



HAL
open science

Occurrence, distribution and population size of on skin and mucosae of atopic dogs

Simona Nardoni, Monica Dini, Fabrizio Taccini, Francesca Mancianti

► **To cite this version:**

Simona Nardoni, Monica Dini, Fabrizio Taccini, Francesca Mancianti. Occurrence, distribution and population size of on skin and mucosae of atopic dogs. *Veterinary Microbiology*, 2007, 122 (1-2), pp.172. 10.1016/j.vetmic.2006.12.023 . hal-00532190

HAL Id: hal-00532190

<https://hal.science/hal-00532190>

Submitted on 4 Nov 2010

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Accepted Manuscript

Title: Occurrence, distribution and population size of *Malassezia pachydermatis* on skin and mucosae of atopic dogs

Authors: Simona Nardoni, Monica Dini, Fabrizio Taccini, Francesca Mancianti



PII: S0378-1135(07)00005-3
DOI: doi:10.1016/j.vetmic.2006.12.023
Reference: VETMIC 3552

To appear in: *VETMIC*

Received date: 28-7-2006
Revised date: 22-12-2006
Accepted date: 27-12-2006

Please cite this article as: Nardoni, S., Dini, M., Taccini, F., Mancianti, F., Occurrence, distribution and population size of *Malassezia pachydermatis* on skin and mucosae of atopic dogs, *Veterinary Microbiology* (2006), doi:10.1016/j.vetmic.2006.12.023

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26

TITLE - Occurrence, distribution and population size of *Malassezia pachydermatis* on skin and mucosae of atopic dogs

Authors: Simona NARDONI*, Monica DINI*, Fabrizio TACCINI** and Francesca MANCIANTI*

*Dipartimento di Patologia Animale, Profilassi ed Igiene degli Alimenti, Università di Pisa, viale delle Piagge 2, 56124 Pisa, Italy

**Dipartimento di Produzioni Animali, Università di Pisa, viale delle Piagge 2, 56124 Pisa, Italy

Corresponding author - Simona Nardoni

Address - Dipartimento di Patologia Animale, Profilassi ed Igiene degli Alimenti, Università di Pisa, viale delle Piagge 2, 56124 Pisa, Italy.

Phone number- 0039 050 2216952

Fax number– 0039 050 2216941

e-mail address – snardoni@vet.unipi.it

ABSTRACT

Aim of the present study was to determine the distribution and quantification of *Malassezia* yeasts on a wide number of cutaneous sites in atopic dogs by means of a semiquantitative swab technique. A possible relationship between the presence of clinical signs and the occurrence and population

27 size of yeasts was attempted. Forty-one privately owned atopic dogs of different age and breed were
28 sampled. Results were expressed as colony forming units per swab. *Malassezia* colonies obtained
29 from each plate were counted, scored and typed. All dogs yielded *Malassezia pachydermatis* from
30 at least one skin area. Yeast population mean size by site was 6.98 (sd = 3.47) as compared to other
31 body areas. The frequency of isolation was higher from interdigital areas (70.7%), ears (63.4%),
32 nail folds (35.7%), mouth (33.3%), groin (30.9%), conjunctiva and axillae (23.8%), perineum and
33 anus (19%), perianal glands (9.5%). Ears, anus, interdigital areas, perianal glands and groin yielded
34 the largest mycotic amount. *M. pachydermatis* was the sole species of yeast to colonize canine skin
35 in examined animals. No statistical correlation between the presence of cutaneous alterations and
36 *Malassezia* isolation was detected. Highest scores were not exclusively found on affected areas, but
37 also on lesion-free sites, demonstrating that atopic animals can be heavily colonized also in
38 apparently healthy areas.

39

40 *Keywords: Malassezia pachydermatis; dog; atopic disease*

41

42 INTRODUCTION

43 *Malassezia* genus includes eleven distinct lipophilic yeast species recently reclassified based on
44 morphological, ultrastructural, physiological and molecular features (Batra et al., 2005). *Malassezia*
45 *pachydermatis* is the sole species characterized by a not absolute requirement of lipid
46 supplementation for its growth, even if strains apparently lipid-dependent are reported (Bond and
47 Anthony, 1995; Guillot and Bond, 1999). It is a common skin colonizer of wild and pet carnivores,
48 especially dogs. Its presence has been described in various anatomic locations of clinically normal
49 dogs (Kennis et al., 1996) and from perianal glands, rectum, groin and ear canals of healthy and
50 sick dogs (Lukman, 1982). As the other members of the genus, *M. pachydermatis* is considered an
51 opportunistic yeast of increasing importance both in humans and animals (Chryssantou et al., 2001).

