DERMATOLOGIC DISORDERS IN DOGS

By
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THESIS

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DECLARATION

I hereby declare that the thesis entitled **"DERMATOLOGIC DISORDERS IN DOGS"** is a bonafied record of research work done by me during the course of research and that this thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

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Certified that the thesis entitled **"DERMATOLOGIC DISORDERS IN DOGS"** is a record of research work done independently by **Dr. Madhu Rajan Mathews**, under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, associateship, fellowship to him.

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Dr. Madhu Rajan Mathews

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MY AMMA

Prof. REBECCA ZACHARIAH

who lights my life.

CONTENTS

LIST OF TABLES

LIST OF PLATES

LIST OF FIGURES

LIST OF PROFORMA AND CHARTS

INTRODUCTION

1.INTRODUCTION

Though dogs are reared primarily as companion animals and for watch and ward duty, of late they are utilised for other services and purposes as in defence and police departments for crime detection and tracking. In addition to these social values or privileges, pet dogs contribute substantially to the income of pet breeders by way of sale of pups. Since the market value of pups depends largely on breed characters and health status of both dam and her pups, pet owners are anxious about the maintenance of the health of their dogs. Owing to these reasons the social status of dog as a pet is increasing day by day in our country also like that in western countries.

Of late many newer maladies are met with among dogs due to import, mixing of animals and management errors. Of these maladies dermatological disorders occupy a paramount position and often warrant our relentless attention in view of their zoonotic, economic and aesthetic importance. Skin, as the outermost integument of body, is the most commonly exposed organ to the adversities of environment.

Boddie (1970) classified skin diseases broadly into parasitic and non-parasitic. Parasitic diseases are caused by animal or vegetable parasites. Animal parasites include large ectoparasites like lice, fleas, ticks and small animal parasites which include mites like sacrcoptes and demodex. Fungi and yeast constitute the vegetable parasites and produce ring worm, favus etc. The non-parasitic skin diseases include those caused by invasion of micro-orgnaisms like bacteria and viruses; hormonal imbalances, immunologic abnormalities, heriditory factors and nutritional and environmental effects.

Normally the skin of the dogs harbour a variety of flora, both resident and transient and which live in a symbiotic relationship with the host. Staphylococci are considered to be the primary skin pathogen. They may attain a pathogenic role when there is break down of immunity or improper care and attention of the skin and coat.

A review of literature indicates that bacterial infections are the main causative factor for dermatitis. Among mange parasites, *Sarcoptes scabiei* var *canis* and *Demodex canis* are important. Mange is troublesome to the patients because of the intense pruritus and restlessness which they cause.

Mycotic infections are caused by two groups of fungi, namely ermatophytes and non-dermatophytes. The dermatophytes include

Microsporum and Trichophyton spp. which are keratophilic in nature, while the non-dermatophytes viz Aspergillus, Penicillium, Candida, Mucour, Rhizopus and Alternaria spp. invade the different layers of skin.

Most of the dermatitic zoonoses are transmitted by direct or indirect contact with infected animals. The management of animals, hygenic conditions, extremes of climatic conditions and food habits are other important factors aggravating these conditions.

The skin of pets is also of great aesthetic value and of much concern to the owner since they can neither be allowed mingling fully with the family nor be killed, because of the affection and sentimental attachment.

Data on the incidence of different dermatological disorders are not available in Kerala, as no cognizable work has so far been carried out. Keeping in view of the increasing association of man with pets, especially with dogs, and the severity and frequency of occurance of skin diseases, the objective of this study is directed to collection of relevant information on etiopathogenesis and diagnosis to suggest better treatment and control measures of canine dermatological disorders.

REVIEW OF LITERATURE

2.REVIEW OF LITERATURE

2.1. Predisposing Factors.

2.1.1. Age

Dall (1958) reported that aging will increase the tendency to chronic dermatosis. Misra and Basistan (1972) observed 68% occurence of *Sarcoptes scabiei* in puppies under five months of age.

In a study by Keen *et al.* (1981) serum copper concentration in Beagles increased with age upto 5.5 years and then decreased, whereas serum zinc concentration increased to the age of 7.5 years and then began to decrease.

According to Goldston and Wilkies (1982) incidence of dermatophytosis is greater among young animals below three years than in old ones.

There was 22, 47 and 31% prevalence of *Demodex canis* in dogs below six months, 7-12 months and above 12 months of age respectively (Cannon, 1983).

Shirk (1983) reported 21, 47.5 and 31.4% occurance of canine demodicosis in dogs below six months, 7-12 months and above 12 months of age respectively.

Folz *et al.* (1984) observed that the incidence of scabies was 43.7 in dogs under six months of age and 17.1% in dogs of 7-12 months.

Grant (1985) was of opinion that flea allergy dermatitis can develop at any age, but mostly occurs before six months of age.

Thomset (1986) has not attributed any breed or age group susceptibility to dermatophytosis.

Grant (1987) stated that impetigo is frequently seen in young dogs of 1-3 months age.

Rai and Yathiraj (1988) reported 35.71% prevalence of scabies in dogs under six months of age and 26.19% in the age group of 7-12 months.

Vargas (1988) reported 5.5% prevalence of demodectic mange in dogs of less than 6 months of age and 1% in dogs above 12 months of age.

Henfrey (1990) stated that the transmission of Demodex mite occurs in the first three days of the life of puppies.

Jeffers (1990) postulated no sex predilection for development of hypothyroidism. Hypothyroidism typically affects dogs of four to ten years of age, although it can occur at any age.

According to Medleau (1990) the onset of atopy is generally between 1 and 3 years of age,but younger dogs are also occasionally affected. It is very unusual for an older dog to develop atopy unless its environment is changed. The report said that there is no age or breed predilection for food allergy dermatitis. Dogs can become food allergic even after years of being fed with the same diet.

According to Sausa (1990) spontaneous canine hyper adrenocortisism is usually detected in middle aged to older dogs but has also been reported in animals from 1-15 years of age.

Yathiraj *et al.* (1990) reported 20.8, 45.8 and 33.4% prevalence of demodectic mange in dogs of six months or less, at 6-12 months of age and above one year of age respectively.

Medleau and Sosna (1992) have opined that in demodicosis, transmission of the mite from the bitch to neonate occurs within the first two or three days of life.

Dogs between the age group of 1-2 years are reported to be more susceptible (26.48%) to bacterial dermatitis (Aujla, 1993)

Chalmers and Medleau (1994) stated that atopy can have any age of onset from 6 months to 7 years, but usually between 1 and 3 years of age.

Wawrzkienicz *et al.* (1994) found that dermatophytosis is mostly seen in dogs in the age of two years and below two years.

2.1.2 Breed

Nesbitt *et al.* (1980) stated that higher prevalence of hypothyroidism is seen in Golden Retriever, Doberman Pinscher, Dachshund, Irish Setter, Miniature Schnauser, Great Dane, Boxer and Poodle.

Mackin *et al.* (1983) reviewed 78 cases of flea allergy dermatitis and stated that the disease was seen more frequently in long haired dogs.

Folz *et al.* (1984) studied the breed-wise distribution and reported that 55.8% were pure bred dogs, and of the pure bred dogs Cocker spaniel (6.6%) and German Shepherd (5.5%) were commonly affected.

Grant (1985) reported that demodicosis can occur in dogs of any age, breed or sex, but in his opinion demodicosis is more common in pure bred dogs like Doberman Pinscher, Staffordshire Bull Terrier, Boxer, Pug and in some long haired breeds like Old English Sheep Dog, Afghan hount, German Shepherd and Collie.

According to Rai and Yathiraj (1988) breed wise distribution of demodicosis was as follows: German Shepherd (38.09%), Spitz (11.9%) and mixed breeds (28.57%).

Muller *et al.* (1989) stated that more frequently Dachshunds and large breed dogs are affected with adrenal tumours. It has been reported that Poodles, Dachshunds and Boxers appeared to be predisposed to pituitary dependent hyper adrenocorticism.

Medleau (1990) suggested that a strong breed prediliction existed for Terrier breeds towards atopy. It is stated that Dalmatians, Irish Setteres, Schnauzers, Golden Retrievers, Labrador Retrievers, Shar Peis and German Shepherds are the other breeds having prediliction to atopy.

Jeffers (1990) stated that large and giant breed dogs are at increased risk of developing the signs of hypothyroidism upto three years of age.

Scott and Paradis (1990) reported that breed predilictions were found in following conditions viz bacterial folliculitis and furunculosis in Collie, German Shepherd, Golden retrievers, Newfoundland; atopy in Boxer, German Shepherd; hyperadrenocorticism in Miniature poodle; hypothyroidism in Dobermann Pinscher, Gordon Setter; castration responsive alopecia in Chow-chow; demodicosis in Old English Sheepdog and idiopathic pruritus in Pit Bull Terrier.

Based on a study of five hypothyroid dogs, Roche *et al.* (1991) stated that breed or sex predilections were not evident in hypothyroidism.

Ohlen (1992) found that in Sweden; Boxers and Fox Terriers are predisposed to atopy.

Among pure bred, Spitz was the most affected breed (57.69%) followed by German Shepherd (11.54%) (Aujla 1993).

Barrie *et al.* (1993) reported that breed type and age have no effect upon cholesterol and lipoprotein concentration in canines.

Chalmers and Medleau (1994) were of the opinion that certain breed namely Terriers, Retrievers, Boxer, Chinese Shar Pei, Dalmation, English Bull Dog, Lhasa Apso, Miniature Schnauzer, Setters, Cocker Spaniel and German Shepherd have got high risk to have atopy.

Denis *et al.* (1994) stated that among 30 dogs studied; Dachshunds had the highest risk for food allergy.

2.2. Etiological Factors

2.2.1. Bacteria

Guilhon and Barnabe (1973) isolated *Pseudomonas aeruginosa* and *Staphylococcus spp.* from 10 cases of canine pyodemodicosis.

Guilahon *et al.* (1974) observed 904 dogs suffering from pyodermatitis, otitis and suppurative conjuctivitis over a period of six years. They reported that Staphylococci were predominent in 85%, 53% and 77% of cases respectively.

Ihrke *et al.* (1978) isolated coagulase negative staphylococci and coagulase positive *Staphylococcus aureus* from normal and seborrheic dogs respectively.

While studying normal microflora of skin of 10 dogs Krogh and Kristensen (1978) found that Micrococcus spp. alpha haemolytic Staphylococcus spp. and Acetobacter spp. were present consistently. *Staphylococcus aureus* was isolated in nine cases, and *S. epidermidis* from seven dogs. Beta hamolytic Streptococci, Corynebacterium spp., Bacillus spp., *E. coli, Proteus mirabilis,* and Alkaligenes spp. were found sporadically. Kristensen and Krogh (1981) isolated *Staphylococcus aureus* from 98 percent cases of canine dermatitis.

In a microbiological study on 493 cases of canine pyodermatitis during the period of 1975-79 Amine-Khodja *et al.* (1983) reported bacterial isolates as follows: *Staphylococcus aureus* (84%), *E. coli* (10%), non-haemolytic streptococci (7%), Pseudomonas spp. (5%) and Proteus (5%).

Cox and Newman (1984) reported that the primary skin pathogen of the dog is *Staphylococcus intermedius.*

Ihrke (1987) reported that pyodermas are the common cause of skin diseases in the dog. According to him, deep pyodermas are considerably less common than superficial pyodermas and that deep pyodermas beyond acne should be evaluated for underlying disease which is much more likely to exist. Deep pyodermas may be seen as sequelae to hypothyroidism and immunologic incompetance. *Staphylococcus intermedius* is the primary bacterial pathogen of canine skin. Involvement of other bacteria such as Pseudomonas spp. Proteus spp. and *E.coli* is usually secondary to initial infection by coagulase positive Staphylococci such as *S. intermedius.*

Wisselink (1988) hypothesised that German Shepherd Pyoderma is a type of hypersensistivity reaction to Staphaylococcal antigens eventually occurring in flea bite hypersensitivity, atopic dermatitis or repeated microtrauma.

Gupta (1989) reported prevalence of bacterial dermatitis in a clinical survey of skin diseases at Ludhiana.

While studying canine pyoderma during a period from 1982 to 1988 Love (1989) isolated 190 cultures of Staphylococci. Of this 97.4% were coagulase positive Staphylococci (85.8% *S. intermedius,* and 11.6% *S. aureus*), while the remainder were coagulase negative. He reported that Staphylococci are normal inhabitants of skin of most animals of which *S. intermedius* is the only normal Staphylococcal inhabitant of the skin of dogs. The isolation of *S. aureus* in the dog may indicate contamination from a human

or other primates. In that study 85.8% isolates identified were *S. intermedius* whereas *S.aureus* was 11.6% and *S. epidermidis* was only 1.6%.

Muller *et al.* (1989) reported that superficial bacterial foliculitis is very common and often misdiagnosed commonly as dermatophytosis or endocrine imbalance as it may have a "moth eaten" appearance.

Medleau (1990) reported that coagulase positive Staphylococci were the pathogenic bacteria in skin infections and stated that if the culture fails to isolate Staphylococci, either the organism was missed because of poor culture technique or the animal does not have a pyoderma. In his opinion non-staphylococci bacteria isolated from deep pyoderma cases in mixed cultures are secondary invaders that usually does not survive if the Staphylococcal infection is successfully treated.

Lloyd *et al.* (1991) reported that counts of total bacteria and coagulase positive *S. intermedius* on the abdomen of infected dogs (ie. with superficial pyoderma) were significantly greater than those on normal dogs. Coagulase negative Staphylococcal populations were similar in both the groups.

Pyogenic skin lesions should be cultured for bacteria and antibacterial sensitivity tests should be performed (Sosna and Medleau, 1992).

Aujla (1993) reported an overall prevalence of bacterial dermatitis as 31.31% in Ludhiana with a higher susceptibility in bitches (70.59%) than in males (29.41%).

Kamboj *et al.*(1995) reported 40.24% incidence of bacterial dermatitis in the 825 dogs examined. They isolated 229 bacterial strains either singly or in mixed infections out of 210 dermatitis cases, and the coagulase positive Staphylococcus spp. were found to be the main organism (82.96%).

According to Panciera (1997) pyoderma is sometimes found in hypothyroid dogs and hypothyroidism can predispose to recurrent pyoderma.

2.2.2. Fungi

Carman *et al.* (1979) isolated 552 dermatophytes from 12 animal species, during the period of 1971-1978 in New Zealand. Many dermatophytes isolated from dogs were *Microsporum distortum, M. gypseum, Trichophyton mentagrophytes,* and *Keratinomyces ajelloi.*

Of the 330 animals examined, Chatterjee and Sengupta (1979) isolated and identified the dermatophytes as follows : *Trichophyton verrucosum* (2), *Trichophyton mentagrophytes* (6), *Microsporum gypseum* (4) and *M. distortum* (1).

Trichophyton mentagrophytes, T. rubrum and *Candida albicans* were found to be the main causative organisms of dermatitis when 227 samples of hair and skin scrapings from human beings, cattle, calves and dogs were examined (Sharma *et al.* 1979).

Weiss *et al.* (1979) examined skin scrapings and hair samples from 4790 animals. They isolated 887 strains of dermatophytes. Of these *M. canis* was the main dermatophyte isolated from dogs, cats and zoo animals, whereas *T. mentagrophytes* were found mainly from guinea pigs, chinchillas and dogs.

During a survey of dermatitis in dogs over a period of 12 months at Jabalpur Veterinary College Hospital, Chittawar and Rao (1982) examined 211 dogs. Of these 18.5% of dogs were positive for fungi including *Trichophyton mentagrophytes* (10) *Microsporum canis* (4), *M. gypseum* (3), *T. simmi* (2) and *Candida albicans* (3). They recorded that the incidence of mycotic infection of skin in dogs in Jabalpur was 18.48% and *Trichophyton, Microsporon* and *Candida* were the organisms isolated among which *Trichophyton* is mainly responsible for the infection. They stated that involvement of Candida and *T. simmi* in canine dermatitis was rare.

Goldston and Wilkies (1982) reported that the incidence of dermatophytosis in companion animals was less than many practitioners think. Reportedly only 2.12% of all dermatological problems of small animals are caused by dermatophytes. They said among the organisms causing the dermatophytosis in dogs *Microsporum canis* alone causes 70%

of the infections. In this report they stated that *M. gypsium*, *M. canis* and *Trichophyton mentagrophytes* were the three main dermatophytes growing on the outer surface of the hair shaft (ectothrix).

Stenwing (1985) collected 2066 skin scrapings from domestic animals from July 1981 to June 1984. Dermatophytes were identified in 439 samples.

Thomset (1986) in his 14 year sample survey, with of 247 positive samples from dogs suffering from dermatophytosis reported that 65% were of *Microsporum canis*, and 23% *Trichophyton mentagrophytes*. He also stated that not all those animals coming into contact with the infection will develop dermatomycosis. According to him animals suffering from nutritional disorders, those who have poor cell mediated immunity or have not acquired immunity to the infection are most susceptible. Adults having acquired immunity and those in good health are less susceptible. According to him ring worm infection takes place by transmission of fungal spores, usually by direct contact from animal to animal, by infected grooming tools or from the environment. Airborne infection in kennels and catteries has also been reported. He also reported that ring worm fungi may invade hair, nails, claws and stratum corneum of the epidermis. Hair is invaded in its active (anagen) phase of the growth cycle and the extent of hyphal invasion is to the point at which keratinization of the hair takes place (Adamson's fringe).

Ihrke (1987) reported that dermatophytosis and allergy are common misdiagnoses in cases of superficial pyoderma.

Komarek and Wurst (1989) examined skin and hair samples from 268 healthy dogs. They isolated *Trichophyton mentagrophytes* (6), *Microsporum canis* (4) *T. ajelloi* (1) and *T. rubrum* (1).

Lewis *et al.* (1991) isolated 70 (3.8%) cases of dermatophytosis from 1824 canine samples submitted over a period of 10 years. *Microsporum canis* was the most common species isolated, followed by *M. gypseum*.

Vokoun and Kucera (1991) examined 836 dogs and 12 cats from Prague over a 5 year period from 1985 to 1989. Incidence of dermatophytosis was 18% and 21% in dogs and cats respectively.

Medleau and Ristic (1992) were of the opinion that a definitive diagnosis of dermatophytosis should be made before initiating treatment because fungi are not a frequent cause of skin disease in dogs and cats. They reported that in young animals kept in contact with infected animals, the infection with zoophilic dermatophytes was common. According to them conditions commonly misdiagnosed as dermatophytosis in dogs include superficial pyoderma, deep pyoderma and demodicosis. Kerions are misdiagnosed as neoplasia or acral lick dermatitis. *Microsporum canis* is so well adapted to cats that it may

live on their hair and skin without eliciting an inflammatory reaction. They also noted that exposure of dogs and cats to contaminated soil will lead to infection with geophilic dermatophytes. According to them Dermatophyte Test Medium (DTM) is the most commonly used culture medium for isolating dermatophytes in Veterinary practice. In a DTM the colour change occurs in case of dermatophytosis, along with the colony growth. Dermatophyte colonies are white, cream or buff-coloured. According to them dermatophytes usually grow within 10 days. Cultures may take as long as 14-21 days to grow in animals undergoing antifungal therapy and in asymptomatic cats if only a few spores were obtained.

Sidhu *et al.* (1992) infected the shaved area of skin of Guinea pigs using suspension of 21 day old cultures of *Aspergillus flavus*, Alternaria spp. or Penicillium isolated from skin lesions of clinical dermatitis in dogs. All the animals developed rashes, alopecia, scabs and scaly skin and the signs in the animals inoculated with *Aspergillus flavus* were more severe.

Breuer-Strosberg (1993) stated that during a four year period 636 samples obtained from dogs in Austria were examined for dermatophytes. Seventy nine dogs (12.4%) were positive, of which 46 (58.2%) were infected with *Microsporum canis*, 15 (19%) with *Trichophyton mentagrophytes* and six (7.6%) with other Trychophyton species.

Chalmers and Medleau (1994) stated that atopic dogs were more susceptible to yeast infection than other dogs.

In a study of 21 dogs of different breeds suspected of dermatophytosis Wawrzkienicz (1994) confirmed that 42.9% cases are caused by *Microsporum canis.*

2.2.3. Ectoparasites

Gething and Walton (1972) suggested a host specificity for Cheyletiellosis.

Alson (1973) observed a change in the prevalence of sarcoptic mange as he recorded one case of scabies for every 15 cases of demodectic mange.

Santos-Matos *et al.* (1982) reported the occurance of demodectic mange as 29% and that of sarcoptic mange and psoroptic mange as 1.7 and 0.3% respectively.

Aghome and Adetosoye (1985) observed 60% prevalence of *Demodex canis* in dogs.

Grant (1985) reported that there are two clinical syndromes caused by fleas namely Flea dermatitis and Flea allergy dermatitis. According to him the poultry mite *Dermanyssus gallinae* can affect the dogs and occasionally humans and the dogs get the mite if they have access to poultry houses. He has opined that the diagnosis of *Sarcoptes scabiei* infection can be done by examining the skin scrapings but the mite is difficult to

be found and so multiple (upto 10) scrapings are advised per dog and even after careful examinations no mites are found in half of the affected dogs.

Gross and Halliwell (1985) reported that flea bite hypersensitivity in dogs is a combination of immediate and delayed response to fleas which is similar to those in man and guinea pigs.

Moriello (1987) reported that dogs with flea strike almost always live outdoors. He reported that young dogs are more commonly affected than adults, with Cheyletiella mites, and louse infestations (Pediculosis) rarely seen.

Flea allergic dermatitis is more common than flea dermatitis and is more difficult to diagnose, since in the case of flea allergic dermatitis at the time of examination presence of flea on the animal could not be established (Grant, 1987).

Henfrey (1990) reported that transmission of Demodex mites among dogs occurs only in the first 2-3 days of life and is by direct contact between dam and puppies. It has been opined that demodicosis is not contagious under other natural circumstances.

Medleau (1990) reported that of all the pruritic skin diseases in dogs flea allergic deramtitis is undoubtedly the most common and suggested that making a diagnosis of flea allergic dermatitis does not necessarily depend on finding fleas or flea excreta on the dog,

because although the adult fleas prefer to live on the dog, the more pruritic the animal the more likely the fleas will "jump ship". According to the report Cheyletiella mites are highly contagious and can affect dogs, cats, rabbits and humans; and any dog that has been receiving steroid therapy can develop demodicosis. This report agrees with the report of Moriello (1987) that louse infestation is a rare problem in dogs.

Merchant (1990) has given a general account of the more important and common zoonotic dermatological conditions. Flea allergy dermatitis is described as the most common skin disease of dogs. Cheyletiella mites are parasites of domestic animals and can be freely transmitted to other hosts including man. According to this report 30-50% of canine infestations with *Sarcoptes scabiei* spread to humans.

According to Sosna and Medleau (1992) a diagnosis of pododemodicosis or localised or generalised juvenile onset demodicosis is made by identifying *Demodex canis* mites in 8-10 deep skin scrapings, in a fecal flotation test, on swabs from the external ear canal or skin biopsies. They are of the opinion that *Sarcoptes scabiei* affects primarily dogs, but can also affect foxes, cats (rarely) and humans (transiently).

Kamboj *et al.* (1993) reported a 17.05% prevalance of canine dermatitis, of which 7.27% was contributed by demodicosis.

2.2.4. Allergic Determinants

2.2.4.1. Atopy

According to Chamberlain (1978) by learning the date of onset, chronicity, periodicity and persistence, the clinician can determine if there was an initial recurrent seasonal reaction or if it was perennial at the onset. Many allergic animals have a seasonal condition which after 2-3 years becomes a perennial condition. Seasonal allergies by inhalant allergens are mainly due to pollen of trees, grasses, weeds and flowers, moulds and pollutants. The non-seasonal allergens are chiefly household products such as wool, feathers, animal or human hair and dander, house dust and house dust mites. It has been stated that hereditary allergy is determined by a single pair of genes and the allergic factor is an incomplete recessive one.

Grant (1987) reported that the incidence of atopy in practice is between 3 and 8% of dermatological cases. Allergy develops predominantly to inhalant allergens such as house dust mites, pollen and human and animal dander.

Ackerman (1988) listed moulds as a the frequent cause of allergic inhalant dermatitis; the most important being Alternaria, Hormodendrum (Cladosporidium), Aspergillus, Penicillium, Heliminthosporium, Mucor and Rhizopus. House dust also causes allergies due to mites *Dermatophagoides farinae* and *D. pteronyssinus.*

Medleau (1990) agreed with Chamberlain (1978) that the most important allergen causing atopy includes the large number of light weight pollen grains in the air from wind pollinated plants (trees, weeds or grasses). This report also agrees with Ackerman (1988) that fungal spores are important aero allergens and may be found in the air year round. This report suggested that flowering plants are not considered a problem because they are usually insect pollinated or produce small amounts of heavy pollen that do not become airborne.

Umesh *et al.* (1995) diagnosed 60 dogs out of 927 as atopic, based on history and clinical signs, supported by stain tests.

Panajotovic *et al.* (1994) studied dogs with inhalant allergies and found that 78.6% were positive to house dust, 50% to bed linen, 50% to house dust mite, 42.9% to cigarette smoke and 28.6% to pollen.

Magalon-Laruelle (1995) have studied 25 dogs with atopic dermatitis and found that in *in vitro* allergen testing four dogs were significantly and three moderately were positive to cockroach extract, where as four dogs were positive to dermatophagoides spp.

2.2.4.2. Contact

Ripps (1958) recorded a case of contact allergy in a dog caused by Jasmine blossoms.

Walton (1966) listed the common allergens causing allergic contact dermatitis as dyes used for fabrics, carpets and bedding and accelarators and antioxidants used in processing of rubber and plastics.

According to Grant and Thoday (1980), the actual incidence of allergic contact dermatitis is difficult to determine and is reported to have a 10% incidence. They have suggested that there can be allergic reactions to skin dressings and ointments, to soaps (especially derived from cresol and tar) and to chlorinated water used for bathing.

Thoday (1980) reported that contact irritants like strong acids and alkalies produce severe skin changes, whereas there are relative primary irritants which are substances of low potency or corrosive agents in low concentration like soap, detergents, disinfectants and solvents, which on repeated application produce irritation, inflammation and pruritus.

Thoday (1981) stated that contact allergic dermatitis has been recorded due to plant pollens, dye stuffs, chemicals used in rubber and plastic manufacture and dicholorvos impregnated flea collars.

Grant (1987) stated that primary irritant dermatitis is more common than allergic contact dermatitis, which is thought to account for approximately 1% of dermatological cases.

Allergic contact dermatitis is observed in animals that have a delayed hyersensitivity reaction to substances such as cleaning agents, topical medication, wool, grass, vinyl toys, collars or food bowls (Medleau, 1990).

2.2.4.3. Food

Thoday (1981) stated that eventhough food allergy is uncommon in veterinary practice it occasionly results in cutaneous manifestaions.

