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Page

Table of Contents

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PERFORMANCE AND HAEMATOLOGICAL PROFILE OF BROILER STARTER BIRDS FED GRADED LEVELS OF RAW *Allamanda cathartica* (L) SEED MEAL DIETS

BY

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ABSTRACT

The response of 120 day-old broiler starter birds to graded dietary inclusion levels of 0.0 %, 2.5 %, 5.0 %, 7.5 % and 10.0 % of raw *Allamanda cathartica* (L) seed meal (ACSM) to form diets 1, 2, 3, 4 and 5 respectively was investigated. The isocaloric and isonitrogenous diets were fed to the birds for 4 weeks, after which a digestibility trial was carried out. Blood samples were collected for haematological and biochemical analyses at the end of the second week. Feed intake/bird/week and weight gain/bird/week decreased progressively as the dietary inclusion level of ACSM increased (280.52g/209.34g, 160.20g/99.50g, 90.41g/53.18g, 70.10g/38.73g and 41.30g/21.51g for diets 1, 2, 3, 4 and 5 respectively); while feed conversion ratio increased progressively ($p<0.05$) as the dietary ACSM level increased (1.34, 1.61, 1.70, 1.81 and 1.92 for diets 1, 2, 3, 4 and 5 respectively). No mortality was recorded for the control diet (with 0 % dietary inclusion level of ACSM), while mortality increased progressively as the dietary ACSM level increased ($p<0.05$), reaching up to 100 % at 10 % inclusion level. Dietary treatments had no effect on ether extract digestibility but birds on 0 % and 5 % ACSM diet significantly digested crude protein and crude fibre better than the 2.5 % ACSM diet. No significant ($p>0.05$) effect was observed on all the haematological and biochemical parameters investigated for the five dietary treatments. It is therefore concluded that ACSM contains potent anti-nutritional factors which are extremely toxic to broiler starter birds at whatever dietary inclusion level. So, there is the greatest need to detoxify the raw seed meal before it can be effectively incorporated into broiler starter diets.

Key words: *Allamanda* seed meal, growth performance, digestibility, haematological profile

INTRODUCTION

Cost of feed is about 60-80 % of the total cost of production for livestock (Oruwani *et al.*, 1995), and about 65-75 % of the cost of production in monogastric animals (Esonu, 2002). This high cost of feed is due to the cost of conventional energy and protein sources such as maize, groundnut cake, soya bean meal and fish meal; and have been the most important factors militating against increased commercial poultry production in developing countries. Hence, there is the intensive search by nutritionists in developing countries for alternative feed ingredients that have comparable nutritive values; have less competition between man and animals and are cheaper than the conventional ones.

One of the plant protein sources that have the potential of being used as a feed ingredient in poultry diets is *Allamanda cathartica* (L) seed meal. The plant is also called Golden Trumpet, Yellow Bell or Butter Cup and is used as a common ornamental plant. It belongs to the Dogbane family (*Apocynaceae*). It is a woody, evergreen shrub with vigorous growth and may reach a free standing height of two metres or more. The leathery leaves are lance-like, pointed and may either

be opposite or in whorls of three or four, producing blooms which are orange in colour; the seed capsules are oval in shape (Dalziel, 1981).

A. cathartica (L) has long been used in traditional medicine for different purposes, including, for example, the treatment of liver tumours (Mors *et al*., 2000). Also, leaf extracts of *A. cathartica* (L) has been found to be an excellent potential fungicide for control of nursery diseases of eggplant such as damping off and seedling blight caused by *Phomopsis vexans*, *Fusarium* sp., *Rhizoctina solani*, *Scelotium rolfsii* and *Phytophthora capsici*, that cause crop loss up to 30-50 % in Bangladesh, affecting 8 million farm families involved in eggplant cultivation (Anon., 2004). Moreover, some species of *Allamanda* have been found to demonstrate antifungal, antileukemic, antimicrobiological and anti-HIV properties because of the presence of an iridoid lactone, fulvoplumierin. This lactone is an inhibitor of HIV reverse transcriptase by inhibiting recombinant HIV-1 reverse transcriptase enzyme in an ELISA-based technique (Kardono *et al*., 1990; Tan *et al*., 1991).