52 The passage of *M. pachydermatis* isolates from pet dogs to humans is also proved (Chang et al.,
53 1998; Morris, 2005).

54 Abnormally high fungal population seems to be a preliminary step to *Malassezia* disease, even if
55 some breeds such as Basset Hounds can harbour large amounts of organisms on their skin, with no
56 sign of cutaneous alterations (Bond and Lloyd, 1997). Aim of the present study was to determine
57 the distribution and quantification of *Malassezia* yeasts on a wide number of cutaneous sites by
58 means of a semiquantitative swab technique. The evaluation of a possible relationship between
59 clinical status and occurrence and population size of yeasts was attempted.

60

61 MATERIAL AND METHODS

62 Dogs and sampling procedures

63 Forty-one privately owned dogs, aged between 2 months and 12 years (median 5 yrs), were
64 included in the study. Animals were of both sexes (22 male, 24 female), 38 pure breed subjects and
65 8 crossbred. More information about age, breed, and clinical signs of animals is reported in Table 1.

66 All dogs were referred to clinical examination with a history of skin disease. They were all
67 diagnosed as atopic based on a relapsing or persistent history of pruritic dermatitis affecting the
68 face, ears, feet and/or ventrum which did not completely resolve following antimicrobial and
69 antiparasitic therapy, and fulfilment of the clinical criteria as proposed by Willemse (1986). The
70 dogs had not received any medical treatment for a month prior to sample collection.

71 Samples were collected from 16 anatomic sites for each animal: mouth, conjunctiva, left and right
72 external ear canal, left and right axilla, left and right groin, nail folds and of front and hind legs and
73 interdigital areas, perineum, anus, perianal glands, prepuce or vulva.

74 Skin was sampled using a sterile cotton swab from each body site. The cotton tip of the swab was
75 rolled and rubbed firmly against the entire skin area for 10 sec, and collected samples were
76 immediately transferred to the laboratory for culture.

77 Sample processing & culture method

78 Samples from the swabs were cultured onto modified Dixon medium and Sabouraud dextrose agar
79 additioned with chloramphenicol (0.5%) and cicloheximide (0.5%) as previously described
80 (Nardoni et al., 2004). All the plates were incubated at 30°C for about 7 days, and daily inspected
81 for *Malassezia* growth from day 4 post inoculation.

82 Preliminary identification of yeasts was based both on macroscopic appearance of colonies and
83 microscopic cell morphology. *M. pachydermatis* strains apparently lipid-dependent were identified
84 by serial transfers on a lipid-free culture medium. The Tween assimilation test as described by
85 Guillot et al. (1996), and catalase activity were performed as additional tests both to confirm the
86 identification, and to exclude the presence of other *Malassezia* species.

87 The results were expressed as colony forming units (CFU) per swab. *Malassezia* colonies obtained
88 from each plate were counted and categorized into five groups as being <5 (A) , 6-24 (B), 25-50
89 (C), 51-99 (D), >100 (E).

90 Statistical analysis

91 Differences in *Malassezia* prevalence among different body sites were evaluated by use of
92 Wilcoxon/Kruskal-Wallis test. Non-parametric tests (Spearman Rho and Kendall Tau) were used to
93 compare population sizes at each site per dog. A value of $P < 0.0001$ was considered significant for
94 all tests.

95 The correlation between the occurrence of lesions and the presence of *Malassezia* in ear canals was
96 evaluated by means of chi-square test.

97

98 RESULTS

99 Dogs and sampling procedures

100 All dogs yielded *Malassezia* yeasts from at least one skin area. They were isolated from all sites in
101 only one dog, while 2 animals were positive for 13 sites. Yeast population mean size (expressed as
102 CFU) by site was 6.98 (sd = 3.47) as compared to other body sites.

