CLINICOTHERAPEUTIC STUDIES ON MYCOTIC DERMATITIS IN CATTLE

By

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THESIS

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DECLARATION

I hereby declare that the thesis entitled **"CLINICOTHERAPEUTIC STUDIES ON MYCOTIC DERMATITIS IN CATTLE"** is a bonafide record of research work done by me during the course of research and that the 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.

Mannuthy

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CERTIFICATE

Certified that the thesis, entitled **"CLINICOTHERAPEUTIC STUDIES ON MYCOTIC DERMATITIS IN CATTLE"** is a record of research work done independently by Sri. P. Arun Raphael, under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.

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P. ARUN RAPHAEL

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LIST OF ABBREVIATION

A/G	-	Albumin/Globulin
DTM	-	Dermatophyte test medium
PCV	-	Packed cell volume
RBC	-	Red blood corpuscles
SDA-C and C	-	Sabouraud's dextrose agar with chloramphenicol and cyclohexamide
Spp.	-	Species
T. mentagrophytes	-	*Trichophyton mentagrophytes*
T. verrucosum	-	*Trichophyton verrucosum*
Tr. Iodine	-	Tincture iodine

Introduction

INTRODUCTION

Skin is the largest organ in the body constituting 12 to 24 per cent of animal's body weight and is considered to be the mirror of health. The major functions of the skin are maintenance of normal body temperature and fluid and electrolytic balance within the animal. Moreover skin is the outermost integument of the body which is exposed to the adversities of environment.

The major effects of skin diseases in animal are esthetic and economic. The unsightly appearance of the animal distressesthe owner. Discomfort and scratching interfere with normal rest and feeding. Intervention of secondary infection may lead to grave consequences.

Skin diseases are broadly classified into parasitic and non-parasitic diseases. Parasitic diseases include those caused by parasites like fungi, mites, ticks, lice, fleas and flies. Non-parasitic skin diseases include those caused by bacteria, viruses, hormonal imbalances, immunologic abnormalities, hereditary factors, nutritional and environmental effects.

Mycotic infections are more prevalent in areas where the climate is hot and humid. Majority of cutaneous fungal infections are caused by dermatophytes belonging to *Microsporum* spp. and *Trichophyton* spp. The other group of fungi (non-dermatophytes) such as *Penicillium* spp. and *Aspergillus* spp. also produce cutaneous fungal infection (Sidhu *et al.*, 1992).

A peculiar type of dermatitis was reported in cattle and buffaloes from various parts of Kerala during 1990s. It was suspected to be of mycotic in origin and affected mainly the lower parts of hind limbs, udder and thighs. This disease caused severe loss of production, secondary complications, pain and sufferings to the animal (Madhusoodannan Pillai, 1993). Special emphasis was given to this disease in the present study.

Many topical medications like 0.5 per cent lime sulfur, 1 per cent Bordeaux mixture, 1 per cent povidone-iodine, 0.5 per cent sodium hypochlorite, tincture iodine, salicilic acid and benzoic acid are reported to be effective in treating mycoses. Moreover many indigenous preparations like paste made from *Cassia alata* leaves, cinnamon oil, karanji oil, garlic cream, and clove oil, are also reported to have good antifungal properties.

Under the above circumstances a study was designed with the following objectives.

1. *Documentation of clinical signs in various dermatological problems of cattle.*
2. Isolation and identification of causative organisms.
3. To understand the haematological and biochemical changes in skin disorders.
4. Biopsy and histopathological studies in selected cases.
5. Comparison of the efficacy of *Cassia alata* leaves paste, tincture iodine-glycerine combination and agricultural Bordeaux mixture (one per cent) in mycotic dermatitis of cattle.

REVIEW OF LITERATURE

Epidemiology and etiology

Dermatological disorders in cattle were caused by a variety of bacterial, viral and fungal agents, parasites, plant poisons and chemical agents

Kamyszek (1978) conducted clinical examinations of 2290 young bulls and heifers and reported skin lesions in 88 per cent of the animals. He found that the skin lesions were due to ectoparasites in 53 per cent of the animals, due to ectoparasites and fungi in 36 per cent of the animals and fungi alone in 11 per cent of the animals.

Nicholls and Rubria (1981) isolated *Staphylococcus aureus* from skin lesions of generalised exudative dermatitis.

Grunder (1984) reported skin lesions in 22 per cent of the cattle he examined. Out of this, 55 per cent were wounds, 34 per cent mange, 9 per cent lice, 1 per cent ring worm, and 0.2 per cent other skin diseases.

Boni *et al.* (1989) reported that the important dermatological disorders were chorioptic mange (29.47 per cent). Trichophyton infection (17.89 per cent), and lice infestation (15.79 per cent).

Al-Khafaji *et al.* (1995) reported an overall prevalence of 2.9 per cent of skin disease in cattle, of which 26.5 per cent were darmatomycosis.

Anilkumar (1996) reported that dermatological problems like tick infestation (37.22 per cent), lice infestation (25.72 per cent), mangy dermatitis (13.82 per cent), cutaneous mycosis (10.58 per cent), eczematosis (6.09 per cent), pox (4.75 per cent), tail necrosis (1.44 per cent) and wart (0.36 per cent) were common in crossbred cattle of Kerala.

Thyagaraja *et al.* (1997) in an epidemiological study of apeculiar leg dermatitis reported that it was caused by *Staphylococcus hyicus*, *Aspergillus*, *Mucor* and *Absidia* spp. and it was more prevalent during monsoon, in high humidity, in animals reared on concrete floors, those fed with commercial concentrates and infested with biting flies.

Mycotic dermatitis

Weiss and Bohm (1978) identified *Trichophyton verrucosum* (99.1 per cent), *T. mentagrophytes* (0.3 per cent) and *Microsporum canis* (0.3 per cent) from cattle mycotic dermatitis.

Pop *et al.* (1979) reported clinical and experimental features of dermatomycosis in calves due to *Penicillium*, *Rhizopus* and *Trichoderma* spp.

Jacobson (1980) isolated *Penicillium* spp. and *Geotrichum* from necrotizing mycotic dermatitis in snakes.

Sarkisov (1981) isolated *T. verrucosum*, *T. mentagrophytes* and *T. equinum* from cattle with mycotic dermatitis, and identified them as the main pathogens of trichophytosis in cattle

Nooruddin and Dey (1981) conducted a prevalence study of dermatophytosis in cattle and found that 4.96 per cent were positive for *T. verrucosum*.

Malik *et al.* (1984) isolated 18.33 per cent of *Trichophyton mentagrophytes* and 3.33 per cent of *T. verrucosum* from calves with ring worm.

Medvedeva *et al.* (1985) isolated *Penicillium*, *Mucor*, *Aspergillus*, *Alternaria* spp. and *T. verrucosum* from cattle with skin lesions.

Hasegawa (1986) diagnosed opportunistic fungus infection in animals. He isolated *Aspergillus* from cutaneous lesions in dogs.

Guha and Takur (1987) studied the mycoflora on body surface of cattle and found 29.5 per cent positive for fungi like *Aspergillus* and *Penicillium* and observed that these moulds remained as saprophytes on body surface and became pathogenic in conjunction with other factors.

Nooruddin and Singh (1987) reported an incidence of 1.56 per cent of mycotic dermatitis and isolated *T. verrucosum*, *T. mentagrophytes* and *M. gypseum* from cattle. The disease occurred throughout the year in all ages, breeds and sex. Prevalence was more in young crossbred cattle, especially during winter.

Vitos and Laszlo (1987) isolated *Aspergillus* spp.,*Penicillium* spp. and *Trichophyton* spp. from skin lesions of calves.

Jand and Gupta (1989) reported that non-dermatophytes like Penicillium and Aspergillus spp. caused skin lesions in dogs and the incidence was greater in warm and humid climate.

Glazebrook and Campbell (1990) isolated *Penicillium* spp. and *Fusarium* spp. along with various spp. of bacteria from traumatic ulcerative dermatitis of farmed turtles.

Mitra *et al.* (1990) isolated *Microsporum gypseum* and *T. mentagrophytes* from cattle with dermatophytosis.

Salambere and Rouille (1990) isolated *T. mentagrophytes* from zebu crossbred cattle aged three to 12 months.

Frye *et al.* (1991) reported penicillium dermatitis in three American alligators. *Penicillium* spp. was isolated from the skin lesions.

Anilkumar *et al.* (1992) isolated *Tricophyton* spp., *Microsporum* spp., *Aspergillus* spp. and *Penicillium* spp. from 6-18 month old calves.

Mahmoud (1993) reported an incidence of 48 per cent of fungal infection in camels with skin lesions. The most common organisms isolated were *T. verrucosum*, *T. mentagrophytes*, *Aspergillus* spp., *Penicillium* spp., *M. canis* and *M. gypseum*.

Borikar *et al.* (1994) studied the incidence of skin lesions in cattle and found that only 0.38 per cent were positive for dermatomycosis and the organisms isolated were of *Trichophyton* spp.

Pathogenesis

Jungerman and Schwartzman (1972) explained ring worm as a biologic contact dermatitis. Dermatophytes existed on the dead tissues of the skin such as the keratin of stratum corneum, hair and nail. Their direction of growth was downward. They produced the diseases through the excretion of toxins or allergens. These allergens evoked an inflammatory reaction followed by erythema, exudation, heat and alopecia. Dermatophytes were unable to survive with the inflammatory reaction and hence spread to periphery, leading to a circular patch of alopecia with central healing and an inflammatory reaction at periphery which created the classical ringed lesion.

Muller *et al.* (1989) explained that mycelia and spores could be seen affecting only the keratinized portions of the skin appendages. They infected only the hairs in the anagen stage of growth cycle. Acanthosis and inflammatory reaction were recorded in such cases. Hairs might break off but roots were intact. Fungi grew downward on the hair and stopped at Adamson's fringe. Folliculitis observed might be due to secondary bacterial infection.

Plauska *et al.* (1981) established the pathogenicity of fungi of various genera like *Aspergillus*, *Penicillium* and *Mucor* obtained from skin of the cows by

injecting them intraperitonially into guinea pigs and mice. Their pathogenic properties were assessed by histopathological examination of liver and kidneys.

Goldston and Wilkes (1982) reported that fungi released metabolic products into tissues causing an inflammatory reaction at the site.

Scott (1988) explained that fungal spores were viable for years and their incubation period varied from one to six weeks. It was transmitted by direct and indirect contact. Fungal elements deposited on skin surface, reached the follicle orifice in a couple of days and penetrated the hair shaft by working under cuticle and lifting it away from the shaft and growing downwardly. It reached the Adamson's fringe by 7th and 8th day. Fungi did not penetrate the mitotic region of hair and when the hair growth ceased, fungal growth also terminated.

Smith (1988) stated that dermatophytes did not involve or survive on living cells. He also stated that fungal growth enzymatically weakened the hair shaft and it broke off leaving a short stubble.

Medleau and Ristic (1992) pointed out that following penetration of hair cuticle the dermatophyte proliferated on the surface of the hair and migrated down to the hair bulb at the same rate that the hair grew upward.

Sidhu *et al.* (1992) established pathogenicity of non-dermatophytes. Suspensions of *Aspergillus* spp. *Penicillium* isolated from skin lesions were used

to infect guinea pigs. All the animals developed rashes, scabs, alopecia and scaly skin. Cultural examination of the skin scrapings were positive for these fungi.

Radostits *et al.* (1994) explained that a mycotoxin produced by *Penicillium* spp. and *Aspergillus* spp. viz., citrinin caused pruritis, hair loss, exudative papular dermatitis of perineum, udder, head and neck.

