POULTRY SCIENCE

January, 1962, Vol. 41, No. 1

Contents

		Page
1.	Higher Education and the Federal Government. . . . . *E. A. Walker*	3
2.	The Effect of Dietary Fat Level on the Rate of Mortality in Caged Layers. . . . . *B. E. March and J. Biely*	9
3.	The Heritability of Breast Blister Condition and Breast Feather Coverage in a White Rock Broiler Strain . . . . . *N. R. Gyles, J. Kan and R. M. Smith*	13
4.	Sexual Development of Coturnix as Affected by Changes in Photoperiods. . . . . *W. O. Wilson, H. Abplanalp and L. Arrington*	17
5.	Hydropericardium Assay and Safety of Fats and Fatty Acid Products . . . . . *J. C. Alexander, R. J. Young, C. M. Burnett and H. D. Hathaway*	22
6.	The Influence of Dietary Energy Level, Energy Source, Breed and Sex on Vitamin A Requirement in the Chick . . . . . *P. A. Thornton and W. A. Whittet*	32
7.	Effect of Water Treatment and Enzyme Supplementation on the Metabolizable Energy of Barley . . . . . *K. C. Leong, L. S. Jensen and J. McGinnis*	32
8.	The Influence of Reserpine on Plasma Cholesterol, Hemodynamics and Arteriosclerotic Lesions in the Broad Breasted Bronze Turkey . . . . . *E. W. Speckmann and R. K. Ringer*	40
9.	The Utilization of a Number of Fats, Fatty Materials and Mixtures Thereof Evaluated in Terms of Metabolizable Energy, Chick Weight Gains and Gain:Feed Ratios . . . . . *I. R. Sibbald, S. J. Slinger and G. C. Ashton*	46
10.	Relation of Arginine and Sulphur Amino Acids to the Development of Muscular Dystrophy in the Chick . . . . . *K. J. Jenkins, D. C. Hill, L. M. Hutcheson and H. D. Branion*	61
11.	The Influence of pH on Fluid Tolerance and Preferences . . *W. F. Fuerst Jr. and M. R. Kare*	71
12.	Studies of the Effect of Some Antibacterial and Antifungal Agents on Growth and Egg Production of Chickens . . . . . *R. Dam and L. C. Norris*	78
13.	Studies on Local Tissue Reaction and Adjuvant Effect on the Antigenicity of Fowl Cholera Emulsified Bacterins in Chickens . . . . . *M. Mitrivic, P. H. Malisheck and L. C. Lynch*	87
14.	The Effect of Restricted Feeding of Broad Breasted Bronze Turkeys During the Holding Period on Subsequent Reproductive Performance. . . . . *R. H. Mitchell, C. R. Creger, R. E. Davies, R. L. Atkinson, T. M. Ferguson and J. R. Couch*	91
15.	The Decline of Internal Egg Quality During Storage at 30°F. and 70°F. Among Six Strains of Leghorns Reared in Confinement and on Range . . . . . *F. G. Proudfoot*	98
16.	The Comparative Availability of Fresh and Frozen Fryers in Grocery Stores in Three Counties in Idaho . . . . . *E. A. Sauter, M. V. Zaehringer and C. A. Rickard*	103
17.	Factors Affecting the Metabolizable Energy Content of Poultry Feeds. 5. 6. . . . . *I. R. Sibbald, S. J. Slinger and G. C. Ashton*	107
18.	The Role of Proline and Certain Non-Essential Amino Acids in Chick Nutrition. . . . . *D. E. Greene, H. M. Scott and B. C. Johnson*	116
19.	A Comparison of Feed Grade Tallow and Acidulated Soapstocks in Practical Chick Starter Rations . . . . . *I. R. Sibbald, W. F. Pepper and S. J. Slinger*	120
20.	Use of Barley in High-Efficiency Broiler Rations. 5. . . . . *R. J. Rose and G. H. Arscott*	124
21.	Yolk Discolorations from Cottonseed Meal When Eggs Were Oiled Before Storage. . . . . *B. W. Heywang, A. R. Kemmerer and R. W. Lowe*	131
22.	Observations on Radiothyroidectomized Chickens . . . . *W. J. Mellen and B. C. Wentworth*	134

The official publication of the Poultry Science Association. ¶A bi-monthly journal published for the purpose of advancing the scientific study of poultry. ¶Manuscripts for publication should be sent to the Editor, Ontario Agricultural College, Guelph, Ont., Canada. All manuscripts should be typewritten and double spaced. An original and a copy, together with an abstract, are required. References should be arranged alphabetically. Tables and legends for figures must be typed on separate sheets.