103 The frequency of isolation was higher from interdigital areas (70.7%), ears (63.4%), nail folds
104 (35.7%), mouth (33.3%), groin (30.9%), conjunctiva and axillae (23.8%), perineum and anus
105 (19%), perianal glands (9.5%). *Malassezia* counts were higher on ears, followed by anus,
106 interdigital areas, perianal glands and groin. Conjunctiva was the unique body site in which D and E
107 population size was never recorded.

108 The prevalence in animals affected by otitis was 72% versus the 81% of unaffected dogs, while the
109 higher population sizes (scores D and E) was 5 out of 18 (27%) in affected and 7 out of 13 (54%) in
110 the others. Similarly only 1 out of 5 dogs with ocular disease yielded positive culture with a low
111 number of colonies (score A) versus 11 out of 36 (30.5%) unaffected with scores ranging from A to
112 C. Detailed data are reported in Table 2.

113 Statistical analysis

114 Interdigital spaces and external ear canal were significantly more colonized rather than the other
115 body sites. The simultaneous colonization of right and left ear, right and left axilla, right and left
116 groin, front and hind interdigital spaces, perineum and right groin, perineum and hind nails,
117 respectively, was also statistically significant. Although the recovery of *Malassezia* was higher
118 from lesion-free ears rather than from animals with otitis, the difference was not statistically
119 significant.

120

121 DISCUSSION

122 The 100% prevalence of positivity of *M. pachydermatis* confirmed the wide colonization by this
123 yeast species in different body sites of atopic dogs, as previously reported in literature (Morris and
124 DeBoer, 2003; Farver et al., 2005). Large differences in the intensity of colonization were observed
125 both among different animals and in distinct anatomic sites in the same dog. Perianal area was less
126 colonized than other sites, both concerning frequency of isolation and population size.

127 Other authors have investigated the presence of *Malassezia* in different body areas in healthy and
128 dermatologically diseased dogs. Nardoni et al., (2004) investigated the yeast prevalence and the

129 occurrence of different species in 4 sites while Cafarchia et al. (2005b) evaluated the frequency,
130 body distribution and population size of *Malassezia* species in 7 anatomical sites. To the best of
131 our knowledge, the present survey is unique in assessing and quantifying the yeast presence in such
132 a number of body sites.

133 *M. pachydermatis* was the sole species isolated from dogs included in this study. However, the
134 presence of lipid-dependent *Malassezia* species in dogs is well documented (Crespo et al., 2002;
135 Cafarchia et al., 2005a). Cafarchia et al. (2005b) in a work performed both on healthy dogs and on
136 dogs with cutaneous lesions, report a prevalence of 95.7% for *M. pachydermatis* and 4.3% of lipid
137 dependent *Malassezia* species. In the present paper, the lack of recovery of lipid dependent species
138 could be ascribed to the strongly modified skin habitat due to atopy. These alterations could have
139 determined an overgrowth of *M. pachydermatis* with the consequent inhibition of lipid dependent
140 species, less adapted to the cutaneous microhabitat of dogs.

141 The correlation between *Malassezia* positivity and dermatological signs has been previously
142 investigated. Fungal overgrowth seems to be a factor capable of inducing disease, as demonstrated
143 in the experimentally-induced otitis externa by Uchida et al. (1992). Ears are an optimal site for *M.*
144 *pachydermatis* colonization, in accordance with observations already present in literature.
145 Nevertheless, in the present study we found this area was not the most affected one. Fungal
146 prevalence was higher in interdigital spaces, and this site harboured also high yeast populations.

147 Culture from conjunctiva was positive in 23.8% of animals. These data agree with the findings of
148 Prado et al. (2004), who cultured *M. pachydermatis* in 23% of ocular specimens collected from eyes
149 with corneal ulcers. In contrast with this work, it has to be specified that our results refer mainly to
150 unaffected eyes (11 on 12 positive subjects). The unique dog with ocular signs scored A, while the
151 others scored from A to C. Any other relation occurred between positive animals with and without
152 ocular alterations. Axillae and groin area yielded similar results. These two areas were colonized in
153 46% and 39% of animals, respectively, even if relatively lower numbers of yeasts were recovered
154 from the first site, with respect to the other. This result could be explained by the fact that these

