The occurrence of Otodectes cynotis in owned cats: prevalence, morphometry and risk factors in Egypt

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Research Article

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Abstract

Feline otoacariasis is a worldwide parasitic infestation caused by the common ear mite, *Otodectes cynotis*Hering, 1838 (Family: Psoroptidae). The current study aimed to detect the occurrence of *Otodectes cynotis* in owned cats of various breeds in Cairo, Giza and Beni-Suef provinces, Egypt. The life cycle and risk factors including age, sex, breed and seasons were considered. Questionnaire of cat owners was done. Data including age, sex, season, breed and residence assessed. Mites were collected from cats and underwent laboratory investigations for further identification. The recovered mites were microscopically identified. Adult males, females as well as developmental stages, including eggs, protonymphs and deuto-/tritonymphs, were recognized. The overall prevalence of mites was 25.47% (174/683). The mite was predominant in the ear canal of infested cats. Among risk factors, it has been found that age, seasons and breed significantly influenced the prevalence of otoacariasis. On the other hand, no statistical significance relative to the sex was obtained. Based on the revealed criteria, it has been found that the recovered mite was *Otodectes cynotis*. Further investigations are needed for molecular identification of the mites as well as control programming in terms of hygiene.

Introduction

The family Psoroptidae Gervais 1841 consists of 29 genera, and the species are sometimes referred to as "mange mites" or "scab mites." They parasitize the skin and ears of various mammals (Bochkov 2010). Among those, *Otodectes* Canestrini 1894, is monotypic with *Otodectes cynotis* (*O. cynotis*) Hering 1838 is a significant ectoparasitic species in carnivores (Ismail et al. 1982; Wilson and Zarnke 1985; Gunnarson et al. 1991; Davidson et al. 1992; Degiorgis et al. 2001; Lohse et al. 2002; Vickers et al. 2015; Keel et al. 2018). Cats, dogs, foxes, ferrets, and occasionally humans are preferable hosts (Gunnarsson et al. 1991; Campbell 2005). Humans could be infected when they come in contact with infested animals (Kraft et al. 1988). *O. cynotis* is a mandatory parasitic and non-burrowing mites feed on tissue fluids and epidermal detritus, with all life cycle stages are found in the same host's ear, close to the eardrum. In severe infestations, the tail, back, and head could be additionally infested (Sweatman 1958; Wall and Sheares 2001) and mites occasionally move to the skin and hair of the interscapular area. Under some instances, mites might survive for several days outside the host (Otranto et al. 2004).

O. cynotis is white and large measuring 300×400 µm (Scott et al. 2001; Campbell 2005; Radlinsky and Mason 2005). The life cycle of the mite lasts three weeks. Females oviposit approximately 15–20 eggs and sticks eggs to the epithermal surface. Thereafter, eggs hatch to 6-legged larvae and molt into 8-legged protonymphs and tritonymphs (Harvey et al. 2001; Wall and Shearer 2001; Campbell 2005).

Animals of all ages possibly become infected, even kittens, but young cats appear to be particularly vulnerable (Six et al. 2000; Sotiraki et al. 2001). Cats play a crucial role in the transmission of the ear mite in adult dogs, rabbits and ferrets (Sasikala et al. 2011). Though they can affect dogs of all ages, with the typical infestation occurs in puppies. The cat is the frequent source of transmission to adult dogs (Harvey et al. 2001; Wall and Shearer 2001). The main route of transmission is the direct contact with the infected host (Harvey et al. 2001). Despite being uncommon, *O. cynotis* has occasionally been identified in human external ear canals, where it caused severe itching (Lopez 1993). In cats, the main route of infestation is from infested dams to kittens. Mites capable to exist with contaminated combs, brushes, bedding and other grooming accessories, particularly where cats are bred/sheltered. Transmission through cerumen or crusts expelled from infested ears is rare (Kraft et al.1988). The motility and feeding behavior of mites, as well as the immune response of the hosts, all play concomitant roles in the development of otitis externa (Weisbroth et al. 1974; Powell et al. 1980).

The parasite affects all breeds of cats, with more frequently in wild cats and cats housed in shelters because the interaction with infected animals is more prevalent (Peregro et al. 2014). Due to parallel development of immune system with the age, young cats are the most vulnerable to otoacariasis (Larsson 1989). According to the closed relationship between the infestation rate and lifestyle, outdoor cats are being exposed to the higher infestation rate than indoor ones, meanwhile, cold climates extremely increase the infestation rates (Maslova 2018). Non-significant impact estimated regarding breeds and sex could be detected (Al-Hosary and Mostafa 2022).

Scarce literature was published denoting the existence and frequency of *O. cynotis* in cats in Egypt. Therefore, the purpose of the current study was to investigate the occurrence of the ear mite, *Otodectes cynotis*, in owned cats in 3 provinces, Cairo, Giza and Beni-Suef, Egypt with detailed morphological description of the recovered mites. The life cycle and risk factors including age and sex, breed and lifestyle of infested cats were undertaken.

Materials and methods

Study area

The present investigation was done on owned cats in 3 provinces; Cairo (coordinates: 30° 2' 40" N, 31° 14' 9" E), Giza (29° 59' 13.2" N, 31° 12' 42.48" E) and Beni-Suef (29° 4' 0" N, 31° 5' 0" E) (Fig. 1). The 3 provinces are located at the northern Egypt. Cairo is the capital and the other 2 cities are large provinces with various climatic characteristics and multiple topographical alterations along the year. This property, together with the higher populations of owned cats among resident people either staying or on travel, permits the ease transmission of the parasitic mites and thus increasing the infestation rate, from locality to another, particularly when hygienic measures are inadequate.