There is dearth of information on the nutritional value of the seeds of *A. cathartica* in the diets of broilers, hence this study was undertaken to investigate the growth performance, nutrient digestibility and haematological characteristics of broiler starter birds fed graded levels of raw *Allamanda cathartica* (L) seed meal diets.

MATERIALS AND METHODS

(i) Experimental diets and experimental animals

One hundred naira (120) day-old broiler birds of the Anac 2000 breed obtained from Avian Specialities Limited, Ibadan, Nigeria, were used for this study. The site of the experimental study was the Poultry Section of the Animal Production Teaching and Research Farm, Federal University of Technology, Minna. Before the arrival of the birds, the deep litter pens were thoroughly cleaned, washed and disinfected with MORIGAD® and condoned off for about a week. Feeders, drinkers and heating equipments were later put in place awaiting the arrival of the birds. Hours to their arrival, the pens were heated up to a suitable temperature. On arrival, the birds were carefully removed from their packing boxes and randomly allotted to five dietary treatments of two replicates each, consisting of 12 birds per replicate and 24 birds per treatment. The diets consisted of 0.0 %, 2.5 %, 5.0 %, 7.5 % and 10.0 % dietary inclusion levels of *Allamanda cathartica* (L) seed meal mixed with other feed ingredients purchased within Minna metropolis (Table 1). The diets were formulated to be *isocaloric* and *isonitrogenous*.

Processing of *Allamanda* fruits were carried out as follows. Matured *Allamanda* fruits that had fallen on the ground beneath the tree canopies were collected from Minna metropolis and environs; though as an ornamental plant, it is readily available throughout Nigeria. Matured and dried *Allamanda* fruits were stripped of their mesocarp and the stony endocarp were cracked to obtain the raw seeds; these were grinded with an attrition mill to obtain the seed meal which were then mixed with other feed ingredients to form the experimental diets.

Table 1: Composition of the experimental diets for broiler starter birds (%)

Ingredients	Diets 1	2	3	4	5
Maize	50.00	48.00	48.00	47.00	46.00
Groundnut Cake	30.00	32.00	32.00	31.00	30.00
Maize Offal	5.25	3.05	3.55	3.00	2.55
Fish Meal	4.00	3.00	3.00	3.00	3.00
Bone Meal	5.50	5.50	5.50	5.50	5.50
Palm Oil	3.00	3.00	0.00	0.00	0.00
Salt	0.30	1.00	1.00	1.00	1.00
Limestone	1.20	1.20	1.20	1.20	1.20
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
*Premix	0.25	0.25	0.25	0.25	0.25
ACSM	0.00	2.50	5.00	7.50	10.00
Total	100.00	100.00	100.00	100.00	100.00
Analyzed composition (%)					
Dry matter	90.19	89.47	89.27	89.16	88.84
Crude protein	23.17	22.68	22.43	22.41	22.28
Ether extract	3.63	3.89	3.93	4.08	4.13
Crude fibre	3.63	3.79	3.83	3.88	3.96
Ash	5.07	5.23	5.36	5.61	5.89
NFE	54.69	53.96	53.72	53.18	52.58

*Premix to supply the following per kg of diet: Vit A, 13,340 iu; Vit D3, 2,680 iu; Vit E, 10 iu, Vit K, 2.68mg, Calcium pantothenate, 10.68mg, Vit B12, 0.022mg, Folic Acid, 0.668mg; Choline Chloride, 400mg, Chlortetracycline, 26.68mg, Mn, 133.34mg; Iron, 66.68mg; Zn, 53.34mg, Cu, 3.2mg, Iodine, 1.86mg, Cobalt, 0.268mg; Selenium, 0.10

ACSM = *Allamanda cathartica* seed meal NFE = Nitrogen free extract

(ii) Growth performance trial

The experimental diets were supplied to the birds *ad libitum* daily; with the leftover (uneaten) feed removed the following day. Clean drinking water was also supplied to the birds after washing the drinkers daily. The experiment lasted for four weeks during which time the birds were given the recommended drugs and antibiotics; and were also vaccinated against the major poultry diseases using a standard vaccination regime recommended for broilers in this region. Records of daily feed intake and mortality were taken; while the birds were weighed weekly to determine their body weight gain.

