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Co-Prevalence of Poultry, Rodent and House Dust Mites in Nigerian Poultry Confinements and Its Possible Association with Respiratory Health Hazards

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Abstract

The study was aimed at assessing the prevalence of mites in poultry dust and its possible contribution to respiratory diseases among the Nigerian poultry workers. Settled dusts from 20 poultry confinements were analysed for the presence of mites. Questionnaire was administered to assess the symptoms of respiratory ill-health and socio-demographic profiles of poultry workers. Mites were recovered from of all the poultry twenty dust samples. The species of mites isolated were poultry mite *Dermanyssus gallinae*, house dust mite *Dermatophagoides evansi* and rodent mite *Ornithosonysus bacoti.* Significantly higher frequencies ($p<0.001$) for symptoms of bronchitis/hyperactive airways (cough, sputum, shortness of breath, tightness in chest, wheezing) and symptoms of mucous membrane irritation (running nose, scratchy throat burning/watering eyes), were reported by poultry workers than control populace. Employers in the poultry industry have to undertake a careful health surveillance of their employees.

Key words: Dust mites, poultry, respiratory health

Introduction

Mites belong to the family arachnid; they possess exoskeleton and eight legs; an adult mite can be as long as 300**µ**m in diameter and lives in organic debris. Mites are named based on the places of occurrence, e.g. poultry mites in poultry houses, storage mites in stored hay, grains or straw and domestic/house dust mites in people's homes (SNBOSH, 1994; WHO, 2000; Soo-Youg et al., 2008).

A temperature of 25-30^{O}C and relative humidity approximately 80% are necessary for growth and reproduction of storage mites. When the temperature and relative humidity are favorable storage mites may be found in the house dust (Tee, 1994; Macan *et al*, 1998). Dust mites numbers could be reduced by maintaining relative humidity below 50% (Soo-Young *et al.,* 2008)

Mites are most commonly transferred to poultry through wild birds such as sparrows, starlings, swallows and pigeons roosting or nesting in poultry house. Mite infestations on poultry vary from reduce production of laying hens caused by decreased feed intake, rough feathers as well as scabs and pink combs; while severe cases could result in death (Beyer and Mock, 1999).

Mites excrement contain allergic substances (SNBOSH, 1994; WHO, 2000). Mite antigen could be up to 10-20**µ**m in diameter and will not be suspended in air for a long time (WHO, 2000). Enzymes derived from gut of mites have been identified as the source of allergens and that the enzymes remain allergenic potent in the environment long after mites population have disappeared (Feather *et al.,* 1993). The presence of dust mites and

their antigens are determined by sampling of air and settled dust. The latter approach is more commonly used than the former. However significant correlations have been found between the level of dust mite allergen in both air and settled dust (WHO, 2000).

The accepted, recommended and best-validated index of exposure to dust mite allergen is dust sampling for measurement of the level of mite infestation. This approach considers that the quality of mite allergen released into the air is a function of what is present in the settled dust (WHO, 2000).

Storage mite antigen has been found to be the commonest form of allergy, despite daily exposure of farmers to other allergens such as pollen, animal epithelium and domestic dust mites. Thirty eight percent of farmers and agricultural workers with allergic asthma or hay fever have been found to be allergic to mites (SNBOSH, 1994).

Dust from poultry confinements in Nigeria has been reported to contain several toxic chemicals, mycotoxins, toxigenic, microfungi and multidrug resistant bacteria (Okiki and Ogbimi, 2011; Okiki et al., 2012). Also the Nigerian poultry workers have been found to experience significantly higher frequency of symptoms of physical ill-health and anxiety than the control populace (Okiki et al. 2013). The present study was aimed at assessing the prevalence of mites in poultry dust and its possible contribution to respiratory diseases among the Nigerian poultry workers.

