTING STAFF

Main campus, Hisar

1. Sh. Ishwar Singh
2. Sh. Guru Datt Sharma
3. Sh. Jai Singh
4. Sh. Mahabir Prasad
5. Sh. Ramesh Chander
6. Sh. Mardan
7. Sh. Desh Raj
8. Sh. Ishwar Chander
9. Sh. Om Parkash
10. Sh. Hanuman Singh
11. Sh. Subhash Chander
12. Sh. Ishwar Singh
13. Sh. Ram Singh
14. Smt. Santra
15. Sh. Sant Ram
16. Sh. Soma Devi
17. Sh. Lilu Ram

Equine Production Campus, Bikaner

1. Sh. Raju Ram
2. Sh. M.P. Meena
3. Sh. Ashok Kumar

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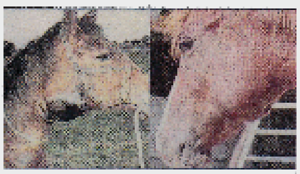
हिसार में फैला ग्लैंडर्स, तीन पॉजिटिव केस मिले

सुनील कौशिक • हिसार

प्रशासन की बिना अनुमति शहर में तीन दिनों तक घोड़ों का मेला लगाया गया था। मेले को खत्म हुए 24 घंटे ही बीते कि हिसार के घोड़ों में ग्लैंडर्स की पुष्टि हुई है। बुधवार को राष्ट्रीय अश्व अनुसंधान केंद्र के वैज्ञानिकों और पशुपालन विभाग के अधिकारियों ने तीन घोड़े व घोड़ियों के ग्लैंडर्स पॉजिटिव होने की पुष्टि की है। इसके अलावा चार और सैंपलों के ग्लैंडर्स संभावित होने की आशंका जताई जा रही है।

पशुपालन विभाग के अधिकारियों ने सरकार को पत्र भेजकर इस संबंध में आगामी कार्रवाई के लिए अनुमति मांगी है। इसके तहत सरकार की ओर से ग्लैंडर्स को लेकर हाई अलर्ट जारी किया जाएगा। इसके अलावा पॉजिटिव घोड़े-घोड़ियों को मारा जाएगा और उसके मालिकों को सरकार के नियमानुसार मुआवजा राशि जारी की जाएगी। वहीं अधिकारियों ने सभी ग्लैंडर्स पॉजिटिव व संभावित पशुओं को अपनी देखरेख में ले लिया है। इसके अलावा उस बाड़े में रखे गए अन्य घोड़े और घोड़ियों पर भी नजर बनाए हुए हैं। बता दें कि यह बीमारी पशु से पशु और पशु से इंसानों में फैल सकती है। इस बीमारी का अभी तक कोई इलाज नहीं है। अभी तक देश भर में किसी इंसान ने इस बीमारी की पुष्टि नहीं हुई है।



एक सप्ताह पहले लुवास में मरे थे दो घोड़े

पशुपालन विभाग के डिप्टी डायरेक्टर मोती लाल ने बताया कि एक सप्ताह पहले लाला लाजपत राय पशु चिकित्सा एवं पशु विज्ञान विश्वविद्यालय (लुवास) में दो घोड़े गंभीर रूप से बीमार होकर आए थे, जिनकी मौत हो गई थी। लुवास प्रशासन ने इसकी सूचना पशुपालन विभाग को दी।

"महावीर कॉलोनी के एक पशुबाड़े के तीन घोड़े और घोड़ियों में ग्लैंडर्स की पुष्टि हुई है। चार सैंपल और संभावित बताए जा रहे हैं। इसको लेकर सरकार को पत्र भेजकर आगामी प्रक्रिया के लिए अनुमति मांगी गई है। जैसे ही अनुमति मिलती है, अलर्ट जारी कर दिया जाएगा। इसके बाद पांच किलोमीटर दायरे के सभी पशुओं के सैंपल लिए जाएंगे, जिससे इस बीमारी को रोका जा सके।

डा. मोतीलाल, उप निदेशक, पशुपालन विभाग हिसार।

सरकार को ग्लैंडर्स को लेकर गंभीरता दिखाने की जरूरत है, ताकि पूरे देश में एक साथ अभियान चलाकर इस बीमारी को जड़ से खत्म किया जा सके।

