

## Review

# Clinical and Diagnostic Aspects of Feline Demodicosis Caused by *Demodex cati* and *Demodex gatoi*

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## Abstract

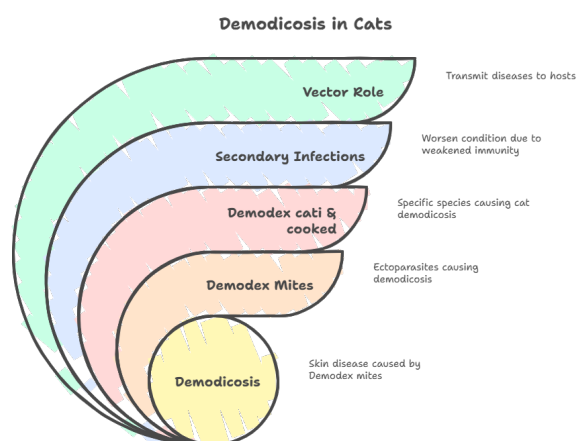
Demodicosis is a skin disease caused by *Demodex* sp with immuno-opportunistic properties. In cats, demodicosis is caused by *Demodex cati* and *Demodex cooked*. *D. the floor* is a normal microflora in cats; pruritus in *D. how is* generally mild to moderate but may worsen with secondary infections resulting from scratching. *D. gatoi* is pathogenic and can be transmitted through direct contact. It causes more severe symptoms, including erythema, pruritus, hyperpigmentation, alopecia, and crust—confirmation of diagnosis through skin scrapings and trichograms. Treatment is carried out causally with Amitraz and Ivermectin, symptomatic treatment with antihistamines, and supportive treatment.

**Keywords:** Demodicosis; *Demodex cati*; *Demodex gatoi*; immuno-opportunistic

## Introduction

Cats are susceptible to ectoparasites, such as fleas, mites, ticks, and fleas. The prevalence of flea infestation in cats in Indonesia is relatively high, especially in stray cats. Research in Surabaya showed that the prevalence of flea infestation in stray cats was 11.3% (Rosyidah et al., 2021). The prevalence of mites attacking pet cats in Purwokerto is 85%, which is included in the category of moderate infestation prevalence (Hidayah et al., 2021). Research from government Veterinary hospital and private pet clinics in Indore presented total of 140 cats (male 69 and female 71) having dermatitis were examined and sixteen cats (11.42%) were found positive for demodicosis. The prevalence of demodicosis was found higher in cats of 6-18 months of age (37.5%). Infestation of *Demodex* was significantly ( $p < 0.05$ ) higher in male (62.5%) than female (37.5%) cats (Dangi et al., 2022).

Ectoparasites can harm their hosts because they act as vectors. When the host's immune system is low, they can trigger secondary infections that worsen the condition of the infected animal. One of the mites that can attack cats is *Demodex* sp., which is called demodicosis. Three species of feline demodex mites have been described *Demodex gatoi*, *Demodex cati* and an, as yet unnamed. Species *Demodex cati*



and *Demodex gatoi* are two of the main species identified as the cause of demodicosis in cats.

*Demodex* is a normal microflora in cats, but if it is present in more than normal amounts and causes infection, it will be of particular concern. Predilection *Demodex* under the hair follicles or sebaceous glands causes erythema, pruritus, alopecia, and hair loss. Generally attacks the head, nose, tail, and front legs, but demodicosis lesions can attack the entire body, usually accompanied by secondary infections (Sardjana, 2012). Wounds from scratching the skin can increase the risk of bacterial infection.

Diagnosis *Demodex* can be done by skin scraping (deep scraping) or trichography (Goth 2014). Demodicosis is more often reported in dogs because it is more pathogenic and easily develops when immunity is compromised, compared to demodicosis in cats because the cat's immune system is more efficient in controlling the population. *Demodex* naturally. However, this condition can cause significant dermatological disorders, especially if not treated properly. The lack of case reports and limitations in diagnosis make this disease often overlooked by owners and veterinary medical practitioners. Therefore, a thorough understanding of demodicosis is important to increase awareness and appropriate treatment.