TERMS OF SUBSCRIPTION

Fifteen dollars ($15.00) annually in advance, single copies $2.85. The journal is sent to all members of the Poultry Science Association in good standing. All subscriptions should be sent to the Secretary-Treasurer, The Poultry Science Association, Texas A and M College System, College Station, Texas. Advertising rates $100 per page. ¶Copyright, 1962, by the Poultry Science Association.

Second class postage has been paid at Menasha, Wisconsin. Acceptance for mailing at special rate of postage provided for in Act of February 28, 1925, embodied in paragraph 4, Section 412, P.L. & R. authorized April 4, 1932. Printed in U.S.A.



WATER_PCB-SD0000017752

Hydropericardium and Ascites in Chicks Fed a Chlorinated Hydrocarbon*

E. L. McCune, J. E. Savage and B. L. O'Dell
Departments of Veterinary Bacteriology, Poultry Husbandry and Agricultural Chemistry, University of Missouri, Columbia, Missouri

(Received for publication May 3, 1961)

An epoxy-resin paint† has been used in our laboratory to coat galvanized batteries employed for trace mineral studies. This paint was supplied as two separate fractions which were mixed just prior to use. One portion contained the epoxy monomer and the other the amine hardener which catalyzed polymerization. On one occasion the paint did not harden before chicks were placed in the battery and within 3 weeks the chicks showed symptoms closely resembling those of the "chick edema" or "toxic fat" syndrome described by Schmittle *et al.* (1958) and Sanger *et al.* (1958). Because of the interest in the chemical nature of the toxic factor (Brew *et al.*, 1959; Friedman *et al.*, 1959; Wooton and Alexander, 1959; Harman *et al.*, 1960) that has been observed in feed-grade fats and the lipid origin of certain components of the paint, it seemed worthwhile to investigate further the causative agent in the epoxy-resin paint.

EXPERIMENTAL

Groups of ten, straight-run, Vantress-White Rock, cross-bred chicks were placed in electrically heated batteries at hatching and allowed to consume the experimental rations *ad libitum* for a four-week period. They were weighed weekly and examined daily for gross symptoms. All chicks were autopsied at death and at least two individuals per group were selected during the third and fourth weeks for histological examination of liver, kidney, heart, lung and spleen. The tissues were processed in the routine manner for histological examination and were stained with hematoxylin and eosin.

The basal ration was a practical-type broiler ration composed of soybean oil meal 36%, yellow corn 59.5%, $CaHPO_4$ 2%, limestone 1.3%, iodized salt 0.5%, methionine 0.1%, a trace mineral mixture and a vitamin supplement. The various paint fractions were dissolved in isopropyl alcohol and added to the mixed ration. Since some of the components were slightly volatile, the feeds were stored in closed containers and kept under refrigeration. Small portions were placed in the feeders daily.

RESULTS

In a preliminary trial the two fractions of the paint, the amine hardener and the epoxy monomer, were tested at a level of 0.1%. One-half of the chicks that received the amine hardener died whereas the other group lived and grew at a normal rate. From this test it was clear that the toxic substance was associated with the amine hardener. According to the manufacturer this fraction contained isopropyl alcohol, polyamid (made from diethylenetriamine and dimerized fatty acids), tri-dimethyl-

* Contribution from the Missouri Agricultural Experiment Station, Journal Series No. 2295.

† The paint (Epo Floor Top) was obtained from the Steelcote Manufacturing Co., St. Louis, Missouri. We gratefully acknowledge the assistance of Mr. A. G. Sternberg of this company who kindly supplied the various fractions tested.

WATER_PCB-SD0000017753

drome such as distended abdomen and labored respiration were evident, but there was no mortality during the four-week test period. At necropsy hydropericardium was evident. The 0.04% level produced symptoms resembling those observed among chicks fed 0.1% level of the amine hardener fraction. Feeding the polyamid along with chlorinated biphenyl did not change the results appreciably.

Gross Pathology. The gross pathology produced by chlorinated biphenyl closely resembled that observed in the "chick edema" syndrome. Losses usually started during the third week and reached major proportions during the fourth week. Before death the chicks exhibited symptoms of labored respiration with rales and in some cases the abdominal cavity was distended with fluid. At necropsy the most striking pathology was hydropericardium as illustrated in Figure 1. The crop of several birds contained bloody fluid. The kidneys were swollen and pale in most chicks but in the advanced stages many were hemorrhagic. The liver was sometimes enlarged and mottled in appearance. The lungs were commonly hydropic and hemorrhagic. A yellow, jelly-like fluid was frequently found under the skin and within body cavities. A large amount of fibrin was often present in this fluid.