Questionnaire of cat owners

In various countries, emotional and familiar bonds between pets and their owners have been established. In many instances, cats move from feral populations to pets. Pet owners make an extreme attention for their pets. Veterinarians and pet owners were asked via social media and telephone calls about cases of feline otoacariasis. Detectable abnormal behavior immediately encourages owners to visit veterinary clinics. A complete history, beginning from recording the name, breed, age and gender, is the basic line for veterinarians. Residence of cats (outdoor/indoor), the habitat allowed for cats at homes, and the existence of other animals in the same place were also noted.

Owners are asked for the aim of keeping cats, either as pets or for breeding. Additionally, the history of cats either neutered or not, was considered. Routinely, all cats were weighed. The time elapsed from owning cats, the source of obtaining cats (stray, shelter, pet shop or breeder) are important criteria denoting the epidemiological status of them. Pet's temperament, receiving training, sleeping and feeding place, type of food, source of protein and previous treatments are guides to accurate suspected diagnosis.

Collection and preparation of mites

Examination of fresh specimens

By the use of cotton buds, ear canal secretions from cats were collected. Accordingly, glycerin was added to clearly disperse secretions onto clean glass slides. The later were microscopically examined at a magnification of x40. Then, using a self-made pick needle and distilled water, each recovered mite moved to another glass slide. Mites were cleaned by gently rocking glass slides.

Modified aqueous potassium hydroxide digestion technique

Dark brown ceruminous exudates softly attached to the inner surface of pinnae as well as waxy materials were taken from the ear of cats using ear swab, put into glass beaker containing 5 ml 10% KOH and heated, but not boiled, for 5 min then centrifuged for 10 min at 10000 rpm. The mixture allowed settling down for up to 24 hours permitting sedimentation of all mites found. The sediment was carefully examined under a magnification of x 40 (Alonso et al. 1998; Zahler et al. 1999; Alasaad et al. 2009).

Heating and vibration stimulation techniques

Ear exudates and waxy material were put into Petri dishes and placed on a metal tray that is vibrated and heated by a magnetic stirrer of a hot plate. Mites are prompted to leave ear exudates and waxy materials by heating, then dishes were examined by the use of stereomicroscope followed by isolation and ethanol storage (Sheahan and Hatch 1975; Skerratt 2001; Berrilli et al. 2002; Skerratt et al. 2002). This approach (heating and vibration stimulation) is effective for mite identification, morphological analysis, DNA extraction, experimental infestation, and/or *in vitro* bioassays since the *Otodectes* mites that are collected are live and of excellent biological quality.

Slides preparation

Intact specimens were cleared in lactophenol. Mites were mounted using DPX onto clean glass slides under cover slips. Upon drying, slides were microscopically examined at 40 x magnification. Recovered mites were properly identified under a stereomicroscope according to standard identification keys (Bochkov 2010; Agu et al. 2020).

Morphometry and direct microscopy

Of the revealed mites, taxonomic criteria including body length and width, length of legs, length of gnathosoma as well as dimensions of egg were recorded. All measurements were in micrometers (Lohse et al. 2002; Bochkov 2010). Images of the recovered mites, either adults or larval stages, photographed using a digital microscope (Leica Microsystems, CH-9435 Heerbrugg, Ec3, Singapore) under various magnification powers.

Statistical analysis

Descriptive statistics denoting the effect of risk factors; age, sex, season and breed, on the prevalence of otoacariasis were indicated. Chi-square test was used for assessment. Variables were significant at $P < 0.05$.

Results and discussion

It has been found that, out of 683 examined cats of various breeds, 174 (25.47%) were infested with the common ear mite, *Otodectes cynotis* (Fig. 2). The mite was predominant in the ear canal as well as the skin of the area between the ear and eyes of infested cats.

Taxonomy of the *Otodectes cynotis*

Class Arachnida Cuvier, 1812

Subclass Acari Leach, 1817

Order Sarcoptiformes Reuter, 1909

Family Psoroptidae Gervais, 1841

Genus *Otodectes* Canestrini**,** 1894

Species *Otodectes cynotis* Hering, 1838

Syn. *Sarcoptes cynotis* Hering, 1838

Psoroptes cynotis Gervais, 1841

Otodectes cynotis Canestrini, 1894

Description of the ear mite (Table 1)

Adult male (Fig. 3)

Both internal structures and setae were microscopically observed. The present findings revealed that the adult male was slightly oval with sclerotized dorsal opisthosomal and propodonotal plates. It measured 320 x 269 µm. Gnathosoma was cone-shaped, measured 60 µm long with a distinct line of demarcation between it and the ventrocephalic region of the idiosoma. It extended/retracted via a cavity in the idiosoma formed by a band of tissue surrounding the area of attachment. It had a broad end attached to the body forming basis capitulum, and a terminal narrower region, rostrum. The later and basis capitulum included proboscis which composed of a pair of pedipalps, pair of chelicerae and some minor structures (Fig. 3 a). Pedipalps form the lateroventral surface of the gnathosoma, extending on either side of the rostrum. Each pedipalp is formed of 3 segments; the first segment was formed from the fusion of coxa, trochanter, femur and genu which are immovable and had simple setae near the apex. The second segment was shorter, movable and shorter. The third one was articulated with median or ventral area of the second segment like a thumb on a hand. The chelicerae originated from the basis capitulum (Fig. 3 b). Cheliceral plates were triangular plates dorsal to chelicera overlapped the chelicerae to the lateral margin of the chela at the apex of the rostrum. The hypostome possessed one pair of fairly long and centrally located setae.