## Result and Discussion

### Etiology

Demodicosis is a skin disease caused by ectoparasite mites *Demodex sp.* *Demodex* is a normal microflora in dogs and cats but is an opportunistic parasite. When the immune system is low, it can trigger secondary infections that can worsen the host's condition. Morphology *Demodex sp.* cigar-shaped with a size of  $\pm 250 - 300 \mu\text{m} \times 400 \mu\text{m}$ . Life cycle *Demodex sp.* consists of four stages, namely filiform eggs, six-legged larvae, eight-legged nymphs, and *Demodex sp.* adult eight-legged (Sardjana, 2012). *Demodex sp.* lives and reproduces under hair follicles and sebaceous glands by eating epidermal layer debris. Demodicosis is divided into local and general lesions (Ballari et al., 2019). Local lesions are characterized by one or more small, circumscribed areas

of alopecia, usually appearing on the face and legs. In demodicosis, generalized lesions can attack young and adult cats with lesions that spread widely throughout the body, with symptoms in local and general lesions that are the same, such as redness (erythema), itching (pruritus), darker color (hyperpigmentation), alopecia. The generalized form indicates a more severe condition and is more widespread. Two main species of cats cause demodicosis, namely *Demodex cati* and *Demodex gatoi*. Both have significant differences in morphology, infestation location, and transmission mode.

### *Demodex cati*

*Demodex*, a typical, non-contagious commensal parasite in the body, has a predilection for the skin's lower part of the hair follicle in the dermis layer (Ilievet al., 2019). *Demodex* are long and slender in shape, resembling a cigar with a body length of about  $200 \mu\text{m}$ . The pathogenesis of this disorder is unknown. The mite is considered to be part of the naturally occurring microfauna of feline skin. Mite reproduction to the point of causing dermatitis may be associated with an underlying systemic disease. However, some patients with *D. cati* infestation have no apparent underlying disease or history of predisposing drug use (much like infestation in the dog). Patients should be screened for retroviral infections, and concurrent systemic or infectious disease. In the case of localized, very inflamed lesions, biopsy is recommended as *D. cati* infection has been reported to occur in conjunction with squamous cell carcinoma in situ. Demodicosis is caused by *D. cati* usually triggered by an underlying systemic disease, including Feline Immunodeficiency Virus (FIV) infection (Lowenstein et al., 2005). This is followed by a progressive decline in immune system function and increased host susceptibility to opportunistic infections (Teixeira et al., 2012). *D. cati* cause local demodicosis with symptoms around the eyes, eyelids, or external ear canal. The cat may or may not be pruritic. The disease may be generalized in distribution or localized; when localized, it tends to involve the face. *D. cati* may also be the cause of a ceruminous otitis externa; the otodemodicosis may be associated

with skin disease, or may occur by itself. Local demodicosis is self-limiting and is characterized by lesions that vary in degree of itching, including alopecia, patchy erythema, peeling, and crusting (Scott et al., 2001).

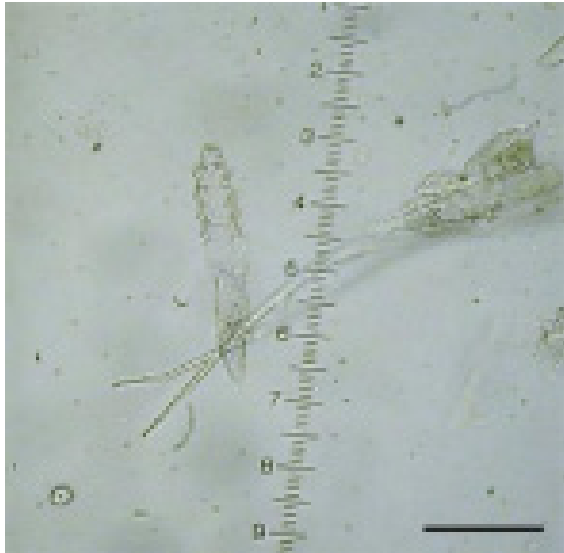


Figure 1. *Demodex cati* (Iliev et al., 2019)