155 body areas are characterized by very similar skin surface microhabitats. The simultaneous recovery
156 of *Malassezia* both from ears and paws could suggest a two-way contamination, due to scratching.
157 The pathogenic role of *M. pachydermatis* has been exhaustively investigated. Castellà et al. (2005)
158 in a RAPD analysis on yeast isolates from different domestic animals and body sites, found that the
159 same animal could harbour more than one type of *M. pachydermatis*, and different genetic types
160 were present in the same body site. Other authors (Cafarchia and Otranto, 2004) studied the
161 phospholipase activity of *M. pachydermatis* strains isolated from lesional and non-lesional dog skin.
162 They reported the presence of different populations of enzyme-producing and non-producing strains
163 in dogs with localized lesions versus dermatologically healthy animals.
164 In the present work, any statistical correlation between the simultaneous presence of cutaneous
165 alterations and *Malassezia* could be detected. Furthermore, highest scores (from C to E) were not
166 exclusively found on affected areas, but also on lesion-free sites, demonstrating that affected
167 animals can be colonized by high yeast populations also in apparently healthy areas.
168 From our results, it appears that in widely colonized dogs a secondary overgrowth by *M.*
169 *pachydermatis* as a consequence of the alteration of cutaneous microhabitat, rather than a role of
170 this species in the onset of infection, could be hypothesized. The yeast seems to act as an
171 aggravating factor in the occurrence of cutaneous disease, but its recovery on skin without the
172 simultaneous presence of some other pathogenic factors cannot be automatically associated to the
173 appearance of lesions. This study could contribute new insights into the colonization by *Malassezia*
174 yeasts in atopy, which seems to be distinctly characterized with respect to other skin disease in
175 dogs.

176

177 REFERENCES

178

- 179 Batra, R., Boekhout, T., Guého, E., Javier Cabañes, F., Dawson, Jr., T. L., Gupta, A. K., 2005.
180 *Malassezia* Baillon, emerging clinical yeasts. FEMS Yeast Res. 5, 1101-13.

181

182 Bond, R., Anthony, R. M., 1995. Characterization of markedly lipid-dependent *Malassezia*
183 *pachydermatis* isolates from healthy dogs. J. Appl. Bacteriol. 78, 537-542.

184

185 Bond, R., Lloyd, D. H. 1997. Skin and mucosal populations of *Malassezia pachydermatis* in healthy
186 and seborrheic Basset Hounds. Vet. Dermatol 8: 101–6.

187

188 Cafarchia, C., Otranto, D., 2004. Association between phospholipase production by *Malassezia*
189 *pachydermatis* and skin lesions. J. Clin. Microbiol. 42, 4868-4869.

190

191 Cafarchia, C., Gallo, S., Capelli, G., Otranto, D., 2005a. Occurrence and population size of
192 *Malassezia* spp. in the external ear canal of dogs and cats both healthy and with otitis.

193 Mycopathologia. 160,143-149.

194

195 Cafarchia, C., Gallo, S., Romito, D., Capelli, G., Chermette, R., Guillot, J., Otranto, D., 2005b.
196 Frequence, body distribution, and population size of *Malassezia* species in healthy dogs and in dogs
197 with localized cutaneous lesions. J. Vet. Diagn. Invest. 17, 316-322.

198

199 Castellà, G., Hernandez, J. J., Cabanes, F. J., 2005. Genetic typing of *Malassezia pachydermatis*
200 from different domestic animals. Vet. Microbiol.108, 291-296.

201

202 Chang, H. J., Miller, H. L., Nancy Watkins, N., Arduino, M. J., Ashford, D. A., Midgley, G.,
203 Aguero, S. M., Pinto-Powell, R., Fordham von Reyn, C., Edwards, W., M. McNeil, M. M.,

204 William R. Jarvis, W. R., Pruitt R., 1998. An epidemic of *Malassezia pachydermatis* in an intensive
205 care nursery associated with colonization of health care workers' pet dogs. N. Engl. J. Med. 338,

206 706-711.

207

208 Chryssantou, E., Broberger, U., Petrini, B., 2001. *Malassezia pachydermatis* fungaemia in a
209 neonatal intensive care unit. *Acta Paediatr.* 90, 323-7.