In the venter, heavily sclerotized coxal apodemes (Fig. 3 c) are especially in legs I and II and fused ventrally. In association with the reproductive system, sclerotized areas are found posterior and lateral to the genital suckers and around the aedeagus. On the metapodosomal region, the male’s ventral surface had a gonopore with two cuticular pits (genital suckers). A pair of adanal suckers, retractile, mushroom-like which gives the male the weakly bilobed appearance (opisthomal lobe), completely surrounded by sclerotized plates and attached to the dorsoposterior tubercles of the tritonymph. Adanal setae present dorsal to each adanal sucker (Fig. 3 d).

Legs were long and slender, with the fourth pair were the shortest. Each was provided with segmented pretarsi with non-segmented pedicles and ended with pulvillus. Legs I and II measured 168 µm and 200 µm long, respectively. Leg III was the longest, measuring 210 µm and leg IV measured 130 µm. The first and last two pairs of legs coxae are usually continuous. Apodemes were often closed on legs I and II. The third tarsi beard a pair of long, whip-like setae in addition to the pulvilli (Fig. 3 e, f).

Adult female (Fig. 4)

It measured 450 x 275 µm with being ovoid-shaped. Gnathostoma was 75 µm long. The degree of tapering posteriorly depended on the existence of eggs. It lacked the genital sucker. The ventral aspect had epigynal apodeme, horse-shoe-shaped epigynium and transverse slit-shaped vulva (genital opening) located between legs II and III (Fig. 4 a). Ovipore located at the middle third of idiosoma (Fig. 4 b). Legs I (~165 µm long) and II (~163 µm long) ended with suckers, while legs III (~130 µm long) and IV (~ 40 µm long) terminated with long setae with the leg IV was rudimentary (Fig. 4 c).

Developmental stages (Fig. 5)

Egg

Freshly deposited eggs measured ~197 x ~95 µm, elliptical- or subcylindrical-shaped, and more or less flattened on one side. It was filled with an opaque mass, soft-shelled which later harden when adhered to the cemented materials (keratin of the ear canal) of the surroundings (Fig. 5 a).

Larvae

It measured ~ 214 x ~ 121 µm, oval-shaped, brown-colored, hexapodous, soft body, slightly larger than the egg and smaller than protonymph with no sexual dimorphism could be detected. Gnathostoma was 40 µm long and similar to that of the adult but smaller. Legs I, II and III were ~ 85, ~ 89 and ~72 µm long, respectively (Fig. 5 b).

Protonymph

It showed no sexual dimorphism and smaller than deutonymph. The whole body measured ~ 260 x ~165 µm. Gnathostoma was ~ 35 µm long. Adanal suckers were absent. Legs were easily recognized, with signs of articulation and provided with a long terminal and a smaller subterminal seta. Legs I, II, III and IV were ~ 98, ~ 97, ~ 61 and ~ 6.1 µm long, receptively (Fig. 5 c).

Tritonymph/deutonymph

It was larger than protonymph but smaller than adult male and female. It measured ~ 297 x ~207 µm. Gnathostoma was ~53 µm long. Posteriorly, opisthosoma was weakly bilobed with copulatory tubercles. Ventrally, seta *1a* in the propodosomal plate, seta *c3* located dorsally to leg III and setae *3a, 4b,4a* appeared medially were noticed. Moreover, Paraproctal setae could be seen. Legs I, II ended with suckers and were ~ 137 µm and ~ 135 µm long, respectively. Leg III was ~75 µm long with two terminal whip-like setae. Leg IV was visible under a higher magnification (Fig. 5 d-f).

Based on the descriptive morphology of adults and larval stages, habitats, history of infestation as well as clinical findings and lesions induced by the recovered mites, it could be concluded that the obtained mites are recognized as the common ear mite, *Otodectes cynotis*.

Biologically, the prevalence of *O. cynotis* infestation is closely related to age, sex and breed of infested cats as well as season (Table 2 and Fig. 6). Concerning the age, the present work revealed that cats aged 1-6 months were highly susceptible (82; 71.30%), followed by cats aged 6-12 months (40; 54.79%), cats aged 1-4 years (34; 14.71%) and cats aged 4-10 years (18; 6.81%) with a statistical significance at $P < 0.05$. Scare literature denoted the effect of age on the prevalence of *O. cynotis* infestation in Egypt. Among those, Saliba and Baraka (2011) indicated that young cats were more susceptible to the ear mite infestation than adults. On the other hand, El-Seify et al. (2016) found that cats aged more than one year were highly (87.03%) infected with both Psoroptidae and Sarcoptidae than those aged less than one year (81.25%). Age is a crucial factor that determines the pathogenic involvement, prevalence and intensity of the mite occurrence. Concomitantly, in Hungary, Farkas et al. (2007) coincided with the current findings and revealed that the highest infestation rate was recorded in kittens less than 3 months as a result of the frequent and close contact between them and their queen. In Greece, Lefkaditis et al. (2009) reported that kittens aged 3-6 months were more susceptible due to the fact that cats' immunity is directly proportional to the age and a less contact with their queen. In Parallel, in Bangladesh, Ahazuzzaman (2014) observed that young cats were more susceptible to severe mites' infestation than adults. On the other hand, Alger and Alger (2003) indicated a higher infestation rate in adult cats. Their findings based on the fact that adult cats have more frequent social bonds; they often sleep in contact with more congeners and mutually rub against each other.