(ii) Digestibility study

During the last week of the experiment (i.e. at the end of the 4th week), a digestibility study was carried out on the broiler starter birds in specially-made metabolic cages using 4 randomly-selected birds per treatment. The birds were transferred to the cages and allowed to adjust to the conditions in the cages for three days during which time they were given feed and water *ad libitum*. Before the commencement of the faecal collection, the birds were fasted for 12 hours to evacuate the residual feed in their gut. Weighed quantities of feed were then supplied to the birds, and the voided faecal droppings were collected over a period of 72 hours on pre-weighed aluminium foils using the total collection method. This was carried out according to the procedures of Lamidi *et al*. (2008). Faecal droppings for each replicate per day were oven-dried at 80°C for 24 hours. The collections for the three days were then pooled together, grinded and kept for laboratory analysis in order to determine the apparent digestibility of nutrients.

(iii) Blood collection and analysis

At the end of the 2nd week, one bird per replicate was selected and slaughtered through severance of the jugular vein in the neck. 5 ml of blood was collected after slaughtering. The collected blood sample was immediately transferred into a sample bottle containing EDTA (Ethylene Di-amine Tetra Acetic Acid) to prevent coagulation. The same process was repeated for blood collection into another sample bottle but containing no EDTA, so as to obtain the serum. The blood samples were then subjected to haematological assay using the methods described by Hemening (1992) to analyze for packed cell volume (PCV), haemoglobin (Hb) concentration, mean corpuscular volume (MCV), mean corpuscular haemoglobin concentration (MCHC), total leucocyte (WBC) counts, total plasma proteins, urea, creatinine, triglycerides and albumin and globulin levels.