Methodology

Isolation of mites from poultry dust

Dust samples from 20 poultry houses, in different parts of Lagos and Ogun States Nigeria, were collected into newly purchased brown envelops, and taken to the laboratory for mite isolation at the Department of Animal and Environmental Biology of the University of Benin, Nigeria. The isolation of mites from the dust samples was carried out by sedimentation and filtration of dust suspension in alcohol under heat exposure using 100W electric bulb for 24 hours. The procedure and equipment used are the ones commonly employed by the Department of Animal and Environmental Biology of the University of Benin, Nigeria, for isolation of mites.

The filtrates were placed in petridishes and mites observed under the stereomicroscope. Mites were picked under the stereomicroscope with the aid of pasture pipette and placed on glass slides, followed by dehydration with increasing strength of alcohol (75%, 80%, 90% and absolute) and two changes of xylene, before mounting in Canada balsam. Photograph of the mites were taken with the aid of a digital camera under the light microscope. The isolated mites were identified according to Baker (1999) and Stoll and Verlag (2000).

Questionnaire

A set of questionnaire was developed to assess the symptoms of ill-health and socio-demographic profiles of poultry workers. Questions on socio-economic profiles included age, gender, literacy, personal hygiene and use of respirators/face masks when working in poultry confinements. The workers were asked if they experienced the symptoms of ill health that lasted 2–5 days or more within the 6 months that preceded the interview.

Information was obtained on the symptoms respiratory illness such as, symptoms of bronchitis and hyperactive airways (cough, sputum, shortness of breath, tightness in chest, wheezing) and symptoms of mucous membrane irritation (running nose, scratchy throat burning/watering eyes). The questionnaires were administered to 100 poultry workers and 100 non-poultry workers.

Statistical Analysis

Paired t-test was used to test for significant difference in mean symptoms values between the poultry workers and the control subjects. Analysis of data was carried out using SPSS 15.0 for Windows Evaluation Version.

Results

Mites were recovered from of all the poultry twenty dust samples. The species of mites isolated were poultry mite *Dermanyssus gallinae*, house dust mite *Dermatophagoides evansi* and rodent mite *Ornithosonysus bacoti* (Figure 1).

The sociodemographics of the groups studied are as presented in Table 1, showing no significant difference between the sociodemographics of poultry workers and those of control subjects. All the poultry workers were not in strict compliance with the use of nose mask when discharging their duties in poultry confinements. Significantly higher frequencies ($p<0.001$) of both Symptoms of bronchitis/hyperactive airways (Cough, sputum, shortness of breath, tightness in chest, wheezing) and Symptoms of mucous membrane irritation (Running nose, scratchy throat, burning/watering eyes), were reported by poultry workers than control populace (Figure 2).