The present investigation detected that infestation rates of *O. cynotis* were non-significantly differed; 23.38% (94/402) and 28.46% (80/281) in both males and females. Similar results were obtained by Sotiraki et al. (2001), Perego et al. (2014) and Acar and Yipel (2016), El-Seify et al. (2016).

Seasonal variation is considered one of the incriminated factors that enhance ear mites infestation. For survival and rapid release from hosts, *O. cynotis* requires a high relative humidity, approximately 80.0% (Wan Norulhuda et al. 2017). In Egypt, the average annual relative humidity is 55.8% and average monthly relative humidity ranges from 46.0% in May to 61.0% in August. The current study recorded that the highest infestation rate was in autumn (47.61%; 60/126) followed by winter (34.02%; 49/144) and spring (24.12%; 55/228) and the lowest prevalence was found in summer (5.40%; 10/185) with a detectable statistical significance at $P < 0.05$. No literature discussed the effect of seasonal variation on the prevalence of *O. cynotis* infestation except El-Seify et al. (2016) who revealed that the prevalence of ectoparasites, *O. cynotis* and other species, was the highest in summer and the lowest in winter considering low numbers of surveyed animals.

Concerning cat breeds, the present work revealed that the highest infestation rate was found in Persian cats (42.15%; 137/325), followed by Baladi cats (28.88%; 13/45), Angora (10.52%; 12/114), mixed breeds (8.16%; 4/49) and Siamese cats (6.25%; 6/96) with the lowest prevalence in Himalayan cats (3.84%; 2/54) with a statistical significance at $P < 0.05$. Meanwhile, household cats showed infestation rates 38.23% (125/327) and 11.92% (23/193) for both cats bred alone and those bred with other pets, respectively. The infestation rate in outdoor cats was 15.95% (26/163). Lifestyle has no significant effect on the risk of otodectic mange (Sotiraki et al. 2001; Perego et al. 2014), despite, some literature indicated that the infestation is more frequent in animals having outdoor lifestyle due to both the high infectivity of *O. cynotis* together with the higher possibility of contact between feral and free-roaming cats (Dégi et al. 2010; Acar and Yipel 2016). Discrepancies could be attributed to being cats underwent improper sampling from ear canals of live cats or by using otoscopic examination (Lefkaditis et al. 2009). Furthermore, Sotiraki et al. (2001) found that 13.6% of indoor cats living alone infested by *O. cynotis*, while indoor cats sharing household with other pets exhibited an infestation rate of 42%. Those findings agreed with the obtained ones. It is worthy to mention that *O. cynotis* is widely distributed and could be detected even in indoor cats without apparent contact with other pets (Lefkaditis et al. 2009).

In conclusion, *Otodectes cynotis* is a common ear mite in cats, particularly in Egypt, with scarce data revealing distribution pattern and epidemiology. Further investigation including molecular approach and phylogenetic analyses are extremely demanded for accurate identification and recognition of other mite species in pets to facilitate easily diagnosis and proper control.

Declarations

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Authors contribution MAB; samples collection, lab work. KhME; Manuscript designing, samples preparation, revising, photo editing, drafting and submission. WMA; designing, laboratory guidance. MMA; sampling and drafting. HIM; data analysis and statistical analysis. All the authors read and approved the final manuscript

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Ethics approval The authors assert that all procedures contributing to this work comply with the ethical standards of the institutional Animal Care and Use Committee Beni-Suef University (BSU-IACUC 022-284).

Conflict of interest The authors declare that they have no conflict of interest.

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Tables

Table 1 Morphometrical characters of the recovered *Otodectescynotis* in infested cats

Stage/Developmental stage	Morphological character	A previous study (Lose et al. 2002)	The current study
Egg	Length	205.9±10.7	197
	Width	98.8±5.5	95
Larva	Body length	194.9±19.4	214
	Body width	129.8±10.0	121
	Leg I	84.0±2.0	85
	Leg II	85.7±3.5	89
	Leg III	65.5±11.1	72
	Gnathosoma	36.1±4.1	40
Protonymph	Body length	243.8±17.8	260
	Body width	158.8±14.9	165
	Leg I	93.7±8.7	98
	Leg II	93.2±8.8	97
	Leg III	65.9±7.2	61
	Leg IV	7.8±1.0	6.1
	Gnathosoma	31.1±5.3*	35
Tritonymph	Body length	334.3±43.4	297
	Body width	234.8±29.1	207
	Leg I	126.8±15.9	137
	Leg II	126.8±18.7	135
	Leg III	78.5±24.6	75
	Gnathosoma	50.8±5.4	53
Male	Body length	319.3±9.9	320
	Body width	267.3±26.0	269
	Leg I	161.2±8.8	186
	Leg II	197.0±10.3	200
	Leg III	205.9±4.4	210
	Leg IV	127.9±16.3	130
	Gnathosoma	58.2±5.4	60
Female	Body length	319.3±9.9	450
	Body width	267.3±26.0	275
	Leg I	161.2±8.8	165
	Leg II	197.0±10.3	163
	Leg III	205.9±4.4	130
	Leg IV	127.9±16.3	40
	Gnathosoma	58.2±5.4	75

Table 2 The prevalence of *Otodectes cynotis* in infested cats relative to risk factors

