



WORLD'S POULTRY SCIENCE JOURNAL

education
organization
research



www.wpsa.com

volume 68, September 2012 number 3



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**



Mycofix®



Mycofix®

More protective.

Mycotoxins decrease performance and interfere with the health status of your animals.

Mycofix® is **the** solution for mycotoxin risk management.



*For more information please visit
mycofix.biomin.net*

Naturally ahead

≡ **Biomin®** ≡



VIV Worldwide Calendar 2012 - 2014

VIV China 2012

September 23 - 25, 2012
Beijing, China

FIGAP/VIV Mexico 2012

October 17 - 19, 2012
Guadalajara, Mexico

VIV Asia 2013

March 13 - 15, 2013
Bangkok, Thailand

VIV Russia 2013

May 22 - 24, 2013
Moscow, Russia

VIV Turkey 2013

June 13 - 15, 2013
Istanbul, Turkey

VIV/Ildex India 2014

April 23 - 25, 2014
Bangalore, India

VIV Europe 2014

May 20 - 22, 2014
Utrecht, the Netherlands



VIV is the official Industry Development Sponsor of the XXIV World's Poultry Congress Salvador, Bahia, Brazil August 5 - 8, 2012

www.viv.net

 **vnu** exhibitions
europe

WORLD'S
POULTRY SCIENCE
JOURNAL

Volume 68 September 2012 Number 3

383 **Editorial**

384 **Sponsorship**

Reviews

387 New phenotypes for new breeding goals in layers

W. Icken, D. Cavero, M. Schmutz and R. Preisinger

401 *Thymus vulgaris*: alternative to antibiotics in poultry feed

R.U. Khan, S. Naz, Z. Nikousefat, V. Tufarelli and V. Laudadio

409 From biogas energy, biotechnology to new agriculture

J.C.H. Shih

417 Garlic (*Allium sativum*) supplementation in poultry diets: effect on production and physiology

R.U. Khan, Z. Nikousefat, V. Tufarelli, S. Naz, M. Javdani and V. Laudadio

425 Comb: An important reliable visual ornamental trait for selection in chickens

N. Mukhtar and S.H. Khan

435 Insects as poultry feed: a scoping study for poultry production systems in Australia

M. Khusro, N.R. Andrew and A. Nicholas

447 Exogenous carbohydrase in corn-soy diets for broilers

U. Aftab

465 The antioxidant properties of canthaxanthin and its potential effects in the poultry eggs and on embryonic development of the chick. Part 1.

P.F. Surai

477 Effect of ascorbic acid in heat-stressed poultry

R.U. Khan, S. Naz, Z. Nikousefat, M. Selvaggi, V. Laudadio and V. Tufarelli

Small-Scale Family Poultry Production

491 Feed resources and chicken production in Ethiopia

Mammo Mengesha

503 Impact of the avian influenza outbreak on indigenous chicken genetic resources in Thailand

M. Duangjinda, K. Choprakarn, S. Suwanlee, P. Amnueysit and O. Thieme

513 The management of smallholder duck flocks in Central Java, Indonesia, and potential hazards promoting the spread of Highly Pathogenic Avian Influenza virus

J. Henning, H. Wibawa, D. Yulianto, T.B. Usman, A. Junaidi and J. Meers

529 Avian influenza shock and performance of the chicken markets in Benin

N. Foussemi Barres, A. Mensah-Bonsu and D.B. Sarpong

Centenary Papers

543 WPSA: 100 years of service to the worldwide poultry industry

R.A.E. Pym

551 A century of progress in waterfowl production, and a history of the WPSA Waterfowl Working Group

J.F. Huang, H. Pingel, G. Guy, E. Łukaszewicz, E. Baéza and S.D. Wang

Summaries

564 Chinese, French, German, Russian, Spanish

World's Poultry Science Association

597 Information and Officers

602 **Obituaries**

605 **Association News**

614 **Calendar**

616 **Education and Training**

619 **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
Prof S.E. Solomon, France
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 55 506 4858, 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.

2012 subscription rates: £186/\$334 for organisational online & print; £141/\$260 for organisational online only; £96/\$175 for individuals online & print; £83/\$150 for individuals online only.

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 55 506 4858, 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.