Quinn *et al.* (1994) explained that most fungi were opportunistic pathogens and predisposing factors like immuno-suppression, concurrent infections, constantly moist areas of the skin, breaks in the skin, often contributed to the establishment of fungal infection. The mechanisms by which dermatophytes caused lesions in the host was by a hypersensitivity reaction caused by fungal metabolic products.

Clinical features

Pandey and Cabaret (1980) reported that the lesions of *T. verrucosum* in adult cows occurred in thorax, limbs, dewlap, and inter maxillary area; and calves had lesions mostly around eyes.

Scott (1988) stated that tick-bite dermatitis had skin lesions like papules, pustules and wheals. Later these lesions developed into crusts, erosions, ulcers and alopecia. Only pain and pruritis were detected in some cases. Hypersensitivity and secondary bacterial infections were observed in some other

cases. He also reported that lice infestation produced varying degrees of anaemia. The clinical signs included patchy alopecia and excoriations.

Biting flies like *Haematopota*, *Stomoxys*, *Liperosia* and mosquitoes caused annoyance, irritation, pruritis and hyper sensitivity reaction in cattle. The clinical features of 'ring worm' wereannular areas of alopecia, raised crusty plaques, stubbled hairs, scaling, crusting and dermatitis. Combined infection of various fungi, furunculosis and folliculitis were common. Pain and pruritis were also present in some cases (Scott, 1988).

Salambare and Rouille (1990) reported that scaly crusted lesions were detected on the head, withers and dewlap in ring worm infection in calves due to *Trichophyton mentagrophytes*.

Frye *et al.* (1991) reported shallow, erosive integumentary lesions in penicillium dermatitis in American alligators.

Medleau and Ristic (1992) pointed out that dermatophytosis was usually non-pruritic and clinical signs included alopecia, erythema, scales and crusts. The lesions varied from scaly patches of alopecia to raised erythrematous nodules called kerions.

Munoz-Cobenas *et al.* (1992) reported that pruritis was seen in all animals, and in some cases wide areas of alopecia were observed in *Trichophyton mentagrophytes* and *T. verrucosum* infection.

Sidhu *et al.* (1992) reported the mycotic dermatitis produced by non-dermatophytes like *Aspergillus* spp. and *Penicillium* spp. All animals developed rashes, scabs, scaly skin, and alopecia

Thyagaraja *et al.* (1997) reported a peculiar leg dermatitis in dairy cattle, characterised by progression of dermatitis with erythema, and crust formation. It occurred upwards from interdigital joints to the carpal joints in the foreleg and to the stiffle joints in the hind leg, with occasional presence on the udder and groin area.

Clinical pathology

Jungerman and Schwartzman (1972) explained that histopathologic features of ring worm were variable. Little to no inflammatory reaction may be observed in association with presence of spores and hyphae in stratum corneum or on the hair shafts. On the other hand, an intense and destructive inflammatory reaction of the integument without evidence of fungal elements might be present. Moderate hyperkeratosis of epidermis, acanthosis and mononuclear cell infiltration might be the major pathologic findings in some other cases.

Benjamin (1978) observed neutrophilia in mycotic infection and eosinophilia in allergic conditions of skin in animals.

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

Ibrahim *et al.* (1984) reported haematological and biochemical changes in ring worm infected buffaloes and found that they had low erythrocyte count, low haemoglobin and packed cell volume, marked decrease in total protein, calcium and phosphorus levels and an increase in lymphocyte count.

Thomsen and Fougt (1984) stated that poor health, anaemia, staring coat and low selenium status were often associated with ring worm in calves.

Wisneiewski (1984) reported the subnormal amounts of copper, zinc, calcium and carotenes were found in plasma, serum and hairs of bulls with mycosis.

Wronska *et al.* (1984) studied the effect of ring worm on haematological values of cattle and found that *Trichophyton verrucosum* infection led to an increase in the proportion of gamma-globulin and lymphocytes. It had no effect on haemoglobin content, haematocrit and total protein.

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

Scott (1988) studied the histopathology of tick bite dermatitis in cattle and found focal epidermal necrosis and oedema along with infiltration of neutrophils, eosinophils and mononuclear cells.

Sidhu *et al.* (1992) found non-significant neutrophilia, decreased packed cell volume, lymphocytosis and monocytosis in mycotic dermatitis caused by non dermatophytes like *Penicillium* spp. and *Aspergillus* spp.

Zannetti (1992) observed that skin lesions in sheep were associated with a fall in the blood zinc levels, and the lesions cured when blood zinc levels became normal.

Logas *et al.* (1993) stated that various dermatological diseases were associated with low serum zinc levels.

Randhava *et al.* (1994) analysed various micro and macro-elements in leucodermic buffaloes and recorded decreased copper and zinc levels.

Willard *et al.* (1994) reported that fungal infection caused eosinophilia and neutrophilia.

Yadav *et al.* (1996) reported that dermatomycosis in cattle caused lower total erythrocyte count, total leucocyte count and eosinophils and higher percentage of lymphocytes.

Thyagaraja *et al.* (1997) found that there was moderate neutrophilia and eosinophilia in a peculiar leg dermatitis in cattle.

Diagnosis

Jungerman and Schwartzman (1972) reported that microscopic examination of hair and scales in 10 per cent potassium hydroxide solution was a rapid and reliable method for diagnosing ring worm infection. They also stated that Sabouraud's dextrose agar with chloramphenicol and cyclohexamide was an excellent medium for fungal culture.

Dion (1978) stated that dermatophyte test medium was found to be a useful aid for diagnosing animal ring worm along with other tests. A colour change of culture medium within a specified period indicated whether the organisms were pathogenic or saprophytic.

Takur and Verma (1984) identified fungal infection histologically from skin scrapings and biopsy specimens.

Pal (1987) diagnosed an outbreak of *Trichopphyton verrucosum* infection by potassium hydroxide method and cultures from skin scrapings of calves.

Llyod (1985) adopted techniques such as wood's lamp, skin scrapings, hair plucking, biopsies and blood sample examination for the diagnosis of bacterial, fungal, viral and protozoal infections of skin.

Smith (1988) stated that dermatophyte test medium was very helpful in diagnosing pathogenic dermatophytes; which metabolized proteins initially, thereby creating alkaline bye-products that turned media deep red, in the first three

to ten days. Non-pathogenic saprophytic fungi which initially used dextrose, produced no colour change within 14 days.

Dai *et al.* (1990) diagnosed dermatophytosis by microscopy after incubating the samples in Sabouraud's dextrose agar and dermatophyte test medium at 30°C and 37°C.

Medleau (1990) described various diagnostic methods like Woods light examination, direct microscopic examination of scales and hairs, histopathology of skin biopsy with H&E staining and PAS staining and fungal culture to diagnose mycotic infections.

Shearer (1991) stated that hair samples required for microscopy or fungal culture should be plucked with forceps, especially from the edge of active lesions and hairs should be mounted in potassium hydroxide or lactophenol cotton blue for microscopical examination.

Medleau and Ristic (1992) reported that positive identification of dermatophytes could be made by examining the slide preparations of a fungal colony. They also described the characteristics of the macro conidia and micro conidia of common dermatophytes.

Munoz-Cobenas *et al.* (1992) used direct microscopy and culture to identify *Trichophyton verrucosum* and *T. mentagrophytes* in cattle.

Quinn *et al.* (1994) explained the gross morphology of the fungal colony and type of pigmentation, along with microscopic appearance of fruiting heads and spores from the mount colonies identifying the species of dermatophytes cultured.

Treatment

Chopra *et al.* (1958) reported that local application of bruised leaves of *Cassia alata* against ring worm and other skin diseases was effective.

Murthy and Sirsi (1958) reported that the juice of the leaves of *Cassia* species was used to cure ring worm in man.

Jungerman and Schwartzman (1972) reported that solutions and tinctures of iodine at a concentration of two to five per cent were strongly fungicidal.

Ahmed *et al.* (1995) found that washing parts repeatedly with strong decoction of leaves and flowers of *Cassia alata* cured eczema.

Kritikar and Basu (1975) reported that *Cassia alata* was distributed in tropics like western and eastern Africa, India, Guniea and Gold coast. Its leaves, bark and flowers were effective against ring worm, eczema and other skin diseases.

Fuzellier *et al.* (1982) reported the antifungal activity of aqueous extract of *Cassia alata* against *Trichophyton* species, *Microsporum* species and *Candida* species.

Washes or sprays of agricultural Bordeaux mixture can also be used as a treatment in dermatophytosis in cattle (Fraser, 1986).

Prasad *et al.* (1986) found the antifungal activity of essential oils of ocimum species and clove oil, against *Microsporum* and *Trichophyton* species.

Sarkar (1986) found that ether extract of *Euphorbia thymifolia* was effective against *T. verrucosum* and *T. mentagrophytes* infection and cure was obtained after 19 days of treatment.

Al-Wakeel (1987) found that 5 per cent copper sulphate lotion had antifungal effects against *Aspergillus*, *Rhizopus* and *Mucor*.

Siqueira (1987) treated ring worm affected cattle using levamisole along with various agents and found that the levamisole treated group got cured sooner than other groups, showing the non-specific immunostimulant action of levamisole.

Guth (1988) found that thiabendazole was effective against ring worm in cattle at a dose rate of 20 mg/kg orally for 10 days.

Muller *et al.* (1989) found that iodine preparations had antifungal activity. Drugs like Ketaconazole, Clotrimazole and Gresiofulvin were also effective against fungal infection.

Sharma and Dwivedi (1990) used a herbal preparation containing onion, garlic, lemon extracts and powders of turmeric and camphor in karanji oil to treat

T. verrucosum infection in cattle and *M. canis* infection in dogs and obtained complete cure in 12-15 days.

Brander *et al.* (1991) reported that copper sulphate ointment and Whitfield's ointment were useful in fungal infections.

Frye *et al.* (1991) used povidone solution against penicillium dermatitis in American alligators and the disease was cured in 10 days. No recurrence of the disease was reported in three years follow up.

Goldston and Wilkes (1992) used shampoos containing iodine for treating dermatophytosis. They also used gresiofulvin in microsize form at a dosage of 20 mg/lb body weight orally for six weeks and was found effective.

Mnimh (1993) reported that the essential oil of cinnamon species distilled from the bark had antifungal properties and was used against a wide range of chronic skin infections in many parts of the world.

Radostits *et al.* (1994) reported that washes or sprays of agricultural Bordeaux mixture was having very good effect in treating dermatomycosis in horses.

Sharma *et al.* (1994) reported that local application of aqueous extract of garlic cream 10 per cent v/v cured *Trichophyton verrucosum* infection in 13 days.

Abou-Zaid (1995) found that Magenta mixture, and 3 per cent tincture iodine were highly effective against ring worm in camels caused by *T. verrucosum* and *M. canis*.

Materials and Methods

MATERIALS AND METHODS

Occurrence of dermatological disorders

Data on the occurrence of common dermatological disorders in cattle during last five years (from January, 1994 to December, 1998) were collected from the records maintained in the University Veterinary Hospitals, Kokkalai and Mannuthy.

Dermatological disorders selected at random were subjected to detailed clinical examination suggested by Scott (1988) and recorded in the proforma (Appendix).

Collection of clinical materials

Skin scrapings were collected aseptically as described by Jungerman and Schwartzman (1972) and Scott (1988). Whole blood and blood smears were obtained by the method suggested by Benjamin (1978). Biopsy specimens were collected as per the method suggested by Scott (1988).

Laboratory diagnosis

Skin scrapings collected were subjected to direct microscopical examination using ten per cent potassium hydroxide solution for the presence of fungal spores as described by Jungerman and Schwartzman (1972). Those clinical cases found positive for fungal spores were confirmed by cultural

examination in Sabouraud's dextrose agar with chloramphenicol and cyclohexamide (Jungerman and Schwartzman, 1972) and Dermatophytetest medium (Dion, 1978).