Risk factor	Number examined	Number infested	Prevalence (%)	Chi-square	$P < 0.05$	Risk factor	Number examined	Number infested	Prevalence (%)	Chi-square	$P < 0.05$
Age						Breed					
1-6 months	115	82	71.30	114.1738	< 0.00001*	Persian	325	137	42.15	49.8993	< 0.00001*
6-12 months	73	40	54.79			Siamese	96	6	6.25		
1-4 years	231	34	14.71			Angora	114	12	10.52		
4-10 years	264	18	6.81			Baladi	45	13	28.88		
Sex						Mixed	49	4	8.16		
Male	402	94	23.38	1.3297	0.248859	Himalayan	54	2	3.84		
Female	281	80	28.46			Residence					
Season						Household					
Winter	144	49	34.02	47.3962	< 0.00001*	Alone	327	125	38.23		
Spring	228	55	24.12			With other pets	193	23	11.92		
Summer	185	10	5.40				163	26			
Autumn	126	60	47.61			Outdoor			15.95		

Figures

Figure 1

A map depicting feline otoacariasis in Cairo, Giza and Beni-Suef, Egypt

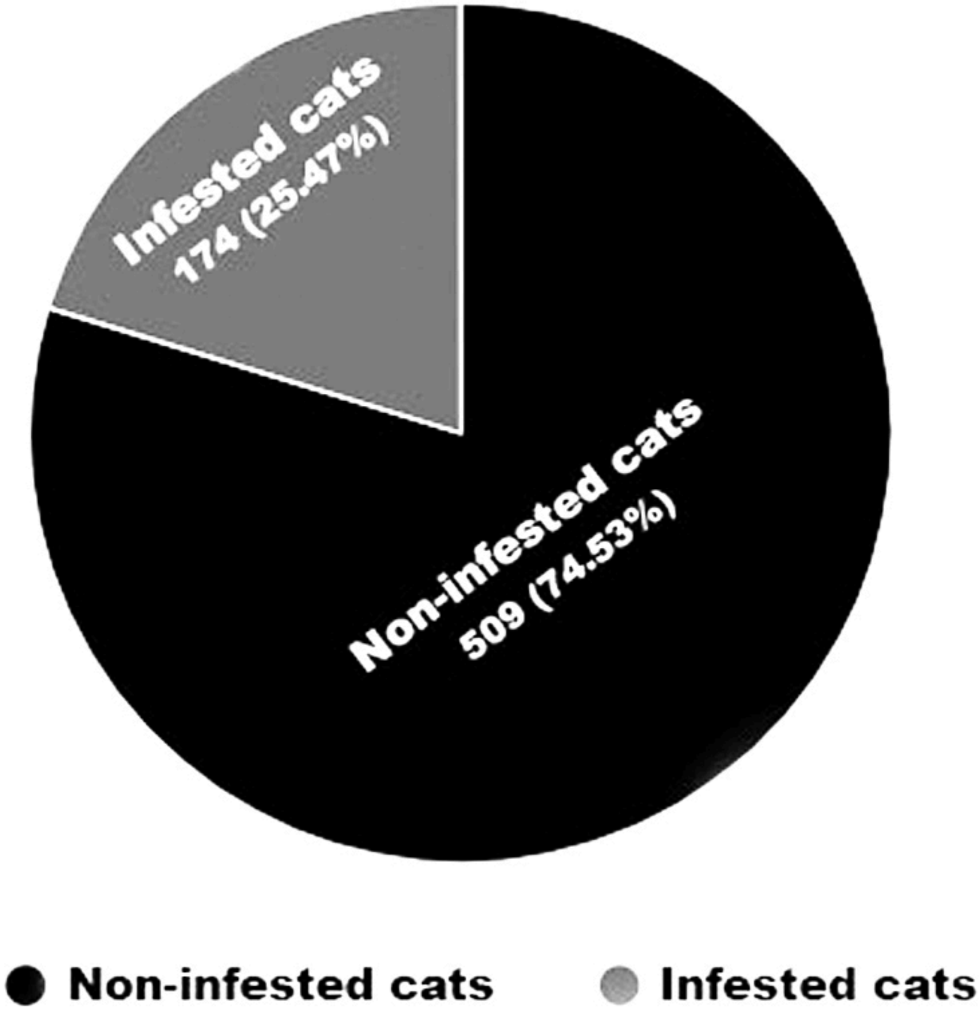

Figure 2

The overall prevalence of *Otodectes cynotis* among infested cats

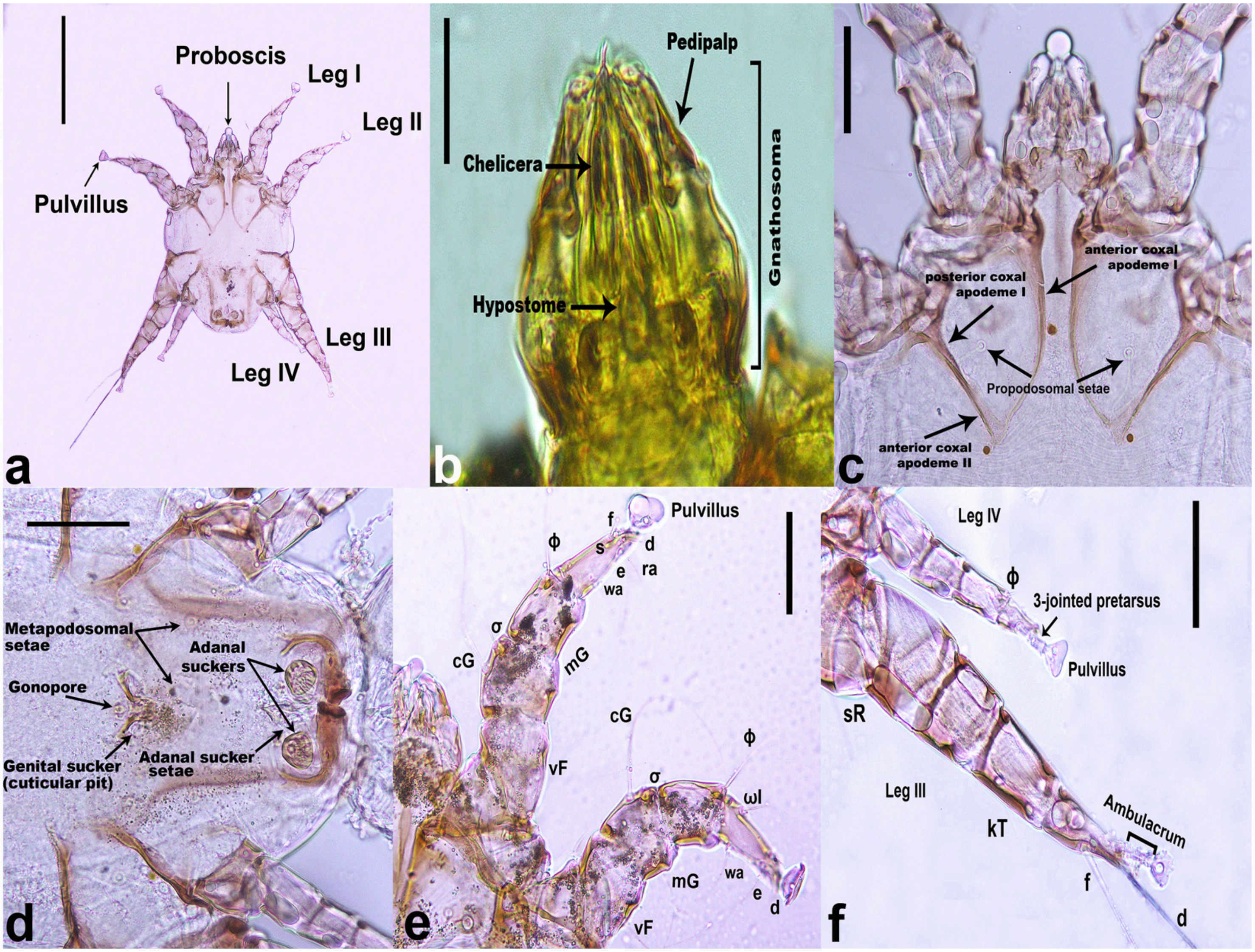

Figure 3

Morphometry of adult male *Otodectes cynotis* from infested cats. **a** The ventral aspect of revealing pretarsal caruncles (pullvilli) on legs 1, 2, 3, and 4. The posterior end of opisthosoma was weakly bilobed (Scale bar =200 µm). **b** A cone-shaped gnathosoma with broad end rounded, basis capitulum, and the narrower end, rostrum. Note the existence of a pair of pedipalps, pair of chelicerae and hypostome (Scale bar =25µm). **c** Coxal fields I and II. Note that the anterior coxal apodeme I was not medially fused (no sternum). The posterior coxal apodeme I and anterior coxal apodeme II ventrally