डा. बीएन त्रिपाठी, निदेशक, राष्ट्रीय अश्व अनुसंधान केंद्र।

हर्बल पार्क का शुभारंभ

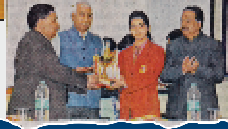
बीकानेर। राष्ट्रीय अश्व अनुसंधान केंद्र परिसर में हर्बल पार्क का शुभारंभ गुरुवार को मुख्य अतिथि बीआईएस के चेयरमैन डॉ. महेशचंद्र शर्मा व संस्थान के निदेशक डॉ. बीएन त्रिपाठी ने तुलसी एवं मीठे नीम का पौधारोपण कर किया। इस अवसर पर आयोजित औषधीय पौधों की महत्ता और अश्व पर्यटन से किसानों की आय दुगुनी करने विषय पर कार्यशाला हुई। डॉ. शर्मा ने पौधों के औषधीय गुणों से होने वाले लाभों की जानकारी दी। डॉ. त्रिपाठी ने किसानों की आय दुगुनी करने के हरसंभव प्रयासों का आह्वान किया। केंद्र प्रभारी डॉ. शरत चंद मेहता ने केंद्र में चल रहे अनुसंधान की जानकारी दी। डॉ. रमेश कुमार देदर, डॉ. पीए बाला, डॉ. टी राव, डॉ. संजय रवि, डॉ. आर लेघा एवं स्टाफ सदस्यों ने कार्यशाला में भाग लिया।

बीकानेर में जल्द घुड़सवारी भी कर सकेंगे पर्यटक

अश्व अनुसंधान केन्द्र बीकानेर ने स्थापना दिवस पर बताई योजना

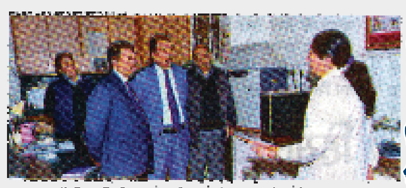
पशु चिकित्सकों की 9 टीम रोकेंगी ग्लैंडर्स, कार्रवाई का दिन तय नहीं

अश्व अनुसंधान केंद्र के स्थापना दिवस पर छात्र व अश्वपालक सम्मानित



जेना ने अनुसंधान केंद्र के शोध कार्यों को सराहा

भास्कर न्यूज | हिसार



भारत सरकार के पशु विज्ञान एवं मत्स्य पालन विभाग के उपनिदेशक जयकल्पना जेना ने राष्ट्रीय अश्व अनुसंधान केन्द्र का दौरा किया। इस दौरान उन्होंने विभिन्न प्रयोगशालाओं एवं अश्व संग्रहालय का निरीक्षण करते हुए स्थानीय वैज्ञानिकों द्वारा किए जा रहे शोध कार्यों को सराहा। केन्द्र के निदेशक डॉ. बीएन त्रिपाठी ने केन्द्र द्वारा किए गए शोध कार्यों एवं विस्तार गतिविधियों के बारे में अवगत कराया। डॉ. त्रिपाठी ने बताया कि केन्द्र अविरल रूप से अश्व विज्ञान के क्षेत्र में उत्कृष्ट अनुसंधान एवं नैदानिक सेवाएं प्रदान करवाने के लिए अद्वितीय संस्थान है। जयकल्पना जेना ने वैज्ञानिकों ... परिसंवाद के दौरान महिला को गतिविधियों के लिए प्रेरित किया। इस मौके पर डॉ. नितिन विरमानी, डॉ. अंजु मनुजा, डॉ. अनुराधा भारद्वाज समेत संस्थान के कई वैज्ञानिक व अधिकारी मौजूद थे।

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घोड़ों में बीमारी जानने और इलाज के लिए बनाया एप, बाहर से आने वाले पशुपालकों का बचेगा समय और पैसा

इन वैज्ञानिकों का रहा योगदान

पशु स्वास्थ्य के बारे में जानेंगे प्रशिक्षु

जैव सूचना विज्ञान की तीन दिवसीय कार्यशाला शुरू

अधिक से अधिक कार्य हिन्दी में निष्पादित करें : डॉ. त्रिपाठी

हिसार। हिन्दी परिष्कृत व प्रभावशाली भाषा है। इसे केवल हिन्दी दिवस या हिन्दी पखवाड़े के अवसर पर ही नहीं अपितु पूरे वर्ष हिन्दी को अंगीकार करें और अधिक से अधिक कार्य हिन्दी में निष्पादित करें। यह बात राष्ट्रीय अश्व अनुसंधान केन्द्र के निदेशक एवं कार्यक्रम अध्यक्ष डॉ. भूपेन्द्र नाथ त्रिपाठी ने कही। डॉ. त्रिपाठी राजभाषा कार्यान्वयन समिति के तत्वधान में हिन्दी पखवाड़ा कार्यक्रम को संबोधित कर रहे थे। उन्होंने उपस्थित अधिकारियों व कर्मचारियों का आह्वान किया कि हिन्दी भाषा का ज्यादा से ज्यादा प्रयोग में लाएं। इस दौरान विभिन्न ज्ञानवर्धक एवं रुचिपूर्ण हिन्दी प्रतियोगिता क्रमशः निबंध प्रतियोगिता, हिन्दी परिछेद अनुवाद, हिन्दी श्रुत लेख, हिन्दी आशुभाषण, हिन्दी श्लोकगरी, हिन्दी कविता पाठ एवं सुलेख, हिन्दी टंकण आदि का आयोजन किया गया। उन्होंने हिन्दी पखवाड़ा में बच्चों की प्रतियोगिता की सराहना की और उन्हें पुरस्कार देकर प्रोत्साहित किया। मंच संचालन प्रभान वैज्ञानिक डॉ. अंजू नरवाल ने किया। संस्थान की हिन्दी अधिकारी डॉ. अनुराधा भारद्वाज ने कार्यक्रम का सफलतापूर्वक आयोजन किया गया तथा हिन्दी पर अपना संबोधन दिया।