(iv) Chemical analysis

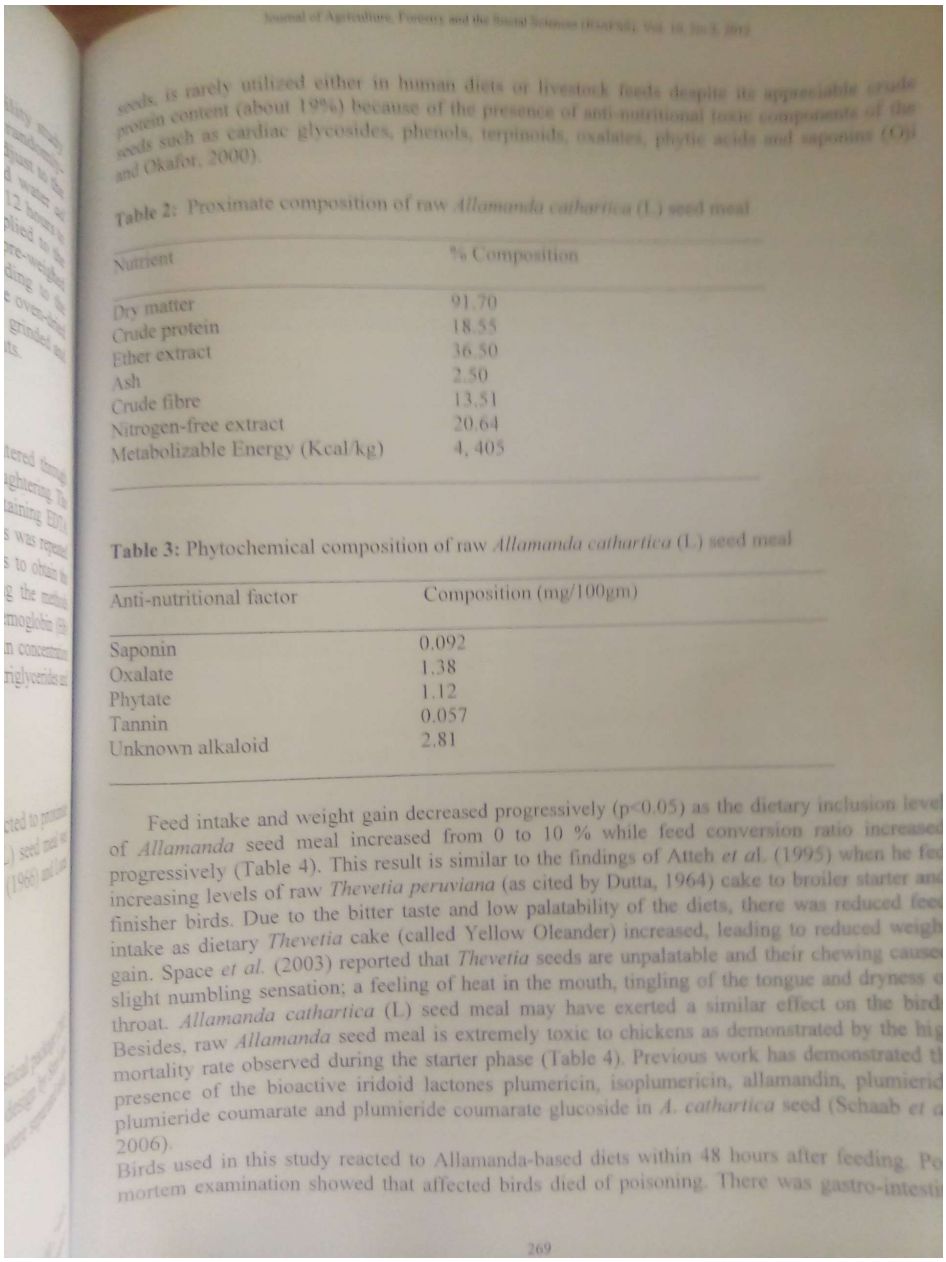
Allamanda cathartica (L) seed meal, feed and faecal droppings were subjected to proximate analysis using the methods of AOAC (2000); while *Allamanda cathartica* (L) seed meal was subjected to phytochemical analysis using the methods of Kakade and Evans (1966) and Lucas and Markakes (1975).

(v) Statistical analysis

All data obtained were subjected to analysis of variance using SPSS statistical package (2005 Version) following the procedures described for a completely randomized design by Steel and Torrie (1990), at 5 % probability test. Where means were significant, they were separated using Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The proximate composition of *Allamanda cathartica* (L) seed meal is shown in Table 2 while its phytochemical composition is shown in Table 3. *A. cathartica* (L) seed, like most legume



seeds, is rarely utilized either in human diets or livestock feeds despite its appreciable crude protein content (about 19%) because of the presence of anti-nutritional toxic components of the seeds such as cardiac glycosides, phenols, terpinoids, oxalates, phytic acids and saponins (Oji and Okafor, 2000).

Table 2: Proximate composition of raw *Allamanda cathartica* (L.) seed meal

Nutrient	% Composition
Dry matter	91.70
Crude protein	18.55
Ether extract	36.50
Ash	2.50
Crude fibre	13.51
Nitrogen-free extract	20.64
Metabolizable Energy (Kcal/kg)	4, 405

Table 3: Phytochemical composition of raw *Allamanda cathartica* (L.) seed meal

Anti-nutritional factor	Composition (mg/100gm)
Saponin	0.092
Oxalate	1.38
Phytate	1.12
Tannin	0.057
Unknown alkaloid	2.81

