

An investigation of cross-reactivity between the poultry red mite and house dust and storage mites in dogs with contact with chickens infested with red mites

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Background – The European poultry red mite (PRM) *Dermanyssus gallinae*, a common ectoparasite of laying chickens and pigeons; it can also feed on other birds, humans and domestic animals, causing clinical signs ranging from mild discomfort to severe dermatitis. Little is known about possible hypersensitivity to PRM or cross-sensitization with house dust or storage mites.

Hypothesis/objectives – Knowledge on possible PRM immunoglobulin E (IgE)-mediated allergy and possible cross-sensitization with house dust and storage mites may facilitate the clinical approach. The aim herein was to clarify possible evidence of type I hypersensitivity to PRM in dogs and possible occurrence of cross-sensitization with house dust and storage mites.

Animals – Sixteen dogs with chronic contact with PRM-infested chickens from traditional bird houses and 10 control dogs with no contact with birds.

Methods and materials – Dogs were subjected to intradermal testing (IDT) and serum specific IgE (sIgE) determination for house dust and storage mites and *D. gallinae*.

Results – The highest wheal score was obtained with 0.1 mg/mL *D. gallinae* extract. Positive IDT reactions to PRM were found in four of 10 control dogs and in 10 of 16 from the chicken-exposed group. sIgE to PRM was detected in one control and in seven dogs exposed to chickens. No significant correlation was found between IDT or sIgE scores to PRM and house dust and storage mites.

Conclusions and clinical significance – Contact with PRM-infested chickens may lead to sensitization without allergy, independently from sensitization to house dust and storage mites.

Introduction

Dermanyssus gallinae, the European poultry red mite (PRM), is a common ectoparasite of laying chickens and pigeons; it can also feed on other birds, humans¹ and domestic animals including cats,² dogs,³ horses⁴ and goats,⁵ causing clinical signs ranging from mild discomfort to severe dermatitis and anaemia,² with the possible transmission of several infectious zoonotic agents.⁶ Dogs affected by PRM infestation typically show lumbosacral/tail/limb pruritus with erythema, scaling, papules and

crusts, resembling a flea allergy dermatitis pattern.³ Infestation and diagnosis of PRM infestation is based on the identification of *D. gallinae* mites by clear acetate tape test. Differential diagnoses should include fleas and *Cheyletiella* mites. Evidence of cross-sensitization between *Cheyletiella* and *Dermatophagoides farinae* and *D. pteronyssinus* (house dust mites) has been reported previously.⁷ The goal of the present study was to investigate possible type I hypersensitivity to PRM in dogs, and the potential occurrence of cross-sensitization between PRM and dust and storage mites.

Methods and materials

Dog population

Sixteen nonatopic dogs with long-lasting close contact with chickens naturally infested with PRM from traditional bird houses and 10 control dogs, without direct contact with birds were selected. An informed consent form, previously approved by the University of Évora ethics committee, was presented to and signed by each dog owner.

Methods

Each dog was subjected to intradermal testing (IDT) with 50 µL of allergen extracts including *Dermatophagoides pteronyssinus*,

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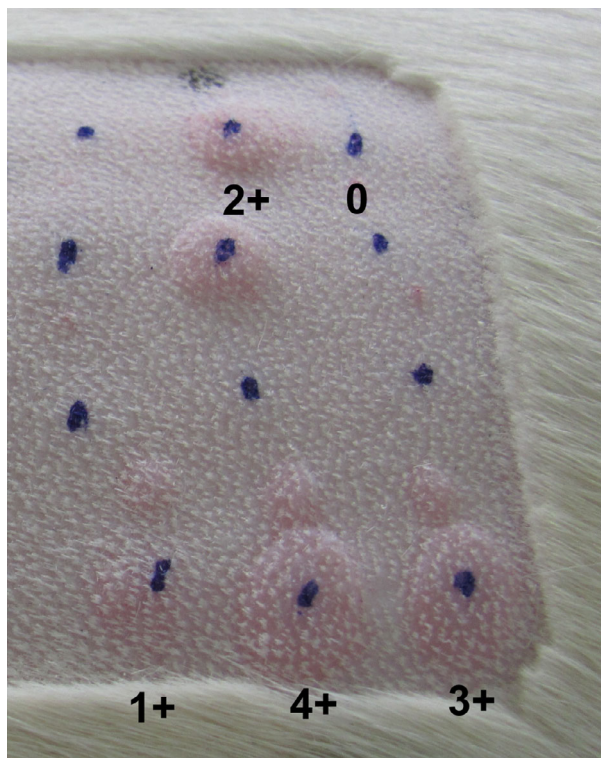


Figure 1. Representation of the reactions seen with intradermal testing using a 0–4 score range.

