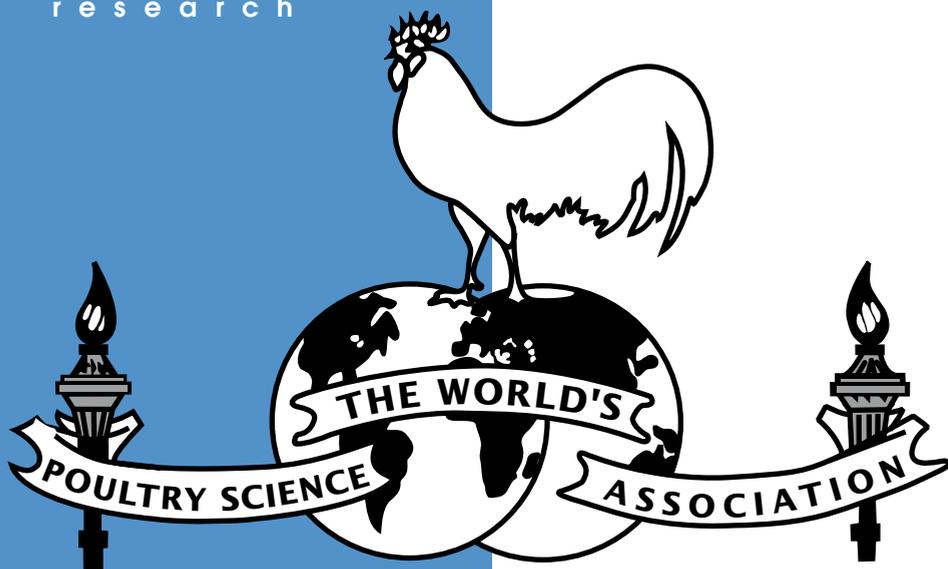


WORLD'S POULTRY SCIENCE JOURNAL

education
organization
research



www.wpsa.com

volume 71, June 2015 number 2



GET MORE VALUE FROM YOUR FEED

- Enzymes
- Toxin binders
- Slow release acidifiers
- Immunomodulators
- Flavors
- Raw materials
- Yeast derivatives

**Quality feed additives for
more cost savings and
better performance**

Escent[®]



Aflorin[®]



Novyrate[®]



Novioro[®]

Novibac[®]



Lumance[®]



- Mycotoxin Risk Assessment
- Wet Litter
- Natural Pigmentation
- Salmonella Control
- Liver Support
- Intestinal Health

www.innovad-global.com





WORLDWIDE CALENDAR 2015 - 2018

VIV MEA 2016

FEBRUARI 16 - 18, ABU DHABI, U. A. E.

VIV ASIA 2017

MARCH 15 - 17, BANGKOK, THAILAND

VIV EUROPE 2018

JUNE 20 - 22, UTRECHT, THE NETHERLANDS

VIV RUSSIA 2015

MAY 19 - 21, MOSCOW, RUSSIA

VIV TURKEY 2015

JUNE 11 - 12, ISTANBUL, TURKEY

VIV CHINA 2016

SEPTEMBER 6 - 8, BEIJING, CHINA

WWW.VIV.NET

 **vnu** exhibitions
europe

WORLD'S
POULTRY SCIENCE
JOURNAL

Volume 71 June 2015 Number 2

245 **Editorial**

246 **Sponsorship**

Reviews

- 249 Avian pathogenic *Escherichia coli*- methods for improved diagnosis
H.C. Kunert Filho, D. Carvalho, T.T. Grassotti, B.D. Soares, J.M. Rossato, A.C. Cunha, K.C.T. Brito, L.S. Cavallian and B.G. Brito
- 259 New issues and science in broiler chicken intestinal health: intestinal microbial composition, shifts, and impacts
T. Roberts, J. Wilson, A. Guthrie, K. Cookson, D. Vancraeynest, J. Schaeffer, R. Moody and S. Clark
- 271 Modulation of NF- κ B and Nrf2 pathways by lycopene supplementation in heat-stressed poultry
K. Sahin
- 285 Early *post hatch* nutrition on immune system development and function in broiler chickens
A.K. Panda, S.K. Bhanja and G. Shyam Sunder
- 297 A consideration of starch and protein digestive dynamics in chicken-meat production
S.Y. Liu and P.H. Selle
- 311 The role of mitochondrial DNA to determine the origin of domestic chicken
P.di Lorenzo, S. Ceccobelli, F. Panella, G. Attardand E. Lasagna
- 319 Production of added-value poultry meat: enrichment with n-3 polyunsaturated fatty acids
H. Al-Khalifa
- 327 An evaluation on the potential role of boron in poultry nutrition.
Part I: Production performance
M. Bozkurtand K. Küçükyilmaz
- 339 Challenges facing poultry production in Kuwait
A. Al-Nasser, H. Al-Khlaifa, M. Al-Bahouh, F. Khalil, M. Boareki and G. Ragheb
- 349 From the wild red jungle fowl to domesticated chickens: modification of eimerian-microbiome-host interactions
K.R. Price, B.M. Hargisand J.R. Barta
- 363 Meat quality in fast-growing broiler chickens
M. Petracci, S. Mudalal, F. Sogliaand C. Cavani
- 375 Effects of pasture management on poultry welfare and meat quality in organic poultry production systems
E.N. Sossidou, A. Dal Bosco, C. Castelliniand M.A. Grashorn
- Small-scale Family Poultry Production**
- 385 Traditions and local use of native Vietnamese chicken breeds in sustainable rural farming
T.N. Lan Phuong, K.D.T. Dong Xuanand I. Szalay
- Summaries**
- 397 Chinese, French, German, Russian, Spanish
World's Poultry Science Association
- 424 Information and Officers
- 429 **Obituary**
- 431 **Association News**
- 436 **Calendar**
- 438 **Education and Training**
- 441 **Notes for Contributors**