Feed intake and weight gain decreased progressively ($p<0.05$) as the dietary inclusion level of *Allamanda* seed meal increased from 0 to 10 % while feed conversion ratio increased progressively (Table 4). This result is similar to the findings of Atteh *et al.* (1995) when he fed increasing levels of raw *Thevetia peruviana* (as cited by Dutta, 1964) cake to broiler starter and finisher birds. Due to the bitter taste and low palatability of the diets, there was reduced feed intake as dietary *Thevetia* cake (called Yellow Oleander) increased, leading to reduced weight gain. Space *et al.* (2003) reported that *Thevetia* seeds are unpalatable and their chewing causes slight numbling sensation; a feeling of heat in the mouth, tingling of the tongue and dryness of throat. *Allamanda cathartica* (L) seed meal may have exerted a similar effect on the birds. Besides, raw *Allamanda* seed meal is extremely toxic to chickens as demonstrated by the high mortality rate observed during the starter phase (Table 4). Previous work has demonstrated the presence of the bioactive iridoid lactones plumericin, isoplumericin, allamandin, plumieride, plumieride coumarate and plumieride coumarate glucoside in *A. cathartica* seed (Schaab *et al.* 2006).

Birds used in this study reacted to Allamanda-based diets within 48 hours after feeding. Post mortem examination showed that affected birds died of poisoning. There was gastro-intesti

269

tract irritation, rapid fluid loss, diarrhoea and dehydration. At a later stage, birds showed dullness, anorexia, wobbling gait and loss of condition which made the birds to stagger about in a drunken fashion and fall over, with the toes flexed and legs outstretched. There was twisting of the neck and twitching of the legs leading to paralysis of the legs and eventual death. The birds died in an extended supine position and not in crouched prone position, with the sciatic nerves of the thigh muscle unaffected. This ruled out the possibility of Marek's disease attack.

Table 4: Performance of broiler starter birds fed graded levels of *Allamanda cathartica* (L) seed meal diets (0-4 weeks)

	Inclusion levels of *Allamanda cathartica* (L) seed meal (%)					
Parameter	0.0	2.5	5.0	7.5	10.0	SEM
Av. feed intake (g/bird/week)	280.52^{a}	160.20^{b}	90.41^{c}	70.10^{d}	41.30^{d}	31.51
Av. weight gain (g/bird/week)	209.34^{a}	99.50^{b}	53.18^{bc}	38.73^{c}	21.51^{c}	23.59
Feed: Gain	1.34^{c}	1.61^{b}	1.70^{b}	1.81^{ab}	1.92^{a}	0.14
Mortality	0.0^{c}	33.3^{bc}	43.8^{b}	91.7^{a}	100.0^{a}	23.56

^{a,b,c,d} Means in a row with different superscripts were significantly different ($p< 0.05$).
SEM = Standard error of means

At times, the birds will remain immobile in the same position for several minutes in a crouching posture. When forced to move, they moved in a zigzag, jerky manner. The anti-nutritional factor present in the seed meal is believed to have a neuromuscular effect on the birds. Also, the eyes were affected as they were droopy and cloudy in appearance, with a clear watery exudate oozing out of the eyes. It was also observed in about 50 % of the mortalities that the birds were already blind before they finally died, due to the severity of the eye malady. This is similar to the findings of Taiwo *et al*. (2004) when he fed diets containing10 % and 15 % raw *Thevetia peruviana* seed cake to rabbits. He observed diarrhoea, rough dry coat, mydriasis and hyperaesthesia in survivors; with muscle spasm, ataxia, paralysis of hind limbs and severe convulsions preceding death.