In the test above the allergens were 2+ = positive control; below 2+ = *Acarus siro*; 0 = *Quercus rubor*; 1+ = *Malassezia pachydermatis*; 3+ = *Alternaria alternata*; 4+ = *Aspergillus fumigatus*.

D. farinae, *Lepidoglyphus destructor*, *Acarus siro*, *Tyrophagus putrescentiae* (Diater; Madrid, Spain) and *Dermanyssus gallinae* (LETI Animal Health Laboratories; Barcelona, Spain). Allergen concentrations tested were 0.01, 0.1, 0.5 and 1 mg/mL. Positive (0.01% histamine phosphate solution) and negative (physiological saline solution) commercial controls (Diater) were administered. Dermal wheal and flare reactions were evaluated after 15 min. Reactions were considered positive when the resulting wheals were at least equal to or higher than halfway between the negative and the positive control reaction; then scored increasingly from 0 (negative) to 4 (maximum positive) (Figure 1).⁸ All dogs were sedated with medetomidine (Orion Pharma; Espoo, Finland) (≈ 0.03 mg/kg body weight, administered subcutaneously) and sedation was reversed

post-testing with atipamezole (Orion Pharma) administered intramuscularly. Serum samples were obtained for macELISA determination of sIgE to *D. pteronyssinus*, *D. farinae*, *L. destructor*, *A. siro*, *T. putrescentiae* and *D. gallinae* (Greer Laboratories; Lenoir, NC, USA). Differences between intradermal wheal scores and sIgE ELISA absorbance units (EAU) were compared between groups using the Pearson correlation coefficient (www.socscistatistics.com and SPSS, Chicago, IL, USA). Statistical significance was set at $P < 0.05$.

Results

The maximum wheal score was obtained with *D. gallinae* extract at a concentration of 0.1 mg/mL with smaller responses observed between 0.01 and 0.1 mg/mL. Poultry red mite, and house dust and storage mite IDT scores and sIgE are presented in Table 1 and Figure 1. Four of 10 (40%) control dogs tested positive on IDT to PRM, whereas only one (10%) had detectable serum sIgE to PRM. In the chicken-exposed group, the figures were higher at 10 (62.5%) and seven (43.8%) of 16 individuals, respectively.

No significant correlation was found between reactions to PRM, and house dust and storage mites when comparing IDT reactions ($P \geq 0.08$) or when comparing values for sIgE ($P \geq 0.39$). No significant correlation was found between IDT reactions and positive values for sIgE when comparing PRM ($P = 0.11$) or house dust and storage mites ($P \geq 0.18$).

Discussion

The increased proportion of dogs IDT- and sIgE-positive for *D. gallinae* found among the population exposed to the PRM-infested chickens reveals a state of sensitization without clinical signs. In the present study, 0.1 mg/mL was the lowest concentration inducing the largest wheal on IDT; further studies with larger dog populations are needed to standardize *D. gallinae* extract for IDT assessment.

Sensitization to PRM did not correlate with sensitization to house dust and storage mites. In fact, despite belonging to the same subclass (Acari), these mites are reasonably different because *Dermanyssus* is a micro-predator,⁹ whereas house dust and storage mites are mainly opportunistic dandruff eaters.¹⁰

Table 1. *Dermanyssus gallinae*, house dust and storage mites, intradermal test (IDT) scores and serum specific IgE (sIgE) in control and chicken-exposed dogs