fused. The coxal apodemes were heavily sclerotized. Coxal plates located along either side of the base of the propodosomal plate showing teardrop-shapes; each beard a long whip-like seta (propodosomal setae) arising from the center (Scale bar =50 µm). **d** Metapodosomal plate showed sclerotized areas posteriorolateral to genital suckers (cuticular pits) and around the aedeagus. The later was cone-shaped, out from gonopore, situated between the coxal apodemes of legs I and II, and is surrounded, both internally and externally, by heavily sclerotized areas. On the metapodosomal region, the male's ventral surface had a gonopore with two cuticular pits. A pair of retractile adanal suckers were completely surrounded by sclerotized plates (Scale bar =50µm). **e** The distribution of setae of Leg I of *Otodectes cynotis*. Note that femoral seta *vF* approximately reached the tip of the genu; setae *cG* was longer than *mG*; sigma setae *σ* was to the tip of the tibia; solenidion *φ* of the tibia plainly extends beyond the tip of the tarsal claw; *wa* as long as *ra*; *e* as long as *f*, and *d* almost reaches the tip of the tarsal claw, while Leg II showed *vF* nearly extended to base of genual solenidion (*σ*), *σ* nearly extended to half-length of tibia, seta *cG* as long as or slightly longer than *mG*,*d* nearly extending to tarsal claw tip, *ω1* tapering towards its apex , *wa* as long as *ra* (Scale bar =50µm). **f** The distribution of setae of Leg III revealed that tibial seta *kT* of leg III was long, *d* seta was longer than *f*. Leg III was longer than leg IV (Scale bar =50 µm)