Table 5: Effects of graded levels of *Allamanda cathartica* (L) seed meal on the apparent nutrient digestibility of broiler starter birds

	Inclusion levels of *Allamanda cathartica* (L) seed meal (%)					
Parameter	0.0	2.5	5.0	7.5	10.0	SEM
Crude protein (%)	76.59^{ab}	75.64^{b}	78.59^{a}	-	-	0.07

Ether extract (%)	76.81	75.65	78.09	-	-	0.55
Crude fibre (%)	56.35[ab]	55.52[b]	58.55[a]	-	-	0.61

[a,b]Means in a row with different superscripts differ significantly ($p<0.05$). SEM = Standard error of means

Table 6: Haematological and biochemical parameters of broiler starter birds fed graded levels of *Allamanda cathartica* (L.) seed meal (ACSM)

	Inclusion levels of ACSM (%)					
Parameters	0	2.5	5.0	7.5	10.0	SEM
Haemoglobin (g/dl)	7.65	7.30	11.00	10.50	11.95	0.79
White blood cell (No/mm^3)	563.20	654.40	851.20	1084.60	1219.12	126.59
PCV (%)	23.00	22.00	33.00	31.50	36.00	2.36
MCV (%)	70.50	66.00	84.00	82.65	84.35	3.46
MCHC (%)	15.00	13.50	20.50	19.65	23.35	1.86
Albumin (mg/dl)	3.50	3.40	3.60	3.75	3.55	0.06
Globulin (mg/dl)	2.70	2.80	2.40	2.40	2.50	0.07
Albumin:globulin	1.30	1.21	1.50	1.56	1.42	0.88
Total protein (mg/dl)	2.70	3.25	3.90	3.55	3.55	0.16
Urea (mg/dl)	8.85	9.30	9.65	6.70	11.45	0.80
Creatinine (mg/dl)	104.00	100.50	99.50	84.50	100.50	4.10
Glucose (mg/dl)	8.90	9.90	7.70	10.15	8.55	0.64
Triglyceride (mg/dl)	1.80	1.45	1.50	2.20	1.50	0.16

Means on the same row with no superscripts were not significantly different ($p>0.05$)
SEM=Standard error of means
PCV = Packed cell volume
MCV = Mean corpuscular haemoglobin
MCHC = Mean corpuscular haemoglobin concentration

In this research study, no mortality was recorded for the control diet with 0 % dietary inclusion level of *A. cathartica* seed meal, while mortality increased progressively as the *A. cathartica* seed meal level increased ($p<0.05$), with 100 % mortality recorded at 10 % dietary inclusion level.

Results from the digestibility studies showed that dietary treatments had no effect on ether extract digestibility; but crude protein and crude fibre digestibility were significantly ($p<0.05$) affected, with birds on 0 % and 5 % ACSM retaining significantly more crude protein and fibre than the 2.5 % ACSM (Table 5). The increased crude protein and crude fibre retention by birds fed 5 % ACSM may have been due to their reduced feed intake leading to the maximal utilization of the consumed nutrients by the stressed birds.

Results of haematological and biochemical profile of birds fed graded levels of ACSM are shown in Tables 6. There were no significant ($p>0.05$) differences in all the haematological and biochemical parameters investigated among the five dietary treatments. This shows that the anti-

nutritional factors in *Allamanda cathartica* (L) seed meals do not exert any direct effect on the haematological and biochemical parameters of broiler starter birds, but rather exert neuromuscular effect on the birds. The fact that the numbers of white blood cells were normal showed that the birds did not have any secondary systemic bacterial or viral infections.

CONCLUSION AND RECOMMENDATIONS

Based on the above findings, it can be concluded that *Allamanda cathartica* (L.) seed meal, even at low inclusion levels in broiler starter diets, is extremely toxic to broiler birds. It contains powerful and potent non-thermolabile but thermostable factors that are not just mere anti-nutritional factors but toxins. Therefore, raw *Allamanda cathartica* seed meal should be detoxified, using effective detoxification techniques such as .anaerobic and microbial fermentation or using chemical methods, before it can be effectively incorporated into broiler starter diets. However, the high protein content of the raw seed meal (18.55 %) shows the potential of the seed meal as an alternative protein source in broiler diets, especially, if some of the high oil content (36.50 %) is removed through extraction.