Mite allergen species		IDT		sIgE in ELISA absorbance units	
		Positive	Mean $\pm$ standard deviation (SD)	Positive	Mean $\pm$ SD
<i>Dermanyssus gallinae</i>	Control	4	2.25 $\pm$ 0.5	1	290 (n = 1)
	Exposed	10	2.06 $\pm$ 0.98	7	277.29 $\pm$ 148.6
<i>Dermatophagoides pteronyssinus</i>	Control	1	-	5	247.4 $\pm$ 38.88
	Exposed	3	1.67 $\pm$ 0.58	6	402.83 $\pm$ 302.35
<i>Dermatophagoides farinae</i>	Control	4	2.13 $\pm$ 1.03	4	1,539.5 $\pm$ 1518.2
	Exposed	9	2.67 $\pm$ 0.87	15	1,521 $\pm$ 1,113.3
<i>Lepidoglyphus destructor</i>	Control	4	2 $\pm$ 0.82	2	401 $\pm$ 100.41
	Exposed	9	1.5 $\pm$ 0.87	6	358 $\pm$ 588.14
<i>Acarus siro</i>	Control	6	3.17 $\pm$ 1.17	6	863.5 $\pm$ 910.42
	Exposed	13	3.04 $\pm$ 0.9	15	1,243.8 $\pm$ 969.14
<i>Tyrophagus putrescentiae</i>	Control	6	3.33 $\pm$ 0.82	4	1,223.3 $\pm$ 1,303.5
	Exposed	10	3.3 $\pm$ 1.0	14	873.07 $\pm$ 763.89

Positive values relates to the number of positive individuals from 10 controls and from 16 chicken-exposed dogs. ELISA enzyme-linked immunosorbent assay.

Dog exposure to PRM may result in sensitization with sIgE production and in some cases clinical signs of allergy also could occur.³ The lack of significant correlation found between sensitization to PRM and to house dust and storage mites suggests that dog sensitization to the first should not result in cross-reaction with the second, minimizing the risk of misdiagnosis with house dust and storage mites in allergic dogs. Further study of cross-reactivity between mite species using immunoassay inhibition testing is indicated to investigate the basis of cross-sensitivity phenomena.

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Résumé

Contexte – L'acarien rouge de volaille européenne (PRM) *Dermanyssus gallinae* est un ectoparasite fréquent des poules pondeuses et pigeons, et peut aussi se nourrir sur d'autres oiseaux, homme ou animaux domestiques, causant des signes cliniques allant de l'inconfort modéré à une dermatite sévère. On en sait peu sur l'hypersensibilité possible à PRM ou de sensibilisation croisée avec les acariens de poussière ou de stockage.

Hypothèses/Objectifs – Les connaissances sur une possible l'allergie médiée par immunoglobulines E (IgE) à PRM et une sensibilisation croisée possible avec les acariens de poussière et de stockage pourrait faciliter l'approche clinique. Le but ici était de clarifier la potentielle preuve d'une hypersensibilité de type I à PRM chez les chiens et la possible circonstance de sensibilisation croisée avec les acariens de poussière de maison et de stockage.

Sujets – Seize chiens ayant des contacts chroniques avec des poules infestées par PRM et 10 chiens contrôles sans contact avec des oiseaux.

Matériels et méthodes – Les chiens ont été soumis à des intradermoréactions (IDT) et les IgE sériques spécifiques (sIgE) ont été déterminés pour les acariens de poussière de maison, de stockage et *D. gallinae*.

Résultats – Le score le plus élevé a été obtenu avec un extrait de 0,1 mg/mL de *D. gallinae*. Les réactions positives à PRM ont été trouvées pour quatre des 10 chiens contrôles et 10 des 16 chiens du groupe exposées aux poules. Aucune corrélation significative n'a été trouvée entre les scores d'IDT et IgE à PRM, acariens de poussière ou de stockage.

Conclusions et importance clinique – Un contact avec les poules infestées par PRM peut mener à une sensibilisation sans allergie, indépendamment de sensibilisation aux acariens de poussière ou de stockage.

Resumen

Introducción – el ácaro rojo europeo de las aves de corral (PRM) *Dermanyssus gallinae*, un ectoparásito común de pollos y palomas ponedoras, también puede alimentarse de otras aves, humanos y animales domésticos, causando signos clínicos que van desde molestias leves hasta dermatitis severa. Poco se sabe sobre la posible hipersensibilidad a PRM o la sensibilización cruzada con ácaros del polvo doméstico o los ácaros de almacenamiento.

Hipótesis/objetivos – el conocimiento sobre la posible reacción alérgica mediada por inmunoglobulina E (IgE) a PRM y la posible sensibilización cruzada con ácaros del polvo doméstico y los ácaros de almacenamiento pueden facilitar la estrategia clínica. El objetivo en este documento fue aclarar la posible evidencia

de hipersensibilidad de tipo I a PRM en perros y la posible aparición de sensibilización cruzada con ácaros del polvo doméstico y los ácaros de almacenamiento.