Food allergy dermatitis has been found to be primarily caused by meat protein, milk or wheat (Grant, 1987)

Medleau (1990) suggested that food allergy is a possibility in any dog that is non-seasonally pruritic, regardless of the onset of age. It has been suggested that hypoallergenic diets containing a single protein and a single carbohydrate should be given for at least 3 weeks in the case of food allergy and the feed may include home cooked diets containing long grained rice or potatoes and cooked lamb, chicken, rabbit, venison or fish. Protein to carbohydrate ratio should be 1:3 by volume.

Harvey (1993) reported that food allergy is thought to account for as much as 1% of all canine dermatoses in general practice. In this study it is suggested that in the UK, the hypoallergenic diet which contains lamb, chicken and egg causes pruritic skin diseases in dogs, whereas rice is rarely identified as an allergen in diets.

Paterson (1995) in a study showed that the food allergy to wheat was 25% whereas to egg, lamb and chicken are 20, 25 and 10% respectively.

Denis and Paradis (1994) stated that in dogs the major food allergens identified were beef, dairy products, egg, chicken, lamb, corn, rabbit, maize, pork and rice in the decreasing order of incidence.

Panajotovic *et al.* (1994) has reported that of the 11 dogs tested with food allergens; 54.5% were positive for beef, 45.5% to pork, 36.4% to fish, 18% to chicken meat, 18% to milk and 9% to eggs.

2.2.5. Other factors

Dall (1958) stated that unpigmented skin is extremely sensitive to radiation either from the sun or from electric fires. He reported that there is a marked exfoliative dermatitis with considerable irritation and baldnes in diabetes mellitus, whereas dogs with mild nephritis lick and chew their paws causing a pedal eczema.

The most obvious sign according to Robertson and Burns (1963) in dogs fed with excess calcium carbonate without zinc supplementation was the failure to make normal weight gain, which resulted in extreme emaciation. Emesis was a common sign in the later stages of the experiment. The dogs were debilitated and weak; their coats were rough and dull.

According to Chamberlain (1978) sunlight is the most important cause of allergic conditions over the nose, ear or along the back and exposed surfaces in light coloured or white animals with poor coat.

Thoday (1980) reported that; with chronic interstetial nephritis, lesions may develop bilaterally and symmetrically. There is partial or total loss of hair and the skin is dry, thickend and forms large folds covered with squamous- crusted eruptions. With liver disease, eruptions may occur on both sides of the neck, the shoulders and trunk. The affected skin is partially hairless, dry, thick, thrown into folds and covered with scales and crusts. Diabetes mellitus may result in dry coat, pruritus and secondary bacterial infection.

Keen (1981) reported that animals consuming a diet inadequate in either copper or zinc will have reduced serum concentrations of either elements.

Sanecki *et al.*(1982) suggested that the possibilities of zinc deficiency occuring in the field are not great; but if a feed with a low quantity of zinc (less than 90mg zinc/Kg of feed) is mixed with a high calcium source or low zinc containing feed stuff such as oil, sugar or some vegetables levels at or below recommended levels could be reached, so that borderline deficiency would develop and mild lesions might be seen. They stated that the skin of dogs with zinc deficiency is more prone to infection than skin of dogs given a zinc adequate diet.

According to van den-Broek and Thoday (1986) the value of serum zinc concentration in the diagnosis of zinc responsive dermatosis is limited even in the presence of appropriate clinical signs. They have reported five cases of skin disease in dogs associated with zinc deficiency and all the dogs were fed with an unsupplemented cereal based diets with some milk.

Roche and Mason (1991) described a case of fixed drug eruption in a dog caused by diethyl carbamazine.

According to Medleau and Sosna (1992) hook worm dermatitis is most often diagnosed in dogs confined to hook worm infected earth or grass kennels or runs.

2.3. Clinical signs

Thoday (1980) reported that pruritus can be either physiological or pathological. Physiological pruritus is from moderate to sharp, but not a persistent sensation. But pathological pruritus is a persistent and troublesome sensation which is usually, although not invariably accompanied by skin changes.

Nesbitt and Helton (1984) described different diagnostic algorithms for diagnosing chronic canine dermatoses based on alopecia and pruritus.

Muller and Scott (1989) stated that the presence and degree of itching is an important criterion in differential diagnosis in many skin diseases.

2.3.1. Conditions due to Bacteria

According to Ihrke (1987) in cases of deep pyoderma, pruritus is variable, but evidence of pain is a more frequnt sign. According to him pruritus without marked gross skin changes may be a salient feature of superficial pyoderma. Nodular pustules or haemorrhagic bullae with or without fistulous tracts and lesions of superficial pyoderma indicate the transition from superficial to deep pyoderma. He reported that, in case of deep pyoderma, as in superficial pyoderma, intact pustules may not be obvious. Seropurulent debris drains from ruptured pustules and erythema, hyperpigmentation, maceration, induration and swelling are common. He stated contrary to popular belief that pustules are not the most commonly seen skin lesion of superficial pyoderma. Crusted papular lesions are most commonly seen since pustules in canine skin are transient, self trauma frequently obliterates intact pustules and pustules may be so small that they appear to the naked eye as papules or simply areas of erythema. Lesions of superficial pyoderma may develop in a variety of ways. Papules or pustules may remain distinct, or may become confluent, circular, erythematus plaques or macules with adherent crusts and irregular serpingilous margins. The stratum corneum surrounding a lesion may peel back to form a collarette. Hyperpigmentation and alopecia are variable but may occur with surprising rapidity.

In the opinion of Medleau (1990, bacterial skin infection is a very common cause of steroid - non responsive pruritus in dogs. It has been categorised as a steroid non responsive pruritus which includes dermatophytosis, sarcoptic mange, Cheyletiellosis, Pelodera dermatitis, cutaneous neoplasia and autoimmune skin diseases; and steroid responsive pruritus which includes atopy, food allergic dermatitis and allergic contact dermatitis. Deep pyoderma is characterised by erythema, alopecia, exudation, crusting, ulceration, erosions and fistulation. Clinical signs in food allergic dermatitis are extremely variable and include pruritic folliculitis, pruritic seborrhoea, atopy or flea bite like skin signs and otitis externa. In that report it has been described that the lesions of superficial pyoderma are: papules; pustules; erythema; scale; crust; circular area of alopecia that may be centrally depigmented; and epidermal collarettes; and it may be difficult to find superficial lesions in heavily coated dogs and hence it is suggested to clip a small portion of the coat in the pruritic area to expose the lesion. It has been opined that depending on the allergens the atopic dogs can be seasonally or non-seasonally pruritic and the dermatologic manifestation of an allergy to food is characterised by non-seasonal pruritus. In the flea allergy dermatitis the dog is usually pruritic over the caudal dorsal region of the back (rump) and the caudo-medial aspects of the hind legs. Dogs that are very flea allergic may develop clinical signs that may mimic those of atopy, including axillary pruritus, face rubbing and otitis externa. Recurrent episodes of acute moist dermatitis (hot spots), may also be associated with flea allergic dermatitis. If the dog is presented with papules and crusts, it is most probable that a secondary bacterial infection has developed. With chronicity, affected skin may become hyperpigmented, thickened and lichenifed.

Rhodes (1990) reported that the primary lesion of superficial pyoderma is a small inflammatory pustule with a hair protruding from the centre. If the condition is chronic, the staphylococcal folliculitis may appear as a "moth eaten" alopecia. Short coated breeds such as Dobermann Pinschers, Dalmations and Shar Pei frequently manifest superficial pyoderma as non-inflammatory alopecia and are often misdiagnosed as having endocrine disorders.

In a study Pal (1993) showed that in case of pyoderma in canines the affected skin showed hyperkeratinization, acanthosis, papillomatosis, thinning and erosion of epidermis.

Curtis (1995) reported three cases of canine eosinophilic folliculitis and furunculosis. The disease was characterised by the rapid development of pruritic, papular, pustular and ulcerative lesions on the dorsum and muzzle. Skin lesions were confined to the face in two cases out of three studied and the third dog had generalised pustular lesions. Previously similar facial lesions were described as nasal pyoderma, but in pyoderma the biopsy should show a neutrophilic inflammatory cell with few eosinophils. In these cases marked eosinophil infiltration was prominent. Dermal collagen necrosis was evident in two cases.

2.3.2. Conditions due to fungi

Moe (1980) observed that 95% of ring worm cases in cats and dogs were due to *Microsporum canis*, *Trichophyton mentagrophytes* and *M. gypseum* infection. Main

lesions were alopecia, hyperemia and discoloration of hair.

According to Thomset (1986) among the dermatophytes causing fungal skin infections, in general, Trichophyton infections are more inflammatory. *Trichophyton mentgrophyte* and *T. mentagrophyte var. erinacei* give rise to lesions resembling pyoderma. *T. mentagrophytes* lesions can be extensive with erythema, total hair loss and all the appearanace of severe bacterial infection. Along the advancing border of the lesion is an intense inflammatory response with broken hairs, crust and apparently purulent excudate which may continue for many weeks.

Rhodes (1990) stated that fungal infections caused by *Microsporum canis*, *M.gypseum* and *Trichophyton mentagrophytes* may cause focal or generalised alopecia with minimal inflammation and mild scaling. With truncal or perineal distribution, a dermatophytosis can mimic the pattern of alopecia associated with endocrine dermatoses. Folliculitis and broken hairs are present in most cases of dermatophytosis and may help in distinguishing dermatophytosis from endocrine conditions causing dermatopathies.

Medleau and Ristick (1992) described that the lesions of dermatophytosis as being focal, especially when involving the head or legs; multifocal or diffused. According to them dermatophytosis is usually non-pruritic, but occasionally can be moderately to intensly pruritic. Clinical signs may include folliculitis, alopecia, erythema, scales and crusts. The lesion may range from scaly patches of alopecia with little evidence of inflammation to raised erythematous nodules called kerions.

2.3.3. Conditions due to Ectoparasites

Grant (1985) is of the opinion that the clinical feature of tick infestation may be variable and many include asymptomatic, skin irritation or hypersensitivity reaction. However, anemia occur in severe infections. According to him, human lesions are very common in Cheyletiellosis. In dogs, dandruff is the principal clinical sign. He says that occasionally in heavy infestations the mites can be moving causing the appearance of a walking dandruff.

Rhodes (1990) stated that Demodicosis has a variety of clinical presentation that include small circumscribed areas of alopecia, mild scaling and erythema. If inflammation is minimal as in localised demodicosis and distribution is truncal, the clinical signs may resemble an early stage of endocrinopathy.

According to Medleau (1997) the lesions of flea bite dermatitis and flea allergy dermatitis range from mild irritation to pruritic papular eruptions, alopecia, lichenification and hyperpigmentation, superficial pyoderma and extensive moist exudative dermatitis.

2.3.4. Other Dermatological conditions.

Chalmers and Medleau (1994) summarized in a symposium that the clinical manifestaions in atopy are affected by concurrent diseases and non-allergenic factors such as stress.

According to Robertson and Burns (1963), in the dog with serum zinc level below normal the skin lesions were not severe, loss of hair occured only at the site of the lesion. There was no evidence of parakeratosis with thickening of the epidermis. In the dog fed with excess calcium carbonate with out the zinc supplementation there were pathologic alteration of the skin along the posterior aspect of the abdomen and the hind legs. These superficial lesions varied from 10 to 20 mm in diameter. Desquamation of the epidermis was followed by a crust like formation covering the erosions. The number of these lesions varied from 3-6 per dog.

Sanecki (1982) fed corn-soy based zinc deficient diet to six week old puppies and showed the development of lesions of parakeratosis, mild hyperkeratosis, alteration in germinal epithelium, erosions, ulcerations, vesiculation, alopecia and inflammation of the skin. These changes were prominenet in the skin of dependent regions, in areas of stretch and friction and external contact.

According to Shaw (1985) endocrine alopecia is usually bilaterally symmetrical except in cases where friction exacerbates hair loss, producing an asymmetrical alopecia. It is non-pruritic except where bacterial dermatitis is concurrent. It is often associated with scale formation, hyperpigmentation and alteration in skin thickness. Hairs are easily plucked and are in telogen phase. Areas of the coat which are clipped show negligible and slow hair growth. In some cases the texture and the colour of the hair is altered. The onset of alopecia is gradual.

Moriello (1989) describes two syndromes which are zinc responsive skin diseases. Syndrome I is due to a genetic defect in the zinc absorption and seen mainly in Siberian Huskies and Malamutes and also in Great Danes and Dobermann Pinschers. The syndrome is clinically characterised by erythema, crusting, scaling and suppuration around the body orifices and pressure points. Syndrome II primarily affects dogs or rapidly growing puppies that are being fed zinc deficient diets or excessive amounts of mineral and vitamin supplements; with clinical signs of thick crusting on plana nasale, foot pads and pressure points, lymphadenopathy and depression.

According to Jeffers (1990) recurrent pyoderma and otitis externa may be the only clinical sign of the hypothyroidism which is a non-pruritic disease, unless secondary pyoderma or seborrhoea develops.

Shanley (1990) enlisted the conditions namely dermatophytosis, demodicosis, pyoderma, congenital or heriditary dermatoses, acquired alopecia as the conditions which can be clinically confused with endocrine dermatosis. It has been stated that the well known clues of endocrine deramtosis include a dull, dry coat with bilaterally symmetrical alopecia and poor regrowth of hair after clipping. Initially, patients with endocrine dermatoses are non-pruritic but when the secondary pyoderma and seborrhoea develop, the condition becomes pruritic.

According to Sausa (1990) cutaneous signs of hyperadrenocorticism include alopecia, hyperpigmentation, thin skin, comedones, pyoderma and calcinosis cutis.

Campbell and Small (1991) reported xanthomatosis in dogs and cats affected with diabetus mellitus. Lesions may appear as yellow pustules surrounded by a ring of bright erythema, pale plaque-like lesions with erythematous margins, or multiple ulcerations of distal extremities. They reported a condition called hepatocutaneous syndrome (diabetes dermatosis) which may develop in diabetic dogs with hepatic cirrhosis. The cutaneous signs can preceed the onset of hyperglycemia and other clinical signs of diabetes and liver diseases by weeks or months. Typical lesions include erythema, crusting, oozing of serum, ulceration and alopecia of the face, genitals and distal extremities. Affected dogs may be predisposed to dermatophyte infection. In diabetus mellitus a thin hypotonic skin with seborrhoea sicca and varying degrees of alopecia is seen. Secondary pyoderma, usually caused by *Staphylococcus intermedius* is common.

Panciera (1997) stated that dermatologic abnormalities, particularly alopecia and seborrhoea, are the most frequent findings occuring in atleast 60% of hypothyroid dogs. In that report it is stated that in hypothyroidism the hair that remains is dull, dry, brittle and easily epilated and become lighter in colour. The earliest dermatologic abnormality seen in hypothyroidism is generalised seborrhoea and it is seen in 40% of affected dogs.

2.4. Type, Pattern and Distribution of Lesions

2.4.1. Conditions due to Bacteria

According to Ihrke (1987) lesions of superficial pyoderma begin most commonly in the groin and axilla. Rapid generalization or severe accompanying erythema are generally poor prognostic signs. In this same report he stated that except in the special case of canine acne, nasal pyoderma and interdigital pyoderma, deep pyodermas tend to spread and not remain localised.

Wisselink *et al.*(1988) reported that German shepherd pyoderma is a chronic skin disease of middle aged German Shepherd dogs characterised by multiple deep seated skin lesions, either generalised in distribution or affecting mainly the dorsal pelvic region, the thighs and the interdigital skin.

Khosla *et al.* (1989) reported that face, neck and limbs were commonly affected; however lesions were also seen on tail and head.

2.4.2. Conditions due to Fungi

According to Chatterjee and Sengupta (1979) common sites of ringworm in animals were head, face and neck, which constituted 77.89% of total lesions. Abdomen and extremities were also affected, but to a lesser extent.

Chittawar and Rao (1982) reported that ringworm lesions were mostly on head, neck, shoulders, legs, abdomen and the interdigital skin. The lesions were mostly circular, slightly raised and crustaceous. Itching was not a constant feature.

2.4.3. Conditions due to Ectoparasites

Alsan (1973) observed that scabies affected dogs had extreme pruritus on legs, flanks and other glabrous areas and the back was affected last.

Belinsky (1973) reported that sarcoptic mange mainly affected the skin of pinnae, dorsal aspect of thorax, muzzle, axillary and inguinal regions. These areas showed lesions of erythema, alopecia and papule formation. Similar lesions were reported by other workers (Buell, 1973; Sidel, 1973)

Grant (1985) is of the opinion that sarcoptic mange is highly pruritic and contagious to other dogs and to man. Lesions in the dog (papules, crust) tend to occur on the ears, elbows, brisket and limbs. He reported that the untreated cases become generalised.

Moriello (1987) noted that the stable flies (*Stomoxys calcitrans*) attack the face and ears of dogs, particularly the tips of the ears and the folded margins of the pendulous ears. The ear margins become crusted with blood and serum.

Sosna and Medleau (1992) reported that Cheyletiellosis is typically most severe in young animals with the primary lesion being scaling over the dorsal midline. Pupies tend to be over affected the rump initially, the lesions then spreading up the back to the head. The coat of an affected animal is somewhat oily. They have noted that in dogs the lesions of flea bite dermatitis and flea allergy dermatitis are usually found on the posterior one third of the body, especially over the lumbar region, tail head, flanks, abdomen and caudo-medial thighs.

2.4.4. Conditions due to Allergy

Grant (1987) reported that pruritus in atopic dogs tend to be in specific facial, pedal and ventral sides

Medleau (1990) described the lesions of contact allergic dermatitis as erythema, papules, alopecia, erosions and ulcers. Chronic lesions tend to be thickened, lichenified and hyperpigmented. In this condition thin haired areas that come in contact with the ground (ventral aspect of the abdomen, tail, perineum, paws, thorax, chin, scrotum and inner pinnae of ear)are affected. If the allergen is a topical shampoo or insecticide the haired areas of the skin are also affected. The nose and lips are affected in allergy to dishes or chew toys. If lesions or pruritus began in thin haired areas, scabies should be on the list of differential diagnoses. In atopy about 10% of cases are reported to have hyperhidrosis (sweating).

According to Umesh *et al.* (1995) the pruritus was noticed in all atopic dogs and was the severest on face, foot, axilla and ventral abdomen.

2.4.5. Other Dermatological Conditions

According to Sanecki *et al.*(1982) after feeding a zinc deficient corn-soy diet to six week old puppies, the appearance and progression of the individual lesions followed a typical pattern. First, as small erythematous spots about 1 mm in diameter appeared. These then enlarged becoming nodules or pustules which were coalesced and formed a brown grainy crust. Some crusted areas, especially those over points of trauma or contact, became eroded and ulcerated and purulent material exuded from their surface Seldom was the back region involved. The lesions began at the paws and tail and spread proximaly with stretch or friction areas more severely involved. Next, the perineal area and the muco-cutaneous junctions showed lesions, along with the abdomen and thorax In no time were the back areas, proximal parts of the limbs and head areas affected, unless preceeded by some paw or pad involvement. Lesions were bilaterally distributed with equal progression and severity.

According to Jeffers (1990) early dermatological signs of hypothyroidism may appear as alopecia on the dorsal, proximal or distal aspect of the tail, causing a "rat-tail" appearance. As the disease progresses hair loss spreads to the entire trunk and proximal limbs, typically sparing the head and lower extremities, except in giant breeds where it may begin on the distal extremities and spread towards the trunk. The remaining hair is

dry, brittle and easly epilated. Bleaching of the normal hair colour may also occur. Seborrhoea sicca, seborrhoea oleosa and seborrheic dermatitis are common early clinical features of canine hypothyroidism.

Roche and Mason (1991) described the lesions of fixed drug eruptions caused by diethyl carbamazine dosage as periocular and lid alopecia and hyperpigmentation of several weeks duration.

Pancierra (1997) has opined that in hypothyroidism alopecia usually begins on the tail and around the neck, where friction causes hairs in telogen phase to fall out. A bilaterally symmetric pattern of hair loss involving the trunk and sparing the extremities occurs in dogs with prolonged hypothyroidism. Giant breeds may suffer alopecia of extremities with minimal hair loss of trunk.

2.5. Haematology

Ramakrishnan *et al* (1972) studied haemograms and proteinograms of dogs suffering from demodectic mange, sarcoptic mange and eczema. In all these conditions, ESR and eosinophil level were increased, whereas serum albumin fraction was reduced In addition, there was neutrophilia in eczema and monocytosis in sarcoptic mange

Fischer (1977) showed that differences in serum zinc values were not found in animals with increased serum urea nitrogen values or decreased PCV. Serum copper was

decreased in dogs with low PCV but unchanged in dogs with increased serum urea nitrogen.

Bauer (1980) stated that ESR is increased in cases of infections, kidney diseases and chronic liver diseases.

Kulkarni *et al.* (1980) conducted haematological studies in twenty dogs suffering from scabies, which revealed leukocytosis, eosinophilia and hypochromic changes.

Thoday (1981) stated that, in the absence of other possible causes , eosinophilia is a useful indicator of various types of skin coditions. It may occur in immediate (Type I) hypersensitivity response and is commonly associated with food allergy. It may be seen in ectoparasitic infestations due to hypersensitivity reaction to the parasite, its secretions and excretions as in flea bite hypersensitivity and this is a support for such a diagnosis, when the clinical signs are suggestive, but fleas or flea faeces can not be demonstrated. In canine hyper adrenocorticism a total eosinopenia is seen.

Chastain (1982) reported that 25-30% of hypothyroid cases have a mild non-regenerative, normocytic, normochronmic anaemia.

Gowda *et al.*(1982) reported that leukocytosis, lymphopenia, eosnophilia, monocytosis and anaemia were seen in non-specific dermatitis.

Ibrahim *et al.* (1984) studied haematological and biochemical changes of ringworm infected buffaloes and reported that infected animals have low erythrocyte count, Hb and PCV; markedly decreased glucose, total protein, total lipid, calcium and inorganic phosphate.

According to Shaw (1985) in hypothyroidism, the complete blood count may show a mild non-regenarative anaemia. There are usually no changes in white cell picture. Cushing's syndrome has mature neutrophilia, absolute lymphopenia, monocytosis and eosinopenia. Prolonged hyperoestrogenism in the dog and bitch may produce bone marrow supression and pancytopenia.

Kalein *et al.* (1986) found that 5 out of 12 dogs tested for hormonal imbalance had a normocytic, normochromic anaemia.

Pathak and Bhatia (1986) studied haematobiochemical changes in canine demodicosis. They observed decreased haemoglobin and PCV. The total leukocyte count revealed leukocytosis.

Khosla *et al.* (1989) revealed that there was no significant change in Hb, total erythrocyte count, PCV, total leukocyte count and differential leukocyte count in eight

dogs experimentally infected with dermatophytosis (*Microsporum canis)*.

According to Jeffers (1990) a normocytic, normochromic anaemia is present in 25-42% of hypothyroid dogs.

According to Sousa (1990), in the case of dogs and cats with hyperadrenocorticism laboratory findings include leukocytosis, neutrophilia, lymphopenia and eosinopenia; occasionally peripheral basophilia, erythrocytosis and nucleated RBC are also found.

According to Kidd (1991) the leukogram has two primary functions as it indicates the presence of information and helps to determine the patient's prognosis, but has the drawback that even when technical skills are excellent, manual cell counting of leukocytes has an inherent error range of apprxiamtely 20%. It is suggested that neutrophilia may or may not develop with diseases such as seborrheic dermatitis and cystitis, where as localised purulent diseases generate greater neutrophilic responses than generalised infections. It has been opined that gram negative bacterial infections, chloramphenicol, oxytetracycline, cephalosporin, antihistamines, oestrogen and debility caused neutropenia, whereas staphylococcus, streptococcus and corynebacterium infections caused neutrophilia. The typical acute inflammatory response is characterised by leukocytosis with increase in mature and immature neutrophils. Other than bacterial and fungal infections, causes of inflammation include immune mediated diseases, chemical irritants

and tissue damage or necrosis. This suggested that WBC counts between 10,000 and 30,000 per microliter are common and represent a moderate response to inflammation. But counts of 30,000 -50,000 per microliter represent a marked leukocytosis.

Morris and Dunn (1992) stated that neutrophilia, monocytosis, eosinopenia and lymphopenia are seen in hyperadrenocorticism, whereas eosinophilia, basophilia and monocytosis are common in hypersensitivity or immune mediated conditions like atopy. In acute infections and inflammations neutrophilia and eosinophilia are seen and in conditions where pyogranulomatous diseases and tissue necrosis occur monocytosis is seen.

Siddhu *et al.* (1992) conducted haematological study of experimentally infected animals (mycotic dermatitis) and did not find any significant change in haematological parameters except a signficant lymphocytosis, neutropenia and monocytosis in penicillium infected guinea pigs. Significant monocytosis was observed in Alternaria infected animals In animals infected with *Aspergillus flavus* there was non-significant neutrophilia and decreased haematocrit.

According to Panciera (1994) mild non-regenerative anaemia is present in 30% of hypothyroid dogs.

Tvedten (1994) stated that, in acute inflammation, acute phase proteins like C-reactive protein (CRP) are increased in the blood and serum CRP increased in dogs during inflammation. Roulex formation is increased because of the protein and it causes RBCs to sediment more rapidly. RBC sedimentation may be measured by the ESR to moniter inflammation.

2.6. Biochemical parameters

Robertson and Burns (1963) stated that zinc plays a very important role in normal growth, because zinc has been found in several enzymes including carboxypeptidase, several dehydrogenases, alkaline phosphatase and carbonic anhydrase. In a study they have shown that when dogs were fed with excess $CaCO_3$ and not supplemented with zinc the zinc levels in the plasma and urine declined approximately eight months from the beginning of the experiment when compared to dogs fed with basal diet only and dogs fed with basal diet, 2% Calcium carbonate, and 200 mg Zinc carbonate /Kg diet.

According to Fischer (1977) there is a highly significant gender difference in serum copper and serum zinc values in Beagles, with male dogs having greater serum copper value and lesser serum zinc value than females which is directly opposite to that found in man. It is shown that serum copper level is normally distributed with means of 0.78 µg/ ml for male dogs and 0.702 µg/ml for female dogs. Mean serum zinc values were 0.885 µg/ml and 0.957 µg/ml for male and female dogs respectively, but distributions were skewed and kurtotic. The report stated that difference in the serum copper and zinc distribution among the studied animals suggested that copper homeostasis is more

narrowly regulated than that of zinc. This regulation difference may reflect the fact that serum copper values essentially reflect the concentration of only one serum enzyme, *ie* ceruloplasmin, where as serum zinc is distributed among many serum components including albumins, macroglobulins and transferrins. In their study it has been shown that mean serum copper and serum zinc values in chronic dermatitis cases were 0.729 µg/ml and 0.912 µg/ml respectively, which were non-significant when compared to normal values of 0.74 µg/ml and 0.923 µg/ml for serum copper and zinc respectively Hypothyroid dogs are reported to have increased but not significantly different serum copper values and decreased serum zinc values ($p<0.05$).

Benjamin (1974) stated that low blood urea nitrogen values are seen in protein malnutrition, hepatic insufficiency and the BUN is elevated in conditions like adrenocortical insufficiency, dehydration, renal disorders and hypotension.