### ***Demodex gato***

Case *D. gato* was first discovered in 1981 in France in two Bengal cats. *D. gato* differs significantly from other known *Demodex* species found in cats (and dogs). Unlike mites that reside deep in the skin, *D. gato* lives on the surface, making it more susceptible to being eliminated through excessive grooming. *D. gato* has a distinctive body shape, shorter and wider than *D. cati*, with a length of  $\pm 81 - 115 \mu\text{m}$ . Size *D. gato* males are smaller than females, which is  $\pm 90 \mu\text{m}$ . The female size is  $\pm 110 \mu\text{m}$ , with oval-shaped eggs measuring  $40 \times 25 \mu\text{m}$ . *D. gato* resides in the stratum corneum, which is more superficial than *D. cati*, becoming an infectious and pathogenic parasite. The niche of *D. gato* in the superficial keratin layer of the skin and its role as a contagious, primarily pathogenic parasite are features that are atypical of demodectic mites. *D. gato* causes severe itching all over the body and can attack young and old animals (Saari et al., 2009). The infestation caused by *D. gato* is considered unusual, as this mite is capable of spreading between cats through simple, non-intimate contact. This mode of transmission has been scientifically verified and is not commonly observed in

infestations by other *Demodex* species affecting cats or dogs. In contrast to *D. cati* infections, this form of demodicosis is generally not linked to underlying immune suppression in most cases. Although a number of confirmed cases have shown a history of glucocorticoid treatment, it is believed that the medications were prescribed in response to pruritus caused by the infestation, rather than being a predisposing factor for the condition itself.

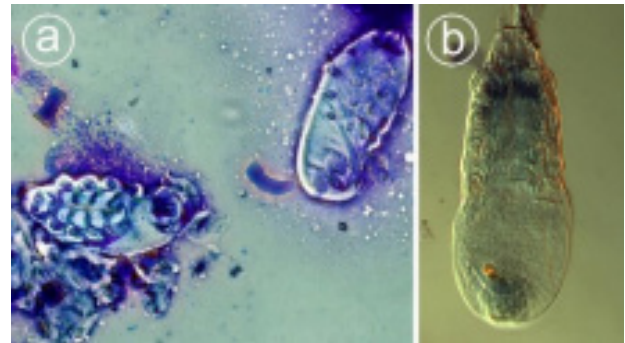


Figure 2. *Demodex gato* (Saari et al., 2009)

### **Epidemiology**

Demodicosis in cats is a skin disease that is rarely reported, especially compared to the incidence in dogs. The incidence of cases in cats is generally low. Data on the prevalence of demodicosis in cats in Indonesia is still limited, mainly because this disease is often undiagnosed or unreported. However, several studies have shown that ectoparasites, including mites, have a high prevalence in cat populations in various regions. A study in Surabaya showed that the prevalence of flea infestation in stray cats was 11.3% (Rosyidah et al., 2021). The prevalence of mites attacking pet cats in Purwokerto is 85%, which is included in the category of moderate infestation prevalence (Hidayah et al., 2021). Research from government Veterinary hospital and private pet clinics in Indore presented total of 140 cats (male 69 and female 71) having dermatitis were examined and sixteen cats (11.42%) were found positive for demodicosis. The prevalence of demodicosis was found higher in cats of 6-18 months of age (37.5%). Infestation of *Demodex* was significantly ( $p < 0.05$ ) higher in male (62.5%) than female (37.5%) cats (Dangi et al., 2022). The increase in *Demodex gato* cases in the Gulf Coast (USA) indicates the potential of an endemic area

(Beale, 2012). Although not all of these cases are caused by *Demodex spp.*, this figure shows that ectoparasite infestation is a significant problem for cat skin health in Indonesia. Clinical cases of demodicosis due to *D. cati* is often found in cats with immune system disorders, such as FIV (Feline Immunodeficiency Virus) infection, FeLV (Feline Leukemia Virus), or other immunosuppressive conditions (Iliev et al., 2019). On the contrary, *Demodex gatoi* has very different properties. Some reports suggest that the infestation of *D. gatoi* is more commonly found in warm and humid climates, such as the southern and southeastern United States. However, data in Indonesia are still minimal. Overall, the low incidence reported in cats is also likely due to difficulties in diagnosis, mainly due to the low number of mites and nonspecific symptoms or resembling other skin diseases such as allergies or dermatophytosis. Therefore, clinical vigilance and appropriate diagnostic techniques are essential in identifying and controlling demodicosis in cats.