Animales – dieciséis perros con contacto crónico con pollos infestados con PRM en alojamientos tradicionales y 10 perros de control sin contacto con aves.

Métodos y materiales – los perros fueron sometidos a pruebas intradérmicas (IDT) y determinación de IgE (sIgE) específica de suero para ácaros del polvo doméstico, ácaros de almacenamiento y *D. gallinae*.

Resultados – la valoración de las pápulas más alta se obtuvo con extracto de *D. gallinae* de 0,1 mg/mL. Se encontraron reacciones IDT positivas a PRM en cuatro de 10 perros control y en 10 de 16 del grupo expuesto a pollos. Se detectó IgE frente a PRM en un control y en siete perros expuestos a pollos. No se encontró una correlación significativa entre los valores de IDT o sIgE a PRM y ácaros del polvo doméstico y de almacenamiento.

Conclusiones e importancia clínica – el contacto con pollos infestados de PRM puede conducir a la sensibilización sin alergia, independientemente de la sensibilización a ácaros del polvo doméstico y a los ácaros de almacenamiento.

Zusammenfassung

Hintergrund – Die europäische rote Vogelmilbe (PRM) *Dermanyssus gallinae*, ein häufiger Ektoparasit von Legehennen und Tauben kann sich auch auf anderen Vögeln, dem Menschen und auf Haustieren ernähren, was klinische Zeichen verursacht, die von mildem Unwohlsein bis zu schwerer Dermatitis reichen können. Es ist wenig bekannt über eine mögliche Hypersensibilität auf die PRM oder einer Kreuz-Sensibilisierung mit andern Hausstaub- oder Futtermittelmilben.

Hypothese/Ziele – Wissen über eine mögliche PRM Immunglobulin E (IgE)-medierte Allergie und mögliche Kreuz-Sensibilisierung mit Hausstaub- und Futtermittelmilben könnte einen klinischen Ansatz erleichtern. Das Ziel dieser Studie war es, das mögliche Auftreten einer Typ I Hypersensibilität auf PRM bei Hunden und das mögliche Auftreten einer Kreuz-Sensibilisierung mit Hausstaub- und Futtermittelmilben klarzustellen.

Tiere – Sechzehn Hunde mit chronischem Kontakt mit PRM-infizierten Hühnern aus traditionellen Hühnerställen und 10 Kontrollhunde mit keinem Kontakt zu Vögeln.

Methoden und Materialien – An den Hunden wurden Intradermaltests (IDT) durchgeführt sowie eine Bestimmung von Serum-spezifischem IgE (sIgE) für Hausstaub- und Futtermittelmilben und *D. gallinae*.

Ergebnisse – Die größte Quaddelmessung wurde mit 0,1 mg/mL *D. gallinae* Extrakt erzielt. Es wurden positive IDT Reaktionen auf PRM bei vier der 10 Kontrollhunde und bei 10 der 16 Hunde aus der Hühner-Kontakt Gruppe festgestellt. sIgE auf PRM wurde bei einem Kontrollhund und bei sieben Hunden aus der Hühner-Kontakt Gruppe festgestellt. Es wurde keine signifikante Korrelation zwischen IDT oder sIgE Werten zu PRM und Hausstaub- und Futtermittelmilben gefunden.

Schlussfolgerungen und klinische Bedeutung – Der Kontakt mit PRM-infizierten Hühnern könnte zu einer Sensibilisierung ohne Allergie führen, unabhängig von einer Sensibilisierung auf Hausstaub- und Futtermittelmilben.

抽象

背景 – 鶏やハトに横たわる一般的な外部寄生虫であるヨーロッパ家禽赤ダニ(PRM)*Dermanyssus gallinae*は、他の鳥、人間、家畜にも感染することができ、軽度の不快感から重度の皮膚炎に至る臨床症状を引き起こす。PRMに対する過敏症またはハウスダストまたは貯蔵ダニとの交差感作についてはほとんど知られていない。

仮説/目的 – PRM免疫グロブリンE(IgE)を介したアレルギーの可能性およびハウスダストおよび貯蔵ダニとの交差感作の可能性に関する知識は、臨床的アプローチを促進する可能性がある。本研究の目的は、犬PRMに対するI型過敏症証拠およびハウスダストおよび貯蔵ダニとの交差感作の発生の可能性を明らかにすることであった。