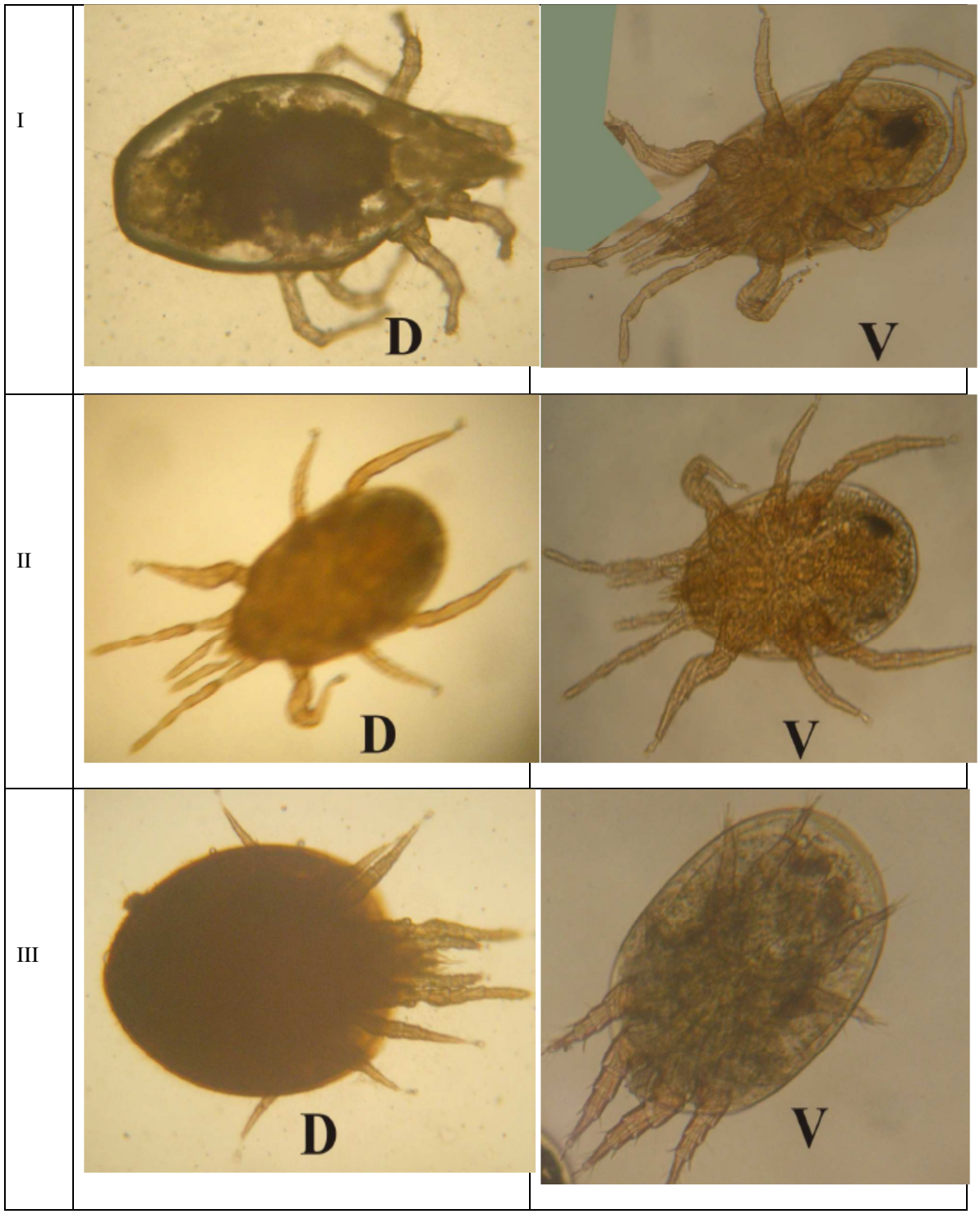

Figure 1a: Mites isolated from poultry dust: (I) *Dermanyssus gallinae*, (II) *Dermatophagoides evansi*, (III) *Ornithosonysus bacoti.* D – Dorsal view, V – ventral view

Table 1: Social demographics of poultry workers and control subjects

Characteristics	Poultry Workers (no)	Control Subjects (no)	Significant (p value)
Sex:			
Male	57	40	1.00
Female	43	50	
Education:			
Primary	18	25	1.00
Secondary	60	45	
Tertiary	22	30	
Age (years):			
21-30	36	31	1.00
31-40	34	28	
41-50	20	32	
51-60	10	9	
Tobacco Smoking:			
Smokers	5	2	1.00
Non Smokers	95	98	
Total compliance to use of nose mask at work	0	Not Applicable	