Ling *et al.* (1979) reported in their study of canine Cushing's syndrome that 90% of cases had increased plasma cholesterol concentration.

According to Ladensen (1980) renal diseases included chronic, acute and nephrotic syndromes; acute pancreatitis, liver diseases, vitamin D deficiency, Magnesium deficiency and disorders of gastro-intestinal tract and bile secretion cause hyper calcaemia. Hypercalcaemia is produced in conditions like primary hyperparathyroidism, malignancy and hypothyroidism.

According to Keen (1981) haemolysis had no measurable effect on serum copper concentration, but it did have significant effect on serum zinc values. Lipemia did not significantly affect either copper or zinc values in serum. The observation was that moderate haemolysis can result in an increase in serum zinc concentration by as much as 20% while having no effect on serum copper values.

Thomsett (1981) stated that the changes in condition of skin and coat may result from diseases of organs such as kidney, liver, exocrine or endocrine pancreas and gastro-intestinal tract. He is of opinion that the routine biochemical tests used in diagnosis of such diseases are of direct value in dermatological practice.

Gowda *et al.* (1982) based on their biochemical and haematological studies in nonspecific dermatitis reported hypocalcemia, hypoglycemia, hypercholesterolemia and without any change in blood phosphorus level.

Zinc is involved in membrane stabilization and has some effect on ATP. In rats the aminoacids namely cystine, glycine, proline and lysine were reduced drastically in skin, when fed with a zinc deficient diet. Phosphofructokinase, which is a zinc containing enzyme, and controls glycolysis in the skin, has shown a decreased activity in zinc deficiency. Some mammalian collagenase may be zinc metalloenzyme, which has actions on skin. In rats it is shown that a decrease in collagen production and alterations in type and quality of collagen occurs with zinc deficiency. Animals with zinc deficiency have

decreased incorporation of thymidine into DNA due to reduced function of the enzyme thymidine kinase. This is important in cases of skin conditions, since rapidly dividing tissues such as skin require large amounts of DNA for normal division and maturation (Sanecki *et al.* 1982).

According to Blakley and Hamilton (1985) in cattle and sheep, ceruloplasmin activity appears to correlate more closely with serum or plasma copper concentration as compared to corresponding liver copper concentration.

Shaw (1985) stated that when investigating the cause of an endocrine alopecia the data base collected should include complete blood count, cholesterol and glucose estimations.

Kalein *et al.* (1986) reported that cholesterol levels were found to be elevated in 10 out of 14 hypothyroid dogs tested.

van den Broek and Stafford (1988) showed that the mean concentration of zinc in serum and hair of dogs with zinc responsive dermatosis was significantly lower (6.9μmol/lit) than in those of normal dogs (10.2μmol/lit), but the range of zinc concentrations of diseased dogs (3.5-10.2 μmol/lit) overlapped that of the normal dogs (4.3- 16μmol/lit).

Moriello (1989) stated that serum and hair analysis are unreliable for zinc estimation, because of contamination from glassware and rubber stoppers.

According to Jeffers (1990) hypercholestrolemia is seen in 66-71 % of canine hypothyroidism.

Sausa (1990) suggested mild to moderate elevation in cholesterol and glucose levels in hyperadrenocorticism.

According to Campbell and Small (1991) upto one third of dogs and cats with diabetes mellitus develop skin disorders.

Roche *et al.* (1991) have suggested that the only consistent abnormality seen in serum biochemistry in hypothyroidism was hypercholesterolemia. They observed five cases of hypothyroidism, where each dog had an elevated serum cholesterol level with a slight increase in two dogs and a marked increase in the other three.

van den Broek and Stafford (1992) suggested that zinc deficiency states are associated with reduced serum and leukocyte zinc concentrations and depressed lymphocyte and neutrophil functions. They have stated that eventhough there is a considerable overlap in the range of serum and leukocyte concentration of normal dogs (5.7-16.4 µmol/lit) and those with hyperadrenocorticism, there is a significant increase in

the mean serum zinc concentrations in case of hyperadrenocortism (15.2 µmol/lit) over the normal dogs (11.4 µmol/lit).

Barrier *et al.* (1993) stated that mean plasma cholesterol concentration was significantly higher in dogs with diabetes mellitus (9.31 mmol/lit), hyperadrenocorticism (8.86 mmol/lit) and hypothyroidism (16.17 mmol/lit) than in normal dogs (4.51mmol/lit).

Hays and Sivenson (1993) suggested that Calcium is required for membrane permeability. An excess of dietary fat or poor digestion of fat may reduce calcium absorption through the formation of insoluble calcium soaps. Phytic acid present in the cereals form insoluble salts with free calcium. Zinc may also make a complex with the calcium-phytate and lead to inefficient utilization of dietary zinc. Liberal calcium intake will compensate for the reduced availability of calcium, but it aggravates the zinc deficiency.

Logas *et al.* (1993) analysed and compared serum zinc levels using AAS in 28 healthy dogs, 28 dogs with non-dermatological diseases, 35 dogs with allergic skin diseases and 32 dogs with other dermatological disorders. No significant differences in the mean serum zinc levels were demonstrated among any of the four groups.

Majno and Joris (1996) suggested that glucose has a very important role in ageing and ageing related skin changes. Proteins such as collagen and haemoglobin are subjected

nutrition, zinc deficiency is seen and the most characteristic symptom of zinc deficiency is dermatitis. This also stated that copper is present in a number of metalloenzymes

to chronic attack from glucose referred to as non-enzymatic glycation. The aldehyde group of glucose react with the amino group of proteins and continues a series of reactions resulting in an irreversible autofluorscent structure called advanced glycosylation end products. Thickening of the basal membranes is a result of protein trapping and cross linking. High glucose level may even upregulate the expression of Type IV collagen genes. These effects of excess glucose is thought to cause premature ageing and diabetes mellitus.

Chang (1997) stated that zinc absorption appeares to be proportional to metallothionein levels in the intestinal mucosa. In humans, after long term parenteral nutrition, zinc deficiency is seen and the most characteristic symptom of zinc deficiency is dermatitis. This also stated that copper is present in a number of metalloenzymes including lysyl oxidase and the lysyl oxidase is necessary for the conversion of certain lysine residues in collagen and elastin to allysine, which is needed for cross linking.

MATERIALS AND METHODS

3. MATERIALS AND METHODS

3.1 Sources of Clinical cases.

Dogs suffering from different dermatological problems presented at the Veterinary Hospitals at Mannuthy and Kokkalai (Trichur) of the College of Veterinary and Animal Sciences, Kerala Agricultural University, were included in the present study.

3.2 History and Clinical Examination.

Signalment and a short previous history of the cases were recorded. Details regarding activity, feed consumption and sexual status were noted. The prescribed proforma, shown elsewhere, was filled up after collecting detailed information such as the initial appearance and site of lesion, how did it spread, whether the colour of hairs has changed or not, was there any seasonality. Information regarding the feeding practices, bathing and brushing practices, method of disinfection of kennel, type of collar used and drug used for deworming as well as the date of its administration were also recorded in the proforma, which is modified from Muller *et al* (1989). History of previous medication applied was recorded.

The entire skin and coat of the affected dog was clinically examined and the lesions seen were classified into primary and secondary. They were recorded in the proforma. The sites of lesions were marked in the proforma.

3.3 Collection of Pathological Specimens.

Different materials viz scrapings, hair, pus or transudate or exudate, piece of the skin affected along with the adjacent normal skin for biopsy and blood and serum were collected from each animal. They were used for examination regarding presence of ectoparasites, fungi, bacteria, non-specific causes, and for ruling out internal diseases.

3.3.1 Methods of Collection of Skin scrapings.

Skin scrapings were collected from various sites in all cases. For diagnosing parasitic dermatitis, in the case of suspected demodicosis, deep scraping after squeezing the lesion were taken. In cases of suspected sarcoptes infection, multiple scrapings from ten sites and in case of suspected Cheyletiellosis, superficial scrapings with flakes were taken. In all cases a part of the scrapings were put in mineral oil and another part in 10% potassium hydroxide solution, (Nesbitt 1983).

3.3.2. Method for collection of material for fungal culture.

The area affected was cleaned with 70% alcohol to remove surface contaminants. Then, the scrapings were taken from the active border areas of lesion with sterile No 10 scalpel blade. The scrapings were placed in disposable sterile vials. Broken hairs from the periphery of active lesions along with crusts and scales were also collected in a disposable sterile vial. (Nesbitt - 1983)

3.3.3. Method for collection of Material for bacterial culture.

In case of pyoderma, before collecting samples, hair around the lesions were clipped avoiding trauma to pustules. The pustules were gently swabbed with 70% alcohol, air dried and then opened with a sterile scalpel blade or needle. A touch swab of the exudate, was collected aseptically and placed in a disposable sterile tube. In cases of crusty lesions the hair around the lesions were cut, area over the crust or scab was thoroughly cleaned with 70% alcohol and allowed to air dry. The crust or scab was then lifted aseptically with a sterile forceps and the exudate beneath the crust or scab was collected using sterile swabs and kept in disposable sterile tube. (Nesbitt. 1983)

3.3.4. Method of collection of material for skin biopsy.

In warrented cases, elliptical skin biopsy was taken. The biopsy site was selected so as to include both the lesion and adjacent normal skin. Local analgesic was administrated in the area using adrenaline-free 2% xylocaine as an L block away from the lesion. The area was clipped carefully with scissors, not disturbing the lesion and was soaked with 70 % alcohol and was allowed to air dry. (Thoday-1981)

A small, full thickness, elliptical incisions was made using a sterile scalpel blade and the skin was grasped gently by one corner with sterile forceps and dissected free of the subcutaneous fat. The specimen was blotted with a sterile swab,

placed subcutis down on a piece of card to prevent curling, and put it in 10% neutral buffered formalin

3.3.5. Method of collection of blood for Heamatological Examination.

Three ml of blood sample was collected from the affected dogs directly from recurrent tarsal or cephalic vein after proper disinfection, in a sterile plasitic syringe smeared with 1% solution of heparin as anticoagulant and the specimen examined within half to one hour of collection.

A drop of blood was taken on clean grease free glass slide to prepare a blood smear.

3.3.6 Method of collection of blood for Biochemical Examination.

Three ml of blood was collected in a vial added with six mg. of Sodium fluoride, and five ml of blood was taken directly into a graduated polypropylene tube with polypropylene within stopper which were washed with double distilled deionized water and dried in hot air over, for separation of serum. The tubes were kept closed for 30 minutes at room temperature and then transferred to refrigerator (four degree centigrade) for 30 minutes for the separation of clot. The separated serum after slow centrifugation at 3000 rpm for two minutes to avoid disruption of clot, was transferred to another similar polypropylene tube by tilting the first tube and not by introducing glass and metal pipettes to draw the serum. The second tube was also again centrifuged to make sure that pure serum is got. The

separated serum was transferred directly into a polypropylene serum vial (washed with double distilled deionized water and dried) as done previously.

Disposable clean plastic micropipette tips were used to draw serum from the vials for various biochemical estimations.

3.4. Processing of Specimens.

The materials collected were processed according to the agent to be identified.

3.4.1. Processing of Skin Scrapings

A part of the skin scrapings was put in 10% potassium hydroxide for 20 minutes, centrifuged and the sediment was examined under microscope to note the mites, and fungal spores.

Another part of scrapings was put in a drop of mineral oil on a glass slide and covered with a cover slip to form an uniform layer. Mites if present were observed as live ones which try to move in the mineral oil. Feacal matter of mite, egg and larva also could be detected.

A part of the scrapings and two to four hairs plucked from the periphery of the lesion were stained with lactophenol cotton blue and examined for fungul spores and hyphae.

3.4.2 Processing of Pus or Exudate swab.

The swabs were put in sterile peptone water and incubated at 37°C for 24 hours and then a drop of the inoculum was streaked aseptically on sterile nutrient agar plates. These plates were incubated for 24 to 48 hours at 37°C . After allowing sufficient growth the colony characters were studied and further biochemical characterisations were done to identify the bacteria. (Carter - 1984)

3.4.3. Processing of Scrapings and Hairs for Fungal Culture.

For the isolation of fungi, the affected hairs and part of skin scrapings were placed in petri plates containing a fungal medium, using a sterile forceps and dissecting needle. Following media were used for isolation of fungi.

3.4.3.1.Dermatophyte Test Medium Agar (DTM Agar)

Dermatophyte Test Medium was used for preliminary screening of skin samples. The growth of organism along with change in colour of medium from yellow to red within fourteen days at 25°C indicated the presence of dermatophytes (Muller *et al* - 1989)

3.4.3.2.Sabouraud's Dextrose Agar with Cyclohexamide and Chloramphenicol (SDA -CC)

Fungi grew in this agar and colony characters were noted and part of the culture was taken for microscopical examination for the identification of the fungi (Muller *et al* 1989)

3.4.3.3 Rice Grain Agar.

The agar was prepared with cooked rice grain and was used to subculture Penicillium species for confirmation.

3.4.4. Haematological Examinations.

Different haematological parameters were noted as described below

3.4.4.1 Haemoglobin (Hb)

Haemoglobin was estimated by acid-haematin method using Sahlis haemoglobinometer and was expressed as gram percentage. (Jain -1986)

3.4.4.2 Total R.B.C Count.

Total RBC Count was estimated using Hayem's solution, as described by Jain (1986). The value was expressed as X 10^6 cells/cubic mm.

3.4.4.3.Total WBC Count

Total WBC Count was estimated using Thoma's fluid as described by Jain (1986).

3.4.4.4 Differential Count

The blood smear was examined after staining with Wright's Stain or Leishman's stain and 100 leucocytes were counted and percentage value of each type of leucocytes were noted.

3.4.4.5 Packed Cell Volume (PCV)

Packed cell volume was estimated using microhaematocrit method as described by Jain (1986). The value was expressed as percentage.

3.4.4.6 Erythrocyte Sedimentation Rate (ESR)

ESR was estimated for one hour using Wintrobe method.

3.4.5. Biochemical Examination.

Various biochemical estimations were done to know whether there was any significant biochemical changes occuring in different dermatological conditions The parameters examined were blood glucose, serum cholesterol, Blood Urea Nitrogen, serum calcium, serum copper, and serum zinc.

3.4.5.1 Blood glucose

Blood glucose level was estimated in the blood sample in which sodium fluoride was added as anticoagulant. Ortho-toluidine method described by Henry (1996) was used.

3.4.5.2.Blood Urea Nitrogen (BUN)

Blood urea was estimated using the serum collected as Henry 1996 has stated that the analytical measurement of urea is termed BUN, although urea

determination is actually performed on serum or plasma. The estimation was conducted using enzymatic colorimetric method.

3.4.5.3 Serum Cholesterol

Serum Cholesterol was estimated using Cholesterol oxidase per oxidase method as described by Henry (1996).

3.4.5.4 Serum Calcium

o-Cresolphthalein Complexone method was used for determination of Calcium.

3.4.5.5. Serum Copper

Serum copper was estimated using Atomic Absorption Spectrophotometry (AAS). The AAS was set for operation as per the recommendations of the instrument manufactures (Perkin-Elmer). Copper was estimated at a wave length of 324.8 with slit 0.7 and air acetylene as the flame gas. Sensitivity check was 4mg/lit. with a linear range of 5 mg /lit. which is the maximum limit, where the absorbance : concentration relationship is linear (Beaty and Kerber, 1993).

3.4.5.6. Serum Zinc

Serum zinc was estimated using Atomic Absorption Spectrophotometry (AAS). The AAS was set for operation as per the

recommendations of the instrument manufactures (Perkin-Elmer). Zinc was estimated at a wave length of 213.9 with slit 0.7 and air acetylene as the flame gas. Sensitivity check was 1mg/lit. with a linear range of 1 mg /lit. which is the maximum limit, where the absorbance : concentration relationship is linear (Beaty and Kerber, 1993).

DERMATOLOGICAL INVESTIGATION PROFORMA AND RECORD

[Adopted from Small Animal Dermatology by Muller *et al* (1989) modified]

Date Case No. of Hospital

Owners Name and Address:

Patient's Name Age
Breed Sex M/F
Chief complaint

History

Castrated / Spayed / Not
Parity Not applicable.
Date of last whelping / N.A.
Mating History

Active/ Lethergic
Feed consumption
Normal/ Less quantity / Anorectic

TYPE OF LESION

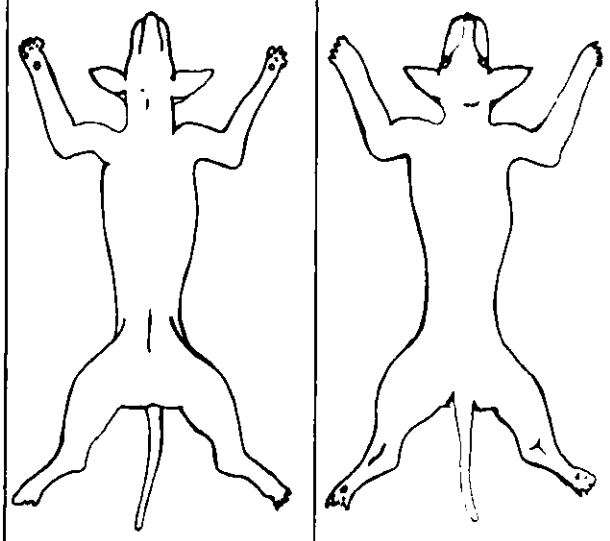
Primary:

- ☐ Macule ☐ Patch ☐ Papule
- ☐ Plaque ☐ Nodule ☐ Pustule
- ☐ Vesicle ☐ Bulla ☐ Wheal
- ☐ Tumor

Secondary

- ☐ Scales ☐ Scars ☐ Crusts
- ☐ Erosions ☐ Ulcers ☐ Excoriation
- ☐ Erythema ☐ Alopecia
- ☐ Abcess ☐ Lichenification
- ☐ Hyperpigmentation
- ☐ Hypopigmentation
- ☐ Patches of hyperpigmentation
- ☐ Hyperkeratosis
- ☐ Comedons
- ☐ Epidermal collarettes
- ☐ Callus

DISTRIBUTION OF LESIONS



Ventral view | Dorsal view

SKIN CHANGES

elasticity extensibility
thickness

QUALITY OF HAIR COAT OTHER FACTORS
Epilation
Pelage is Dry Brittle Nail
Dull Oily Hyperhydrosis

CONFIGURATION OF LESIONS

Linear Annular (target) Grouped

Colour of the lesion

Alopecia Present / Absent
If present localised / diffused / symmetrical / assymetrical
Pruritus Present / Absent
If present constantly / sporadically / only at night
Where did the problem begin
What did it look like then ?
How has it chaged or spread ?
Whether the colour of the hair changes or Not Change/ No change

SEASON: year round/ seasonal/ No seasonality
If seasonal Summer/ Rainy/ Winter

KEPT indoor / outdoor time indoor.....% Time outdoor .....%
Whether any other incontact animals affected: Yes/ No
Whether incontact humans affected : Yes/ No

DIET GIVEN USUALLY

.....

.....

.....

FREQUENCY OF FEEDING

TIME OF FEEDING

LIST OF SUSPECTED FOODS

☐ Cow's milk ☐ beef ☐ Mutton ☐ pork ☐ Chicken ☐ rabbit

☐ Fish (variety) ☐ egg ☐ Oat meal ☐ Corn ☐ Soy

☐ Wheat ☐ Rice ☐ Potatoes ☐ Kidney beans

☐ Canned food ☐ Dog biscuit (Name).....

BATH

FREQUENCY OF BATHING: Daily/ Once In Two Days/ Once In A Week/ Once In A Fortnight/ Once In A Month/ Once In Two Months/ Nil

SOAP : Used / Not used
If used Name of the soap. .....

PRACTICE OF BRUSHING : Yes/ No
If yes. When? : Occassionaly/ Just Before Bath/ Just After Bath

TYPE OF KENNEL
Floor :
Roof :
Side walls :

TYPE OF BREEDING :

MODE OF DISINFECTION OF KENNEL : Just Washing/ Chemical/ Physical
If chemical disinfectant used (including soap and detergent)

Name of chemical .....

Dewormed / Not Dewormed

Date of last deworming.....

Drug used for deworming.....

Age at purchase of the dog.
From where purchased? Kennel/ Pet shop/ Private
If Private, from whom.....

MEDICATIONS:

Previously Applied/ Not Applied/ Not Known
Name of the drug
Duration of treatment
Last date of previous treatment

Other diseases for which treated previously

Name of the disease condition	Drug used	Duration of treatment		Effect of treatment
		Start	End	

Whether the following drugs used or not:

Acetylpromizine
Amitraz
Ampicillin
Aurothioglucose
Azathioprine
Bacterins
Benzyl Peroxide
Bleomycin
Cephalexin
Chlorambucil
Chloramphenicol
Coal Tar
Cyclophosphmide
Cyclosporine
Dapsone
Diethylcarbamazine
Doxorubicin
5-Fluorocytosine
Gentamycin
Griseofulvin
Glucocorticoids
Hydroxyurea
Levamisole
Limesulfer
Mechlorethamine
Neomycin
Penicillin
Phenytoin
Predenisolone
Primidone
Propylthiouracil
Quinidine
Streptomycin
Sulphonamides
Synthetic Estrogens
Tetracycline
Thiabendazole
Thyroid Extract
Triamcinolone
Vaccines
Rabies
Leptospirosis
Canine Distemper
Hepatits
Parvo Viral Diarrhoea
Vitamin K

PARASITES PRESENT : Fleas / Lice/ Tick / Sarcoptes/ Demodex/ Other Mites

RESULTS OF SCRAPINGS : direct method.....
KOH digestion.....

EXAMINATION FOR FUNGUS direct method.....
Lactophenol cotton blue staining.....
Culture on SD agar

EXAMINATION FOR BACTERIA

Culture result from bacteriology lab.....
.....
.....

REMARKS ON HISTOPATHOLOGY SECTIONS

HAEMATOLOGY		
		Normal values
Hb (gm%)		12-18
Total RBC (x 10^6/cmm)		5.5-8.5
Total WBC (per cmm)		6000-18000
Differential count	Neutrophil (%)	60-77
	Lymphocyte (%)	12-30
	Eosinophil(%)	2-10
	Monocyte (%)	3-10
	Basophil (%)	0
PCV (%)		37-55
ESR		

BIOCHEMICAL PARAMETERS
Blood sugar
Blood urea Nitrogen
Serum cholestrol
Serum calcium
Serum zinc
Serum copper

RESULTS

4. RESULTS

4.1. Prevalence of Dermatitis in Dogs

Data on the prevalence of the dermatitis collected from the veterinary institutions of the State Animal Husbandry Department from 1991 to 1995 and University Veterinary Hospitals at Kokkalai and Veterinary College Hospital, Mannuthy from 1991 to 1995 are presented in the Table 1.

Prevalence in dogs affected with dermatitis is presented in Table 2. Breed-wise prevalence in dogs affected with dermatitis is presented in the Fig.1. Sex-wise distribution of the dogs affected with dermatitis is presented in Table 3.

Different etiological agents were involved in the production of different conditions studied; and the distribution pattern is given in Fig.2. Out of 50 cases studied 17 different clinical conditions were identified and their distribution pattern is given in Table 4.

4.2. Bacterial dermatitis

4.2.1. Prevalence

The overall prevalence of bacterial dermatitis was 42%. Out of different clinical bacterial dermatitis conditions, superficial bacterial folliculitis was the most prevalent one (38.1%) followed by impetigo (28.6%) and German Shepherd

Fig.1: Breedwise Distribution of Canine Dermatological Conditions. (n=50).