Identification of fungi was done by observing the gross colony characters in Sabrouraud's dextrose agar and by studying the microscopical characters of fungal spores and their mycelial relationship using a cellotape and staining with lactophenol cotton blue (Quinn *et al.*, 1994).

Experimental design

The cattle affected with various dermatological disorders presented at Veterinary Hospital, Kokkalai and Mannuthy were selected for the study. The study was conducted for a period of 12 months. A total of sixty clinical cases of dermatological disorders were selected at random and subjected to the following studies.

a. History and clinical data (Appendix)

b Examination of skin scrapings for parasitic/mycotic infection.

c. Cultural examination of skin scrapings found positive for fungal spores.

d. Isolation and identification of the fungus.

The collection site was cleaned first with soap and water, then with alcohol to remove bacterial and fungal contaminants. Hair and scales were taken by using

sterile forceps/scalpel and placed in a clean envelop. Then the hairs and scales were pressed aseptically and firmly into Sabouraud's dextrose agar with chloramphenicol and cyclohexamide (SDA-C and C). These plates were incubated in the dark for 30 days. Identifiable growth could be seen in five to eight days.

Another sample of the same material was inoculated in Dermatophyte test medium (DTM). The composition of DTM wasSabouraud's dextrose agar with added phenol red as indicator. The DTM cultures were interpreted before they were 14 days old as per Chandler *et al.* (1991).

Each species of fungus produced characteristic macroconidia which was identified microscopically using cellotape and lactophenol cotton blue staining technique after three weeks (Quinn *et al.*, 1984).

Animals that were confirmed for mycotic dermatitis were subjected to treatment trails.

e. Biopsy and histopathological studies of selected cases (Chandler *et al.*, 1980 and Scott, 1988).

f. Haematological studies: Total erythrocyte count, total leucocyte count, estimation of haemoglobin, packed cell volume and differential leucocyte count (Wintrobe *et al.*, 1981).

g. Biochemical studies

(i) Total plasma protein by Biuret method (Welchselbaum, 1946).

(ii) Estimation of albumin, globulin and A/G ratio by Bromcresol green method (Doumas, 1971).

(iii) Estimation of zinc and copper by atomic absorption spectrophotometry (Perkin-Elmer, 1982).

h. Samples collected from 10 healthy animals served as control.

Experimental design for the therapeutic trails

Twenty four positive cases of mycotic dermatitis were randomly divided into three groups, viz., A, B and C.

In the Group A of eight animals, *Cassia alata* leaves (Plate 1) paste in water (1:1 ratio) was used. The paste was applied topically twice daily for a period of one month.

The paste was prepared by crushing the leaves with equal quantity of water (1:1 ratio) in a mortar and pestle and applied twice daily for a month. Freshly prepared paste was used each time. Bandage was applied over the paste to avoid licking and for having good contact with the skin.

In the Group B of eight animals, tincture iodine-glycerine combination (1:1 ratio) was applied topically twice daily for one month. Bandage was applied over the medicine to prevent licking.

In the Group C of eight animals, Bordeaux mixture (one per cent) was applied twice daily for one month.

The Bordeaux mixture (one per cent) was prepared by mixing solutions of copper sulphate and quick lime. At first stock solution of two constituents were made separately by dissolving 500 g of copper sulphate/quick lime in four litres of water. Copper sulphate was dissolved by placing it in a piece of gunny bag and suspending it in water in earthen vessel.

Lime was first slaked with small quantity of water and then made to a thin paste before remaining water was added to it, each ml of stock solution was made up to eight ml just before use. These diluted solutions were mixed together just before use by pouring copper sulphate solution into lime solution. The pH of the mixture was tested by dipping litmus paper and was confirmed to be either neutral or alkaline. Deterioration of the mixture was prevented by adding some sugar to the mixture at the rate of 60 g/225 litre (Sharma, 1997).

In all the experimental groups the course of the illness and the lesions were observed for a minimum period of one month. Skin scrapings were collected from all the treated animals one week after the course of treatment and were examined for fungal spores. The animals were further observed, for a period of two months as follow up for assessing the efficacy of the treatment and to check any recurrence of the disease.

Results

RESULTS

Occurrence

A total of sixty cattle affected with various dermatological problems were used for this study.

Data on the occurrence of dermatological disorders collected from university veterinary hospitals at Kokkalai and Mannuthy for the period from January - 1994 to December 1998 revealed that out of 69224 cattle treated, 3111 (4.49 per cent) had dermatological problems.

Out of the dermatological cases reported, 1192 (38.32%) had mycotic dermatitis, 994 (31.95%) had fly bite/ectoparasite dermatitis and 925 (29.73%) had non-specific dermatitis or other dermatological problems (Table 1). Highest incidence was noticed in October and November months and lowest in January (Table 2).

Clinical examination

The clinical cases were classified under three groups. Group I. constituted twenty four animals with mycotic dermatitis. Group-II – constituted thirteen animals with non-specific dermatitis and Group III, constituted twenty three animals with fly bite dermatitis\ectoparasitic dermatitis.

Physiological parameters viz., respiration, pulse and temperature were found to be within the normal range.

In Group I animals with mycotic dermatitis, detailed clinical examination of each case revealed that configuration of the lesions were extremely variable in majority of the cases.

The organisms identified were *Trichophyton verrucossum* in eight cases, *Penicillium* species in seven cases, *Penicillium* and *Trichophyton mentagrophytes* in seven cases, *Penicillium* spp. and *Aspergillus* spp. in one case and *Trichophyton mentagrophytes* and *Aspergillus* species in another case.

Important clinical signs in mycotic dermatitis caused by *Trichophyton verrucosum* infections were raised eruptions of one to three cm. in diameter which were initially noticed at the head and later spread to neck, shoulders, flank and perinium. Scaling, itching, and crusty plaque formation were present. Alopecia was evident, at the centre of lesions with inflammatory periphery. Overgrowth and hypopigmentation of hairs at periphery of lesions were noticed. Skin thickness had increased and elasticity of skin reduced at the site of lesions. Slight elevation of temperature was recorded in some cases. Feed consumption and milk production were less in all cases. No correlation was detected between the condition and watering, brand and type of the feed or housing. Presence of biting flies like stomoxys and mosquito was noticed in all cases. Animals were not

healthy in most cases. Most of the affected animals were young (<four years of age).

Important clinical signs in mycotic dermatitis caused by *Penicillium* spp. and mixed infections of *Penicillium* spp,. *Trichophyton mentagrophytes* and *Aspergillus* spp. were slight rise in temperature, skin lesions on all four limbs up to thigh in hind limbs and upto point of elbow on fore-limbs, perinium and udder in most cases. In four cases lesions were also seen on the lower jaw and around mouth.

Severe inflammation and cracked skin were noticed in all cases. Secondary bacterial infection, oedema, pruritis, epilation, difficulty in walking, erythema, hyper keratosis, hypopigmentation and overgrowth of hairs around the lesions were noticed in all cases. The skin was thickened with inflammatory exudate in almost all cases.

In all cases the disease began at pastern region of hind limbs and then spread upwards and then to forelimbs. Biting flies like stomoxys, liperosia and mosquitoes were present in all cases. All animals were fed with concentrates. Ten cases had a history of previous infection. More than one animal of the same shed was affected. Mostly the disease was noticed in dry season (December to April). No significant relation to brand/type of feed, type of water, type of shed or other management practices were found. Fly bite/parasitic dermatitis showed lesions like papules, pustules and wheals which later developed into crusts and erosions. They also showed pruritis, hypersensitivity reaction and irritation. Nonspecific or other types of dermatological disorders were observed mostly in animals with poor health. Pruritis, generalised alopecia, hypopigmentation of hair and anaemia were observed. Secondary bacterial infections were common in these animals.

Laboratory diagnosis

Hair and skin scrapings collected from cows suspected of mycotic dermatitis were subjected to direct microscopic examination. Fungal spores were found arranged in irregular masses on the surface of hair (ectothrix arrangement) (Plate 2).

Isolation and identification of organism

Twenty four fungal cultures obtained were identified. *Trichophyton verrucosum* produced a change of colour from yellow to claret red between five to eight days after inoculation of skin scrapings in dermatophyte test medium.

In mixed infection of penicillium spp., *Trichophyton mentagrophytes* and Aspergillus spp. the colour change was recorded in seven to eleven days after inoculation.

Penicillium spp. cultures produced colour change in eight to fourteen days of inoculation.

Final identification of fungi from the Sabouraud's dextrose agar revealed *Trichophyton verrucosum* (Plate 3) in eight cases, *Penicillium* species (Plate 4) in seven cases, mixed infection of *Penicillium* spp. and *Trichophyton mentagrophytes* (Plate 5) in seven cases, *Penicillium* spp. and *Aspergillus* spp. (Plate 6) in one case and *Trichophyton mentagrophytes* and *Aspergillus* spp. in another case.

Haematological and biochemical changes observed in various types of dermatological disorders in cattle

The dermatological cases were classified under three groups. Group I comprising of twenty four animals with mycotic dermatitis. Group II with thirteen animals suffering from non-specific dermatitis or dermatitis of other etiologies. Group III. constituted twenty three animals with parasitic/fly bite dermatitis. The haematological and biochemical parameters of these animals were compared with ten healthy control animals. The results are given below.

1. Haemoglobin

The mean values of the control group and treated animals are presented in the Table 3. The mean haemoglobin value in the control group was 11.78 ± 0.42 g/dl. For the mycotic dermatitis group the mean haemoglobin value recorded was 10.75 ± 0.59 g/dl.

The mean haemoglobin level of parasitic/fly bite dermatitis group was 10.10 ± 0.45 g/dl and the mean haemoglobin value of animals with nonspecific dermatitis was 6.94 ± 0.27 g/dl.

There was no significant difference between control group and mycotic dermatitis animals. No significant difference was noticed between control group and parasitic/fly bite dermatitis group. But haemoglobin was significantly lower in animals with nonspecific dermatitis in comparison with the control animals.

2. Total erythrocyte count

The mean total erythrocyte count in the control group was 7.34 ± 0.30 millions/µl. For the mycotic dermatitis group the mean was 6.62 ± 0.38 million/µl. The non-specific dermatitis group showed a value of 4.67 ± 0.27 millions/µl. The fly bite dermatitis group showed a mean value of 5.93 ± 0.21 million/µl.

The total erythrocyte count was significantly lower than control animals in non-specific dermatitis group. In mycotic dermatitis group no significant difference was noticed with control group. The parasitic/fly bite dermatitis group showed statistically significant lower values of total erythrocytic count than the control group but the values were within the normal range.

3. Total leucocyte count

The mean total leucocyte count of the control group was 8115.4 ± 343.74 per µl and that of mycotic dermatitis group was 7734.5 ± 425.54. The mean total leucocytic count of non-specific dermatitis was 6324.46 ± 472.89 and that of parasitic/fly bite dermatitis was 6911.91 ± 257.54.

There was no significant difference between control animals and mycotic dermatitis animals. Parasitic/fly bite dermatitis animals also showed non-significant changes when compared to the control animals. But non-specific

dermatitis animals showed statistically significant lower values in comparison with the control group but the mean values were with in the normal range.

4. Differential leucocyte count

a. Neutrophils

The mean neutrophil values of the control group was 32.0 ± 1.53 and that of mycotic dermatitis animals were 40.63 ± 1 25. The mean value of non-specific dermatitis was 31.69 ± 1.55 and that of fly bite/parasitic dermatitis was 33.87 ± 1.14.