被験動物 – 伝統的な鳥小屋のPRM感染鶏と慢性接触した16頭の犬および鳥と接触していない10頭の対照犬。

材料と方法 – 被験犬にハウスダストマイト、貯蔵ダニおよび*D. gallinae*の皮内検査(IDT)および血清特異的IgE(sIgE)の測定を実施した。

結果 – *D. gallinae*抽出物 0.1 mg / mLで最も高い膨疹スコアが得られた。PRMに対する陽性IDT反応は、対照犬群10頭中4頭、鶏暴露群の16頭中10頭で検出された。PRMへのsIgEは、コントロール群1頭および鶏暴露群7頭の犬に検出された。PRMとハウスダストマイトおよび貯蔵ダニ間におけるIDTまたはsIgEスコアに有意な相関関係は検出されなかった。

結論と臨床的重要性 – PRM感染鶏との接触は、ハウスダストマイトおよび貯蔵ダニに対する感作とは独立して、アレルギーを伴わない感作を引き起こす可能性がある。

摘要

背景 — 欧洲禽赤螨(PRM)——鸡皮刺螨是一种常见的产蛋鸡和鸽子的外寄生虫,也可在其他鸟类、人类和家畜身上采食,引起从轻微不适到严重皮炎的临床症状。关于机体对PRM可能的超敏反应,或与户尘螨或储藏螨交叉致敏的研究甚少。

假设/目的 — 了解PRM免疫球蛋白E (IgE)可能介导的过敏和可能的户尘螨和储藏螨交叉致敏,可能有助于临床诊断。本文目的是寻找犬对PRM可能发生I型超敏反应的证据,以及可能发生户尘螨和储藏螨交叉致敏。

动物 — 与传统鸟舍中 PRM感染鸡有长期接触的16只犬;与鸟类没有接触的10只对照犬。

方法和材料 — 对犬进行皮内试验(IDT)和血清特异性IgE (sIgE)试验,以检测户尘螨和储藏螨,以及鸡皮刺螨特异性IgE。

结果 — 0.1mg/mL鸡皮刺螨提取物的风疹评分最高。10只对照犬中的4只,以及接触鸡群的16只犬中的10只,身上发现PRM阳性IDT反应。在1例对照和7例鸡群接触犬中,检测到PRMsIgE。PRM、户尘螨和储藏螨的IDT或sIgE评分无显著相关性。

结论和临床意义 — 与PRM感染的鸡接触可引起致敏,但不过敏,与户尘螨和储藏螨的致敏无关。

Resumo

Contexto — O ácaro vermelho das aves domésticas europeu (PRM), *Dermanyssus gallinae*, um ectoparasita comum de galinhas e pombos, também pode se alimentar de outras aves, humanos e animais domésticos, causando sinais clínicos que variam de leve desconforto a dermatite grave. Pouco se sabe sobre a possível hipersensibilidade ao PRM ou sensibilização cruzada com poeira doméstica ou ácaros de armazenamento.

Hipótese/objetivos — O conhecimento da possível alergia a PRM mediada por imunoglobulina E (IgE) e a possível sensibilização cruzada com poeira doméstica e ácaros de armazenamento podem facilitar a abordagem clínica. O objetivo deste estudo foi esclarecer as possíveis evidências de hipersensibilidade do tipo I ao PRM em cães e possível ocorrência de sensibilização cruzada com poeira doméstica e ácaros de armazenamento.

Animais — Dezesesseis cães com contato crônico com galinhas de aviários tradicionais infestadas por PRM e 10 cães controle sem contato com aves.

Métodos e materiais — Os cães foram submetidos a testes intradérmicos (IDT) e determinação sérica de IgE específica (sIgE) para ácaros da poeira doméstica, ácaros de armazenamento e *D. gallinae*.

Resultados — O maior escore de pápula foi obtido com extrato de *D. gallinae* a 0,1 mg / mL. Reações positivas para PRM no IDT foram encontradas em quatro dos 10 cães controle e em 10 dos 16 do grupo exposto a galinhas. Detectou-se sIgE contra PRM em um controle e em sete cães expostos a galinhas. Não houve correlação significativa entre as pontuações IDT ou sIgE para PRM e os ácaros da poeira doméstica e de armazenamento.

Conclusões e significado clínico — O contato com galinhas infestadas por PRM pode levar à sensibilização sem alergia, independentemente da sensibilização a ácaros da poeira doméstica e a ácaros de armazenamento.