210

211 Crespo, M. J., Abarca, M. L., Cabanes F. J. 2002 Occurrence of *Malassezia* spp. in the external ear
212 canals of dogs and cats with and without otitis externa. *Med. Mycol.* 40, 115-21.

213

214 Farver, K., Morris, D. O., Shofer, F., Esch, B., 2005. Humoral measurement of type-1
215 hypersensitivity reactions to a reactions to a commercial *Malassezia* allergen. *Vet. Derm.* 16, 261-
216 268.

217

218 Guillot, J., Bond, R., 1999. *Malassezia pachydermatis*: a review. *Med. Mycol.* 37, 295-306.

219

220 Guillot, J., Guého, E., Lesourd, M., Midgley, G., Chévrier, G., Dupont, B., 1996. Identification of
221 *Malassezia* species. A practical approach. *J. Mycol. Méd.* 6, 103-110.

222

223 Kennis, A., Rosser, J. R., Bari Oliver, N., Walker, R. W., 1996. Quantity and distribution of
224 *Malassezia* organisms on the skin of clinically normal dogs. *J. Am. Vet. Med. Assoc.* 208, 1048-51.

225

226 Lukman, P., 1982. *Pityrosporum canis* in healthy and diseased dogs. *Vet. Arhiv* 52, 37-44.

227

228 Morris, D. O., 2005. *Malassezia pachydermatis* carriage in dog owners. *Emerg. Infect. Dis.* 11, 83-
229 88.

230

231 Morris, D. O., DeBoer, D. J., 2003. Evaluation of serum obtained from atopic dogs with dermatitis
232 attributable to *Malassezia pachydermatis* for passive transfer of immediate hypersensitivity to that
233 organism. Am. J. Vet. Res. 64, 262-266.

234

235 Nardoni, S., Mancianti, F., Corazza, M., Rum, A., 2004. Occurrence of *Malassezia* species in
236 healthy and dermatologically diseased dogs. Mycopathologia 157, 383-388.

237

238 Prado, M. R., Brito, E. H. S., Girão, M. D., Monteiro, A. J., Sidrim, J. J. C., Rocha, M. F. G., 2004.
239 Higher incidence of *Malassezia pachydermatis* in the eyes of dogs with corneal ulcer than in
240 healthy dogs. Vet. Mic. 100, 115-120.

241

242 Uchida, Y., Mizutani, M., Kubo, T., Nakade, T., Otomo, K., 1992. Otitis externa induced with
243 *Malassezia pachydermatis* in dogs and the efficacy of pimaricin. J. Vet. Med. Sci. 54, 611-614.

244

245 Willemsse, T., 1986. Atopic skin disease: a review and reconsideration of diagnostic criteria. J.
246 Small An. Pract. 27, 771-778.