The values were significantly higher in mycotic dermatitis animals in comparison with the control group. But no significant difference was noticed in the other two groups in comparison with the control animals.

b. Lymphocytes

The mean lymphocyte value in the control group was 61.40 ± 2.03 and that of mycotic dermatitis was 45.46 ± 1.7. The mean values of non-specific dermatitis animals were 59.08 ± 1.73 and that of parasitic dermatitis/fly bite group was 53.70 ± 1.29.

Statistically significant difference was noticed in the mycotic dermatitis group and parasitic/fly bite dermatitis group when compared to the control group. But the values were in the normal range. No significant difference was noticed in the non-specific dermatitis group.

c. Monocytes

The mean monocyte value in the control group was 3.20 ± 0.53 and that of mycotic dermatitis group was 4 ± 0.33. The mean value in the non-specific dermatitis group was 2.85 ± 0.35 and that of parasitic dermatitis group was 2.52 ± 0.23.

There was statistically significant difference in all the 3 groups when compared with control group. But all the values were within the normal range.

d. Eosinophils

The mean value of eosinophills in the control group was 3.40 ± 0.75 and that of mycotic dermatitis group was 10.25 ± 0.48. The mean value in the case of nonspecific dermatitis was 6.39 ± 0.77 and that of fly bite dermatitis was 9.48 ± 0.39.

All groups showed significant difference from the control group. Eosinophilia was present in all the three groups.

5. Packed cell volume

The mean packed cell volume of the control group was 36.3 ± 1.58 per cent and that of mycotic dermatitis group was 32.0 ± 1.79 per cent.

The mean values of non-specific dermatitis were 20.08 ± 0.82 per cent and that of parasitic dermatitis were 29.57 ± 0.90 per cent.

No significant difference noticed between control group and mycotic dermatitis group. The mean values of non-specific dermatitis were significantly lower than the control group. The mean value of parasitic dermatitis group was also significantly lower than the control group but was within the normal range.

6. Total protein

The mean total protein of the control group was 6.96 ± 0.22 g/dl and that of mycotic dermatitis group was 7.56 ± 0.25 g/dl. The mean values of parasitic dermatitis group was 7.35 ± 0.16 g/dl and that of non-specific dermatitis group was 5.05 ± 0.14 g/dl.

The mean total protein of mycotic dermatitis group and parasitic dermatitis group was slightly higher than the control group but were within the normal range. The mean values of non-specific dermatitis group was significantly lower than the control group.

7. Albumin

The mean albumin values of the control group was 3.21 ± 0.11 g/dl and that of mycotic dermatitis group was 3.25 ± 0.94 g/dl. The mean values of non-specific dermatitis group was 2.64 ± 0.10 g/dl and that of parasitic/fly bite dermatitis was 2.84 ± 0.11 g/dl.

No significant change was noticed between control group and mycotic dermatitis group. The albumin values were significantly lower in parasitic

dermatitis group and non-specific dermatitis group when compared with the control group.

8. Globulin

The mean globulin value of the control group was 3.35 ± 0.26 g/dl and that of mycotic dermatitis group was 3.91 ± 0.18 g/dl. The mean value of non-specific dermatitis was 2.02 ± 0.19 g/dl and that of parasitic dermatitis was 4.14 ± 0.12 g/dl.

No significant change was noticed in the mean values of control group and mycotic dermatitis group whereas significantly lower values were obtained in non-specific dermatitis and in parasitic dermatitis. Although statistically significant difference was noticed the values were within the normal range.

9. Albumin/globulin ratio

The mean albumin/globulin ratio in the control group was 1.04 ± 0.13 and that of mycotic dermatitis group was 0.86 ± 0.04. The mean value of non-specific dermatitis was 1.52 ± 0.23 and that of parasitic dermatitis group was 0.69 ± 0.04. No significant difference noticed between mycotic dermatitis group and control group. Significant difference was noticed between control group and both non-specific dermatitis group and parasitic dermatitis group.

10. Copper

The mean value of copper of the control group was 125.6 ± 4.18 µg/ml and that of mycotic dermatitis was 80.67 ± 3.33 µg/ml. The mean value of non-specific dermatitis group was 30.63 ± 2.65 µg/ml and that of parasitic dermatitis group was 93.65 ± 2.19 µg/ml.

The copper values were significantly lowered in all the three groups when compared with the control group.

11. Zinc

The mean values of zinc levels in control group was 183.0 ± 8.17 µg/ml and that of mycotic dermatitis was 95.42 ± 4.14 µg/ml. The mean values of non-specific dermatitis was 72.69 ± 6.21 µg/ml and that of parasitic dermatitis was 150.44 ± 8.03 µg/ml.

The mean zinc values were significantly lower in all the three groups when compared to the control group. But in parasitic dermatitis group the values were in the normal range.

Histopathological examination

A histopathological study was also conducted in selected cases. All sections were stained with haematoxylin and eosin stain and the following observations were made.

In one case of non-specific dermatitis, (Plate 7) there was chronic dermatitis characterised by epidermal hyperplasia involving all the layers, chiefly the stratum corneum and the shedding of the keratinised scales. There was also lymphocytic infiltration into the epidermis.

In another case of non-specific dermatitis (Plate 8) well cornified root sheath surrounded by wide areas of keratinised scales and papillomatous proliferation of dermal papillae were observed.

In another type of non-specific dermatitis (Plate 9) marked ortho and parakeratotic hyperkeratosis and infiltration by inflammatory cells were recorded.

In the case of mycotic dermatitis caused by *Penicillium* spp. (Plate 10) epidermal hyperplasia with marked *hyperkeratosis* was noticed. The root sheath was well cornified. The crusts were composed primarily of fungal hyphae. There was also infiltration of chronic inflammatory cells. In another case of mycotic dermatitis caused by *Penicillium* spp. and *Trichophyton mentagrophytes* (Plate 11) invasion of the hair follicle by the fungus and loss of hair was noticed. There was also invasion of fungi beneath the stratum corneum resulting in the detachment of hair.

Treatment trials

In the Group A (treatment trial with *Cassia alata*), *Penicillium* spp. was isolated from four cases; *Trichophyton verrucosum* in three cases, *Penicillium* spp. and *Trichophyton mentagrophytes* in one case (Plate 12).

In Group B (Tr. Iodine Glycerine combination) *Trichophyton verrucosum* was isolated from 3 cases, *Penicillum* spp. three, *Penicillium* and *Trichophyton mentagrophytes* in one case and *Aspergillus* spp. in another (Plate 14).

In Group C (Bordeaux mixture- 1 per cent) *Trichophyton verrucosum* was isolated in two cases, *Trichophyton mentagrophytes* and *Penicillium* spp. from five cases, *Penicillium* spp. and *Aspergillus* spp. from one case (Plate 16).

Response to treatment trials

All animals in Group A; which were treated with *Cassia alata* leaves paste showed complete recovery (Plate 13). All animals showed signs of improvement from first week onwards. Among the animals treated five animals recovered in fifteen days and the rest by twenty first day. The lesions were completely cured at the end of the treatment. No fungal spores could be demonstrated microscopically in the recovered animals and there was no growth on Sabouraud's Dextrose Agar.

Seven animals in the Tr. Iodine - Glycerine treated group (Group B) showed improvement by the seventh day of treatment and was completely cured by thirteenth day of treatment (Plate 15).

One animal did not show much improvement and was treated with griseofulvin for 30 days.. Skin scrapings were negative for fungal spores and no organisms were isolated in SDA-C and C after thirty days of treatment.

All the animals in the group C that were treated with Bordeaux mixture - 1% showed complete recovery. Most animals showed signs of recovery from the third day onwards. The lesions were almost cured by eleventh day. By about two weeks, complete recovery was noticed in six animals and the rest two animals showed complete recovery by 21st day. Fungal spores could not be observed on microscopical examination of skin scrapings and no fungal growth was obtained on culturing from animals of this group after recovery (Plate 17).

Table 1. Occurrence of mycotic dermatitis from January – 1994 to December – 1998

Total bovine cases	Total dermatological cases	Mycotic dermatitis	Parasitic/fly bite dermatitis	Non-specific/other dermatitis
69224	3111	1192	994	925
		38.32%	31.95%	29.73%
Net	4.49%	1.72%	1.44%	1.34%

Table 2. Monthwise occurrence of different dermatological disorders from Jan. 1994 to December – 1998.

Month	Total bovine cases	Mycotic dermatitis	Parasitic/fly bite dermatitis	Non-specific/ others	Total dermatological cases	Percentage
January	5992	66	67	66	199	3.32
February	5770	100	83	85	264	4.58
March	6430	75	60	80	215	3.34
April	5371	125	124	77	326	6.07
May	5124	80	68	75	223	4.11
June	5430	80	68	75	223	4.11
July	6166	117	79	74	230	3.73
Aug.	6926	170	55	84	318	4.59
Sept.	5450	118	56	84	258	4.73
Oct.	5853	90	146	84	320	6.08
Nov.	5260	90	146	84	320	6.08
Dec.	5452	82	93	81	256	4.70

Table 3. Mean values of haematological and biochemical parameters ± standard deviation.

Parameters	Control	Group I Mycotic dermatitis	II. Non-specific/other dermatitis	Parasitic/fly bite dermatitis
1. Haemoglobin – g%	11.78 ± 0.42	10.75 ± 0.59	6.94 ± 0.27	10.10 ± 0.45
2. Total RBC million/µl	7.34 ± 0.30	6.62 ± 0.38	4.67 ± 0.27	5.93 ± 0.21
3. Total WBC 10^3/µl	8115.40 ± 343.74	7734.50 ± 425.54	6324.46 ± 472.89	6911.91 ± 257.54
4. Neutrophil - %	32.0 ± 1.53	40.63 ± 1.25	31.69 ± 1.55	33.87 ± 1.14
5. Lymphocyte - %	61.4 ± 2.03	45.46 ± 1.7	59.08 ± 1.73	53.70 ± 1.29
6. Monocyte - %	3.2 ± 0.53	4 ± 0.33	2.85 ± 0.35	2.52 ± 0.23
7. Eosinophil - %	3.4 ± 0.75	10.25 ± 0.48	6.39 ± 0.77	9.48 ± 0.39
8. PCV - %	36.3 ± 1.58	32.0 ± 1.79	20.08 ± 0.82	29.57 ± 0.90
9. Total protein – g/dl	6.96 ± 0.22	7.56 ± 0.25	5.05 ± 0.14	7.35 ± 0.16
10. Albumin – g/dl	3.21 ± 0.11	3.25 ± 0.94	2.64 ± 0.10	2.84 ± 0.11
11. Globulin g/dl	3.35 ± 0.26	3.91 ± 0.18	2.02 ± 0.19	4.14 ± 0.12
12. A/G ratio	1.04 ± 0.13	0.86 ± 0.04	1.52 ± 0.23	0.69 ± 0.04
13. Copper µg/ml	125.6 ± 4.18	80.67 ± 3.33	30.63 ± 2.65	93.65 ± 2.19
14. Zinc µg/ml	183.0 ± 8.17	95.42 ± 4.14	72.69 ± 6.21	150.44 ± 8.03

Table 4. Gross colony and microscopic characters of the fungal organisms isolated

Organisms isolated	Gross colony characters	Microscopic characters
Trichophyton verrucosum	Slow growing, small white velvette heaped and folded colony. Colour varies from grey to whitish grey	Macroconidia are rare, but chlamydospores forming chains are characteristics of this species
Trichophyton mentagrophytes	Colony is woolly and white with older colonies becoming cream tan	Macroconidia few in number, elongated and cigar shaped. Walls are thin and smooth and divided by septa to 3-8 cells. Microcondia numerous and borne singly along the hyphae and in grape like clusters.
Penicillium spp.	Rapid growth – Bluish green and velvetty colony	Brush like arrangement of fruiting head. Conidiophores have secondary branches (metulae) bearing whorls of phialides from which the smooth or rough and round conidia (2.5-5.0 µm) are borne.
Aspergillus spp.	Moderately rapid growth. Surface has spreading white, cottony aerial mycelium, later turning grey	Conidiophore unbranched and rising from a foot cell. A swollen vesicle is produced at the tip of the conidiophore and from this arise the phialides, or metulae and then phialides. The latter produce chains of round conidia (2-5 µm)