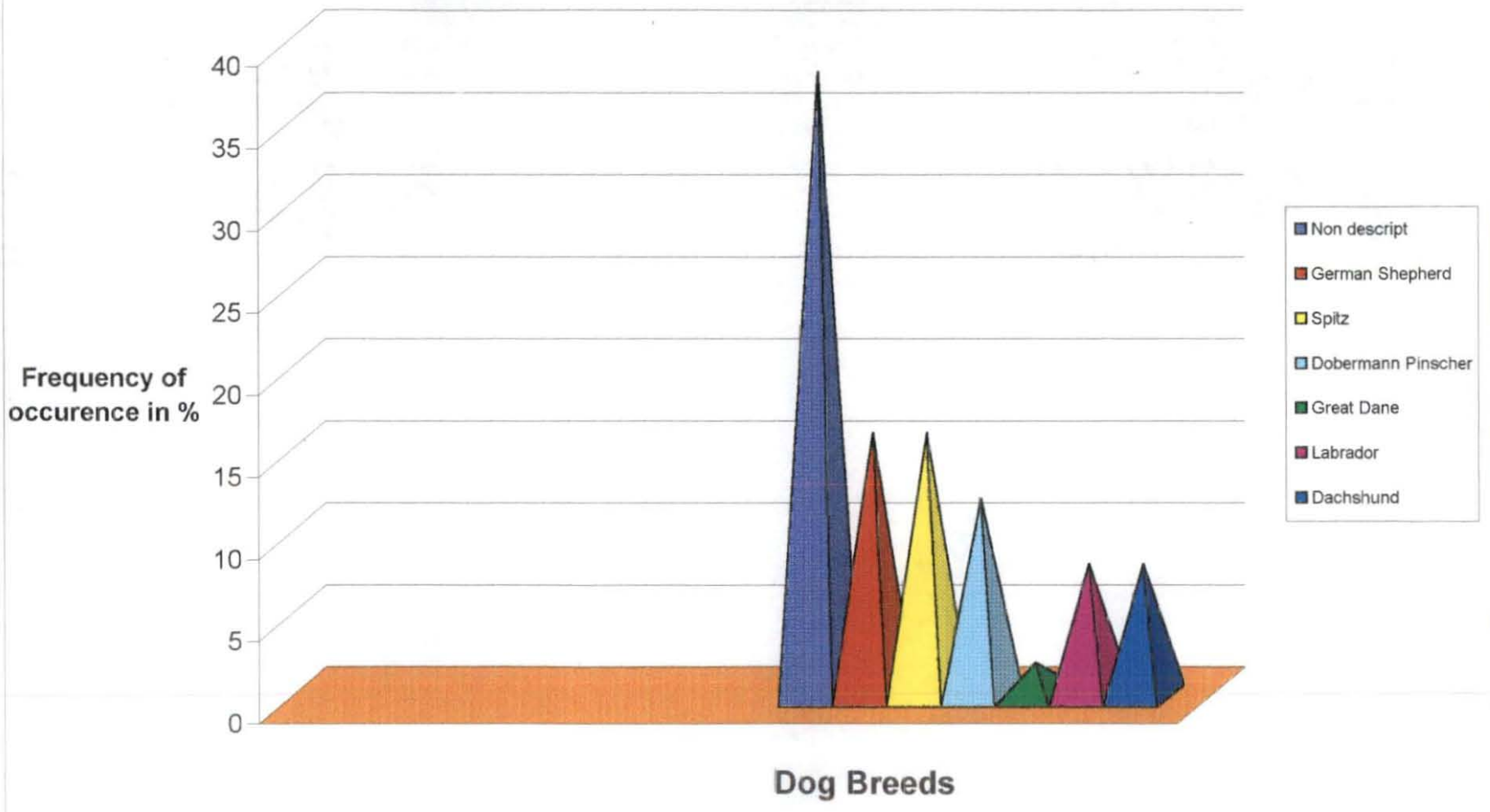


Fig.2: Distribution of Canine Dermatological Conditions Based on Etiological Agents.(n=50)

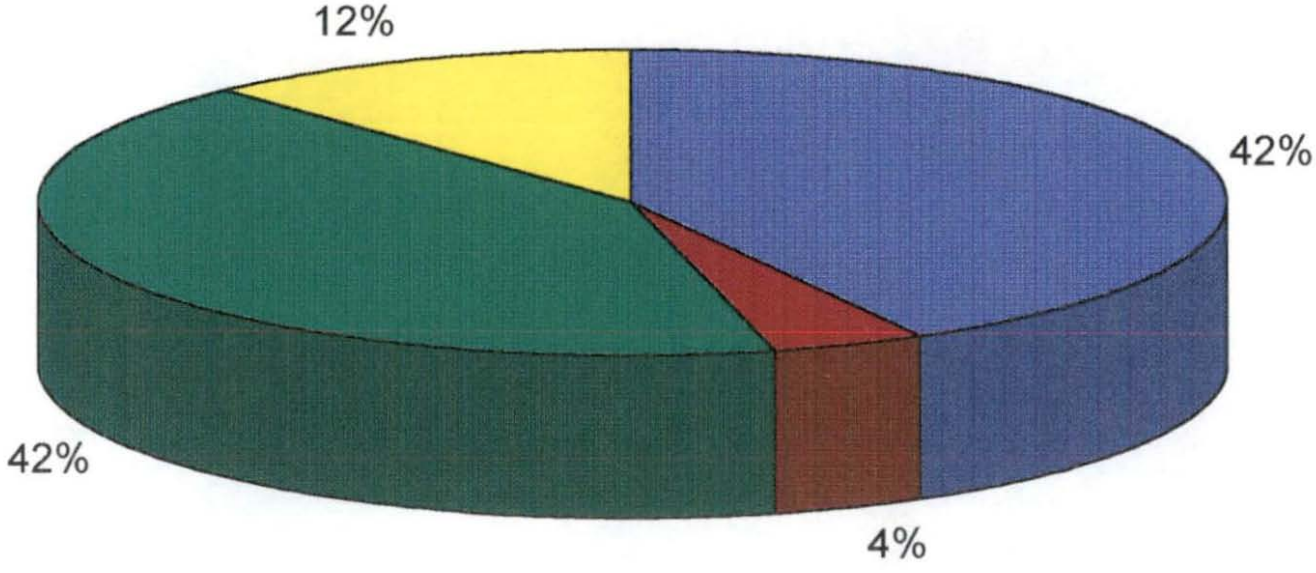


Table 1. Incidence of canine dermatological disorders based on etiological agents from the year 1991 to 1995 (5 years)

Etiological agents	Year	Animal Husbandry Dept., Kerala	Veterinary College Hospital, Mannuthy	University Vet. Hospital, Kokkalai	Percentage incidence	Total dermatological cases
Bacteria	1991	Data not available from department records (Annual reports of Animal Disease Surveillance scheme)	23	97	14	859
	1992		39	120	15.6	1020
	1993		42	104	13.3	1095
	1994		81	118	19.2	1039
	1995		77	113	18.6	1021
Fungal	1991		108	119	26.4	859
	1992		81	126	20.3	1020
	1993		103	144	22.6	1095
	1994		94	139	22.4	1039
	1995		73	122	19.1	1021
Ectoparasitic	1991		176	265	51.3	859
	1192		212	329	53	1020
	1993		207	314	47.6	1095
	1994		193	287	46.2	1039
	1995		162	264	41.7	1021
Others	1991		14	57	8.3	859
	1992		42	71	11.1	1020
	1993		69	112	16.5	1095
	1994		34	93	12.2	1039
	1995		89	121	20.6	1021

Table.2: Age-wise distribution of Canine Dermatological conditions. (n=50)

Age	No. of cases	Percentage
Below 6 months	18	36
Between 6 and 12 months	7	14
Between one and four years	16	32
Above 4 years	9	18
Total no. of cases	50	100

Table.3: Sex-wise distribution of Canine Dermatological conditions. (n=50)

Sex	No. of cases	Percentage
Male	28	56
Female	22	44
Total	50	100

Table.4: Distribution pattern of clinical dermatological conditions in dogs. (n=50)

Conditions	No. of cases	Percentage
Folliculitis	8	16
Impetigo	6	12
German Shepherd Pyoderma (GSP)	4	8
Furunculosis	2	4
Infantile pustular dermatoses	1	2
Dermatophytoses	1	2
Dermatomycoses	1	2
Localised demodicosis	4	8
Generalised demodicosis	5	10
Flea bite hypersensitivity	4	8
Flea bite dermatitis	2	4
Tick infestation	3	6
Pediculosis	3	6
Callus pyoderma	3	6
Telogen defluxion	1	2
Irritant contact dermatitis	1	2
Lentigo	1	2
Total	**50**	**100**

Pyoderma (GSP, 19.0%). The other clinical bacterial dermatitis found were furunculosis (9.5%) and infantile pustular dermatoses (4.8%) (fig.3)

Age-wise prevalence revealed that dogs below six months of age are more frequnently affected followed by an equal incidence in the age group of one to four years, and above four-year group (Table 5).

The breed-wise prevalence indicated that non-descript dogs were more affected (33.3%) followed by German Shepherd (23.8%), Dobermann and Dachshunds (19.1% each) and Labrador (4.8%) (Table 5).

Sex-wise prevalence of bacterial dermatitis showed that 47.6% were females and 52.4% were males.

The prevalence was 38.1% in animals kept outdoor and 23.8% in animals reared under semi intensive system (50% outdoor and 50% indoor) and 38.1% in animals kept indoors (Table 6).

The clinical signs and lesions noted were papules (61.9%), pustules (57.1%), vesicles (14.3%) and patch (4.8%) as the primary lesions. Secondary lesions were erythema (90.4%), alopecia (61.9%), crusts (47.6%), epidermal collarettes (28.5%), erosions (19.1%), excoriations (14.3%), ulcers (9.5%), scar (4.8%), hyperpigmentation (4.8%) and hyperkeratosis (4.8%) (Table 7).

Distribution and pattern of alopecia are given in the flow chart No. 1 and distribution of pruritis is given in Table 8.

The sites of lesions were abdomen (28.6%), hind leg (23.8%), trunk (19.1%), axilla (9.5%), ear, neck, back and fore legs (14.3% each) and head, periocular, chin, lower chest and generalised (4.8% each) (Table 9).

Etiological agents isolated in all the cases were *Staphylococcus intermedius.*

The main haematological values recorded were haemoglobin (13.9±2.4 g%), total RBC ($5.9x10^{6}$±1.4 /cmm), total WBC 14926±4802/cmm), neutrophil (71.9±5.8%), lymphocytes (24.2±4.8%), eosinophil (3.2±2), monocytes (0.6±1.1%), PCV (43.3±7.3%) and ESR (4.0±1.3mm/hr) (Table 10).

The mean serum biochemical values were blood sugar (91.3±11.1mg%), blood urea nitrogen (17.4±4.3 mg%), serum cholesterol (175.8±49 mg%), serum calcium (9.3±0.5 mg%), serum zinc (0.89±0.14 mg%) and serum copper (0.73±0.09 mg%) (Table 10).

Table. 5: Distribution of age and breed in canine dermatological conditions based on primary etiological agent

Agent	N	Age				Breed						
		Below 6 months	6 to 12 months	1 to 4 years	Above 4 years	Non-Descript	German Shepherd dog	Spitz	Doberman	Great Dane	Labrador	Dachshund
Bacterial	21	11 52.4%	2 9.5%	4 19.1%	4 19.1%	7 33.3%	5 23.8&		4 19.1%		1 4.8%	4 19.1%
Fungal	2			2 100%				1 50%				1 50%
Ecto-parasite	21	6 28.6%	5 23.8%	7 33.3%	3 14.3%	11 52.4%	4 19.1%	4 19.1%		1 4.8%	1 4.8%	
Others	6	1 16.7%		3 50.0%	2 33.3%			2 33.3%	1 16.7%			3 50.0%

Table 6. Distribution of housing pattern in canine dermatological conditions based on primary etiology. (n=50).

Primary etiological agent	n	Habitat					Kennel	
		< 50% indoor	50% indoor & 50% outdoor	>50% indoor	100% indoor	100% outdoor	Present	Absent
Bacterial	21		5 (23.8%)	3 (14.3%)	5 (23.8%)	8 (38.1%)	17 (81%)	4 (19.1%)
Fungal	2	1 50%)			1 (50%)		2 (100%)	
Ectoparasitic	21		6 (28.6%)		7 (33.3%)	8 (38.1%)	12 (57.14%)	9 (42.9%)
Others	6		1 (16.7%)		5 (83.3%)		6 (100%)	

Table 7: Distribution of type of lesions in canine dermatological conditions based on primary etiological agents. (n=50)

Etiological agent		Bacterial	Fungal	Ectoparasitic	Others
No. of cases		21	2	21	6
Primary lesions	Macule	-	-	-	1 (16.7%)
	Patch	1 (4.8%)	-	1 (4.8%)	1 (16.7%)
	Papule	13 (61.9%)	1 (50%)	10 (47.6%)	2 (33.3%)
	Nodule	-	-	1 (4.8%)	-
	Pustule	12 (57.1%)	-	6 (28.6%)	-
	Vesicle	3 (14.3%)	-	1 (4.8%)	-
Secondary lesions	Scales	11 (52.4%)	2 (100%)	9 (42.9%)	-
	Scar	1 (4.8%)	-	2 (9.5%)	-
	Crust	10 (47.6%)	-	10 (47.6%)	-
	Erosions	4 (19.1%)	1 (50%)	7 (33.3%)	1 (16.7%)
	Ulcer	2 (9.5%)	1 (50%)	1 (4.8%)	(16.7%)
	Excoriation	3 (14.3%)	-	8 (38.1%)	-
	Erythema	19 (90.5%)	2 (100%)	13 (61.9%)	3 (50%)
	Alopecia	13 (61.9%)	2 (100%)	16 (76.2%)	2 (33.3%)
	Lichenification	-	-	5 (23.8%)	-
	Hyperpigmentation	1 (4.8%)	-	9 (42.9%)	1 (16.7%)
	Patches of hyperpigmentation	-	-	1 (4.8%)	-
	Hyperkeratosis	1 (4.8%)	-	2 (9.5%)	1 (16.7%)
	Epidermal collarettes	6 (28.6%)	-	1 (4.8%)	1 (16.7%)
	Callus	-	-	-	3 (50%)

Flow chart 1. Distribution pattern of alopecia based on primary etiological agents.(n 50)

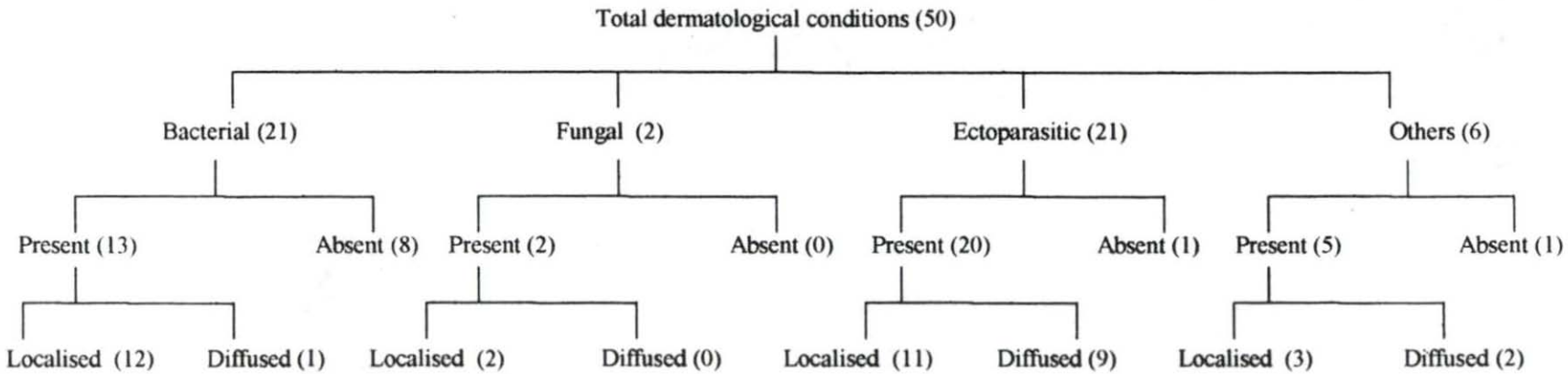


Table 8. Distribution of pruritus pattern in canine dermatological conditions based on primary etiological agents. (n=50).

Primary etiological agents	n	Present			Absent
		Constantly	Sporadically	Total	
Bacterial	21	10 (47.6%)	4 (19.1%)	14 (66.7%)	7 (33.3%)
Fungal	2	1 (50%)	1 (50%)	2 (100%)	
Ectoparasitic	21	13 (61.9%)	7 (33.3%)	20 (95.2%)	1 (4.8%)
Others	6		3 (50%)	3 (50%)	3 (50%)

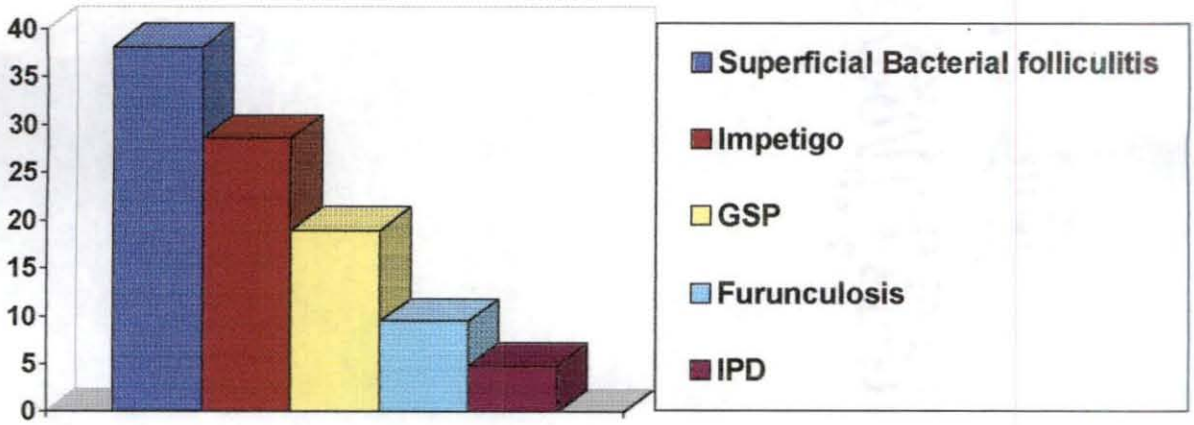
Table. 9: Distribution of Lesions in Canine Dermatological Conditions Based on Primary Etiological Agents. (n=50)

Primary etiological agents		Ectoparasitic	Fungal	Bacterial	Others
No. of cases		21	2	21	6
BODY REGIONS AFFECTED	Head	1 (4.8%)	1 (50%)	1 (4.8%)	1 (16.7%)
	Ear	2 (9.5%)	1 (50%)	3 (14.3%)	0 (0%)
	Periocular	3 (14.3%)	0 (0%)	1 (4.8%)	0 (0%)
	Nasal area	3 (14.3%)	0 (0%)	0 (0%)	0 (0%)
	Chin	2 (9.5%)	0 (0%)	1 (4.8%)	0 (0%)
	Neck	1 (4.8%)	0 (0%)	3 (14.3%)	0 (0%)
	Lower chest	2 (9.5%)	0 (0%)	1 (4.8%)	1 (16.7%)
	Axilla	0 (0%)	0 (0%)	2 (9.5%)	0 (0%)
	Back	7 (33.3%)	0 (0%)	3 (14.3%)	0 (0%)
	Tail	1 (4.8%)	0 (0%)	0 (0%)	0 (0%)
	Trunk	4 (19.1%)	2 (100%)	4 (19.1%)	2 (33.3%)
	Abdomen	2 (19.5%)	0 (0%)	6 (28.6%)	2 (33.3%)
	Flank	1 (4.8%)	0 (0%)	0 (0%)	2 (33.3%)
	Hind legs	3 (14.3%)	2 (100%)	5 (23.8%)	2 (33.3%)
	Foreleg	4 (19.1%)	1 (50%)	3 (14.3%)	3 (50%)
	Generalized	3 (14.3%)	0 (0%)	1 (4.8%)	0 (0%)

Table. 10. Effect of primary etiological agents on haematological and serum biochemical parameters in canine dermatological conditions.

		Control	Primary etiological agents			
No. of cases			Bacterial	Fungal	Ectoparasitic	Others
		10	21	2	21	6
Haematological parameters	Hb g%	14.6±1	13.9±2.4	14.3±2.4	10.5±2.7	14.4±0.5
	RBC x 106 /cmm	7.1±1.1	5.9±1.4	6.1±0.01	5.6±1.4	6.8±0.5
	WBC /cmm	10280.9±312	14926.0± 4802	13000.0±4808	14010.0±5534	11766.0±3729
	Neutrophil %	70.9±4.3	71.9±5.8	63.0± 1.4	70.1± 8.4	69.2 ± 3.7
	Lymphocyte %	24.7± 3.7	24.2± 4.8	32.0± 5.7	24.1± 7.9	26.2± 2.1
	Eosinophil %	2.5± 1.7	3.2 ±2	5.0± 4.2	5.9± 4.4	4.2±4
	Monocyte %	1.3±1.2	0.6±1.1	0.00	0.5±0.8	0.5± 0.8
	Basophil %	0.00	0.00	0.00	0.00	0.00
	PCV %	43.4± 6.8	43.3± 7.3	47.0± 4.2	39.1± 9.4	44.3±2.3
	ESR/ Hr	4.5±1.1	4.0±1.3	3.5±0.7	5.6±3.4	3.8±1.2
Biochemical parameters	Blood glucose mg%	108.0± 19.5	91.3± 11.1	92.5±**13.4**	89.6 ± 12.8	107.3± 8.6
	BUN mg%	17.8 ± 4.3	17.4± 4.3	18.6± 3.4	21.0± 4.4	17.4 ± 3.5
	Serum cholesterol mg%	149.4± 58.9	175.8 ± 49.0	172.0± 0.07	210.8± 68.4	190.6± 66.5
	Serum Calcium mg%	9.6± 0.7	9.3± 0.5	10.3± 0.06	9.2± 0.7	10.1± 1.1
	Serum Zinc mg%	0.86± 0.22	0.89± 0.14	0.93± 0.04	0.83± 0.13	0.86± 0.12
	Serum Copper mg%	0.73± 0.11	0.73± 0.09	0.75± 0.04	0.67± 0.12	0.77± 0.17

Fig. 3. Prevalence of different clinical conditions among bacterial dermatitis



4.2.2. Clinical conditions caused by bacterial etiology

4.2.2.1. Superficial bacterial folliculitis.

In the present study superficial folliculitis was mostly noted in the age group of below six months (50%) and the prevalence was 62.5% in the non-descript dogs followed by Dobermann (25%) and Dachshund (12.5%) (Table 11). There was equal incidence in both males and females.

The prevalence was 37.5% in animals kept outdoors, 12.5% in animals reared under semi intensive system and 50% in animals kept indoors (Table 12).

The clinical signs and lesions noted were papules (87.5%) and pustules (37.5%) as the primary lesions. Secondary lesions such as erythema (100%) alopecia (87.5%) crust (25%), erosions (12.5%) and epidermal collarettes (12.5%) (Table 13). Constant pruritus was noted in 75% cases and the alopecia if present was mostly localised and not diffused (Table 14 and flow chart 2).

The sites of lesions were hind legs and ear (37.5% each), trunk and fore legs (25% each). Impetigo like distribution of lesions in the abdomen was noted in one case (Table 15). In another case the lesion had a moth-eaten appearance. The lesions present in a Dobermann is shown in the Plate 1.

The etiological factor isolated was *Staphylococcus intermedius* in all the cases. The mean haematological values recorded were haemoglobin (14.0±2 g%), total RBC

($5.9x10^6 \pm 1.1x10^6$ /cmm), total WBC (15795±5431.7/cmm), neutrophyl (71.9±6.5%), lymphocyte (24.1±4.7%), eosinophyl (3.5±2.5%), monocyte (0.75±1.4%), PCV (41.3±8.6%) and ESR (3.6±1.8 mm/hr) (Table 16).

The biochemical values were blood sugar (86.8±8.2 mg%), BUN (17.8±5 mg%), serum cholesterol (201.1±67.2 mg%), serum calcium (9.4±0.5 mg%), serum zinc (0.95±0.1 mg%) and serum copper (0.71±0.05 mg%). (Table 16).

4.2.2.2. Impetigo.

In the present study, impetigo was seen only in the age group of below six months (100%) and the prevalence was 33.3% in non-discrit and Dobermann (each) followed by German Shepherd and Labrador (16.7% each) (Table 11). The incidance was more in females (66.7%) than in males (33.3%). The prevalence was 50% in animals kept outside, 33.3% in semi intensive system of rearing and 16.7% in the animals kept indoor (Table 12).

The clinical signs and lesions noted were pustules (83.3%) and papules (66.7%) as the primary lesions. Secondary lesions were erythema (83.3%), epidermal collarettes (66.7%), crusts (50%) and scales (16.7%) (Table 13). None of the animal had alopecia; and pruritus was absent in 83.3% cases (Table 14 and flow chart 2). Lesions seen in an atypical case is given in Plate 2.

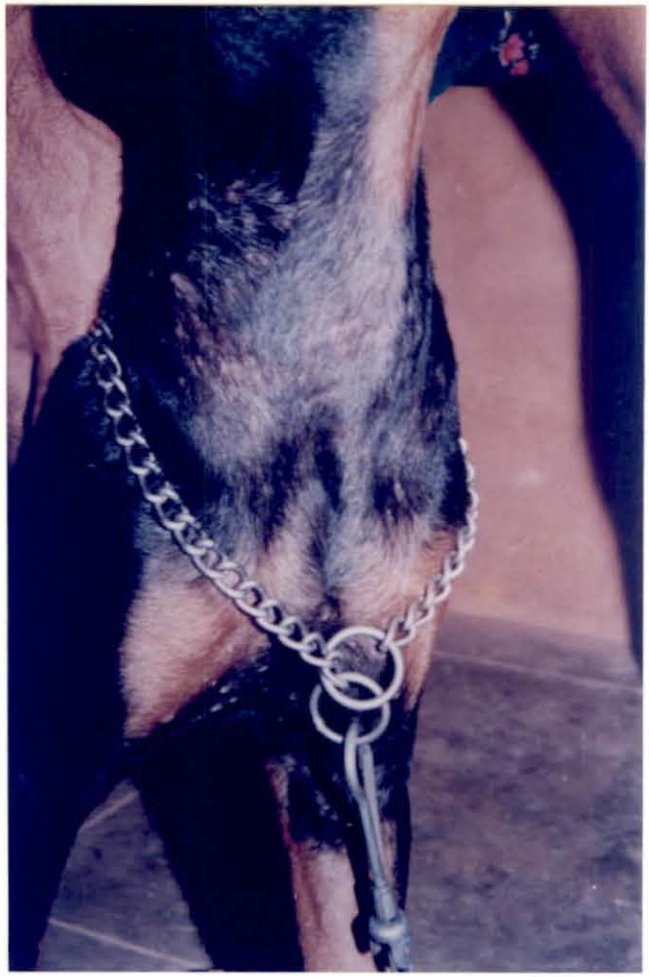


Plate 1. Lesions of Superficial bacterial folliculitis in a Dobermann Pinscher

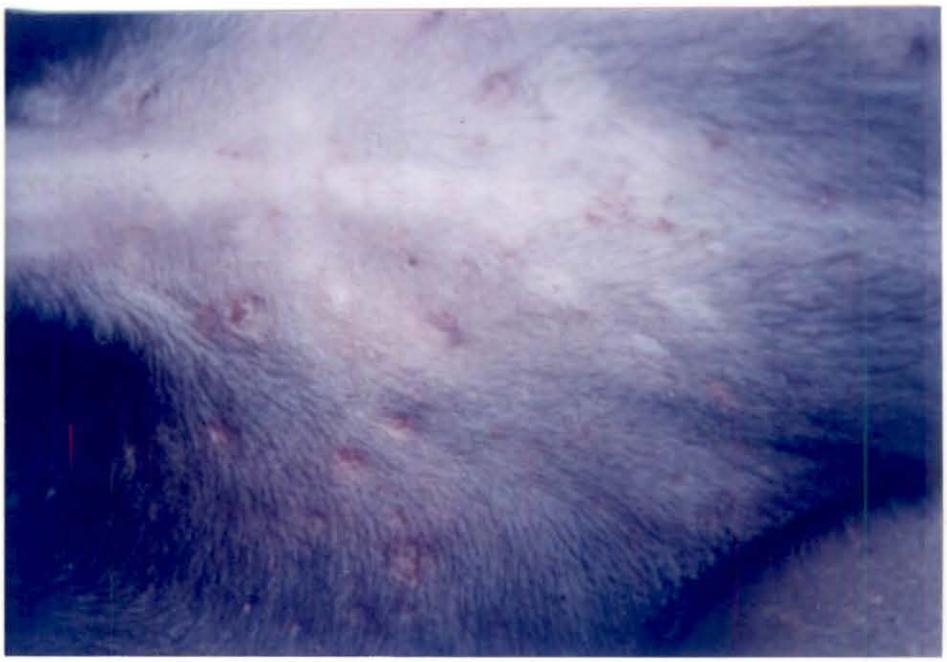


Plate 2. Lesions of Impetigo in a Labrador retriever. Epidermal collarettes can be seen

The site of lesions were abdomen (83.3%), axilla (16.7%) and lower chest (16.7%) (table 15).

The etiological factor isolated was *Staphylococcus intermedius* in all the cases.

The mean haematological and serum biochemical values noted are shown in Table 16.

4.2.2.3. German Shepherd Pyoderma (GSP)

In the present study GSP was mostly noted in the age group of above four years (75%) followed by one to four years (25%) (Table 11). All the dogs were of German Shepherd breed. Females and males were equally affected.

The prevalence was 25% in the animals kept outdoor, 50% in the animals reared in the semi-intensive system and 25% in the animals kept indoors (Table 12).

The clinical signs and lesions noted were pustules (83.3%) and papules (66.7%) as the primary lesions. Secondary lesions were erythema , crust and alopecia (100% each), scale erosions and excoriations (75% each), ulcers (50%), scar, hyperpigmentation, hyperkeratosis and epidermal collarettes (25% each) (Table 13). All the cases had constant pruritus and the alopecia was of localised type in all the cases (Table 14 and Flow chart 2).

The site of lesions were back (75%) hind legs (50%) and trunk (25%) (Table 15).

The etiological factor isolated was *Staphylococcus intermedius* in all the cases.

The mean haematological and serum biochemical values noted are shown in Table 16.