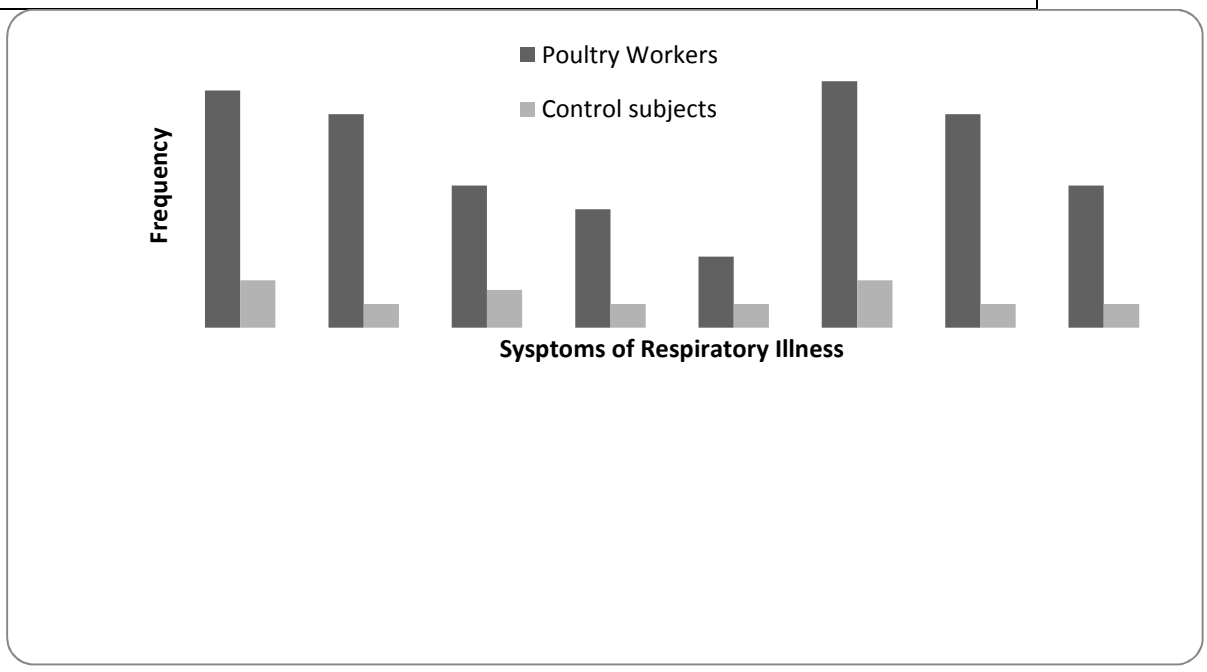

Figure 2: Comparison of frequency of symptoms respiratory illness experienced by poultry workers and control subjects (t=6.956; p<0.001)

Discussion

Poultry dust contains many components which could trigger allergic respiratory disease and make existing disease worse. Three components in particular - softwood dust, grain dust and storage mites - are known asthmagens. The longer someone works in a poultry farm, the more likely he develops chronic respiratory problems. Workers in cage-housed facilities seem to have more problems than those in floor-housed facilities (AllergyCosmos, 2014).

Isolation of mites from poultry dust and the prevalence of symptoms of respiratory illness among poultry workers in this study is an indication that mite allergens might contribute to occupational health risk of Nigerian poultry workers. Mite excreta have been found to contain allergic substances and the temperature of 25 – 30^{O}C and relative humidity of 80% necessary for growth and reproduction of mites are frequently met by poultry confinements in the tropics. Workers with occupational respiratory disease may develop permanent breathing problems, becoming disabled, and unable to work. This not only affects individual workers, but has wider cost implications for employers and the poultry industry as a whole.

The presence of house dust mites in poultry confinements reported in this study is in consonance with the report of Elbers and co-authors (2000) that found *D. evansi* in poultry farms in Western Europe. Most of the poultry farms investigated were highly infested with rats and that could be the source of rodent mites isolated from all the farms.

Elimination of mites in poultry confinements and their infestation in human habitation is best achieved through a combination of eliminating potential vectors (nesting pigeons, backyard poultry, etc.); reducing potential hiding places (rugs); judicious use of pesticides; consistent use of dehumidifiers to maintain a low humidity environment; maintaining a low temperature in the environment; frequent thorough cleaning and maintaining excellent hygiene.

In conclusion, the employers in the poultry industry have to undertake a careful health surveillance of their employees. There should be regulation levels of poultry dust at least adequately controlled by paying attention to ventilation and air purification. Use of nose masks should be made compulsory and allergic individuals should work less in poultry confinements.

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