Plate 1. *Cassia alata* plant

Plate 2. Fungal spores arranged in irregular masses on the surface of hair

Plate 3. *Trichophyton verrucosum* hyphae with chlamydospores

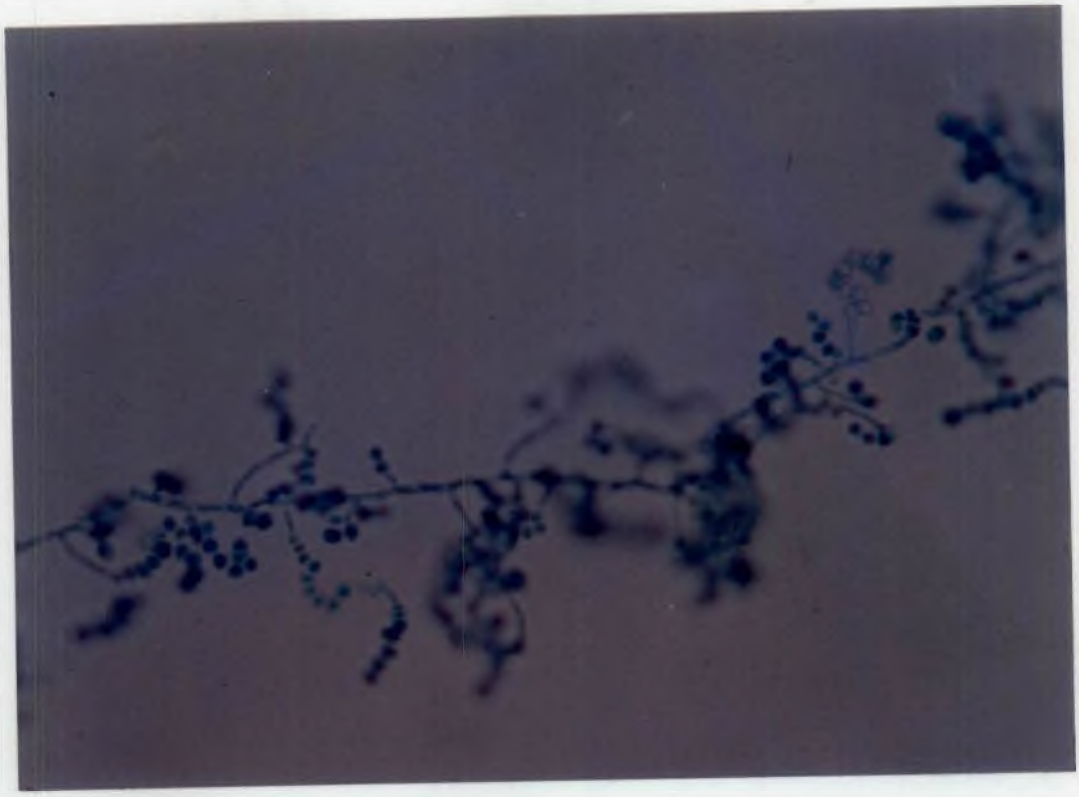
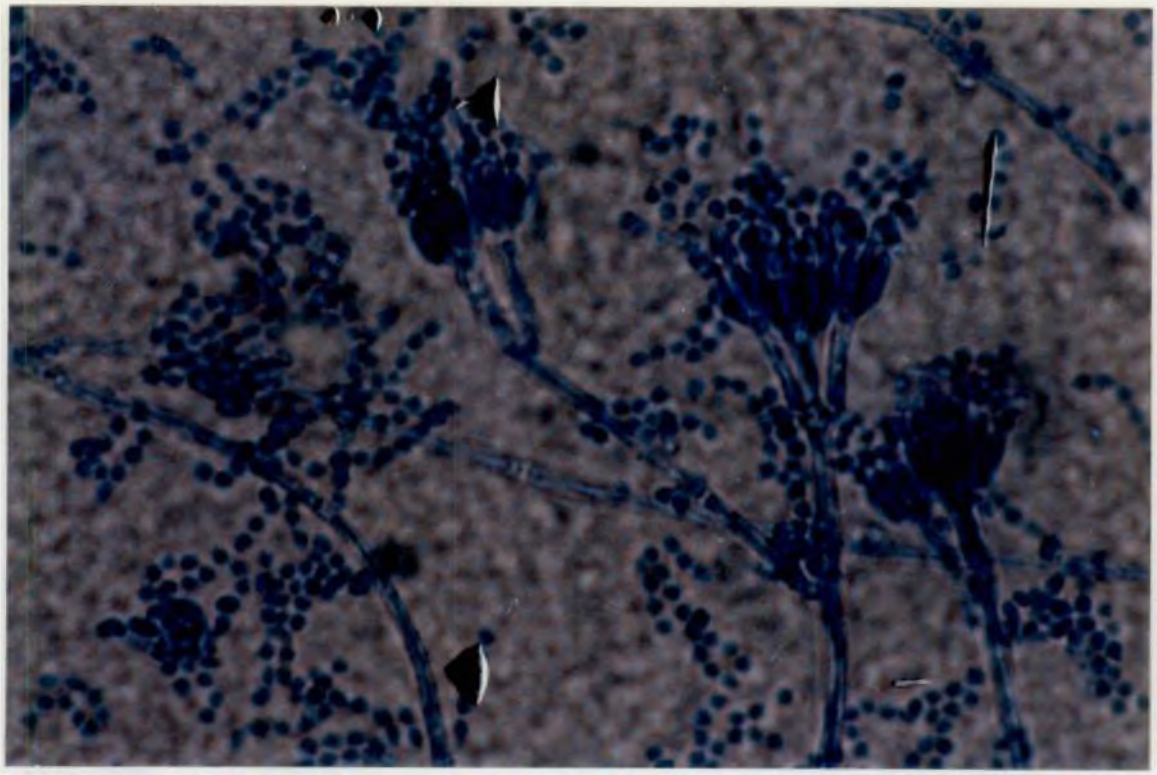


Plate 4. *Penicillium* spp. (Brush like arrangement of fruiting head)

Plate 5. *Trichophyton mentagrophytes* – Elongated and cigar shaped macroconidia



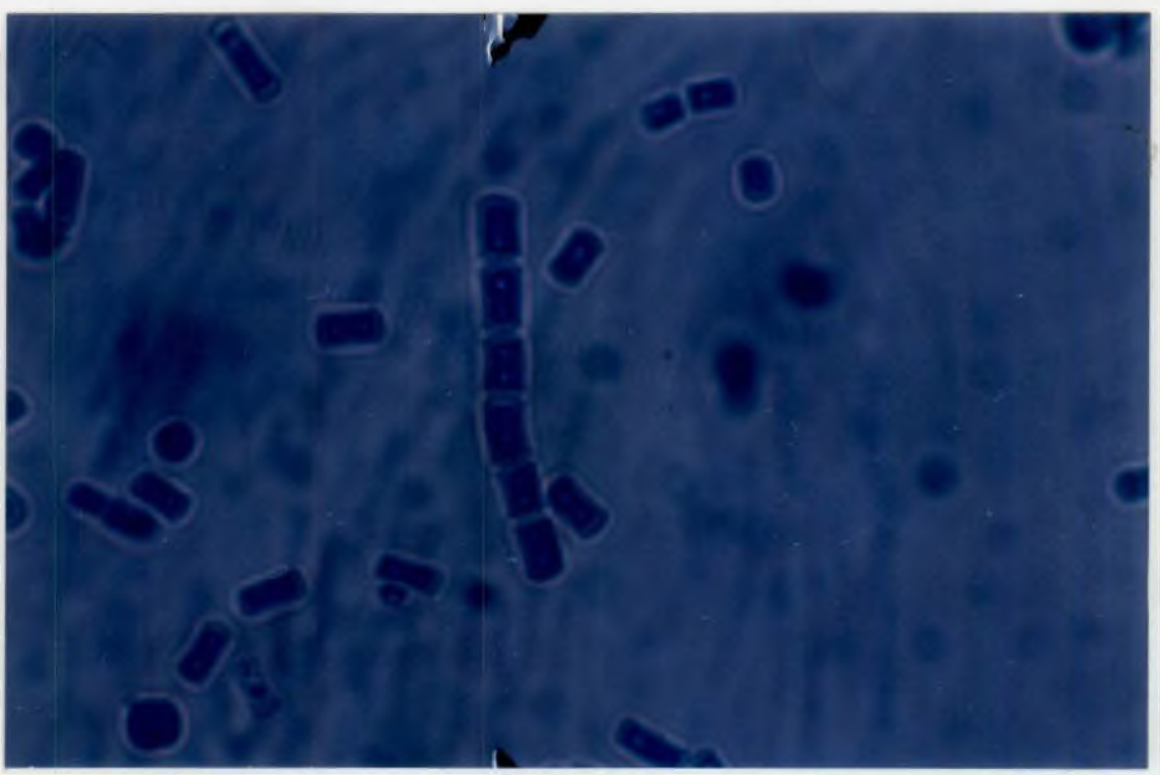
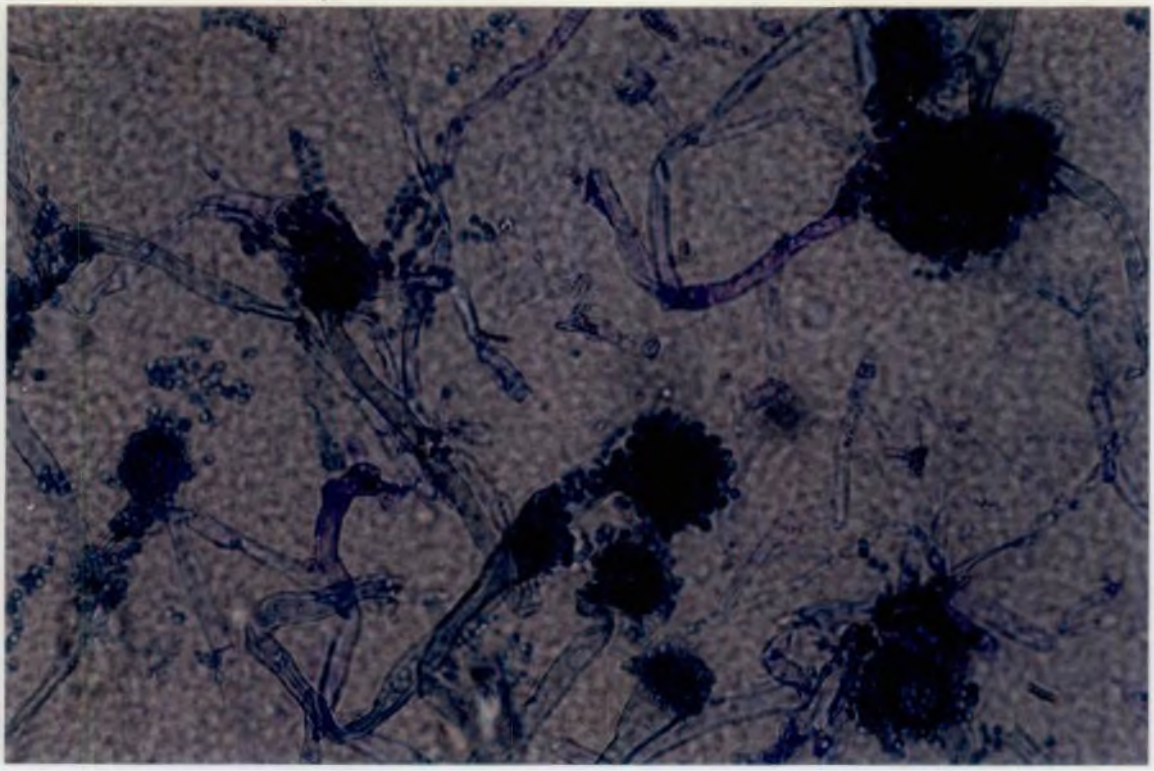


Plate 6. *Aspergillus* spp. – conidiophore, unbranched. A swollen vesicle is produced at the tip of the conidiophore and from this metulae are formed

Plate 7. Chronic dermatitis characterised by epidermal hyperplasia, involving all the layers, chiefly the stratum corneum and shedding of the keratinised scales. Lymphocytic infiltration into the epidermis also seen.