4.2.2.4. Furunculosis

Out of 21 cases of bacterial dermatitis furunculosis was noticed in two male Dachshund dogs of aged three and four years.

The clinical signs and lesions noticed were pustules and vesicles / bullae in both cases and nodules in one case as primary lesion. Secondary lesions were erythema, alopecia in both cases and lichenification and hyperpigmentation in one case (Table 13).

Both the cases had sporadic pruritus and localised alopecia (Table 14 and Flow chart 2). The site of lesions were neck in both the cases and fore leg and hind leg in one case each (Table 15). The lesions are shown in the Plate No. 3.

The etiological factor isolated was *Staphylococcus intermedius* in both the cases.

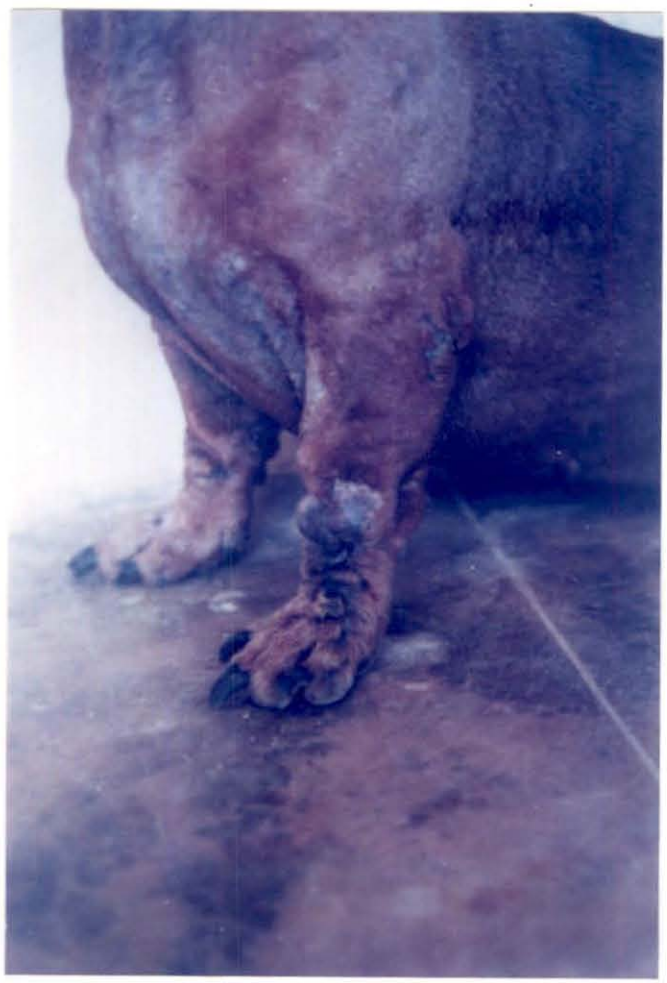


Plate 3. Lesions of Furunculosis in a Dachshund

Table. 11: Distribution of age and breed in canine bacterial dermatological conditions

Clinical condition	n	Age				Breed						
		Below 6 months	6 to 12 months	1 to 4 years	Above 4 years	Non-Descript	German Shepherd dog	Spitz	Doberman	Great Dane	Labrador	Dachshund
Folliculitis	8	4 (50%)	2 (25%)	1 (12.5%)	1 (12.5%)	5 (62.5%)	-	-	2 (25%)	-	-	1 (12.5%)
Impetigo	6	6 (100%)	-	-	-	2 (33.3%)	1 (16.7%)	-	2 (33.3%)	-	1 (16.7%)	-
GSP	4	-	-	1 (25%)	3 (75%)	-	4 (100%)	-	-	-	-	-
Furunculosis	2	-	-	2 (100%)	-	-	-	-	-	-	-	2 (100%)
IPD	1	1 (100%)	-	-	-	-	-	-	-	-	1 (100%)	-

Table 12. Distribution of housing pattern in canine bacterial dermatological conditions based on primary etiology. (n=50).

Primary etiological agent	n	Habitat					Kennel	
		< 50% indoor	50% indoor & 50% outdoor	>50% indoor	100% indoor	100% outdoor	Present	Absent
Folliculitis	8	-	1 (12.5%)	2 (25%)	2 (25%)	3 (37.5%)	6 (75%)	2 (25%)
Impetigo	6	-	2 (33.3%)	-	1 (16.7%)	3 (50%)	5 (83.3%)	1 (16.7%)
GSP	4	-	2 (50%)	-	1 (25%)	1 (25%)	4 (100%)	-
Furunculosis	2	-	-	1 (50%)	-	1 (50%)	2 (100%)	-
IPD	1	-	-	-	1 (100%)	-	-	1 (100%)

Table 13: Distribution of type of lesions in canine bacterial dermatological conditions.

Etiological agent		Folliculitis	Impetigo	G.S.P.	Furunculosis	I.P.D.
No. of cases		8	6	4	2	1
Primary lesions	Macule	-	-	-	-	-
	Patch	1 (12.5%)	-	-	-	-
	Papule	7 (87.5%)	4 (66.7%)	2 (50%)	-	-
	Nodule	-	-	-	1 (50%)	-
	Pustule	3 (37.5%)	5 (83.3%)	5 (83.3%)	2 (100%)	-
	Vesicle	1 (12.5%)	-	-	2 (100%)	1 (100%)
Secondary lesions	Scales	7 (87.5%)	1 (16.7%)	3 (75%)	-	-
	Scar	-	-	1 (25%)	-	-
	Crust	2 (25%)	3 (50%)	4 (100%)	-	1 (100%)
	Erosions	1 (12.5%)	-	3 (75%)	-	-
	Ulcer	-	-	2 (50%)	-	-
	Excoriation	-	-	3 (75%)	-	-
	Erythema	8 (100%)	5 (83.3%)	4 (100%)	2 (100%)	-
	Alopecia	7 (87.5%)	-	4 (100%)	2 (100%)	-
	Lichenification	-	-	-	1 (50%)	-
	Hyperpigmentation	-	-	1 (25%)	1 (50%)	-
	Patches of hyperpigmentation	-	-	-	-	-
	Hyperkeratosis	-	-	1 (25%)	-	-
	Epidermal collarettes	1 (12.5%)	4 (66.7%)	1 (25%)	-	-
	Callus	-	-	-	-	-

Flow chart 2. Distribution pattern of alopacia present in bacterial dermatitis.(n 21)

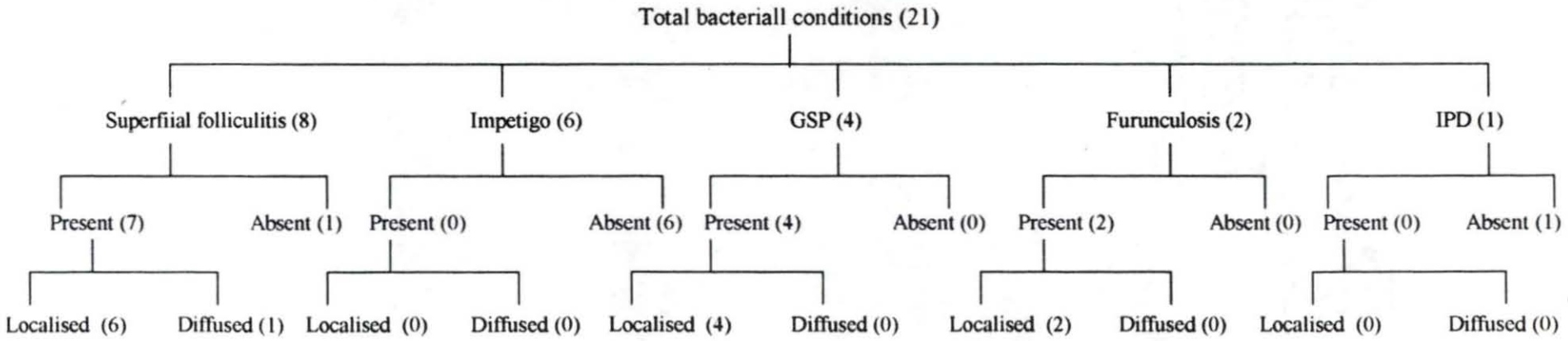


Table 14. Distribution of pruritus pattern in canine bacterial dermatological conditions based on primary etiological agents. (n=50).

Primary etiological agents	n	Present			Absent
		Constantly	Sporadically	Total	
Folliculitis	8	6 (75%)	1 (12.5%)	7 (87.5%)	1 (12.5%)
Impetigo	6	-	1 (16.7%)	1 (16.7%)	5 (83.3%)
GSP	4	4 (100%)	-	4 (100%)	-
Furunculosis	2	-	2 (100%)	2 (100%)	-
IPD	1	-	-	-	1 (100%)

Table 15. Distribution of lesions in canine bacterial dermatological conditions

No. of cases		Folliculitis	Impetigo	GSP	Furunculosis	IPD
		8	6	4	2	1
Body regions affected	Head	-	-	-	-	1 (100%)
	Ear	3 (37.5%)	-	-	-	-
	Periocular	1 (12.5%)	-	-	-	-
	Nasal area	-	-	-	-	-
	Chin	-	-	-	-	1 (100%)
	Neck	-	-	-	2 (100%)	1 (100%)
	Lower chest	-	1 (16.7%)	-	-	-
	Axilla	1 (12.5%)	1 (16.7%)	-	-	-
	Back	-	-	3 (75%)	-	-
	Tail	-	-	-	-	-
	Trunk	2 (25%)	-	1 (25%)	-	1 (100%)
	Abdomen	1 (12.5%)	5 (83.3%)	-	-	-
	Flank	-	-	-	-	-
	Hindlegs	3 (37.5%)	-	2 (50%)	1 (50%)	-
	Forelegs	2 (25%)	-	-	1 (50%)	-
	Generalised	1 (12.5%)	-	-	-	-

Table. 16. Effect of canine bacterial dermatological conditions on haematological and serum biochemical parameters. (Values expressed as Mean ± SD)

		Control	Folliculitis	Impetigo	GSP	Furunculosis	IPD
No. of cases		10	8	6	4	2	1
Haematological parameters	Hb g%	14.56± 1.04	13.98± 2.02	12.20 ± * 1.79	15.9 ± 2.5	16.2 ± 0.28	10.8
	RBC x 10^6 /cmm	7.06± 1.12	5.94 ± * 1.10	5.12 ± * 1.43	6.85 ± 0.64	7.9 ± 0.28	3.4
	WBC /cmm	10280.9 ± 312	15795 ± * 5431.66	13133.33± 5030.97	14125 ± * 4972.8	18500 ± * 282.8	14780
	Neutrophil %	70.9 ± 4.28	71.80± 6.53	73.17 ± 5.08	71.0± 8.41	72.0 ± 2.83	72
	Lymphocyte %	24.7 ± 3.65	24.13± 4.7	24.33 ± 4.23	25.0± 8.08	24.0 ± 1.41	21
	Eosinophil %	2.5 ± 1.72	3.5 ± 2.5	2.33 ± 1.86	3.25 ± 1.5	4.0 ± 1.41	6
	Monocyte %	1.3 ± 1.16	0.75 ± 1.39	0.17 ± 0.4	0.75 ± 1.5	-	1
	Basophil %	-	-	-	-	-	-
	PCV %	43.4 ± 6.75	41.25 ± 8.61	42.33 ± 4.27	46.5 ± 5.74	52.0 ± 1.41	34
	ESR / Hr	4.5 ± 1.08	3.63 ± 1.77	3.67 ± 0.52	4.25 ± 0.5	6.0 ± 0.00	6
Biochemical parameters	Blood glucose mg%	107.95 ± 19.48	86.83 ± 8.21	99.33 ± 12.8	87.88 ± 7.76	83.10 ± * 0.28	108
	BUN mg%	17.79± 4.27	17.80 ± 4.96	14.84 ± 4.67	20.15 ± 2.37	18.40 ± 0.28	16.4
	Serum cholesterol mg%	149.43± 58.68	201.1 ± 67.16	171.38 ± 22.18	138.70 ± 30.90	159.70 ± 0.42	281.4
	Serum Calcium mg%	9.57± 0.67	9.426 ± 0.45	9.183 ± 0.42	9.03 ± 0.39	10.00 ± 0.28	8.7
	Serum Zinc mg%	0.858± 0.22	0.945 ± 0.13	0.97 ± 0.1	0.71 ± 0.06	0.78 ± 0.08	0.84
	Serum Copper mg%	0.726± 0.11	0.713 ± 0.05	0.74 ± 0.08	0.69 ± 0.08	0.9 ± 0.09	0.66

- * - $p<0.05$

The mean haematological and serum biochemical values noted are shown in Table 16.

4.2.2.5. Infantile pustular dermatoses

The condition was noticed in a male Labrador pup of 20 days of age (Table 11). The pup was kept in all the time (100%).

The clinical signs and lesions noticed were pustules as the only primary lesion and the pup was very weak. Secondary lesions were only crusts (Table 13). Pruritus and alopecia were absent (Table 14 and Flow chart 2).

The sites of lesions were in head, neck, lower chest and trunk (Table 15).

The etiological factor isolated was *Staphylococcus intermedius* in all the cases.

The mean haematological and serum biochemical values noted are shown in Table 16.

4.3. Fungal Dermatitis

Out of 50 cases studied only two cases of fungal dermatitis were seen (4%). One of them was caused by a dermatophyte (*Microsporum canis*) in a three year old

female Spitz and the other by a non-dermatophyte ((Penicillium spp.) in a three year old female Dachshund (Table 17).

Both the dogs were kenneled and the Spitz was kept indoor all the time and the Dachshund was kept outdoor for most of the time (Table 18).

The clinical signs and lesions noted in the dermatophytosis were secondary lesions namely scales erosions, ulcers, erythema and alopecia; and no primary lesions were seen. The clinical signs and lesions in the non-dermatophytes-produced dermatomycosis were papule as the primary lesion; and scales, erythema and alopecia as secondary lesions (Table 19). Constant pruritus and localised alopecia were seen in dermatophytosis whereas in non-dermatophytes sporadic spruritis with localised alopecia was seen (Table 20 and Flow chart 3).

The site of lesions in dermatophytosis were ear, trunk and hind legs. The site of lesions in non-dermatophyte (Penicillium spp.) produced dermatomycosis were head, trunk, hind legs and fore legs (Table 21).

The illustration of the dog affected with penicillium produced dermatomycosis is given in the Plate No. 4

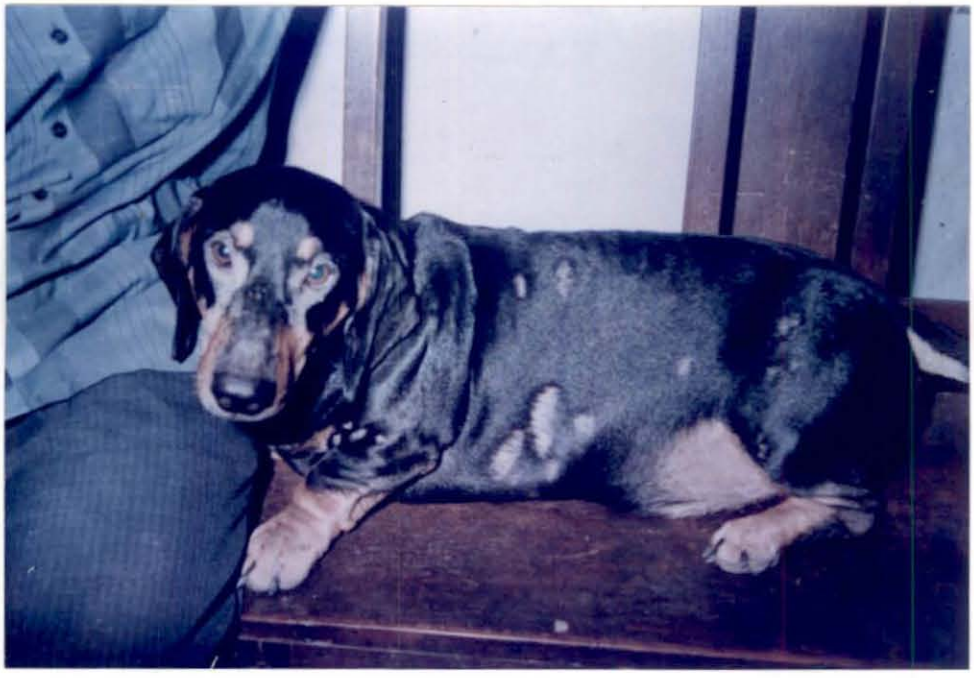


Plate 4. Lesions of Dermatomycosis produced by Pencillium spp.

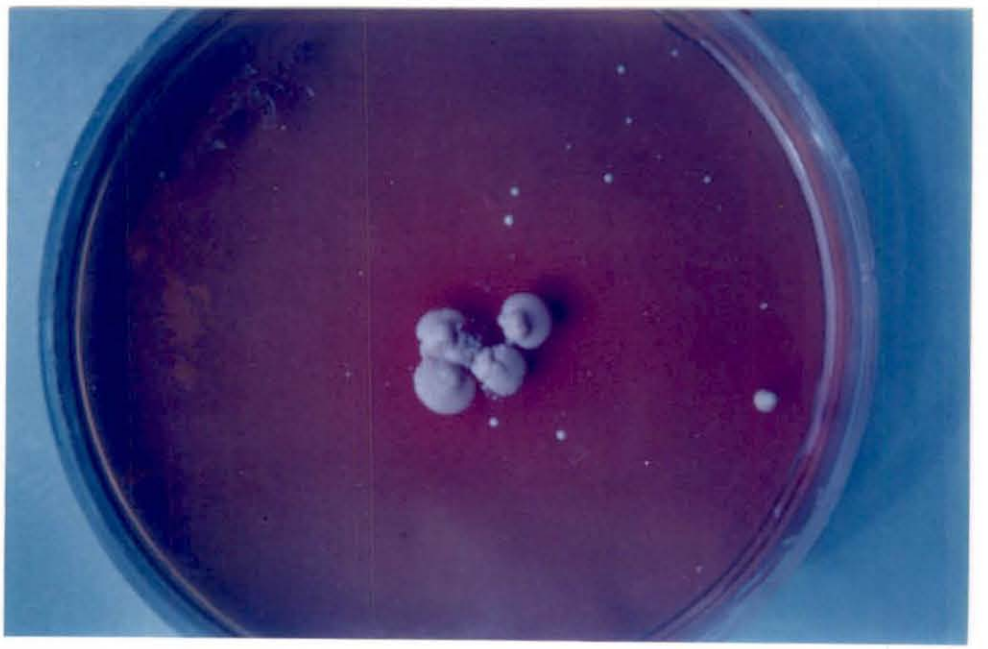


Plate 5. Culture of *Microsporum canis* on dermatophyte test medium on 5th day showing starting of colour change of the medium from yellow to red.

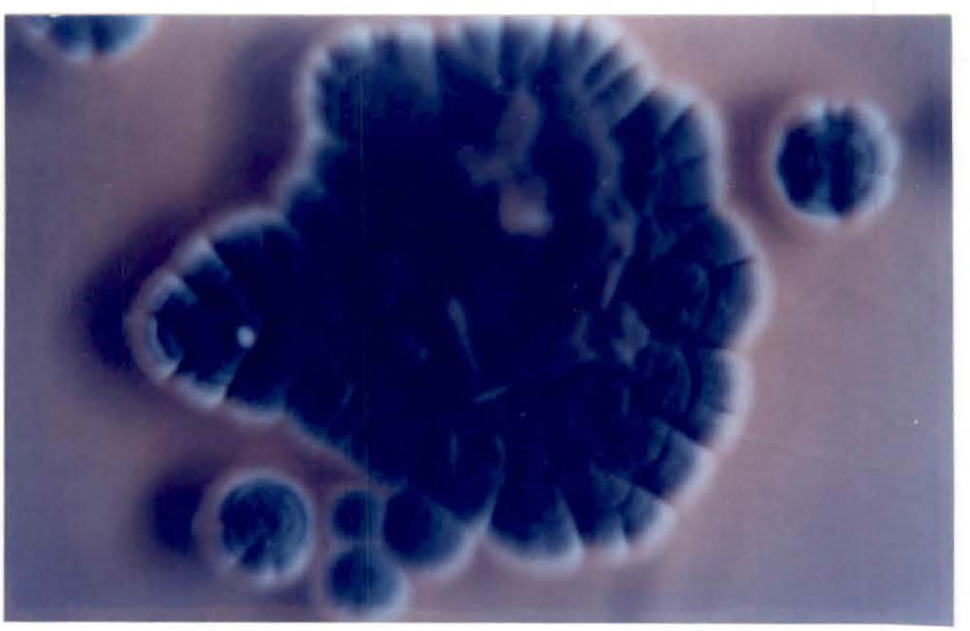


Plate 6. Culture of Penicillium on SDA . Greenish colony with white margin

Table. 17: Distribution of age and breed in canine fungal dermatological conditions

Clinical condition	n	Age				Breed						
		Below 6 months	6 to 12 months	1 to 4 years	Above 4 years	Non-Descript	German Shepherd dog	Spitz	Doberman	Great Dane	Labrador	Dachshund
Dermatophytosis	1	-	-	1 (100%)	-	-	-	1 (100%)	-	-	-	-
Dermatomycoses Due to non dermatophyte	1	-	-	1 (100%)	-	-	-	-	-	-	-	1 (100%)

Table 18. Distribution of housing pattern in canine fungal dermatological conditions based on primary etiology. (n=50).

Primary etiological agent	n	Habitat					Kennel	
		< 50% indoor	50% indoor & 50% outdoor	>50% indoor	100% indoor	100% outdoor	Present	Absent
Dermatophytosis	1	-	-	-	1 (100%)	-	1 (100%)	-
Dermatomycosis due to non dermatophyte	1	1 (100%)	-	-	-	-	1 (100%)	-

Table 19: Distribution of type of lesions in canine fungal dermatological conditions.

Clinical conditions		Dermatophytoses	Dermatomycosis due to non dermatophytes
No. of cases		1	1
Primary lesions	Macule	-	-
	Patch	-	-
	Papule	-	1 (100%)
	Nodule	-	-
	Pustule	-	-
	Vesicle	-	-
Secondary lesions	Scales	1 (100%)	1 (100%)
	Scar	-	-
	Crust	-	-
	Erosions	1 (100%)	-
	Ulcer	1 (100%)	-
	Excoriation	-	-
	Erythema	1 (100%)	1 (100%)
	Alopecia	1 (100%)	1 (100%)
	Lichenification	-	-
	Hyperpigmentation	-	-
	Patches of hyperpigmentation	-	-
	Hyperkeratosis	-	-
	Epidermal collarettes	-	-
	Callus	-	-

Flow chart 3. Distribution pattern of alopacia present in fungal dermatitis.(n 2)

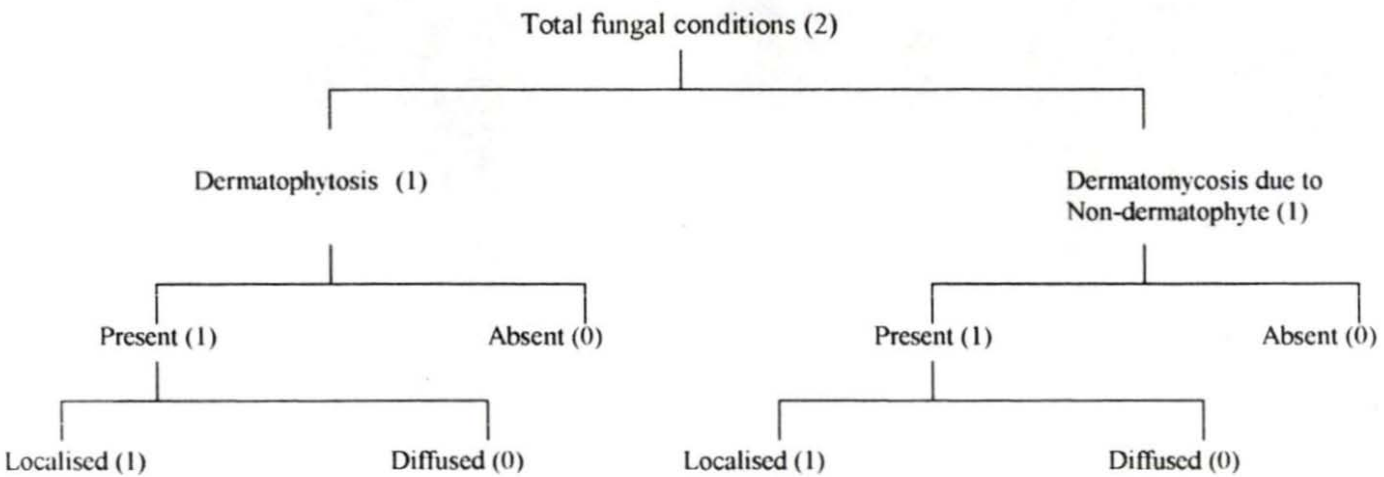


Table 20. Distribution of pruritus pattern in canine fungal dermatological conditions based on primary etiological agents. (n=50).

Primary etiological agents	n	Present			Absent
		Constantly	Sporadically	Total	
Dermatophytosis	1	1 (100%)	-	1 (100%)	-
Dermatomycosis due to non dermatophytes	1	-	1 (100%)	1 (100%)	-

Table 21. Distribution of lesions in canine fungal dermatological conditions

No. of cases		Dermatophytosis	Dermatomycosis due to non-dermatophytes
		1	1
Body regions affected	Head	-	1 (100%)
	Ear	1 (100%)	-
	Periocular	-	-
	Nasal area	-	-
	Chin	-	-
	Neck	-	-
	Lower chest	-	-
	Axilla	-	-
	Back	-	-
	Tail	-	-
	Trunk	1 (100%)	1 (100%)
	Abdomen	-	-
	Flank	-	-
	Hindlegs	1 (100%)	1 (100%)
	Forelegs	-	1 (100%)
	Generalised	-	-

Table. 22. Effect of fungal canine dermatological conditions on haematological and serum biochemical parameters. (Values expressed as Mean ± SD)

		Control	Dermatophytosis	Dermatomycosis due to non dermatophyte
No. of cases		10	1	1
Haematological parameters	Hb g%	14.56 ±1.04	12.6	16
	RBC x 10^6 /cmm	7.06 ± 1.12	6.12	6.14
	WBC /cmm	10280.9 ± 312	16400	9600
	Neutrophil %	70.9 ± 4.28	62	64
	Lymphocyte %	24.7 ± 3.65	36	28
	Eosinophil %	2.5 ± 1.72	2	8
	Monocyte %	1.3 ± 1.16	-	-
	Basophil %	-	-	-
	PCV %	43.4 ± 6.75	44.5	50
	ESR / Hr	4.5 ± 1.08	4	3
Biochemical parameters	Blood glucose mg%	107.95 ± 19.48	83	102
	BUN mg%	17.79 ± 4.27	21	16.2
	Serum cholesterol mg%	149.43 ± 58.68	172	171.9
	Serum Calcium mg%	9.57 ± 0.67	10.2	10.29
	Serum Zinc mg%	0.858 ± 0.22	0.9	0.96
	Serum Copper mg%	0.726 ± 0.11	0.78	0.72

The etiological agent which produced dermatophytosis was identified as *Microsporum canis* (Plate No.5) and the other dermatomycosis was produced by Penicillium spp. (Plate 6).