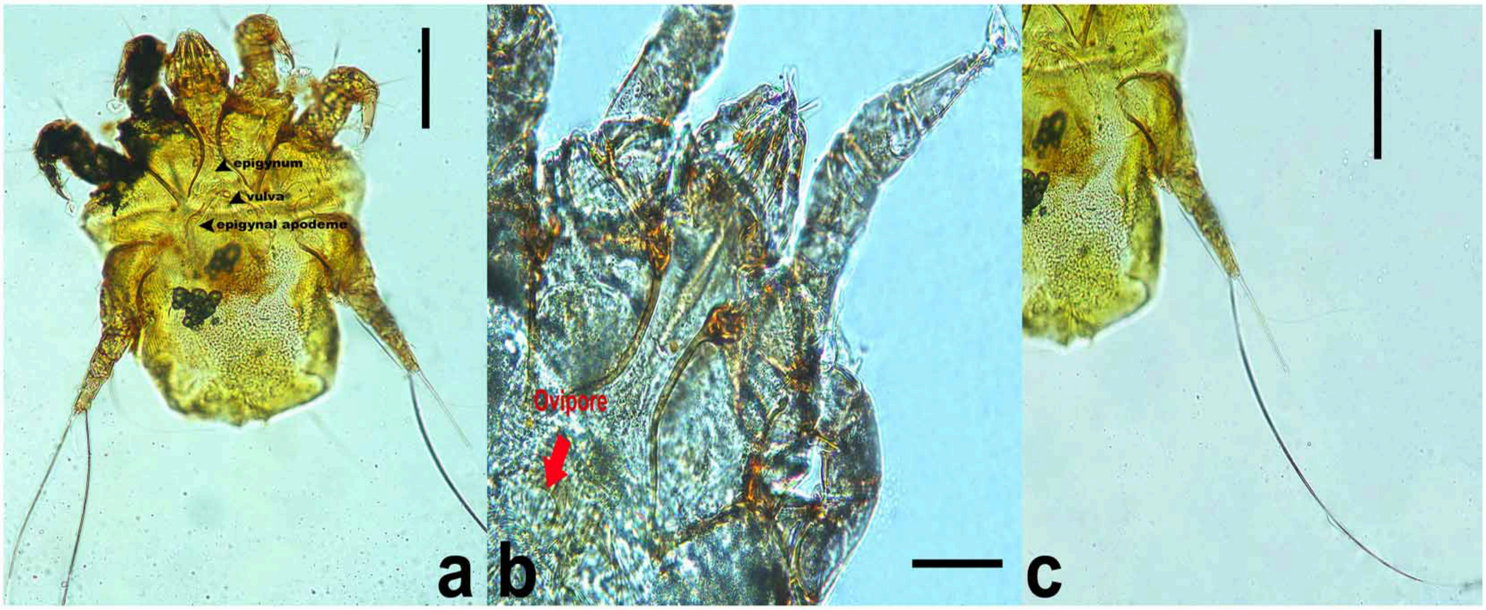

Figure 4

Morphological characters of adult female *Otodectes cynotis*. **a** A ventral view of an ovigerous female showing epigynal apodeme, horse-shoe-shaped epigynium and vulva (Scale bar = 100 μm). **b** Ovipore of the adult female (Scale bar = 50 μm).).**c** Leg III of the adult female with 2 long terminal bristles with rudimentary leg IV (Scale bar = 100 μm)