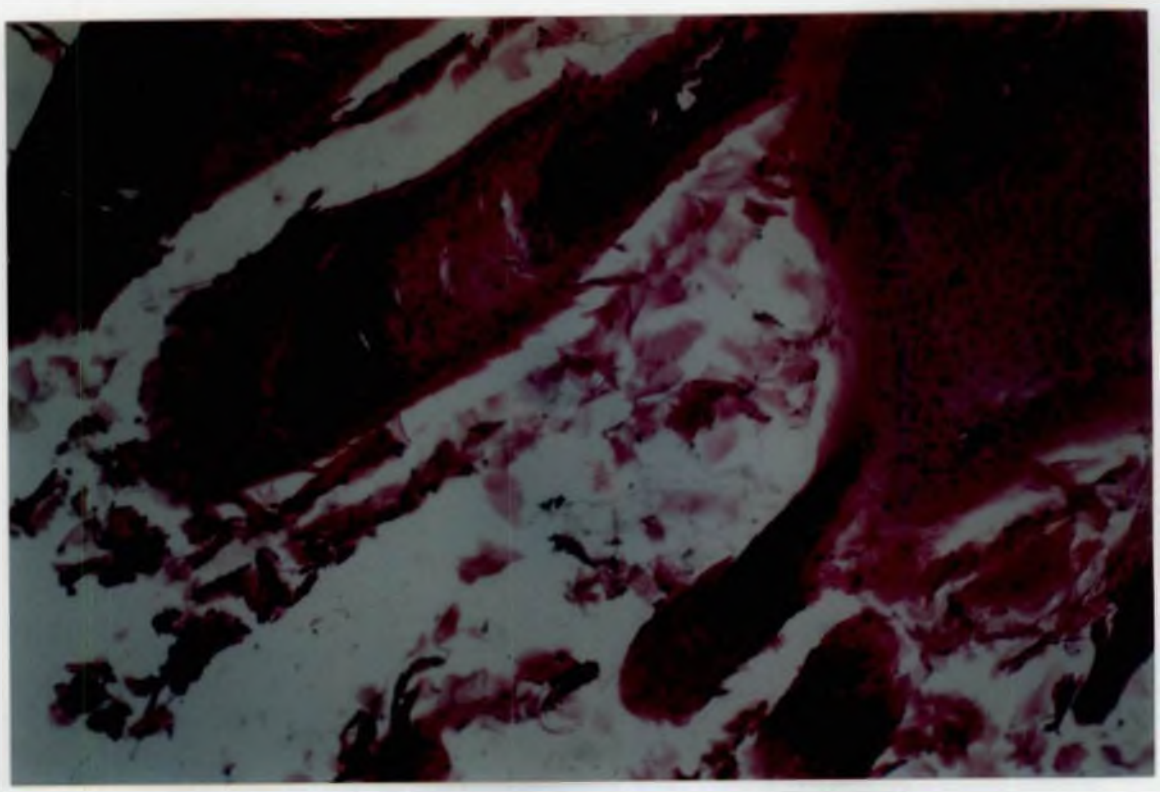


Plate 8. Nonspecific dermatitis showing wide areas of keratinised scales and papillomatous proliferation of dermal papillae.

Plate 9. Nonspecific dermatitis showing marked ortho and parakeratotic hyperkeratosis and infiltration by inflammatory cells. Well cornified root sheath also seen.

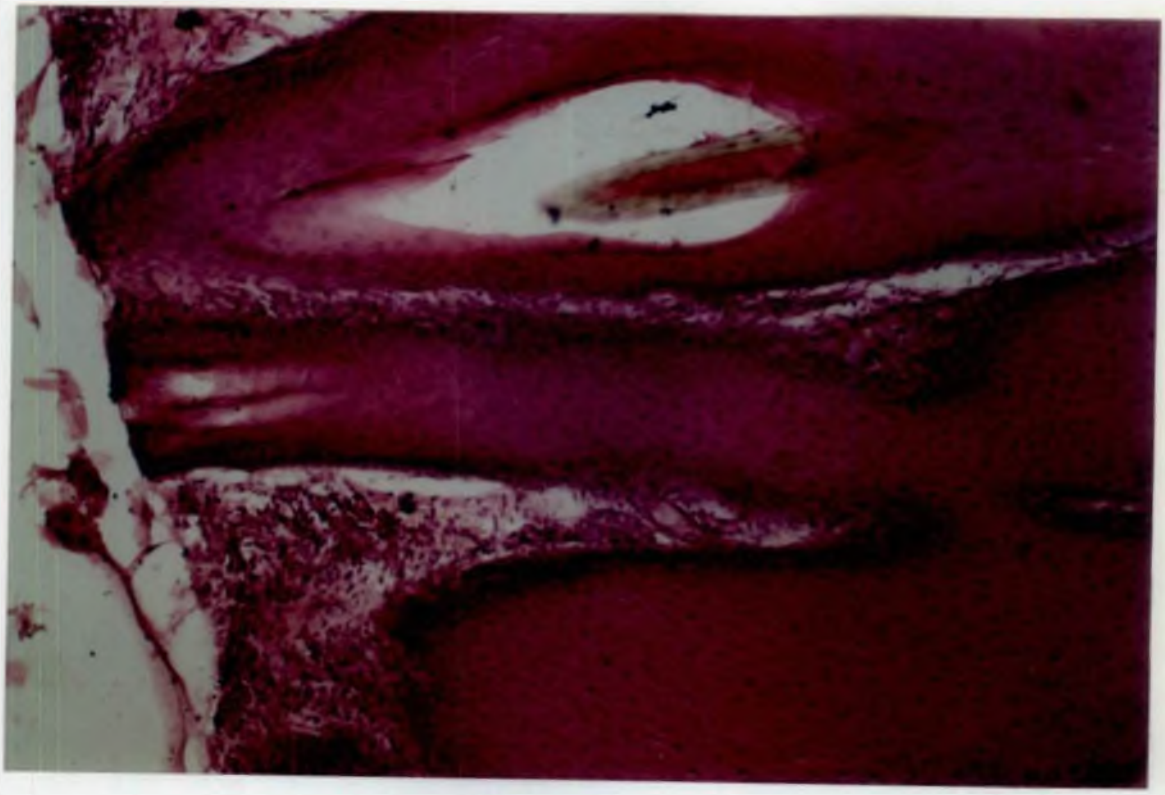
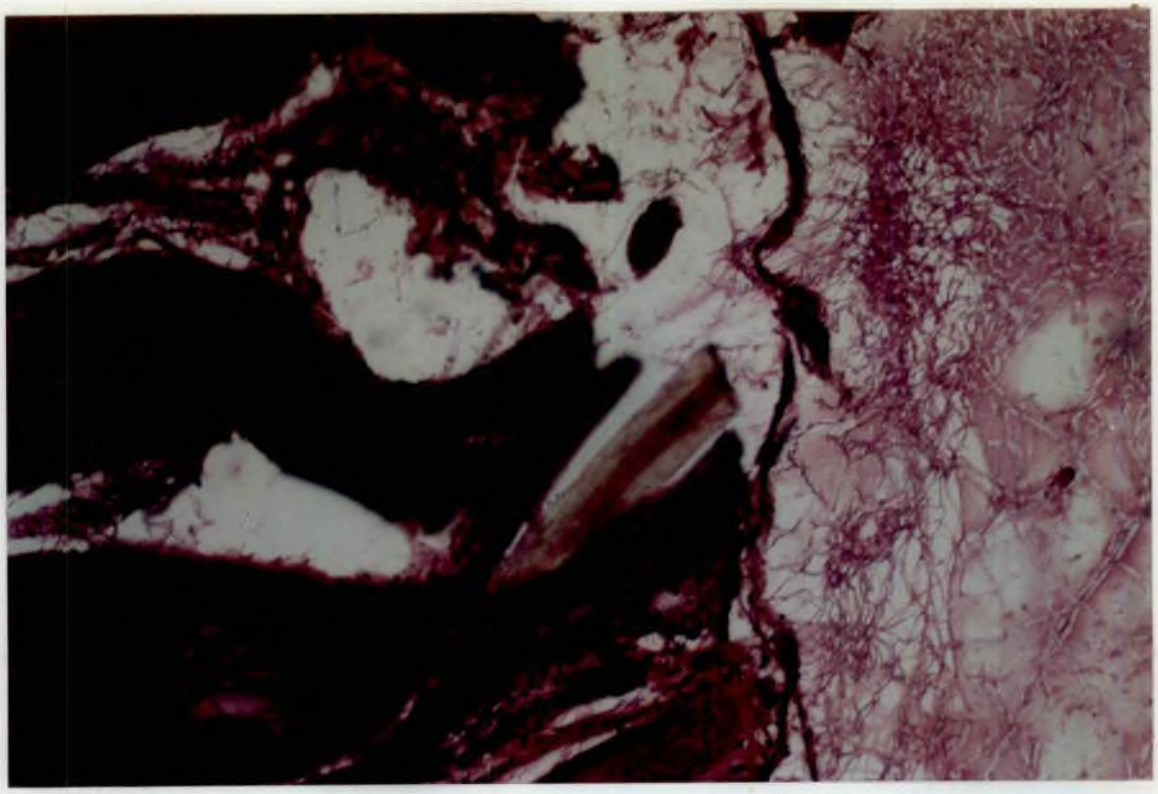


Plate 10. Mycotic dermatitis caused by *Penicillium* spp. showing epidermal hyperplasia with marked hyperkeratosis. Root sheath was well cornified. The crusts were composed of fungal hyphae. Infiltration of chronic inflammatory cells also seen.

Plate 11. Mycotic dermatitis caused by *Penicillium* and *Trichophyton mentagrophytes* showing invasion of the hair follicle by fungus and loss of hair. Invasion of fungi beneath stratum corneum also seen. Infiltration of inflammatory cells also noticed.