राष्ट्रीय अश्व अनुसंधान केन्द्र में स्थापना दिवस पर होंगे कार्यक्रम

राष्ट्रीय अश्व अनुसंधान संस्थान के स्थापना दिवस पर प्रतियोगिता के बाद उपस्थित प्रतिभागी, निदेशक व संस्थान के अधिकारी।

हिसार। राष्ट्रीय अश्व अनुसंधान केन्द्र में 33वां स्थापना दिवस मनाया जा रहा है। पहले दिन 'अश्व-एक सहयोगी पशु' विषय पर स्कूल विद्यार्थियों के लिए चित्रकला प्रतियोगिता कराई गई। इसमें हिसार के विभिन्न विद्यालयों से करीब 50 विद्यार्थियों ने हिस्सा लिया। केंद्र के निदेशक डॉ. भूपेन त्रिपाठी ने बताया कि स्थापना दिवस समारोह पर रविवार को हरियाणा किसान आयोग के अध्यक्ष डॉ. रमेश कुमार यादव मुख्यातिथि होंगे। वह केन्द्र द्वारा अश्व पालकों को सहायता के लिए विकसित मोबाइल एप का प्रमोशन करेंगे तथा प्रगतिशील अश्व-पालक किसानों को सम्मानित करेंगे। राष्ट्रीय अश्व अनुसंधान केन्द्र अपनी स्थापना के बाद से हिसार एवं पूरे देश में अश्व रोग निदान एवं अश्व प्रजनन संरक्षण के क्षेत्र में सुविधाएं प्रदान करता आ रहा है। भारतीय कृषि अनुसंधान परिषद् द्वारा केन्द्र को सरदार पटेल उत्कृष्ट संस्थान-2015 पुरस्कार से सम्मानित किया गया है।

अमरनाथ यात्रा के घोड़ों में ग्लैंडर्स की होगी जांच

जागरण संवाददाता, हिसार : अमरनाथ यात्रा के लिए प्रयोग होने वाले घोड़ों में ग्लैंडर्स जैसी खतरनाक बीमारी है या नहीं इसकी जांच की जा रही है। जांच के लिए जम्मू एंड कश्मीर से यात्रा में शामिल होने वाले घोड़ों के सैंपल हिसार के राष्ट्रीय अश्व अनुसंधान केंद्र में पहुंच गए हैं। अब इन सैंपलों की जांच की जाएगी। जांच के लिए स्पेशल 724 सैंपल भेजे गए हैं।

बीमारी का पता लगाने के लिए जांच रिपोर्ट जल्द से जल्द तैयार होगी। इससे पहले हुए 300 सैंपल की जांच में कोई भी पॉजीटिव केस नहीं मिला। देश में घोड़े, खच्चर, गधे व अन्य जानवर सबसे ज्यादा हैं। इनमें मुख्य रूप से जम्मू में ज्यादा है। इन घोड़ों का अमरनाथ यात्रा के लिए भी प्रयोग किया जाता है। बीमारी को खोजने के लिए शनिवार को अश्व अनुसंधान केंद्र में सैंपल पहुंचे। केंद्र में पिछले दिनों भी 300 सैंपल जम्मू एंड कश्मीर से आए थे। उनकी जांच पूरी होने के बाद कोई भी पॉजीटिव केस उनमें नहीं मिला था।

724 सैंपल भेजे गए हैं यहां जांच के लिए

300 नमूने पहले भी भेजे गए थे यहां

जम्मू एंड कश्मीर में एक लाख 98 हजार 246 घोड़े-खच्चर और गधे हैं

जम्मू एंड कश्मीर में इस समय एक लाख 98 हजार 246 घोड़े, खच्चर और गधे हैं। कश्मीर के मुकाबले जम्मू में इनकी संख्या ज्यादा है। इस क्षेत्र में मौजूद घोड़ों का प्रयोग अमरनाथ यात्रा में होता है।

6 अमरनाथ यात्रा में जाने वाले घोड़ों के सैंपल उनके पास आए हैं। उनकी जांच की जा रही है, ताकि ग्लैंडर्स या अन्य बीमारी होने का पता चल सके। जांच के बाद ही कुछ कहा जा सकता है।

– डा. बीएन त्रिपाठी, डायरेक्टर राष्ट्रीय अश्व अनुसंधान केंद्र, हिसार।

A Painting by ***Simran***
Class X Student
Campus School, Hisar
On the occasion of NRCE Foundation Day

A Painting by **Polina**,
Class XII Student,
Moga Devi Minda Memorial School, Hisar
On the occasion of NRCE Foundation Day