N.	BREED	AGE	SEX	CLINICAL SUMMARY
1	Cocker	4yrs	M	Seborrhoea, erythema, otitis, conjunctivitis
2	Setter	18mo	M	Erythema, cheylitis, conjunctivitis
3	Yorkshire Terrier	7yrs	M	Pruritus, seborrhoea, erythema, otitis
4	Cocker	8yrs	M	Pruritus, scaly plaques, lichenification, keratitis, otitis
5	Pinscher	7yrs	F	Diffuse dermatitis, seborrhoea, otitis
6	Pekinese	4yrs	F	Erythema, scalification, seborrhoea, otitis
7	Crossbred	2yrs	F	Erythema, crusts, alopecia, pruritic dermatitis, otitis
8	Chihuahua	5yrs	F	Lichenification, alopecia
9	Welsh Terrier	3yrs	F	Crusts, seborrhoea, conjunctivitis, otitis
10	Golden Retriever	18mo	F	Scalification, crusts, otitis
11	Labrador Retriever	7yrs	M	Otitis, seborrhoea, erythema
12	Bernese Mountain Dog	6yrs	M	Alopecia, crusts, otitis, conjunctivitis
13	Setter	10yrs	F	Otitis, seborrhoea, pruritus
14	Boxer	2yrs	F	Scalification, otitis
15	Shih-Tzu	6yrs	F	Pustules, alopecia, seborrhoea, erythema
16	Dogo argentino	5yrs	M	Alopecia, crusts, otitis
17	Cane Corso Italiano	6yrs	M	Erythema, pustules
18	Labrador Retriever	3yrs	M	Erythema, pruritus, otitis
19	Crossbred	14yrs	F	Hyperkeratosis, seborrhoea, otitis
20	Dalmatian	4yrs	F	Otitis, dermatitis
21	Crossbred	3yrs	F	Otitis, seborrhoea, erythema
22	Boxer	10yrs	M	Calcinosis on back and perineum, otitis
23	Boxer	3yrs	M	Papules, crusts, otitis. Erythema
24	Newfoundland	4yrs	M	Otitis, seborrhoea, erythema, alopecia
25	Kurzhaar	6yrs	F	Papillomas, scalification
26	Shih-Tzu	2mo	M	Erythema, desquamation, otitis, dermatophytosis
27	Dachshund	2mo	M	Alopecia, crusts, otitis, dermatophytosis
28	German Sheperd	8yrs	M	Erythema, alopecia, seborrhoea, otitis
29	Setter	7yrs	F	Pruritus alopecia on the muzzle
30	German Sheperd	11yrs	M	Erythema, crusts, lichenification
31	Setter	7yrs	F	Pruritus alopecia hyperkeratosis
32	Kurzhaar	4yrs	M	Hypotrichosis, scalification
33	Fox Terrier	10yrs	M	Erythema, crusts
34	Crossbred	1yr	F	Hypotrichosis, scalification
35	Setter	5yrs	F	Otitis, alopecia, hyperkeratosis
36	Bracco Italiano	6yrs	F	Papules, pustules
37	Crossbred	18mo	M	Papules, pustules, alopecia
38	Dalmatian	5yrs	F	Otitis, auricular erythema
39	Carlino	3mo	F	Auricular erythema, papules, pustules
40	Golden Retriever	1yr	F	Erythema, papules
41	Bulldog Terrier	2yrs	M	Erythema intertrigo

Table 1 - Signalment and clinical signs of examined dogs.

Dog N.	Mouth	Eye	R ear°	L ear°	R axilla	L axilla	F ida°	H ida°	F nf	H nf	Anus	Perineum	P/v	Pg	R groin	L groin
1			B	B	A		C	C	A							
2		A						A								
3			B	B			C	C	A	B				C		
4			E	E				B			A	B				
5 B		A	E	E			C	C	A	B			B			C
6					A	B	E	A	B	A						
7 A		A		A			B	D	A	A	C	B	B	B		
8 B		A	E	E	D	D	D	E	E	E	A	E	D	C	E	E
9 E					A		A	A								
10 A			E													
11 E							A		A	B		A	A	A		B
12			C	C												
13			A						A		D	B	A			
14			A	B			E	E	A	B	B		A			
15 B			D	B	A	A	A	A	A	B				B		A
16 A			A		A		B				A			A		
17		A	D				D	C	B	A			A	A		
18				D		A	A	B	A	A		A				
19		A		C	B	B	C	D	B	B	A	C	C	B		A
20			B	B	A		A	A	A	A		A	C	B	A	A
21						A	A	A	A	A		B		A		B
22 A		A	C	C			B	C	A	B						
23			E	E		A	D	B	B							
24		C			A	A	C		B							
25 E		B	B	B	D	C	E	E	C	C	C		B		E	E
26 A		A			A			A		A			A			
27 B			A	B	A		A	A	A	A	E	A	A			
28 B			D		A	A	A	A	B	A			A		B	E
29 B			A			A										
30								B		A						
31 A			E	E	A	A	B	D	A	A			B		B	B
32			B	A			B	E	A	A	D					
33 B							B	A	A							A
34			B				B				C			D		
35 A		A		C	D	C	E	E		B	A	A	B		D	D
36			B				B	D					D			B
37			B	E			A				D		A			
38			B	B												
39 E		B	E	E					A		D					A
40			B	B					B		C		D	B		
41							B	B	A	A	B	A		B		

R = right; L = left; F = fore, H = hind; ida = interdigital areas, nf = nail folds; p/v = prepuce/vulva; pg = perianal glands
 ° = body areas significantly more colonized

Table 2 - Frequency of isolation and population size of *M. pachydermatis* from different body sites.