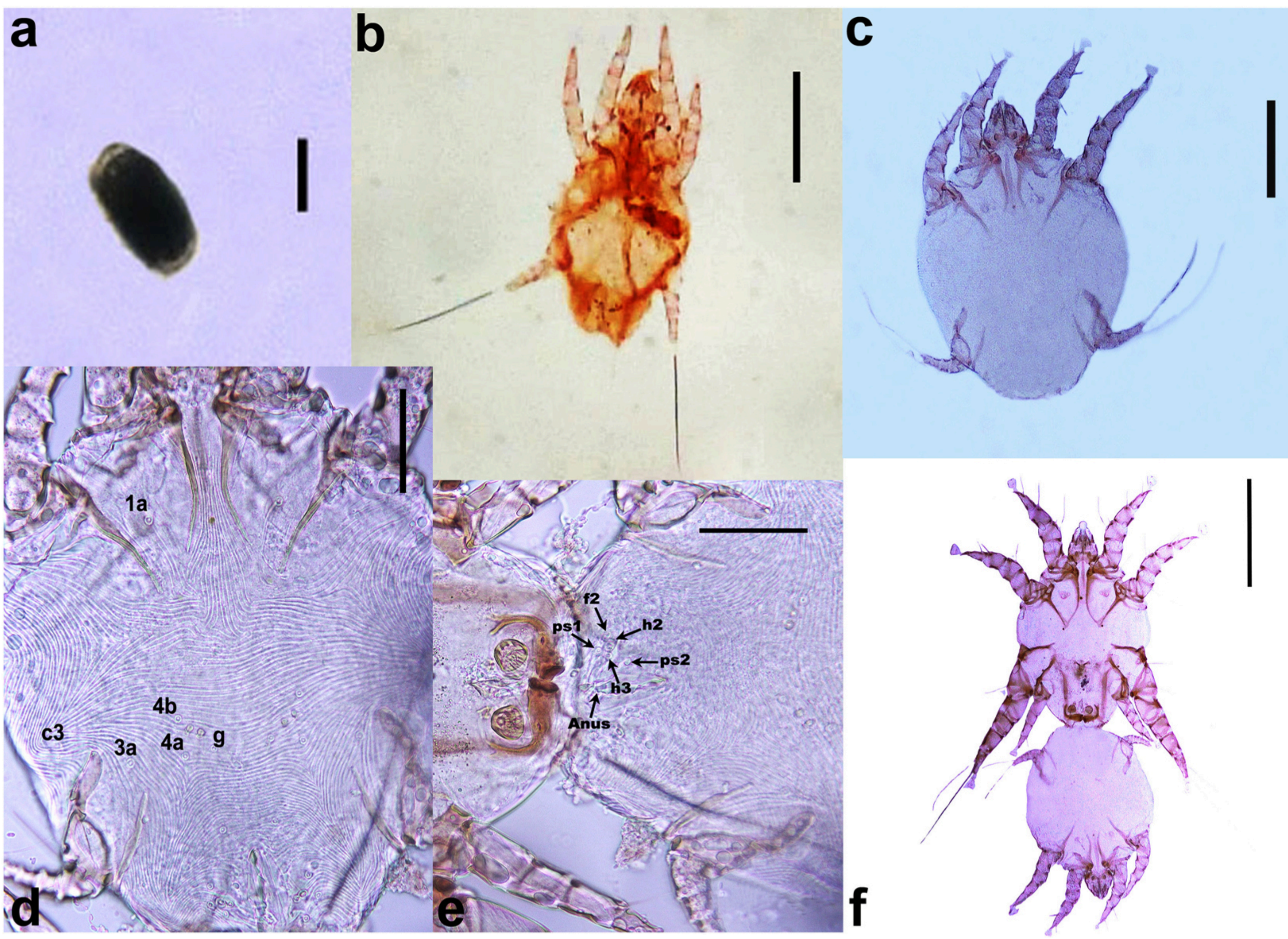

Figure 5

Light micrograph of developmental stages of *Otodectes cynotis*. **a** An egg of *Otodectes cynotis* (Scale bar =100 μm). **b** The ventral aspect of a larva (Scale bar =100um). **c** The ventral aspect of a protonymph (Scale bar =100 μm). **d** Setae of the ventral view of tritonymph revealing seta *1a* in the propodosomal plate. The seta *c3* located dorsal to leg III while setae *3a, 4b,4a* appeared medially (Scale bar = 50 μm). **e** Paraproctal setae of the tritonymph (Scale bar = 50 μm). **f** An adult male and tritonyrmph in a copulatory position (Scale bar =200 μm)

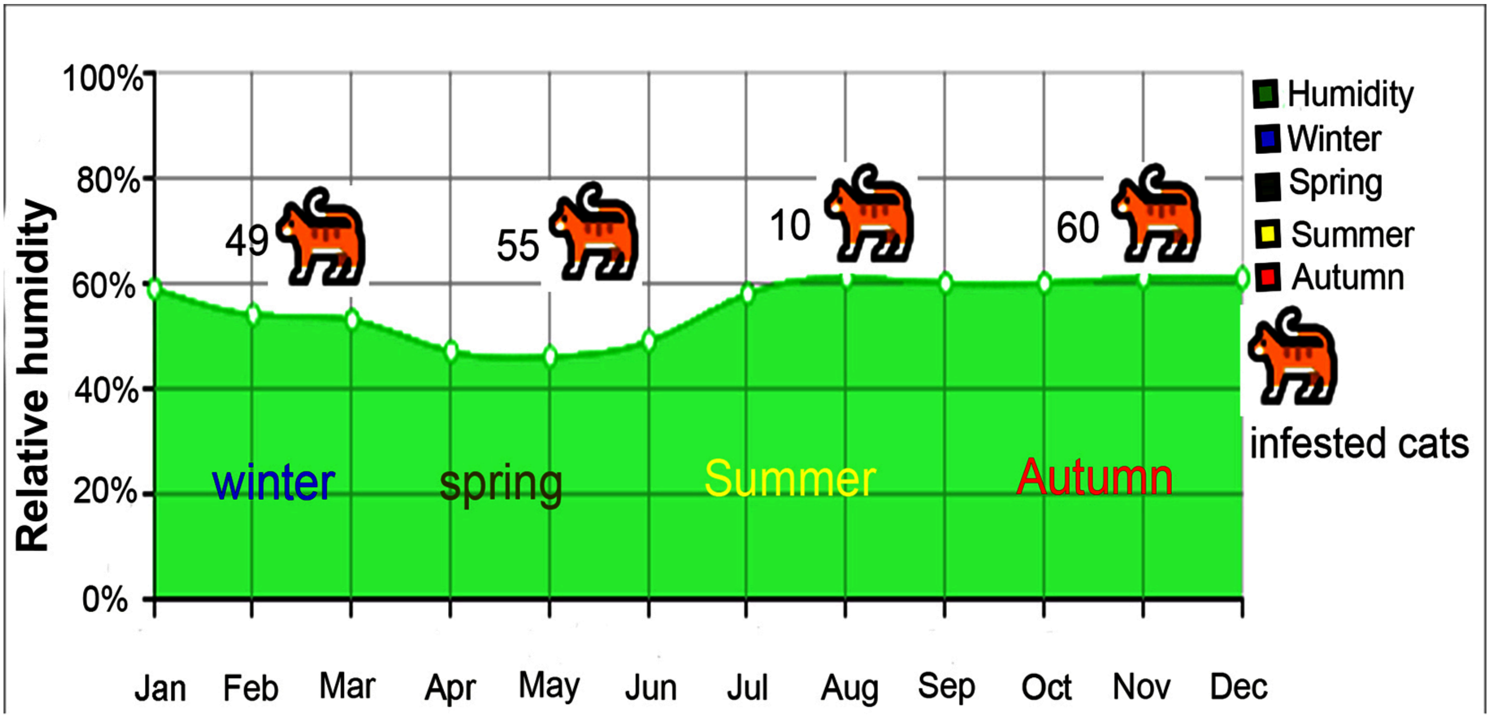

Figure 6

The effect of relative humidity on the occurrence of *Otodectes cynotis*in infested cats