The haematological and serum biochemical values were noted and shown in Table 10 and Table 22.

4.4. Ectoparasitic Dermatitis

4.4.1. Prevalence

The overall prevalence of ectoparasitic condition causing dermatitis was 42% (Fig. 2). Four ectoparasites (Demodex mite, flea, tick and lice) were found to cause six different clinical dermatological diseases.

Generalised demodecosis (23.8%), localised demodecosis (19.1%), flea bite hypersensitivity (19.1%), tick infestation (14.3%) pediculosis (14.3%) and flea bite dermatitis (9.5%). (Fig 4).

Age-wise prevalence revealed that dogs in the age group of one to four years are more affected (33.3%) followed by below six months group (28.6%), six to 12 month group (23.8%) and above four years group (14.3%) (Table 5).

Breed-wise prevalence indicated that the non-descript dogs were more affected (52.4%) followed by German Shepherd and Spitz (19.1% each) and Great

Dane and labrador (4.8% each) (Table 5). Males were more affected (71.4%) than females (28.6%).

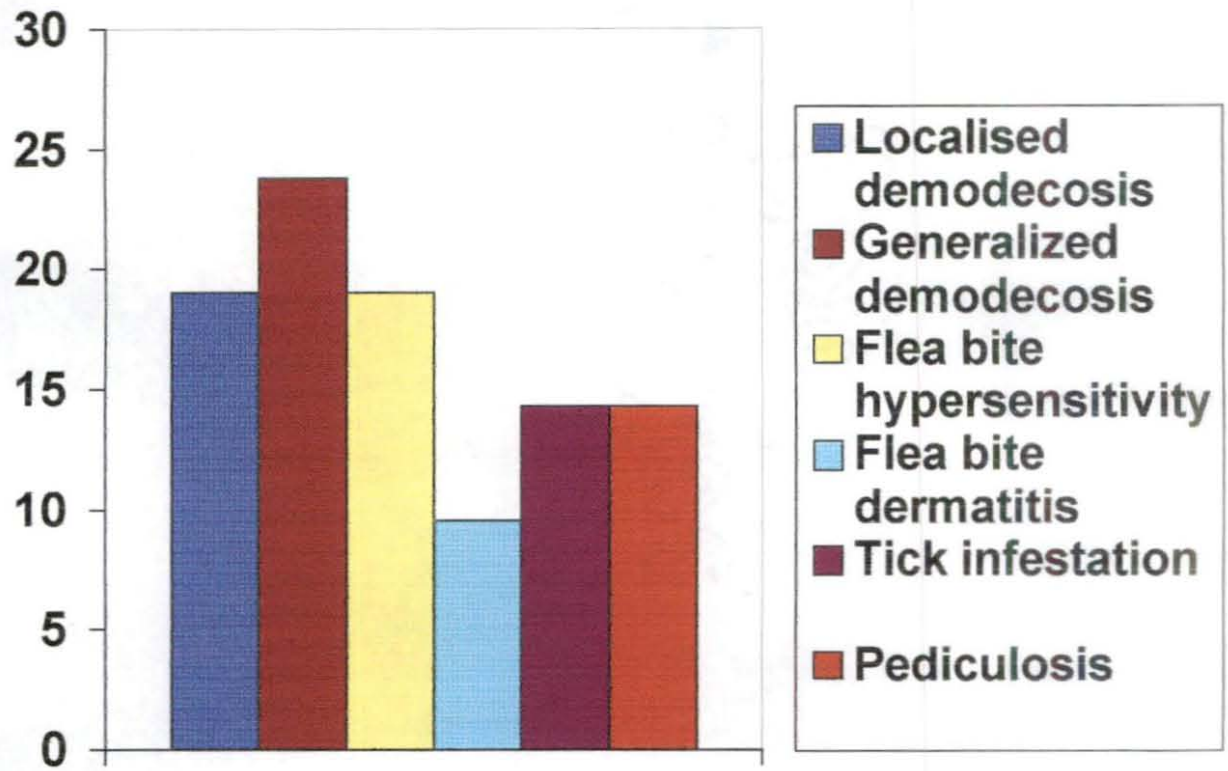
The prevalence was 38.1% in animals kept outdoor, 28.6% in animals reared under semi-intensive system and 33.3% in animals reared indoors (Table 6).

The clinical signs and lesions noted were papules (47.6%), pustules (28.6%), patch, nodule and vesicle (4.8% each) as primary lesions. Secondary lesions were alopecia (76.2%), erythema (61.9%), crust (47.6%), scales (42.9%), hyperpigmentation (42.9%), excoriation (38.1%), erosion (33.3%), lichenification (23.8%), scars and hyperkeratosis (9.5% each), ulcer, patches of hyperpigmentation and epidermal collarette (4.8%) (Table 7). Distribution pattern of alopecia are given in the Flow chart 1. Distribution pattern of pruritus is given in Table 8.

The site of lesions were the back (33.3%), trunk and fore legs (19.1% each), generalised, hind legs, nasal area and periocular (14.3% each), ear, chin, lower chest and abdomen (9.5% each) and head, neck, tail and flank (4.8% each) (Table 9).

The mean haematological and serum biochemical values were observed and they are presented in Table 10.

Fig. 4. Prevalence of different clinical conditions among ectoparasitic dermatitis



4.4.2. Clinical conditions caused by ectoparasitic etiology

4.4.2.1. Localised Demodecosis

In the present study localised demodecosis was seen in the age group of below six months, and six to 12 months, and the prevalence was 50% in German Shepherd and 25% each in Spitz and Non-descript dogs (Table 23). Seventy five percent were male and 25% were females.

The prevalence was 75% in animals kept outside and 25% animals reared in semi-intesnsive system (Table 24).

The clinical signs and lesions noticed were papules (75%) and pustules (25%) as the primary lesions. Secondary lesions were erythema and alopecia (100% each), scars, excoriation (50% each), erosion and hyperpigmentation (25%) (Table 25). Sporadic pruritus was present in 75% cases and in 100% cases the alopecia was of localised type (Table 26 and Flow chart 4).

The site of lesions were periocular and fore legs (50% cases each) and head and lower chest in 25% of cases (Table 27). The illustration of one of the cases with periocular lesion is shown in Plate 7.

4.4.2.2. Generalised demodicosis

In the present study, generalised demodecosis was noted only in the age group of below six months and six to 12 months and the prevalence was 60% in non-

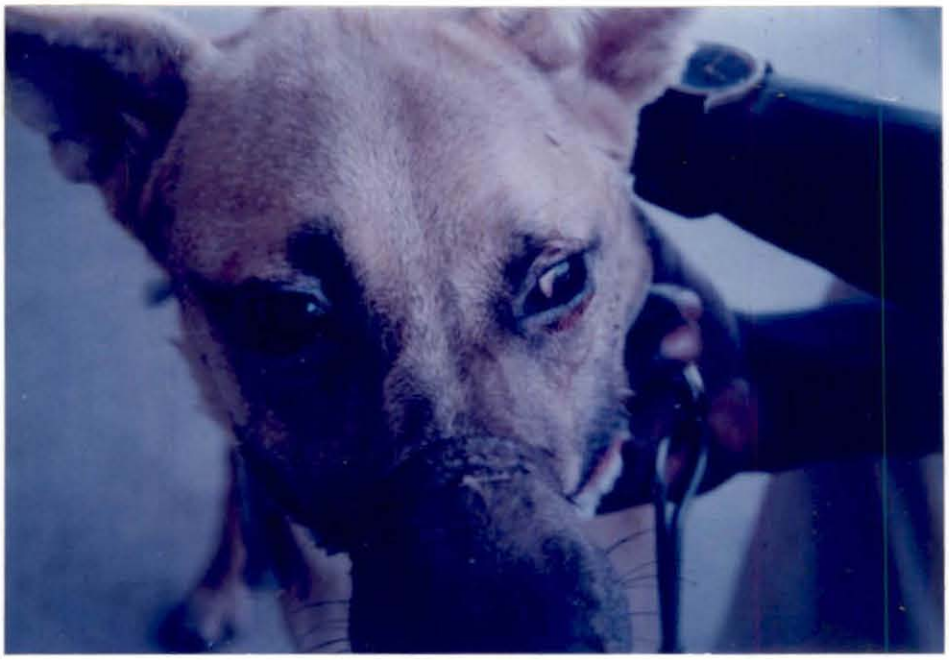


Plate 7. Periocular lesions of localised demodicosis in a non-discript dog.

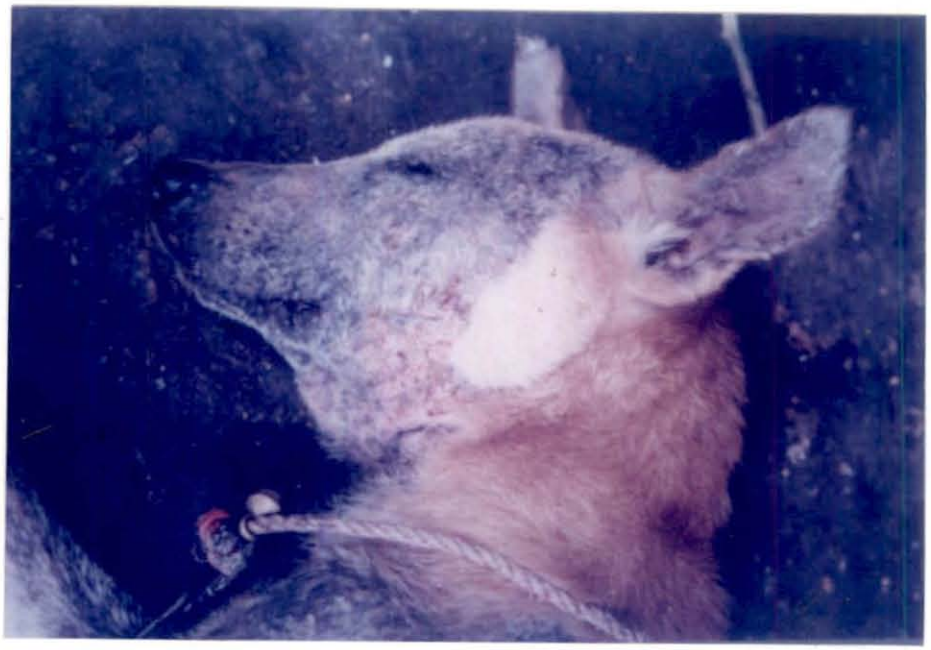


Plate 8. Lesions on the head and neck of a non-descript dog affected with generalised demodicosis.

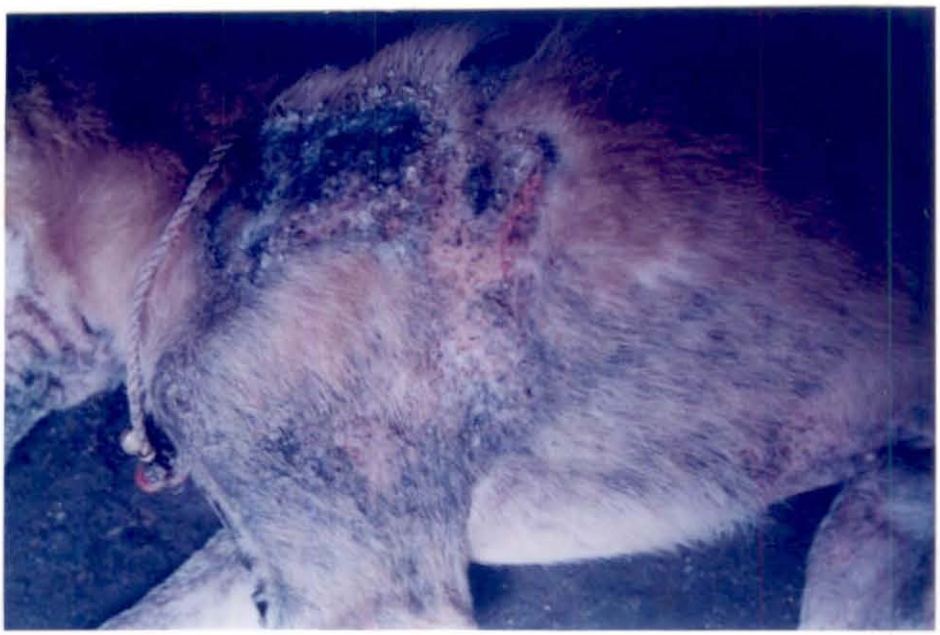


Plate 9. Lesions of the generalised demodicosis on the body of the same dog as in Plate 8.

Plate 10. Lesions of flea bite hypersensitivity on the back of a non-descript dog.

descript dogs followed by 20% in Great Dane and 20% in German Shepherd (Table 23). Forty percent were males and 60% were females.

The prevalence was 40% in animals kept outdoors, 20% in animals reared under semi intensive system and 40% in animals kept indoor (Table 24).

The clinical signs and lesions noted were papules (60%), pustules (40%) and patch (20%) as the primary lesions. Secondary lesions were alopecia (100%), erosion and erythema (80% each), excoriation and ulceration (60% each), hyperpigmentation and hyperkeratosis (40% each) and scales and scars (20% each) (Table 25).

Forty percent of cases had constant pruritus and 40% had sporadic pruritus and the alopecia present was of diffused type in 100% cases (Table 26 and Flow chart 4).

All the cases had generalised lesions (Table 27). One of the typical cases is illustrated in Plate 8 and 9.

4.4.2.3. Flea bite hypersensitivity.

In the present study flea bite hypersensitvity was noted in the age group of one to four years (50%) and above four year group (50%) and the prevalence was 100% in non-descript dogs (Table 23). Males were more involved (75%) than females (25%).

The prevalence was 75% in animals kept outdoor and 25% in animals kept indoor (Table 24).

The clinical signs and lesions noted were papules (25%) only as the primary lesion. Secondary lesions include alopecia, lichenification and hyperpigmentation (100% each) and crusts (25%) (Table 25). Constant pruritus were noted in all cases (100%) whereas the alopecia was of the localised type in 75% of the cases (Table 26 and Flow chart 4).

The site of lesions were back (100%) and trunk (25%) (Table 27). One of those cases affected is shown in Plate 10.

The mean haematological and serum biochemical values are shown in Table 28.

4.4.2.4. Flea bite dermatitis

In the present study only two cases of flea bite dermatitis were noted (4%) and both the cases were in the age group of one to four years (100%) and prevalence was 50% in Labrador and 50% in German Shepherd (Table 23). Both the cases were in males.

The prevalence was 50% in the animals reared outdoor and 50% in semi intensive system (Table 24).

The clinical signs and lesions noted were pustules (100%) followed by papules and vesicle (50% each) as primary lesions. Secondary lesions noted were scales, crusts, erosions, excoriations, erythema, alopecia, lichenification, hyperpigmentation and epidermal collarette (50% each) (Table 25).

Constant pruritus was noted in both the cases (100%) and localised and diffused type alopecia had equal prevalence (50%) (Table 26 and Flow chart 4).

The site of lesions were back, lower chest, trunk and abdomen (50% each) (Table 27).

Etiological agent was identified as fleas, because of the presence of fleas and flea feaces over the body and hairs.

4.4.2.5. Tick infestation

In the present study dermatitis due to tick infestation was noted in the age group of below six months, one to four years and above four years (33.3% prevalence in each) and prevalence was 100% in Spitz (Table 23). 66.7% were males and 33.3% were females.

The prevalence was equal in animals kept outdoor, reared under semi-intensive system and indoor (Table 24).

Plate 11. Microphotograph of a seed tick obtained from a Spitz affected with tick infestation.

Clinical signs and lesions noted were nodules and pustules (33.3% each) as primary lesions. Secondary lesions seen were erythema (100%), scales, crust, alopecia, (66.7% each) and scar, erosion, ulcer, excoriation, hyperpigmentation and patches of hyperpigmentation (33.3% each) (Table 25). Constant pruritus was present in all the cases (100%) and the alopecia was of diffused type in 66.7% and localised in 33.3% (Table 27 and Flow chart 4).

The site of lesions were neck, back, trunk, abdomen and hind legs (33.3%) (Table 27).

The etiological agent was identified as tick , because of the presence of tick in 66.7% cases and by the presence of seed tick in 33.3% cases. Microphotograph of the seed tick is given in Plate 11.

The haematological and serum biochemical values are presented in Table 28.

4.4.2.6. Pediculosis

In the present study pediculosis was mostly seen in the age group of one to four years of age (66.7%) followed by 33.3% in one to two year age group and prevalence was 100% in non-descript dogs (Table 23). All the animals were males.

Table. 23: Distribution of age and breed in canine ectoparasitic dermatological conditions

Clinical condition	n	Age				Breed						
		Below 6 months	6 to 12 months	1 to 4 years	Above 4 years	Non-Descript	German Shepherd dog	Spitz	Doberman	Great Dane	Labrador	Dachshund
Localised demodicosis	4	2 (50%)	2 (50%)	-	-	1 (25%)	2 (50%)	1 (25%)	-	-	-	-
Generalized de,modicosis	5	3 (60%)	2 (40%)	-	-	3 (60%)	1 (20%)	-	-	1 (20%)	-	-
Flea bite hypersensitivity	4	-	-	2 (50%)	2 (50%)	4 (100%)	-	-	-	-	-	-
Flea bite dermatitis	2	-	-	2 (100%)	-	-	1 (50%)	-	-	-	1 (50%)	-
Tick infestation	3	1 (33.3%)	-	1 (33.3%)	1 (33.3%)	-	-	3 (100%)	-	-	-	-
Pediculosis	3	-	1 (33.3%)	2 (66.7%)	-	3 (100%)	-	-	-	-	-	-

Table 24. Distribution of housing pattern in canine ectoparasitic dermatological conditions based on primary etiology. (n=50).

Primary etiological agent	n	Habitat					Kennel	
		< 50% indoor	50% indoor & 50% outdoor	>50% indoor	100% indoor	100% outdoor	Present	Absent
Localised demodicosis	4	-	1 (25%)	-	3 (75%)	-	3 (75%)	1 (25%)
Generalised demodicosis	5	-	1 (20%)	-	2 (40%)	2 (40%)	4 (80%)	1 (20%)
Flea bite hypersensitivity	4	-	-	-	1 (25%)	3 (75%)	1 (25%)	3 (75%)
Flea bite dermatitis	2	-	1 (50%)	-	-	1 (50%)	2 (100%)	-
Tick infestation	3	-	1 (33.3%)	-	1 (33.3%)	1 (33.3%)	2 (66.7%)	1 (33.3%)
Pediculosis	3	-	2 (66.7%)	-	-	1 (33.3%)	2 (66.7%)	1 (33.3%)

Table 25: Distribution of type of lesions in canine ectoparastic dermatological conditions.

Clinical conditions		Localised demodicosis	Generalized demodicosis	Flea bite hypersensitivity	Flea bite dermatitis	Tick infestation	Pediculosis
No. of cases		4	5	4	2	3	3
Primary lesions	Macule	-	-	-	-	-	-
	Patch	-	1 (20%)	-	-	-	-
	Papule	3 (75%)	3 (60%)	1 (25%)	1 (50%)	-	2 (66.7%)
	Nodule	-	-	-	-	1 (33.3%)	-
	Pustule	1 (25%)	2 (40%)	-	2 (100%)	1 33.3%)	-
	Vesicle	-	-	-	1 (50%)	-	-
Secondary lesions	Scales	3 (75%)	1 (20%)	-	1 (50%)	2 (66.7%)	2 66.7%)
	Scar	-	1 (20%)	-	-	1 (33.3%)	-
	Crust	2 (50%)	3 (60%)	1 (25%)	1 (50%)	2 (66.7%)	1 33.3%)
	Erosions	1 (25%)	4 (80%)	-	1 (50%)	1 33.3%)	-
	Ulcer	-	-	-	-	1 (33.3%)	-
	Excoriation	2 (50%)	3 (60%)	-	1 (50%)	1 (33.3%)	1 (33.3%)
	Erythema	4 (100%)	4 (80%)	-	1 (50%)	3 (100%)	-
	Alopecia	4 (100%)	5 (100%)	4 (100%)	1 (50%)	2 66.7%)	2 (66.7%)
	Lichenification	-	-	4 (100%)	1 (50%)	-	-
	Hyperpigmentation	1 (25%)	2 (40%)	4 (100%)	1 (50%)	1 (33.3%)	-
	Patches of hyperpigmentation	-	-	-	-	1 33.3%)	-
	Hyperkeratosis	-	2 (40%)	-	-	-	-
	Epidermal collarettes	-	-	-	-	-	-
	Callus	-	-	-	-	-	-

Flow chart 4. Distribution pattern of alopacia present in ectoparasitic dermatitis.(n 21)

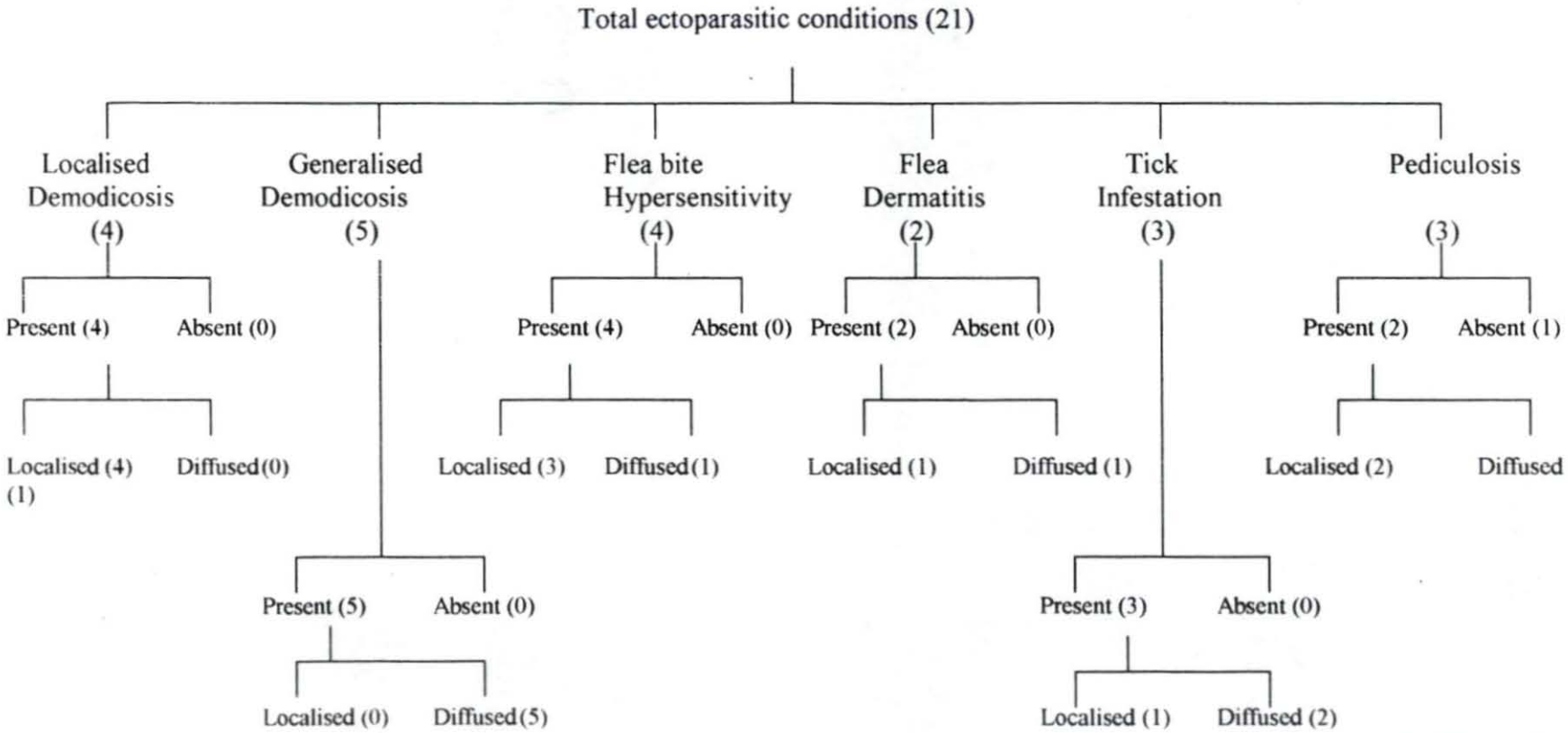


Table 26. Distribution of pruritus pattern in canine ectoparasitic dermatological conditions based on primary etiological agents. (n=50).