### Clinical Symptoms

The clinical symptoms of demodicosis in cats vary depending on the type of *demodex* that infects them. In general, the symptoms caused are erythema (redness), pruritus (itching), hyperpigmentation (darker discoloration), alopecia, crusting, and localized hair loss. Generally, it occurs on the head, front legs, nose, and tail, and some cats are also attacked only in the paw and ear areas (local demodecosis). Demodecosis generally consists of lesions found almost all over the body, usually accompanied by secondary infections. Secondary infections by bacteria can cause skin lesions to become increasingly itchy and cause an unpleasant odor.

In case of infestation, *Demodex cati*, non-contagious, is part of the normal flora of the cat's skin with symptoms that are often not visible if the number of mites is small. However, when the mite population grows excessively, it is usually due to a decrease in the immune system or systemic diseases such as FIV and FeLV accompanied by symptoms of demodicosis. Pruritus on *Demodex* is generally mild to moderate but can worsen with secondary infections that arise from scratching.

Transmission *D. gatoi* generally does not occur horizontally between cats but is transmitted vertically from mother to kitten during nursing. In contrast, infestation by *Demodex gatoi*, which lives on the surface of the skin and is transmitted between cats through direct contact, *D. gatoi* can spread in environments with dense cat populations such as shelters, cats living in one environment can also be a strong indication of an infestation. *D. gatoi*, which is contagious. *D. gatoi* can affect cats of all ages, including those that appear systemically healthy. Infection *D. gatoi* tends to cause more severe symptoms, causing severe pruritus that often triggers cats to lick or scratch their bodies excessively. As a result, patchy alopecia occurs, the skin becomes reddish and scaly, and in some cases, scabs appear. Lesions are usually found on the lower abdomen, inner thighs, neck, and other body parts that are easily licked or scratched. Severe pruritus caused by *D. gatoi* can also affect the cat's behavior, such as becoming restless, uncomfortable when touched or losing appetite (Saari et al., 2009).

### Diagnosis

Diagnosing demodicosis is done through anamnesis, physical examination, and confirmation of the diagnosis through laboratory examination. Predilection *Demodex spp.* are located under hair follicles or sebaceous glands. Therefore, the method used to detect their presence is skin scraping (deep skin scraping) or trichogram (Goth, 2014). Skin scrapings are taken from the part that shows symptoms and scraped until the skin bleeds slightly to ensure it reaches the inner skin. The sample is placed on a glass object, NaCl is dripped, smoothed, covered with a covered glass, and observed under a microscope. The skin scraping technique is the gold standard in examination because it can produce results in *Demodex*. Trichogram removes a few strands of hair from the skin that has lesions and is observed under a microscope (Beco et al., 2007). Trichogram are less sensitive than scrapping when mite infestation is low (Saridomichelakis et al., 2007). Because the symptoms are similar to other skin diseases, such as allergies or fungal infections, an accurate diagnosis is needed to ensure demodicosis as the cause.

## Therapy

Treatment is done with causative and symptomatic therapy. Causative therapy using amitraz and ivermectin. Amitraz is the only drug approved by the FDA (Food and Drug Administration) to treat demodicosis. Amitraz is used as a topical acaricide given twice a week, but in some cases, treatment with amitraz needs to be done every day (Puja, 2014). Treatment with amitraz causes a calming effect for 12-14 hours after bathing. Ivermectin is a broad-spectrum antiparasitic drug that inhibits GABA receptors that can paralyze parasites. Repeated administration of ivermectin can maximize therapy by eradicating parasites in the next cycle. In symptomatic therapy, antihistamines are given, and supportive treatment can be added to support the body's immunity and improve skin and hair conditions (Hasanah et al., 2021). Many factors influence treatment success, including immune condition, intensive treatment, good care, and a supportive environment.

## Conclusion

Demodicosis is a skin disease caused by *Demodex sp.* In cats, demodicosis is caused by *Demodex cati* And *Demodex gatoi*. The symptoms caused are erythema, pruritus, hyperpigmentation, alopecia, and crust. The best confirmation of the diagnosis is through skin scrapings. Demodicosis therapy is based on causative and symptomatic, enhanced with supportive treatment.

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