Editor

Dr L.A. Waldron
LWT Animal Nutrition Ltd
PO Box 119, Feilding 4740
New Zealand
Phone: +64 6328 9026,
Mobile +64 21743374
Fax: +64 6328 9027
E-mail: lucy@animalnutrition.co.nz

Assistant Editor

Mrs D.M. Kleverwal
World's Poultry Science Association
PO Box 31, 7360 AA Beekbergen
The Netherlands
Phone: +31 570 541948
Fax: +31 207 508941
E-mail: wpsa@xs4all.nl

Associate Editors

Prof J.A. Castelló, Spain
Dr S. Cherepanov, Russia
Prof D.K. Flock, Germany
Dr D. Grastilleur, France
Prof N. Yang, China

International Editorial Board

Prof W. Bessei, Germany
Prof I.J. H Duncan, Canada
Prof D.J. Farrell, Australia
Prof R.M. Gous, South Africa
Dr. E.F. Guèye, Mali
Prof P. Horn, Hungary
Dr P. Hunton, Canada

Dr M. Lilburn, USA
Dr R.W.A.W. Mulder, Netherlands
Dr D. Narahari, India
Prof. Y. Nys, France
Prof Jun-ichi Okumura, Japan
Prof H. Pingel, Germany
Dr R.A.E. Pym, Australia

Prof J.R. Roberts, Australia
Prof G.D. Rosen, UK
Prof P.J. Sharp, UK
Prof P.B. Siegel, USA
Dr M. Tixier-Boichard, France
Prof S. Yahav, Israel

The **World's Poultry Science Journal** is published in March, June, September and December by the World's Poultry Science Association. The Secretary of the Association is Dr Roel W.A.W. Mulder, PO Box 31, 7360 AA Beekbergen, The Netherlands (phone: +31 6 51519584, fax: +31 207 508 941, e-mail: roel.mulder@wpsa.com, website: www.wpsa.com).

Disclaimer: The Editors of the World's Poultry Science Journal take all reasonable steps to ensure the accuracy of material published. However, all statements, conclusions and opinions expressed in it are those of the authors and contributors; the Editors, Associate Editors, Members of the Editorial Board and the Publishers accept no responsibility or liability for them.

2015 subscriptions rates: £231/\$417 for organisational online & print; £172/\$318 for organisational online only; £117/\$212 for individuals online & print.

Subscription enquiries and orders: Orders, which must be accompanied by payment, may be sent to a bookseller, subscription agent or to the Publisher: Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge, CB2 2RU, UK; or in the USA, Canada and Mexico: Cambridge University Press, Journals Fulfillment Department, 100 Brook Hill Drive, West Nyack, New York 10994-2133. EU subscribers (outside the UK) who are not registered for VAT should add VAT at their country rate. VAT registered subscribers should provide their VAT registration number. Japanese prices for institutions are available from: Kinokuniya Company Ltd, PO Box 55, Chitose, Tokyo 156, Japan.

Periodicals postage pending at New York, NY, and at additional mailing offices. Postmaster: send address changes in USA, Canada and Mexico to: World's Poultry Science Journal, Cambridge University Press, 100 Brook Hill Drive, West Nyack, New York 10994-2133. Claims for missing issues should be made immediately on receipt of the subsequent issue.

Back issues: Dr Roel Mulder, PO Box 31, 7360 AA Beekbergen, The Netherlands.

Advertising enquiries: Dr Roel Mulder, PO Box 31, 7360 AA Beekbergen, The Netherlands (phone: +31 6 51519584, fax: +31 207 508 941, e-mail: roel.mulder@wpsa.com).

Copyright: All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, optical, mechanical, photocopying, recording or otherwise without the written permission of the copyright holder. © World's Poultry Science Association.

Reprints and Photocopying: Readers who require multiple copies of papers published in this journal may either purchase reprints (minimum order 100) or obtain permission to copy from the Editor. However, permission is granted for the making of single copies of articles for internal or personal use. In North America, this permission is granted by the copyright owner for libraries and others registered with the Copyright Clearance Center Inc. (CCC) to make single copies of any article herein for the flat fee of \$3 per article. Payment should be sent directly to CCC, 2 Congress Street, Salem, MA 01970, USA. The item-free Code for this publication indicates that authorization is to make single copies only for internal or personal use. Serial-free Code: ISSN 0043-9339, \$3. In the UK, the Copyright Licensing Agency (CLA), 90 Tottenham Court Road, London W1P 9HE is mandated to grant permission to make single copies.