Primary etiological agents	n	Present			Absent
		Constantly	Sporadically	Total	
Localised demodicosis	4	1 (25%)	3 (75%)	4 (100%)	-
Generalized demodicosis	5	2 (40%)	2 (40%)	4 (80%)	1 (20%)
Flea bite hypersensitivity	4	4 (100%)	-	4 (100%)	-
Flea bite dermatitis	2	2 (100%)	-	2 (100%)	-
Tick infestation	3	3 (100%)	-	3 (100%)	-
Pediculosis	3	1 (33.3%)	2 (66.7%)	3 (100%)	-

Table 27. Distribution of lesions in canine ectoparasitic dermatological conditions

No. of cases		Localised demodicosis	Generalised demodicosis	Flea bite hypersensitivity	Flea bite dermatitis	Tick infestation	Pediculosis
		4	5	4	2	3	3
Body regions affected	Head	1 (25%)	-	-	-	-	-
	Ear	-	-	-	-	-	2 (66.7%)
	Periocular	2 (50%)	-	-	-	-	-
	Nasal area	-	-	-	-	-	-
	Chin	-	-	-	-	-	-
	Neck	-	-	-	-	1 (33.3%)	-
	Lower chest	1 (25%)	-	-	1 (50%)	-	-
	Axilla	-	-	-	-	-	-
	Back	-	-	4 (100%)	1 (50%)	1 (33.3%)	1 (33.3%)
	Tail	-	-	-	-	-	1 (33.3%)
	Trunk	-	-	1 (25%)	1 (50%)	1 (33.3%)	1 (33.3%)
	Abdomen	-	-	-	1 (50%)	1 (33.3%)	-
	Flank	-	-	-	-	-	-
	Hindlegs	-	-	-	-	1 (33.3%)	-
	Forelegs	2 (50%)	-	-	-	-	-
	Generalised	-	5 (100%)	-	-	-	1 (33.3%)

Table. 28. Effect of canine ectoparasitic dermatological conditions on haematological and serum biochemical parameters. (Values expressed as Mean ± SD)

	No. of cases	Control	Localised demodicosis	Generalized demodicosis	Flea bite hypersensitivity	Flea bite dermatitis	Tick infestation	Pediculosis
		10	4	5	4	2	3	3
Haematological parameters	Hb g%	14.56 ±1.04	15.1 ± 1.23	9.76 * ± 3.32	12.63 * ± 0.58	13.2 ± 0.85	13.8 ±3.03	11.47 * ± 0.81
	RBC x 10^6 /cmm	7.06 ± 1.12	6.25 ±0.64	4.69 ± 2.03	6.33 ± 0.43	5.5 ± 0.99	6.0 ±1.64	4.8 ± 0.1
	WBC /cmm	10280.9 ± 312	14762 * ±1345.8	17510 * ± 8258.1	8595 * ± 1747	19445 * ±2199.1	14050 * ±3170.6	10733.3 ±3752.8
	Neutrophil %	70.9 ± 4.28	72.75 ±7.89	73.2 ± 10.23	65.5 * ± 2.65	80.5 * ± 2.12	66.0 ±10.58	65 ± 4.36
	Lymphocyte %	24.7 ± 3.65	23.5 ± 5.45	24.2 ± 9.44	23.75 ± 5.32	14.5 * ±2.12	25.33 ± 12.7	30.33 ± 5.77
	Eosinophil %	2.5 ± 1.72	3.5 ± 2.64	2.4 ± 3.21	10.25 * ±3.86	4 ± 1.41	8.00 * ± 2.00	4.33 ±1.15
	Monocyte %	1.3 ± 1.16	0.25 ± 0.5	0.6 ± 0.89	0.5 ± 1	1.0 ±1.41	0.67 ±1.15	0.33 ±0.58
	Basophil %	-	-	-	-	-	-	-
	PCV %	43.4 ± 6.75	44.25 ± 6.94	32.51 ± 13.65	44.5 ±6.6	37.0 ± 4.24	41.66 ±9.5	35.33 ±5.03
	ESR / Hr	4.5 ± 1.08	3.75 ± 0.5	8.1 * ± 5.77	4.5 ± 0.58	4.0 ± 0.00	5.33 ±1.15	3.66 ± 1.15
Biochemical parameters	Blood glucose mg%	107.95 ± 19.48	91.35 ± 9.66	78.26 * 13.25	92.35 ±10.39	98.0 ± 8.49	83.97 ±3.45	101.13 ± 14.72
	BUN mg%	17.79 ± 4.27	17.93 ± 4.78	23.06 ± 5.82	21.78 ± 3.51	18.85 ± 2.62	19.44 ±2.6	23.60 ± 3.54
	Serum cholesterol mg%	149.43 ± 58.68	241.42 ± 103.5	199.92 ± 40.29	164.98 ±69.9	279.0 63.64	185 ± 22.9	229.73 ± 70.7
	Serum Calcium mg%	9.57 ± 0.67	9.35 ± 0.34	9.02 ± 1.17	8.9 ± 0.42	9.58 ±0.16	9.23 ±0.69	9.72 ± 0.4
	Serum Zinc mg%	0.858 ± 0.22	1.02 ± 0.05	0.71 ± 0.1	0.8 ± 0.09	0.81 ± 0.04	0.82 ± 0.03	0.86 ±0.07
	Serum Copper mg%	0.726 ± 0.11	0.62 ± 0.06	0.67 ± 0.16	0.69 ± 0.20	0.63 ± 0.13	0.74 ± 0.04	0.64 ± 0.09

* - $p<0.05$

The prevalence was 33.3% in the animals kept outside and 66.7% in the animals reared in the semi - intensive system (Table 24).

The clinical signs and lesions noticed were papule (66.7%) as primary lesion and secondary lesions were scales and alopecia (66.7% each) and crusts, excoriations and hyperpigmentation in 33.3% (Table 25). Sporadic pruritus was present in 66.7% cases and constant pruritus was seen in 33.3% and localised type of alopecia was seen in 66.7% (Table 26 flow chart 4).

The site of lesions were ear, back, trunk and tail (33.3%) (Table 27).

The etiologial agent was identified as lice on examination of the coat.

4.5. Other conditions

4.5.1. Prevalence

The overall prevalence of the conditions causing dermatitis was 12% (Fig 2). Out of different conditions other than bacterial, fungal and ectoparasitic origin, callus pyoderma was most prevalent (50%), followed by one case each of telogen defluxian, irritant contact dermatitis and lentigo (16.6% each) (Fig 5).

Age-wise prevalence reveled that dogs in the age group of one to four years are mostly affected (50%) followed by the age groups of above four years (33.3%) and below six months (16.7%) (Table 5).

Breed-wise prevalence indicated that Dachshund and Spitz were mostly affected (33.3% each) followed by Dobermann and Labrador (16.7% each) (Table 5).

Sex-wise prevalence of the other dermatological conditions showed that 16.7% males and 83.3% females were affected.

The prevalence was 83.3% in animals kept indoors and 16.7% in the animals reared under semi intensive system (Table 6).

The clinical signs and lesions noted were papules (33.3%), macules (16.7%) and patches (16.7%) as primary lesions. Secondary lesions were erythema and calus (50% each) followed by alopecia (33.3%) and erosions, ulcers, hyperpigmentation, hyperkeratosis and epidermal collerettes (16.7% each) (Table 7).

Distribution pattern of the alopecia is given in the flow chart 1. Distribution of pruritus is given in the Table 8.

The site of lesions were fore legs (50%), trunk, flank, abdomen and hind legs (33.3% each) followed by head, lower chest (16.7% each) (Table 9).

The mean haematological and serum biochemical values are shown in Table 10.

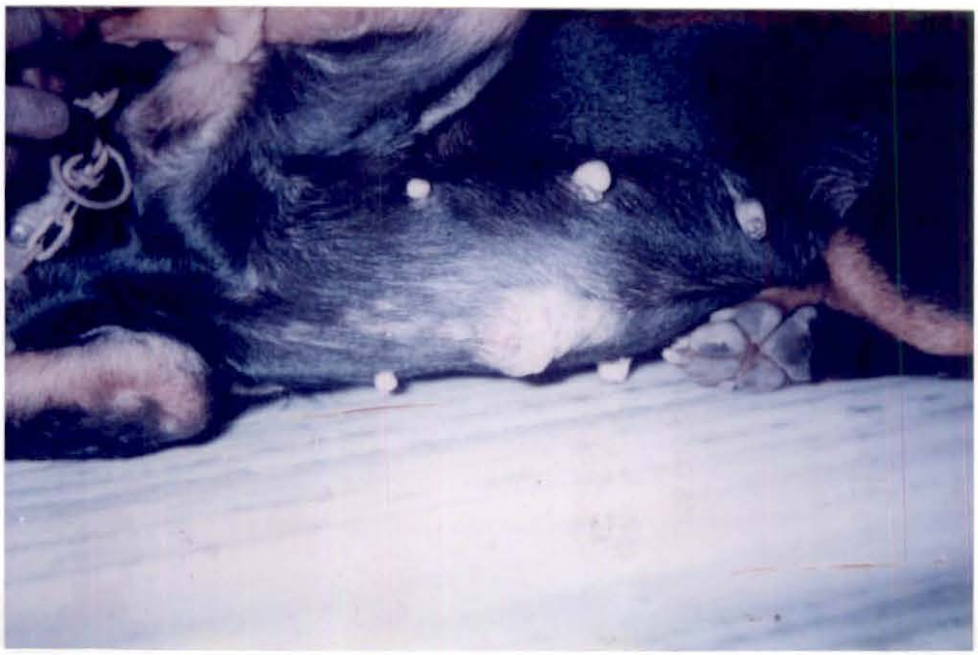


Plate 12. Lesions of sternal callus pyoderma seen in a Dachshund.

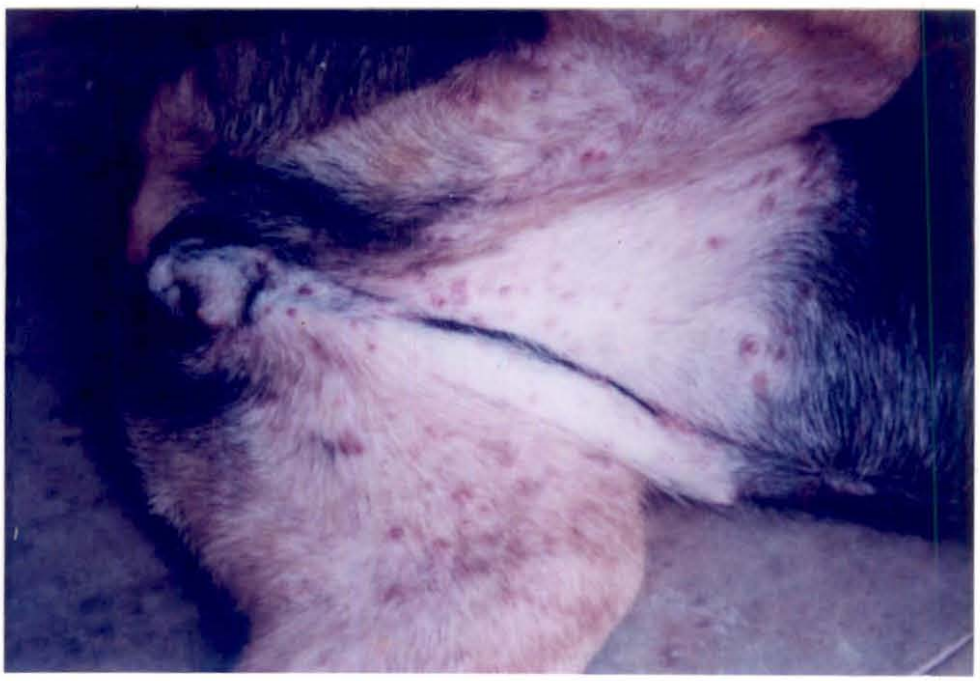
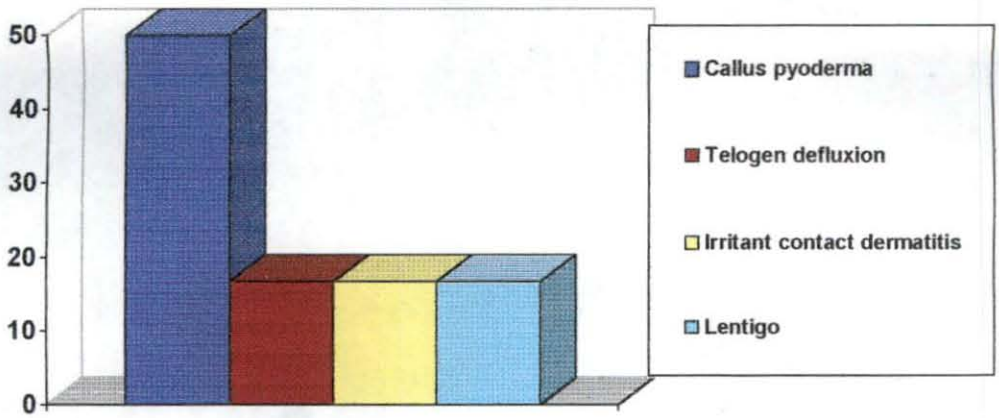


Plate 13. Lesions of Irritant contact dermatitis, in a Dobermann Pincher, produced by contact with phenyl.

Fig. 5. Prevalence of different clinical conditions among other dermatitis



4.5.2. Clinical conditions caused by other etiological factors

4.5.2.1. Callus pyoderma

In the present study three cases of callus pyoderma were noticed in Dachshunds, Labrador and Spitz. Two cases were seen in the age group of above four years and one case was seen in the age group of one to four years (Table 29)

The prevalence was seen only in animals kept indoors (Table 30).

The clinical signs and lesions noted were papules in one case as primary lesion. Secondary lesions include callus formation and alopecia in all the cases (100% each), erythema in two cases (66.7%) and varying degree of presence of erosions, ulcers, hyperpigmentation, hyperkeratosis and epidermal collarettes (Table 31). Two cases had sporadic pruritus and all the cases had localised alopecia (Table 32, Flow chart 5).

The site of lesions were hind legs, fore legs and in one case lower chest (Plate 12). The mean haematological and serum biochemical values are shown in Table 34.

4.5.2.2. Telogen Defluxion

In the present study only one case of telogen defluxion was noted in a one-and-half-year-old female Spitz, two months following whelping (Table 29). The animal was kept indoor for all time (Table 30).

Alopecia was the clinical sign noticed and the alopecia was of diffused pattern and the animal did not have any pruritus (Table 32, Flow chart 5).

The lesions were seen in the trunk and flank (Table 33).

4.5.2.3. Irritant contact Dermatitis

In the present study only one case of irritant contact dermatitis was noted in one two-year-old female Dobermann (Table 29). The animal was kept in semi intensive system, but used to be on phenyl disinfected kennel.

The clinical signs and lesions noted were papules as the primary lesion and secondary lesions were erythema (Table 31). Sporadic pruritus was present (Table 32). The site of lesion was abdomen (Table 33, Plate 13).

The mean haematological and serum biochemical values are shown in Table 34.

4.5.2.4. Lentigo

One case of lentigo was diagnosed in a five-month-old female Spitz (Table 29). The dog was kept indoor (Table 30).

The clinical signs and primary lesions were macules and patches (Table 31). The alopecia and pruritus was absent (Table 32 and Flow chart 5).

The site of lesions were head, trunk, flank, abdomen, fore legs and hind legs (Table 33). The illustration of the lesions are given in the Plate 14 and 15.

The condition was identified as lentigo, after performing histopathological examination of the biopsy. The microphotograph is presented as Plate 16.

The mean hematological and serum biochemical values are shown in Table 34.

Plate 14. Gross appearance of a 5 month old Spitz affected with lentigo.

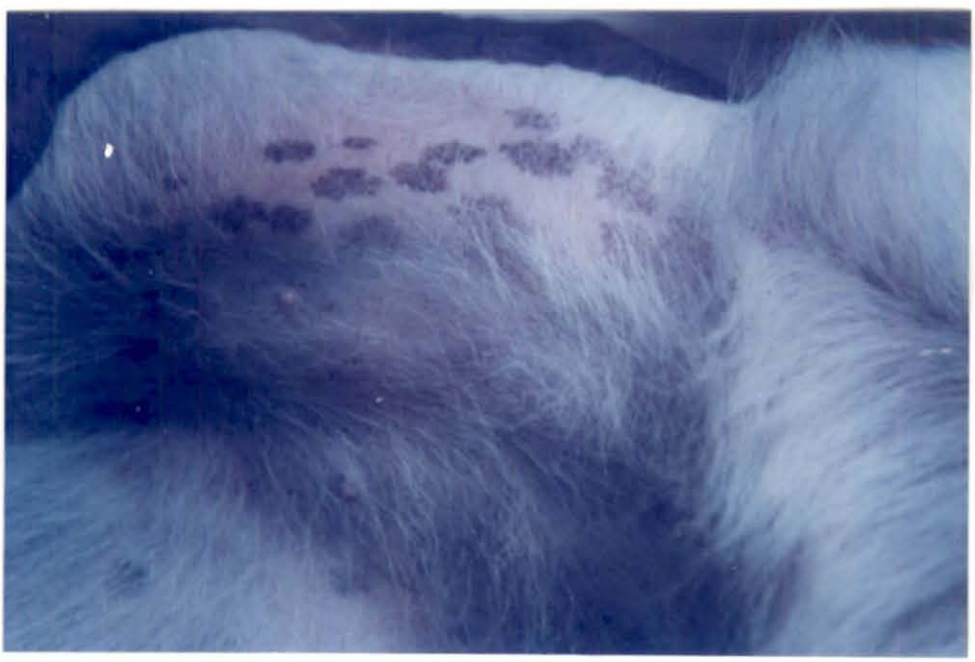


Plate 15. Lesions of Lentigo.

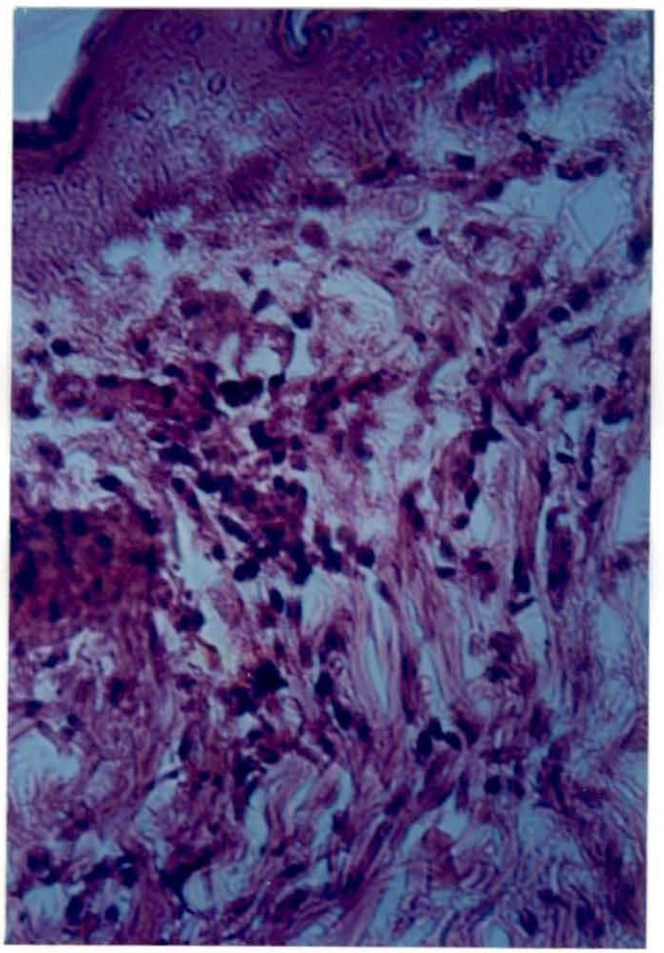


Plate 16. Microphotograph of histopathological section of Lentigo .
(W&E staining 40x100)

Table. 29: Distribution of age and breed in other canine dermatological conditions

Clinical condition	n	Age				Breed						
		Below 6 months	6 to 12 months	1 to 4 years	Above 4 years	Non-Descript	German Shepherd dog	Spitz	Doberman	Great Dane	Labrador	Dachshund
Callus pyoderma	3	-	-	1 (33.3%)	2 (66.7%)	-	-	1 (33.3%)	-	-	1 (33.3%)	1 (33.3%)
Telogen defluxion	1	-	-	1 (100%)	-	-	-	1 (100%)	-	-	-	-
Irritant contact dermatitis	1	-	-	1 (100%)	-	-	-	-	1 (100%)	-	-	-
Lentigo	1	1 (100%)	-	-	-	-	-	1 (100%)	-	-	-	-

Table 30. Distribution of housing pattern in other canine dermatological conditions based on primary etiology. (n=50).

Primary etiological agent	n	Habitat					Kennel	
		< 50% indoor	50% indoor & 50% outdoor	>50% indoor	100% indoor	100% outdoor	Present	Absent
Callus pyoderma	3	-	-	-	3 (100%)	-	3 (100%)	-
Telogen defluxtion	1	-	-	-	1 (100%)	-	1 (100%)	-
Irritant contact dermatitis	1	-	1 (100%)	-	-	-	1 (100%)	-
Lentigo	1	-	-	-	1 (100%)	-	1 (100%)	-

Table 31: Distribution of type of lesions in other canine dermatological conditions.

Clinical conditions		Callus pyoderma	Telogen defluxion	Irritant contact dermatitis	Lentigo
No. of cases		3	1	1	1
Primary lesions	Macule	-	-	-	1 (100%)
	Patch	-	-	-	1 (100%)
	Papule	1 (33.3%)	-	1 (100%)	-
	Nodule	-	-	-	-
	Pustule	-	-	-	-
	Vesicle	-	-	-	-
Secondary lesions	Scales	-	-	-	-
	Scar	-	-	-	-
	Crust	-	-	-	-
	Erosions	1 (33.3%)	-	-	-
	Ulcer	1 (33.3%)	-	-	-
	Excoriation	-	-	-	-
	Erythema	2 (66.7%)	-	1 (100%)	-
	Alopecia	3 (100%)	1 (100%)	-	-
	Lichenification	-	-	-	-
	Hyperpigmentation	1 (33.3%)	-	-	-
	Patches of hyperpigmentation	-	-	-	-
	Hyperkeratosis	1 (33.3%)	-	-	-
	Epidermal collarettes	1 (33.3%)	-	-	-
	Callus	3 (100%)	-	-	-

Flow chart 5. Distribution pattern of alopacia present in other dermatitis.(n 6)

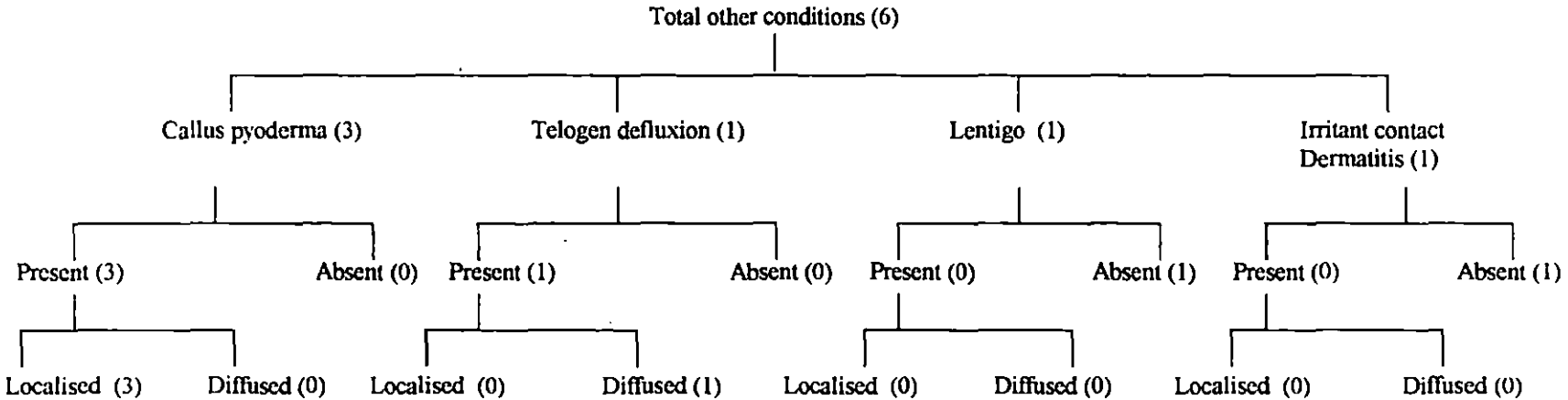


Table 32. Distribution of pruritus pattern in other canine dermatological conditions based on primary etiological agents. (n=50).

Primary etiological agents	n	Present			Absent
		Constantly	Sporadically	Total	
Callus pyoderma	3	-	2 (66.7%)	2 (66.7%)	1 (33.3%)
Telogen defluxion	1	-	-	-	1 (100%)
Irritant contact dermatitis	1	-	1 (100%)	1 (100%)	-
Lentigo	1	-	-	-	1 (100%)

Table 33. Distribution of lesions in other canine dermatological conditions

No. of cases		Callus pyoderma	Telogen defluxion	Irritant contact dermatitis	Lentigo
		3	1	1	1
Body regions affected	Head	-	-	-	1 (100%)
	Ear	-	-	-	-
	Periocular	-	-	-	-
	Nasal area	-	-	-	-
	Chin	-	-	-	-
	Neck	-	-	-	-
	Lower chest	1 (33.3%)	-	-	-
	Axilla	-	-	-	-
	Back	-	-	-	-
	Tail	-	-	-	-
	Trunk	-	1 (100%)	-	1 (100%)
	Abdomen	-	-	1 (100%)	1 (100%)
	Flank	-	1 (100%)	-	1 (100%)
	Hindlegs	1 (33.3%)	-	-	1 (100%)
	Forelegs	2 (66.7%)	-	-	1 (100%)
	Generalised	-	-	-	-

Table. 34. Effect of other canine dermatological conditions on haematological and serum biochemical parameters. (Values expressed as Mean ± SD)

	No. of cases	Control	Callus pyoderma	Telogen defluxion	Irritanat contact dermatitis	Lentigo
		10	3	1	1	1
Haematological parameters	**Hb g%**	14.56 ±1.04	14.53 ± 0.61	14	14.8	14
	RBC x 10^6 /cmm	7.06 ± 1.12	6.5 ± 0.3	6.8	7.2	7.5
	WBC /cmm	10280.9 ± 312	14000 * ± 624.49	7400	14600	6600
	Neutrophil %	70.9 ± 4.28	68.0 ± 3.0	70	66	75
	Lymphocyte %	24.7 ± 3.65	26.33 ± 2.89	28	25	25
	Eosinophil %	2.5 ± 1.72	5.0 ± 4.58	2	8	-
	Monocyte %	1.3 ± 1.16	0.67 ± 1.15	-	1	-
	Basophil %	-	-	-	-	-
	PCV %	43.4 ± 6.75	44.33 ± 4.04	46	44	44
	ESR / Hr	4.5 ± 1.08	3. 0 ± 1.0	4	5	5
Biochemical parameters	**Blood glucose mg%**	107.95 ± 19.48	107.4 ±6.09	109	118.4	94.2
	BUN mg%	17.79 ± 4.27	19.7 ± 1.82	15.88	17.8	11.3
	Serum cholesterol mg%	149.43 ± 58.68	243.27 ± 47.8	161.50	122.8	129.3
	Serum Calcium mg%	9.57 ± 0.67	9.93 ± 0.82	10.39	8.9	11.7
	Serum Zinc mg%	0.858 ± 0.22	0.86 ± 0.17	0.84	0.96	0.78
	Serum Copper mg%	0 726 ± 0.11	0.8 ± 0.12	0.9	0.84	0.48

* - $p<0.05$

DISCUSSION

5. DISCUSSION

5.1. Prevalence

Out of 50 clinical cases studies, the etiological agents identified were bacteria (42%), ectoparasites (42%), fungi(4%) and others (12%). This finding is in agreement with Ihrk (1987). Kamboj (1991) from Ludhiana also reported high Prevalence of bacterial dermatitis (40.24%), but Gupta (1989) and Aujla (1993) reported less prevalence of bacterial dermatitis. The high incidence of bacterial and ectoparasitic dermatoses observed in the present study might be due to the high temperature and high environmental humidity prevailing in the area.

Lesser incidence of fungal infection in the present study is supported by Muller et al. (1989). However, he stated that the superficial bacterial folliculitis is often misdiagonised as the dermatophytosis, because of the moth-eaten appearance of the lesions. Medleau and Ristic (1992) also stated that fungi are not a frequent cause of skin disease in dogs and cats. Goldston and Wilkies (1982) also reported that only 2.12% of all dermatological problems of small animals are caused by dermatophytosis.

5.2. Bacterial dermatitis

5.2.1. Prevalence of etiological agent

A total of 21 cases of bacterial dermatoses, clinically classified as five categories -namely superficial bacterial folliculitis, impetigo, German

Shepherd Pyoderma, furunculosis and infantile pustular dermatoses- studied showed that the etiological agent involved in all the categories was coagulase positive Staphylococcus intermedius. Guinhon *et al.* (1974), Cox and Newmann (1984) and Ihrke (1987) also reported that S. intermedius is the primary bacterial pathogen of dog's skin; where as Love (1989) reported 85.8 % S. Intermedius 11.6 %. S. aurius and 1.6% S. epidermidis after a six years of study in 190 culture of Staphyloccacci. Aujla (1993) reported an over prevalence of 31.31% bacterial dermatitis in Ludhiana where as in the present study 42% of the total cases studied were produced by bacteria.