FIG. 1. Hydropericardium observed in a chick fed 0.02% of chlorinated biphenyl for 4 weeks.



FIG. 2. Tubular dilatation in kidney of a chick fed 0.1% of chlorinated biphenyl. H and E stain (100×).

Histopathology. Chlorinated biphenyl at the 0.1% level caused severe renal tubular dilatation with numerous casts especially near the surface of the kidneys. Figure 2 illustrates the typical kidney damage and Figure 3 is a photomicrograph from a control kidney. The majority of the casts were basophilic, but appeared to be made up of strands resembling fibrin. Many of these basophilic bodies contained smaller homogenous eosinophilic bodies suggestive of amyloid. The damage was concentrated largely in the smaller collecting tubules.

The liver had a few areas of lymphocyt-

WATER_PCB-SD0000017754

Harman *et al.* (1960). It is possible that the toxic component of the chlorinated biphenyl product used here is a contaminant rather than the major component.

Although the toxicity of some chlorinated hydrocarbons has been studied in poultry, the pathology involved has received little attention. Pudelkiewicz *et al.* (1958) observed that a mixture of penta- and hexa-chloronaphthalenes caused high mortality in poults but there was no accumulation of fluid in body cavities.

Hydropericardium and ascites in chicks can be caused by a variety of compounds, the most common cause under practical conditions being excessive amounts of sodium chloride. Gordon *et al.* (1959) observed that a fat-soluble substance in blood meal caused a syndrome resembling the "toxic fat" syndrome. Excess salt increased the incidence of the disease in the presence but not in the absence of the fat-soluble factor. Accumulation of fluid results when the kidney fails to maintain normal water balance either because of excess electrolytes or because of kidney damage. Chlorinated biphenyl causes extensive kidney damage and ascites is probably a secondary result.

SUMMARY

Chicks fed fractions of an epoxy-resin paint developed hydropericardium and ascites. These symptoms were similar to those observed in the "toxic-fat" syndrome. The toxicity was found to be caused by a chlorinated biphenyl product used as a plasticizer in the paint.

Chlorinated biphenyl was moderately toxic when fed at a level of 0.02% and caused high mortality and extensive pathology within 4 weeks at a dietary level of 0.04%. Gross pathology included hydropericardium, hydroperitoneum, enlarged heart, liver and kidneys, and hemorrhage of internal organs. Microscopically the kidneys showed marked tubular dilatation and numerous casts.

REFERENCES

Brew, W. B., J. B. Dore, J. H. Benedict, G. C. Potter and E. Sipos, 1959. Characterization of a type of unidentified compound producing edema in chicks. J. Assoc. Offic. Agr. Chemists, 42: 120–128.

Bullis, K. L., and H. Van Roekel, 1944. Uncommon pathological conditions in chickens and turkeys. Cornell Vet. 34: 313–319.

Friedman, L., D. Firestone, W. Horwitz, D. Banes, M. Anstead and G. Shue, 1959. Studies of the chick edema disease factor. J. Assoc. Offic. Agr. Chemists, 42: 129–140.

Gordon, R. S., R. A. Mulholland, L. J. Machlin and K. H. Maddy, 1959. Hydropericardium and ascites caused by excess salt and a factor in blood meal. Poultry Sci. 38: 1209.

Harman, R. E., G. E. Davis, W. H. Ott, N. G. Brink and F. A. Kuehl, 1960. The isolation and characterization of the chick edema factor. J. Am. Chem. Soc. 82: 2078.

Pudelkiewicz, W. J., R. V. Boucher, E. W. Callenbach and R. C. Miller, 1958. Some physiological responses of Broad Breasted Bronze poults to chlorinated napthalene. Poultry Sci. 37: 185–187.

Sanger, V. L., L. Scott, A. Hamdy, C. Gale and W. D. Pounden, 1958. Alimentary toxemia in chickens. J. Am. Vet. Med. Assoc. 133: 172–176.

Schmittle, S. C., H. M. Edwards and D. Morris, 1958. A disorder of chickens probably due to a toxic feed-preliminary report. J. Am. Vet. Med. Assoc. 132: 216–219.

Wooton, J. C., and J. C. Alexander, 1959. Some chemical characteristics of the chick edema disease factor. J. Assoc. Offic. Agr. Chemists, 42: 141–148.

AUGUST 10–18. TWELFTH WORLD'S POULTRY CONGRESS SYDNEY, AUSTRALIA

SEPTEMBER 18–21. FIRST INTERNATIONAL CONGRESS OF FOOD SCIENCE AND TECHNOLOGY, IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY, LONDON, ENGLAND

WATER_PCB-SD0000017755