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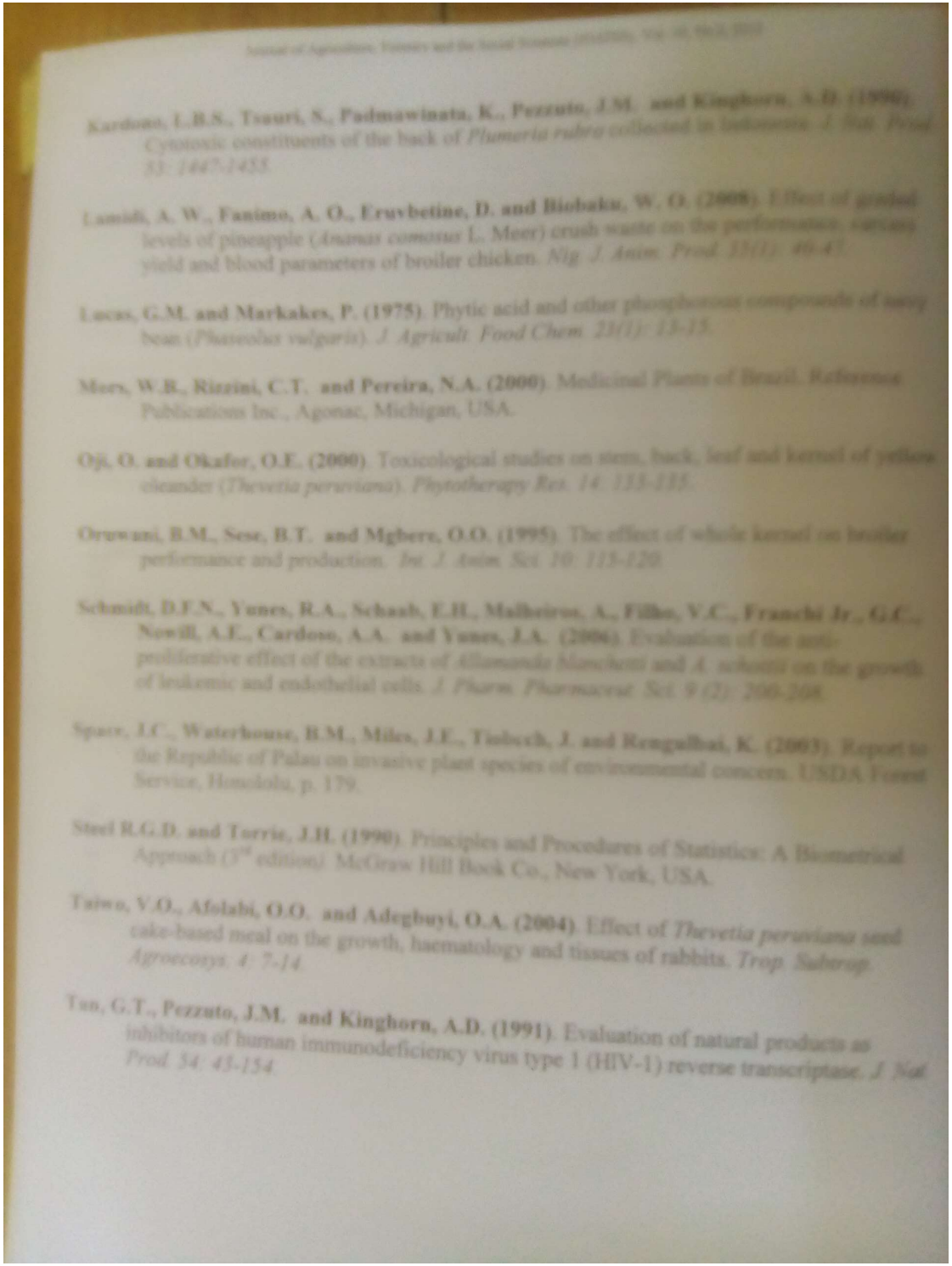

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