5.2.2. Clinical condition caused by bacterial etiology

5.2.2.1. Superficial bacterial folliculitis

Out of five categories of 21 bacterial dermatoses studied eight cases were superficial bacterial folliculitis.

Over crowding before weaning (Nesbitt, 1983), dirty coats, faulty brushing and bathing practices and use of local irritants like washing soap (Muller, 1989), pruritus, defective immune system and poor grooming (Gross, 1992) were reported as predisposing factors for superficial bacterial folliculitis in young age. In the present study also majority of cases occurs below six months of age and 50 per cent of the animals were kept in doors and others either in the semi intensive or outdoor system of rearing (Table 12). This might be due to the confinement of young dogs in-door for longer

periods and the resultant deprivation of exposure to sunlight, dampness of skin, insanitary conditions in the kennel and deficient supply of nutrients. However, Gross (1993) reported that there is no age and sex predisposition for this disease.

Among breeds non-discript dogs were affected more (62.5%), followed by Dobermann (25%) and Dachshunds (12.5%). The high prevalence in non-descript dogs might be due to very high percentage of non-descript dogs in the total dog population. In adequate attention from the owner regarding brushing, bathing and general health and mostly outdoor system of rearing are also attributed as reasons for high incidence in non-descript dogs. Amongst the purebread, Doberman and Dachshunds were found to be more affected and it is in agreement with Nesbitt (1983) and Muller (1989).

Clinical signs and lesions like papules, pustules involving hair follicle, erythema, localised alopecia, constant pruritus, distribution of lesions in hind legs, ear, trunk, fore legs, and abdomen noticed in the present study agree with the earlier findings of Muller (1989). Nesbitt (1983) observed variation in the pattern and distribution of lesions. However, affection of abdomen and trunk was consistent finding.

The statistical analysis of haematological and serum biochemical parameters showed that there was a significant reduction in mean haemoglobin value (5.9 ± 1.1) when compared to control animals (7.1 ± 1.1) ($p<0.05$) which may be reflection of nutritional deficiency which might have predisposed to the occurrence of the disease by marginally decreasing the immune status of the animal.

Significant increase in WBC count compared to control animals ($p<0.05$) might be a response to the infectious agent.

Serum biochemical values did not show any significant variation from those of control animals indicating that there was no intercurrent disease.

5.2.2.2. Impetigo

In the present study impetigo was seen only in the dogs below six months of age. It is in agreement with Nesbitt (1983), Muller et al. (1989) and Yager and Scott (1993). Review of the literature did not reveal any influence of breed variation in the prevalence of the disease, but in the present study Non-descript dogs and Dachshunds were found to be more affected (33.3% each) and the reason for the high incidence in non-descript dogs is attributed as in the case of superficial bacterial folliculitis. Glaborous

skin with less hairs in the abdomen might have predisposed Dachshunds for increased chance of microtrauma and infections.

Clinical signs and lesion like pustules, papules, erythema, epidermal collarettes, crust and distribution pattern in the area of abdomen agree with Nesbitt(1983), Muller et. al. (1989) and Yager et al.(1993)

Significant reduction in haemoglobin compared to control animals might be due to the poor nourishment in the young ones. All other haematological and serum biochemical values were within the normal range.

5.2.2.3. German Shepherd Pyoderma (GSP)

The condition was noted mostly in the age group of four years and above which agrees with Muller et al. (1989) and Wisselink et al (1988).

As the name of the condition indicates the breed affected was entirely German Shepherd. Muller et al. (1989) and Yager et al. (1993) have stated that the condition is an inherited disease an autosomal recessive trait. Wisselink et al. (1988) has stated that repeated microtrauma would be eliciting the condition.

Sex did not seem to have any significance as both the sexes were affected equally.

Clinical signs and lesions noticed in the present study like papules, pustules, erythema, scales, erosions, excoriation, scar and distribution of lesions in the back, hind legs and trunk were also reported my Muller *et al* (1989) and Yager (1989). Wisselink *et al.* (1988) hypothesised that microtruama due to flea bite may predispose the condition and the sites of lesions in the study agrees with his hypothesis.

Significant increase in the WBC count when compared to the control animals might be due to response to severe infection and this finding is supported by Wissellink *et al* (1988). All other haematological and serum biochemical parameters were normal when compared to control animals.

5.2.2.4. Furunculosis

In the present study the condition was seen in two male Dachshunds, and this type of deep pyoderma is comparatively less in occurrence according to Ihrke (1987) and Nesbitt (1983). But Nesbitt (1983) is of opinion that breeds namely German Shepherd, Irish Setter and Dobermann are prone to have furunculosis. This is not in agreement with the findings of present study.

The clinical signs and lesions seen were pustules, vesicles, erythema, localised alopecia, lichenification, hyperpigmentation, pruritus; and

distribution of lesions was in fore legs and hind legs. These findings are in agreement with Medleau (1990) and Gross *et al.* (1992), but do not agree with Muller *et al.* (1989).

Significant increase in the WBC count noted in the present study might be due to response to severe infection. All other haematological parameters were normal when compared to control animals. Among the serum biochemical parameters studied, blood glucose alone showed significant decrease. This might be due to decreased food intake.

5.2.2.5. Infantile Pustular Dermatosis (IPD)

The case was reported in a male Labrador pup of 20 days of age and according to Muller et al (1989) the disease is predisposed in pups of 3 days to 3 weeks of age and a high incidence in Chinese Shar Pei, pointer and Labrador retrievers. The pup was kept indoor in a basket and the damp atmosphere might have favoured the disease. It was weaned on the 12^{th} day and was fed with cow's milk alone.

Muller *et al* (1989) did not believe it to be a bacterial infection but in the case studied *Staphylococcus intermedius* was isolated.

Since there was only one case, it was not possible to statistically analyse the haematological and serum biochemical parameters. However, the

pup had a lower haemoglobin, RBC and PCV levels which could be due to the age of the pup. Increase in WBC count and ESR when compared with the control animals might be due to the reaction of body to the disease.

5.3. Fungal Dermatitis

The prevalence of fungal dermatitis was 4% in the present study, and out of that half was caused by dermatophyte and the other half by a non-dermatophyte. Goldston and Wilkies (1982) and Medleau and Rsitick (1992) reported that the incidence of dermatophytosis in the companion animals was 'less' than many practitioners think and only 2.12% of all dermatological problems are caused by dermatophytes.

In the present study eventhough fungal spores were microscopically detected on examination of hair in eleven number of cases, isolation and identification would be possible only in two cases.

Out of the two cases, one occurred in a three-year-old female Spitz and it was Caused by *Microsporum canis* and the other by a non-dermatophyte Penicillium spp. in a three-year-old Dachshund. Muller et al. (1989) also reported dermatomycosis involving keratinised tissues like nail, hair and stratum corneum caused by dermatophytes and non-dermatophytes, but also reported that the chance of occurrence is generally below six months of age. Gross *et al.* (1992) are also of opinion that Dalmatian and Poodle

below one year are at increased risk. But in the present study both the cases were of three year age, which is in agreement with Thomsett (1986) who stated that all breeds and age groups may be affected. Goldston and Wilkies (1982) observed that younger animals less than three years are more prone to infection.

The clinical signs and lesions like scales, erosions, ulcers, erythema, alopecia and distribution of lesions in ear, trunk and hind legs agree with the findings of Muller *et al.* (1989). But according to Muller *et al.* (1989) erosions and ulcerations may also be seen but due to secondary bacterial infection. In the present study erosions and ulcerations are also noted along with secondary Staphylococcus infection.

Medlaeu and Ristic (1992) observed dermatophyte pseudomyacetoma by *Microsporum canis* involving deep dermal and subcutaneous tissue characterised by firm nodules that may ulcerate and drain usually in the dorsum of trunk and base of the tail but can be anywhere. In the present study ulcers were seen in the hind legs. Gross *et al.* (1992) agree with the present findings. Rhodes (1990) and Medleau and Ristic (1992) could not observe all the clinical signs and lesions seen in the present study.

Other than elevated leukocyte count no abnormalities could be detected; on haematological examinations; this could be due to secondary bacterial infection.

The clinical signs and lesions noticed in the dermatomycosis caused by Penicilluim in the present study were alopeica resembling classical ring worm, erythema around lesions, papules and sporadic pruritus. The lesions were mainly in the trunk followed by fore legs, hind legs and head. Though Muller et al. (1989) enlisted Penicillium as one of the non-dermatophyte causing dermatomycosis, an overview of literature did not reveal occurrence of this condition in dogs.

No significant difference in the haematological and serum biochemical parameters when compared to the control and statistical analysis was unable to be carried out as there was only one case.

5.4. Ectoparastitic dermatitis

5.4.1. Prevalence

In the present study ectoparasitic dermatitis formed a major share in the total dermatological conditions which agrees with Sosna and Medleau (1992). Age group of one to four years seems to be more affected with large ectoparsitisc infestations because of the practice of letting out and more chances to pick up infection. The increased incidence of demodicosis in

below six months group is probably due to the fact that the disease is transmitted to the offspring during the first three days of life and also because of the lower immune status of young animals. Breed wise prevalence indicated that non-descript dogs were affected more due to poor care and management and their free roaming nature. Among the pure breds long coated breeds like German Shephered and Spitz have increased chance owing to their thick long coat which can harbour ectoparasites. Males are affected more probably because of their free roaming behaviour than females.

5.4.2. Clinical conditions caused by ectoparasitic etiology

5.4.2.1. Localized demodicosis

The condition was seen only in the age group below six months and six to 12 months and the prevalence was more in German Shepherd breed This agrees with the reports of Muller *et al.* (1989) and Sosna and Medleau (1992).

Clinical signs and lesions noticed in the present study include papules, pustules, erythema, alopecia, scales, scars, excoration, sporadic pruritis and distribution of lesions in the periocular region, face and fore legs This agrees with the findings of Muller et al(1989), Rigdes (1990) and Sosna and Medleau (1992).

The etiological agent was identified as demodex mites from the skin scrapings.

There was a significant increase in the total WBC count compared to control animals, which may be an indication of host response to infection. All other heamatological parameters were normal compared to control. This finding disagrees with the findings of Aujla *et al.* (1993) who reported that there is no significant difference in total WBC count, but a significant increase in neutrophil and lympocyte percentage.

Serum biochemical values did not show any significant variation from those of control animals indicating that there was no intercurrent internal disease.

5.4.4.2. Generalized demodicosis

The condition in the present study was noted only in dogs below six months of age and six to 12 months. Connon (1983) and Shirk (1983) stated that age group of seven to 12 months has more chance to get demodecosis, which is in partial agreement with the present study. The study disagrees with Marinez (1900) as he said there is only 5.5% prevalence of demodectic mange in dogs below six months of age and one percentage in dogs above 12 months. Muller *et al.* (1989) stated that there is juvenile form

of demodecosis and this - age-predisposition are in agreement with results of the present study.

Most of the animals had a history of having the same disease in their siblings, which were reared by different people in different places. Hence it may be inferred that the disease is transmitted from mother in the neonatal period, as Muller et al. (1989) and Henfrey (1990) reported.

Non-descript dogs were mostly affected followed by German Shepherd and Great Dane. This finding is in disagreement with Muller *et al.* (1989) who stated that pure breds have more chance to have the infection. The probable reason for high percentage of non-discript dogs has been discussed elsewhere. In the present study low percentage incidence in pure breds may be because of the health-care and selective mating which is not practised in non-descript dogs. Among pure breds Muller *et al.* (1989) also agrees that German Shepherd and Great Dane have increased chance.

No significant effect could be seen in the present study regarding housing pattern.

Clinical signs and lesions seen in the present study include papules, pustules, alopecia, erosion, erythema, excoriation, uncleration hyperpigmentation and hyperkeratosis with generalised distribution. This is

in agreement with Muller *et al.* (1989) and Yager and Scott (1993), but they stated that the abdomen is the least affected part, where as in the present study lesions were generalised probably due to the severity of the disease.

All the stages of demodex mites could be detected from the pus expressed from the pustules. The mean haemoglobin value was significantly lower, whereas total WBC count was significantly higher compared to control animals. The low heamoglobin level noticed may be because of the debility of the animal due to inanition and high protein loss as a result of severe skin affection. Elevated total WBC count might be the result of response to severe bacterial infection. ESR value was significantly increased, this may be due to the severe secondary bacterial infection in all the cases.

Serum biochemical values did not show any significant variation from those of control animals indicating that there was no intercurrent internal diseases. Blood glucose level showed significant reduction than control animals, and it might have been due to generalised emaciation caused by lesser food intake.

5.4.2.3. Flea bite Hypersensitivity

As Gross *et al.* (1992) stated this condition is seen only in the age groups of one to four years and above four years. They proposed increased risk for the breeds namely Cairn terrier, Irish setter, West Highland

White Terrier, Border Collie, Scottish Terrier and Lhasa Apso which are rare in this area and no such breed was available for the study. In the present study only non descript dogs have been affected. Probably because of keeping the animals in flea infested areas and free roaming nature of non-descript dogs. Yager and Scott (1993) did not propose any breed specificity. Gross *et al.* (1992) have proposed seasonality, which is in agreement with the present study.

In the present study males seem to be more prone to infection, but no report could be traced.

Clinical signs and lesions noted in the present study include papules, alopecia, lichenification, hyperpigmentation, crusts, prutitus and distribution of lesions in back and trunk. These findings are in agreement with Gross *et al.* (1992) and Yager and Scott (1993).

The possibility of the disease had been reached by collecting the history of habituating in a flea-infested area, presence of flea faeces on the body, distribution and type of lesion. Yager and Scott. (1993) is also in agreement with the nature, distribution and type of lesions to suggest diagnosis and stated that the condition is one of the most common ones encountered in dogs and cats.

The mean haemoglobin level, total WBC count and neutophil percentage were significantly lower probably because of the blood loss by the flea bite and lesser food intake due to constant pruritus. However, the eosinophil percentage was significantly high probably due to the allergic reaction to the flea bite.

All the serum biochemical parameters were normal indicating that there is no other internal disease.

5.4.2.4. Flea bite dermatitis

Only two of such conditions were seen and they were in the age group one to four years. one case was in a German Shepherd and the other in a Labrador. From the study no inference could be reached regarding age, sex and breed predilection since the sample size is too low. Age, breed and sex have no significance in the production of the disease (Grant 1985).

Clinical signs and lesions noticed in the present study were pustules, papules, scales, crusts, erosion, excoriation, erythema, constant pruritus and distribution of lesions in the back, lower chest, trunk and abdomen. This is in agreement with Grant (1985).

The etiological diagnosis was made by seeing the flea and flea faeces. The mean haematological values showed a statistically significant

leukocytosis, neutophilia and lymphopenia. This might be a response to the secondary bacterial infection.

Serum biochemical values did not show any variation indicating that there was no intercurrent internal disease.

5.4.2.5. Tick infestation

In the present study all the age groups were equally affected and the incidence was only in Spitz breed. Two dogs were males and the other was a female. In the literature reviewed no age, breed or sex predispositions have been reported.

Clinical signs and lesions noticed in the present study were pustules, nodules, erythema, scales, crusts and alopecia, and distributions of lesions were in the neck, back, trunk, abdomen and hind legs. These findings are in agreement with Yager and Scott (1993).

A significant increase in the total WBC count and eosinophil percentage were noticed and this may probably be a response to inflammation and allergy caused by flea bite.

Serum biochemical values did not show any variation indicating that there was no intercurrent internal disease.

5.4.2.6. Pediculosis

The age group that is affected mostly is one to four years and only non-descript dogs were affected. No age, breed or sex predilictions were reported in any literature reviewed other than the statement of Yager and Scott. (1993) that the breeds with long fine hair may provide a favourable environment for lice and the conditions are rare in pet dogs. In the present study non-descript dogs were found affected which may be due to their unkempt coat, dirty habitats, free roaming nature and contact with infected animals.

Clinical signs and lesions noticed in the present study were papules, scales, alopecia, crust, excoriation and hyperpigmentation. These findings are in agreement with Nesbitt (1983) and Muller *et al.* (1989). The latter stated that the pediculosis may look like flea bite hypersensitivity in dogs and in the present study one of such cases, resembling flea bite hypersensitivity with linear lesions probably produced by scratching followed by hyperpigmentation, has been come across.

The mean haemoglobin and RBC count were seen to be significantly low probably as the result of blood and protein loss because of lice infestation.

Serum biochemical values did not show any variation indicating that there was no intercurrent internal disease.

5.5. Other conditions

5.5.1. Clinical conditions caused by other etiological factors

5.5.1.1. Callus dermatitis

In the present study three cases of callus dermatitis were seen in the age group of above four years. The age prevalence may be justified as Gross *et al.* (1992) stated that the callus is produced in response to repeated pressure and frictional trauma over bony prominences of pressure points. As the age advances, chance to get repeated pressure or frictional trauma also get increase especially in the animals kept indoors with rough cement floorings as in the cases studied.

The cases were reported in Dachshund, Labrador and Spitz Muller *et al.* (1989) and Gross *et al.* (1992) also have said that Dachshund breed has got more chance to develop sternal callus.

The clinical signs and lesions noticed in the present study were callus as a predominant lesion followed by papules alopecia, erythema, erosion, ulcers, hyperpigmentation and hyperkeratosis. Ulcer and erosions were noticed in spitz with elbow callus which may be due to a secondary infection with Staphylococcus and the lesions in such a condition is in

agreement with those described by Muller *et al.* (1989) and Gross *et al.* (1992).

There was a significant increase in the total WBC count probably as a result of secondary infection.

There was significant increase in the cholesterol level in the affected animals, but as the number of animals studied were only three, it is not known whether elevated cholesterol level has got any bearing on callus formation.

5.5.1.2. Telogen defluxion

The condition was noticed in a one and half year old female Spitz, two months following whelping. According to Gross *et al.* (1992), no age, breed or sex predisposition is present.

The condition had only one clinical sign, namely diffused alopecia and was diagnosed as telogen defluxion after physical examination, fungal culture, haematological and serum biochemical evaluation which were normal when compared to control.

History of whelping two months back, indicated that the hair cycles were synchronised to telogen phase by abrupt cessation of anagen

phase due to stress caused by pregnancy and lactation. This type of approach to diagnose agrees with Muller *et al.* (1989) and Gross *et al.* (1992).

Microscopically telogen hairs were identified by seeing easily epilated hair with uniform shaft diameter and a slightly clubbed, non-pigmented root end that lack a root sheath.

Haematological and serum biochemical values did not show any variation indicating that there was no intercurrent internal disease.

5.5.1.3. Irritant contact dermatitis

The condition was noticed in a two year old female Doberman which had the history of keeping in a kennel disinfected with phenyl without properly washing it afterwards.

The clinical signs and lesions noticed in the present study were papules, erythema, sporadic pruritus and distribution of lesions in the abdomen. They were in agreement with Muller et al. (1989). Gross et al. (1992) reported prevalence of such a condition due to direct contact with irritating substance though it is an uncommon skin reaction in dogs and cats.

The possibility of other etiological agents were ruled out by physical examination, cultural examination, heamatological and serum biochemical examination which were normal.

5.5.1.4. Lentigo

A single case of lentigo was noticed in a five month old female Spitz. According to Gross *et al.* (1989) who stated that if at all young dogs are affected it is heriditory due to autosomal dominant gene and described it as lentigenosis profusa (multicentric lentigo simplex). In the present study it is not possible to assertain whether it is heriditory since the ancesteral history was not traceable. Yager and Scott (1993) have stated that the condition called lentigenosis profusa is a generalised juvenile onset disease which can occur in any breed although reported in Pugs only.

Presence of the macules over head, trunk, abdomen, flanks, fore legs and hind legs were observed in the present study and agree with the report of Muller *et al.* (1989).

The conclusive diagnosis was done based on history, physical examination and characteristic histopathologic findings like focal and diffused collection of pigment-laden melanocytes close to the reteridges that have formed and are extending to the subcutis.

SUMMARY

SUMMARY

Fifty clinical cases of dermatological diseases in dogs presented to the University Veterinary Hospital Kokkalai and Veterinary College Hospital at Mannuthy were systematically investigated to find out the etiology. Out of the 50 cases studied, major share of the cases were caused by bacteria and ectoparasites (42% each) and only a very few percentage were produced by fungi (4%) and other factors (12%). All the cases studied were primary diseases of skin.

Sixteen different clinical dermatological conditions were identified. The bacterial diseases identified were Superficial Bacterial Folliculitis, Impetigo, German Shepherd Pyoderma, Furunculosis, Infantile Pustular Dermatoses. The conditions caused by ectoparasites include Localised Demodicosis, Generalised Demodicosis, Flea Bite Hypersensitivity, Flea Bite Dermatitis, Tick Infestation, Pediculosis. Dermatophytosis and Dermatomycosis were also detected Other conditions identified were Callus Pyoderma, Telogen Defluxion, Irritant Contact Dermatitis and Lentigo.

Non-descript dogs were mostly affected. It was probably due to lesser care and attention given to them by the owners and also due to over presentation of non-descript dogs in the total dog population.

The results suggested that animals kept full time indoors or outdoors were almost equally affected. Animals reared under semi intensive system were less prone to dermatological diseases.

Although five different clinical bacterial dermatitis were identified, only *Staphylococcus intermedis* could be isolated. Non-descript dogs below six months of age were mostly affected. All the bacterial dermatitis cases were presented with more of secondary lesions than primary lesions. The lesions were predominent in abdomen, hind legs and trunk. Alopecia and constant pruritus were present in most of the cases. Amongst bacterial dermatitis, in impetigo, haemoglobin level was seen to be significantly low and in folliculitis and impetigo, RBC count was significantly low WBC count was seen to be significantly elevated in Folliculitis, German Shepherd Pyoderma and Furunculosis. Among the biochemical parameters studied namely blood glucose level, serum cholesterol, blood urea nitrogen, serum calcium, serum zinc and serum copper, the only parameter that showed a change from the normal was blood sugar, which was reduced in furunculosis.

Only two cases of fungal dermatitis were seen, one in a Spitz caused by a dermatophyte *Microsporum canis* and the other in a Dachshund only produced by a non-dermatophyte fungus Penicillium spp. Both the cases had alopecia and pruritus In dermatophytosis ear, trunk and hind legs were affected, whereas in non-dermatophyte produced dermatomycosis, head, trunk, hindlegs and forelegs were affected. In dermatophytosis, only secondary lesions were detected But in non-

dermatophyte produced dermatomycosis, papules were present as primary lesions. The haematological and biochemical parameters did not show any conspicuous variation from the control animals, other than an increased WBC count in dermatophytosis probably due to secondary bacterial infection.

In dermatoses of ectoparasitic origin *Demodex canis*, flea, tick and lice were involved. As in the case of bacterial diseases, non-discript dogs were the mostly affected groups, owing to their free roaming nature, non-selective breeding and lesser care and management they get. The breeds that followed were German Shepherd and Spitz. Demodicosis was more in the age group of below twelve months, where as other ectoparasitisms were more in the age group of above one year. In all the ectoparasitic dermatitis , secondary lesions were very predominant. In all cases there was pruritus. Almost all cases of ectoparasitism developed alopecia. In ectoparasitism, back and trunk were the mostly affected part. Haemoglobin level was significantly reduced in generalised demodicosis, flea bite hypersensitivity and pediculosis; where as WBC counts were significantly increased in localised demodicosis, generalised demodicosis, flea bite dermatitis and tick infestation. WBC count was reduced in flea bite hypersensitivity. In flea bite hypersensitivity eosinophil count was significantly high, but in all other cases there was no specific variation in the differential leukocyte count. In generalised demodicosis there was increased ESR and lower blood glucose level than control animals.

Callus pyoderma was noted in Spitz, Dachshund and Labrador with predominance of secondary lesions namely callus formation. Pruritus was present in

the callus pyoderma cases. A case of Telogen defluxion was noted in Spitzs Irritant contact dermatitis was diagnosed in a Dobermann Pinscher. Lentigo was detected in a five month old Spitz, which did not have any pruritus or alopecia, but developed only primary lesions namely macules and patches. In all the cases caused by other factors, the haematological and biochemical parameters studied did not show any changes from the control values, indicating that there was no role for intercurrent internal diseases in the production of these dermatological diseases.

From the investigation of the 50 cases, it was seen that dermatologic disorders were more common in non-descript dogs. Dogs below age group of six months were mostly affected by skin diseases. Bacterial infections and ectoparasitic infestations were the main etiologies of dermatological disorders. In general, haematological and biochemical parameters did not show any significant alteration from normal values.

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DERMATOLOGIC DISORDERS IN DOGS

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ABSTRACT OF THE THESIS

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ABSTRACT

Fifty dermatological diseases in dogs presented to the University Veterinary Hospital, Kokkalai and Veterinary College Hospital, Mannuthy were systematically investigated to find out the etiology. The results indicated that the conditions were mostly caused by bacteria and ectoparasites (42% each) and only a small proportion was caused by fungi (4%) and other factors (12%).

Sixteen different clinical conditions were identified viz. Superficial Bacterial Folliculitis, Impetigo, German Shepherd Pyoderma, Furunculosis, Infantile Pustular Dermatoses, Localised Demodicosis, Generalised Demodicosis, Flea Bite Hypersensitivity, Flea Bite Dermatitis, Tick infestation, Pediculosis, Dermatophytosis, Dermatomycosis produced by non-dermatophyte, Callus Pyoderma, Telogen Defluxion, Irritant Contact Dermatitis and Lentigo.

Among the dogs which were investigated, non-descript ones were mostly affected probably due to lesser care and attention given to them.

The results suggested that animals kept full time indoor or outdoor were almost equally affected whereas animals reared under semi intensive system were less prone to dermatological diseases.

In almost all conditions secondary lesions were predominant than primary lesions probably due to the delay in medical attention. The only condition, with primary lesions alone, was lentigo.

Lesions of bacterial dermatitis were predominant in the abdomen, hind legs and trunk. In dermatophytosis, ear, trunk and hind legs were affected, where as in dermatomycosis, head, trunk, hind legs and fore legs were affected. The lesions produced by ectoparasites were mostly in the back followed by trunk and fore legs. No characteristic distribution of lesions could be detected in other conditions; with an exception of callus pyoderma in which lesions were seen at the pressure points

The different clinical bacterial dermatitis were produced by *Staphylococcus intermedius*. Ectoparasitic conditions were mostly produced by *Demodex canis*, followed by fleas, ticks and lice. Some cases of the ectoparasitic conditions developed secondary bacterial infection with *S. intermedius*. There were four clinical conditions, namely callus pyoderma, telogen defluxion, irritant contact dermatitis and lentigo caused by factors other than bacteria, fungi and ectoparasites.

The haematological and serum biochemical parameters studied did not suggest any systemic diseases. A significant reduction in haemoglobin level was noticed in impetigo, generalised demodicosis and flea bite hypersensitivity. RBC counts were significantly reduced in impetigo and folliculitis. The total leukocyte count showed significant difference from that of control animals, in conditions such as folliculitis.

German Shepherd Pyoderma, furunculosis, localised demodicosis, generalised demodicosis, flea bite hypersensitivity, flea bite dermatitis, tick infestation and callus pyoderma; suggesting primary or secondary bacterial infections.