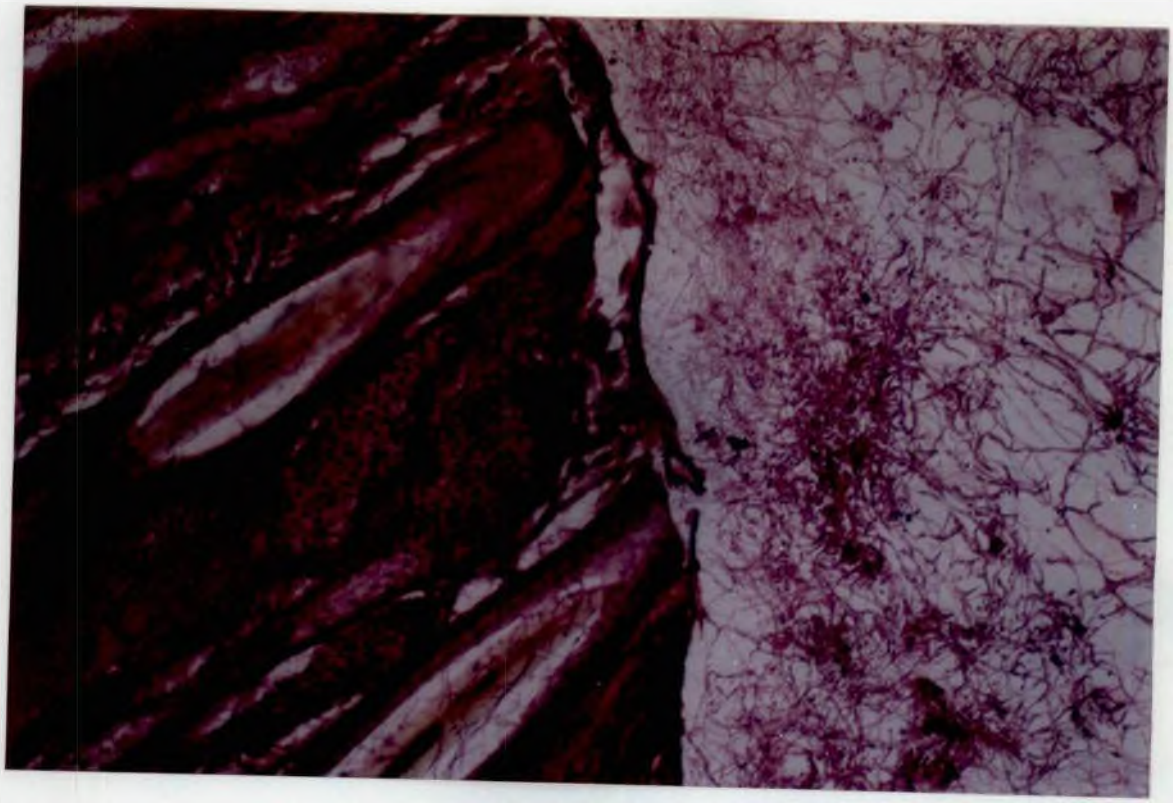
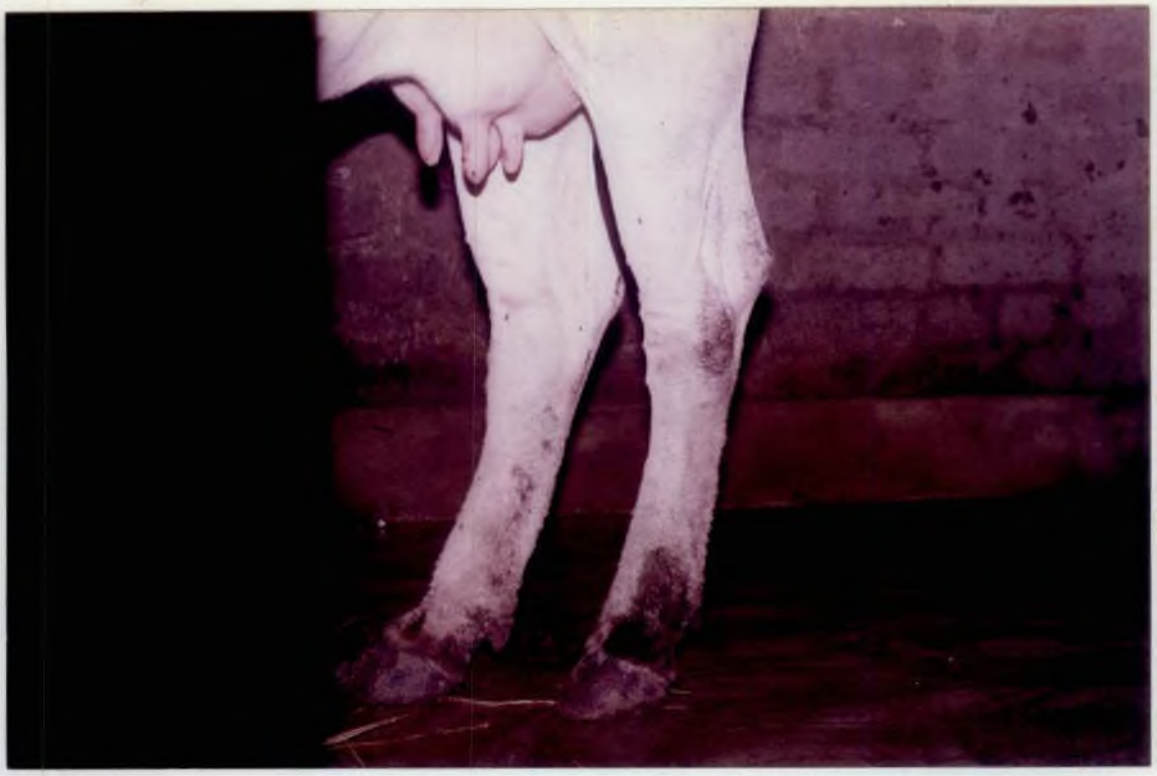


Plate 12. Before treatment with *Cassia alata* leaves paste

Plate 13. After treatment with *Cassia alata* leaves paste



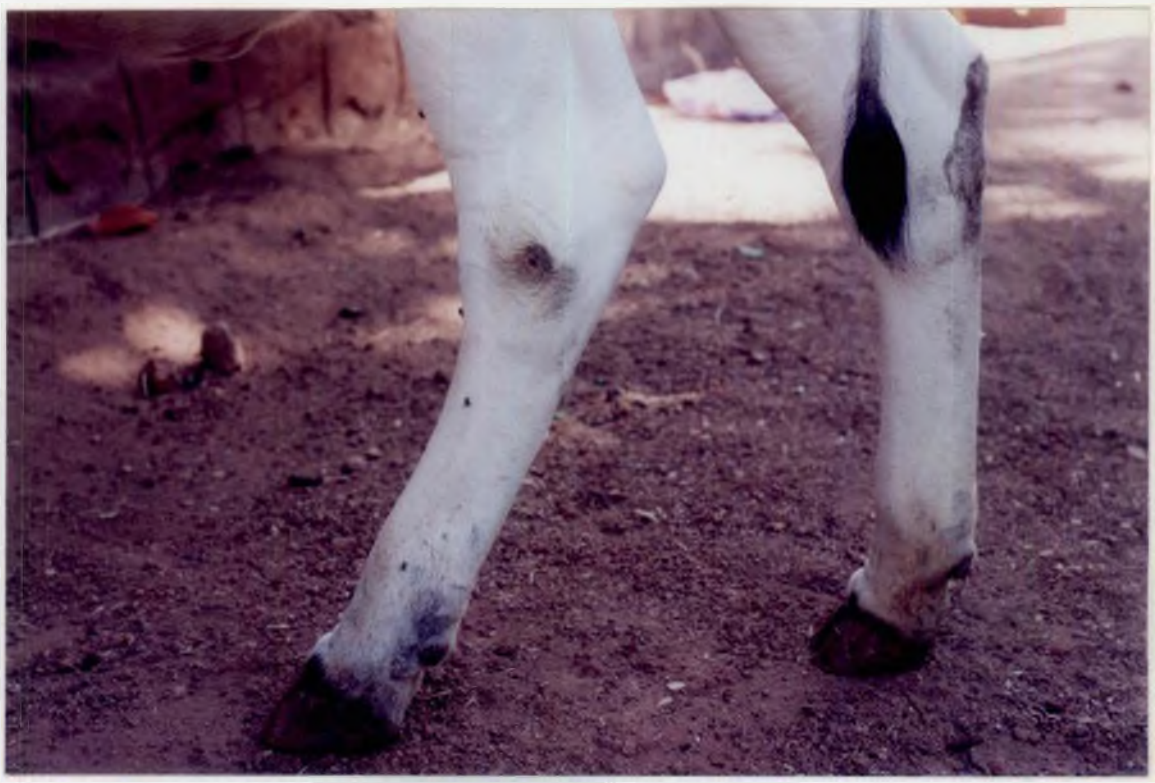
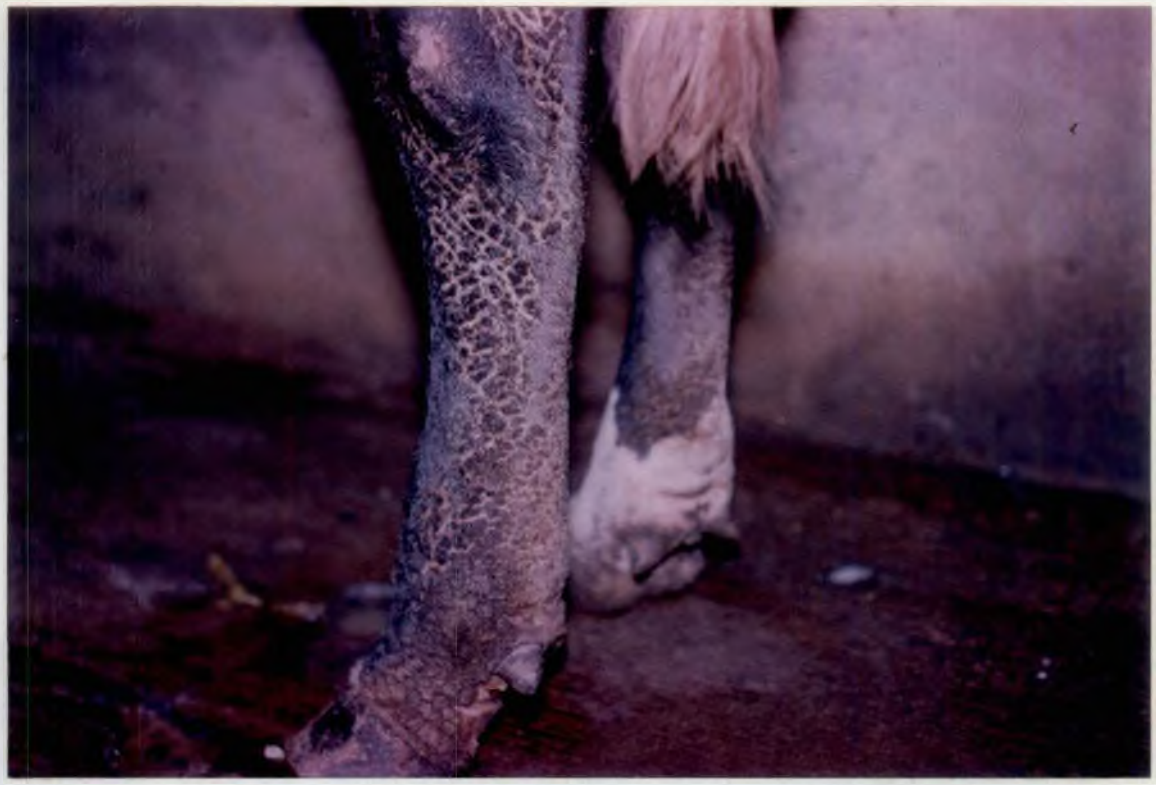


Plate 14. Before treatment with Tr. Iodine-Glycerine combination

Plate 15. After treatment with Tr. Iodine-Glycerine combination



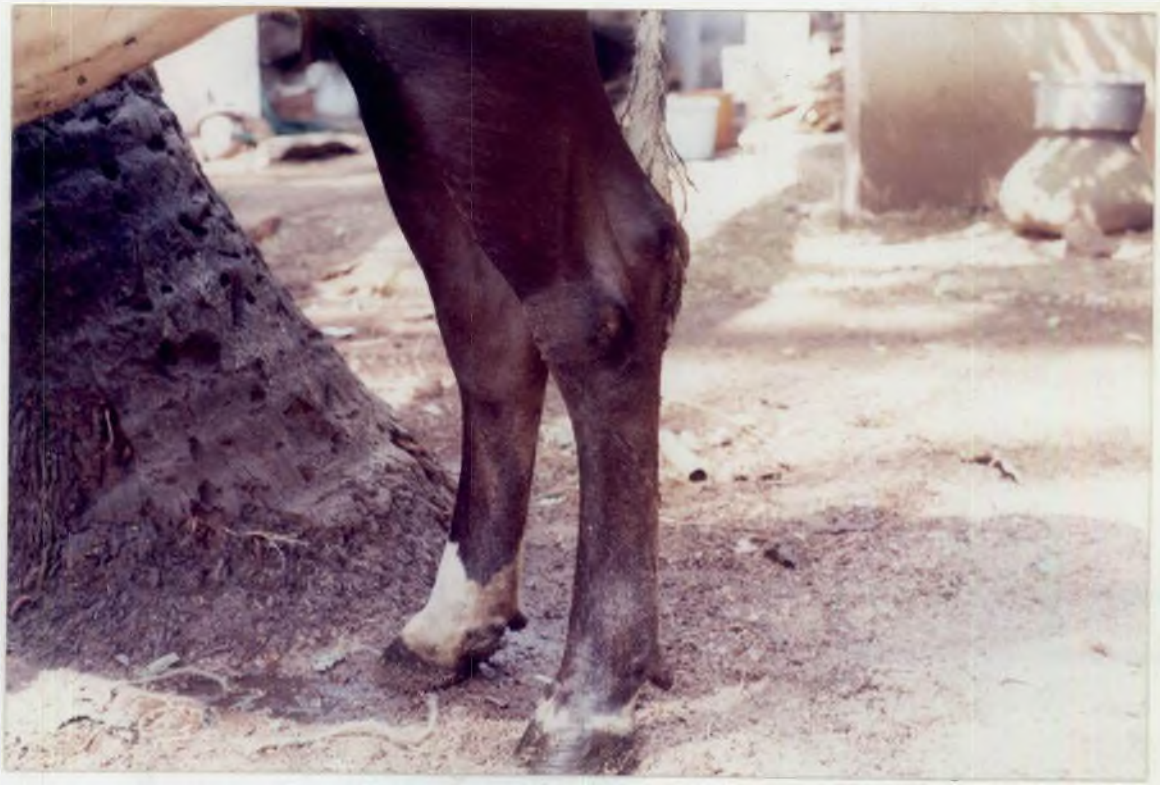


Plate 16. Before treatment with Bordeaux mixture one per cent

Plate 17. After treatment with Bordeaux mixture one per cent

Discussion

DISCUSSION

Occurrence

In the present study, occurrence of dermatological disorders in cattle were 4.49 per cent, of which 38.32 per cent had mycotic dermatitis, 31.95 per cent had fly bite/ectoparasitic dermatitis and 29.73 per cent had nonspecific dermatitis or other dermatological problems.

A wide variation in the rate of incidence has been reported by many authors (Kamyszek, 1978; Nooruddin and Dey, 1984; Grunder, 1984; Boni *et al.*, 1989; Mahmoud, 1993; Borikar *et al.*, 1994; Al-Khafaji *et al.*, 1995 and Anilkumar, 1996). The reason that could be attributed to this variation is the fact that these studies were conducted in various countries with varying climatic conditions. Hot and humid conditions favoured the growth of fungi. A moderately high occurrence rate may be due to the hot and humid condition of Trichur and neighbouring districts.

Anilkumar (1996) conducted a similar study and reported 10.58 per cent of mycotic dermatitis, 62.74 per cent ectoparasitic dermatitis and 26.48 per cent of other types of dermatological disorders. The difference in the incidence rate may be due to the fact that his studies were conducted all over Kerala while the present study was conducted only in a limited area.

Nooruddin and Singh (1987) found that mycotic dermatitis occurred throughout the year, in all ages, breeds and sex. Prevalence was more in young crossbred cattle. The observations of the present study was in agreement with this, except for the fact that female animals were more affected with mycotic dermatitis. The reason could be that more female animals were maintained by farmers than male animals.

Isolation and identification of the organisms

The important organisms isolated and identified under this study were *Trichophyton verrucossum* in eight out of twenty four cases (33.33 per cent); *Penicillium* spp. in seven cases (29.17 per cent); mixed infections of *Penicillium* spp. and *Trichophyton mentagrophytes* in seven (29.17 per cent) cases, *Penicillium* spp. and *Aspergillus* spp. in one case (4.17 per cent) and *Trichophyton mentagrophytes* and *Aspergillus* spp. in one case (4.17 per cent).

These observations were in agreement with various authors who isolated these organisms during different periods (Weiss and Bohm, 1978; Pop *et al.*, 1979; Jacobson, 1980; Sarkisov, 1981; Malik *et al.*, 1984; Medvedeva *et al.*, 1985; Hasegawa, 1986; Guha and Takur, 1987; Nooruddin and Singh, 1987; Vitos and Laszlo, 1987; Salambere and Rouille, 1990; Anilkumar *et al.*, 1992; Mahmoud, 1993 and Borikar *et al.*, 1994. *Trichophyton verrucossum* produced a change of colour from yellow to claret red between five to eight days after the inoculation of skin scrapings in dermatophyte test medium. In mixed infections of *Penicillium*

spp. and *T. mentagrophytes* colour change was observed in seven to eleven days after inoculation. Penicillium spp. and Aspergillus spp. cultures produced colour change in eight to fourteen days.

Usually pathogenic fungi produced a change of colour from yellow to claret red between three to seven days except in some cases where it was delayed upto 14 days. Non-pathogenic fungi may also produce a colour change but only after 14 days (Chandler *et al.*, 1991).

This is because pathogenic fungi initially use proteins and release metabolic products that turns media red whereas non pathogenic fungi initially use carbohydrates and switch over to protein only after its depletion. Phenol red present in the medium changes the colour from yellow to red above pH - 7 and this occurs when fungi digest proteins, releasing ammonia which makes the medium alkaline. Observation by Dion (1978);Goldston and Wilkes (1982); Thomset (1986); Smith (1988);Chandler *et al.* (1991) and Medleau and Ristic (1992) were also in agreement with this.

Non-dermatophytes like *Penicillium* spp. and *Aspergillus* spp. might become pathogenic in these animals in conjunction with other factors. These organisms were isolated from skin lesions of mycotic dermatitis in cattle by authors like Plauska *et al.* (1981). Guha and Takur (1987) and Sidhu *et al.* (1992).

Clinical observations

Clinical signs observed in mycotic dermatitis in cattle in the present study were broadly classified into two groups. Group I constituted eight animals from which *Trichophyton verrucossum* were isolated and Group II contained 16 animals with Penicillium infections and mixed infections of Penicillium spp, Aspergillus spp. and *Trichophyton mentagrophytes*.

Important clinical signs in mycotic dermatitis caused by *Trichophyton verrucosum* infections were raised erruptions of one to three cms in diameter which began at the head and later spreaded to neck, shoulders, flank and perineal regions. Scaling, itching, and crusty plaque formations were present. Alopecia was noted at the centre of lesions with an inflammatory periphery. Overgrowth and hypopigmentation of hairs at periphery of lesions were noticed. Breaking of hairs was also observed. Skin thickness was increased and elasticity reduced at the site of lesions due to keratinisation.

These findings were in agreement with those of various authors (Jungerman . and Schwartzman, 1972; Muller and Krik, 1976; Pandey and Cabaret, 1980; Goldston and Wilkes 1982; Scott, 1988; Muller *et al.*, 1989; Medleau and Ristic, 1992; Munoz-cobenas *et al.*, 1992 and Quinn *et al.*, 1994).

Important clinical signs noticed in 16 animals with *Penicillium* spp. infections and mixed infections of *Penicillium* spp., *Trichophyton mentagrophytes* and *Aspergillus* spp. were skin lesions on all the limbs, upto thigh in hind limbs

and upto point of elbow in forelimbs. Lesions were also seen in udder and perineum in five cases. In four cases, lesions were also seen in lower jaw and around the mouth. This may be due to the licking of the lesions. Severe inflammatory reaction and cracked skins were noticed in all the cases.

Secondary bacterial infections were noticed in most cases. Slight rise in body temperature (1.5°F) was seen in seven cases which were severely affected. There were oedema, pruritis, difficulty in walking due to pain, epilation and breaking of hairs, hyperkeratosis, and erythema of skin, hypopigmentation and overgrowth of hairs in and around the lesions. Skin was thickened and elasticity reduced due to inflammatory exudate and hyperkeratinisation.

Penicillium spp. and *Aspergillus* spp. are non-dermatophytes while *Trichophyton mentagrophytes* is a dermatophyte. *Penicillium* spp. and *Aspergillus* spp. were found to be pathogenic in this study. Many authors like Pop *et al.* (1979), Jacobson (1980), Medvedeva (1985), Hasegawa(1986), Guha and Takur (1987), Vitos and Laszlo (1987), Jand and Gupta (1989), Glazebrook and Campbell (1990), Frye *et al.* (1991), Anilkumar *et al.* (1992) and Mahmoud (1993) have identified these non-dermatophytes as causative organisms of mycotic dermatitis in cattle and various other species of animals.

Plauska *et al.* (1981) and Sidhu *et al.* (1992) established the pathogenicity of non-dermatophytes like *Penicillium* spp. and *Aspergillus* spp. isolated from skin

lesions of cows which also agreed with the present finding that these non-dermatophytes were pathogenic.

Another feature observed in this study was the presence of *Trichophyton mentagrophytes* in eight cases as a mixed infection along with *Penicillium* and *Aspergillus* spp. Similar observations were also made by Weiss and Bohm (1978), Malik *et al.* (1981), Sarkisov (1981), Salambere and Rouille (1990) and Munoz-Cobenas *et al.* (1992) and Mahmoud (1993).

The other clinical signs like inflammatory reaction, scaliness, broken hairs, alopecia, crust formation, scab formation and hair loss were also reported by various research workers (Jungermann and Schwartzman, 1972; Goldston and Wilkes, 1982; Smith 1988; Scott, 1988; Muller *et al.*, 1989; Salambere and Rouille, 1990; Medleau and Ristic, 1992; Munoz *et al.*,1992; Sidhu *et al.*, 1992 and Thyagaraja *et al.*, 1997).

Flybite dermatitis/parasitic dermatitis showed the following lesions like papules, pustules and wheals which later developed into crusts and erosions. They also showed pruritis, hypersensitivity reaction and irritation to animals. These results were in agreement with the findings of Gross and Hallivel (1985) and Scott (1988). Kolbuz *et al.* (1989) also reported exaggerated delayed hypersensitivity response in insect-bite lesions.

In the present study non-specific/other types of dermatological disorders were observed mostly in animals with poor health. Pruritis, generalised alopecia,

hypopigmentation of hair and anaemia were observed. Gowda *et al.* (1982) also observed the presence of nonspecific dermatitis in animal with poor nutritional status. In these cases secondary bacterial infections were common. These animals had very low haemoglobin, PCV and RBC count and very low copper and zinc values and these were mostly attributed to nutritional deficiency.

Laboratory diagnosis

Ectothrix arrangement of fungal spores on hairs was noticed in all cases of mycotic dermatitis and similar arrangement was observed by Jungerman and Schwartzman (1972); Goldston and Wilkes (1982); Smith (1988) and Quinn *et al.* (1994) in cases of mycotic dermatitis.

The important haematological and biochemical changes noticed in animals with mycotic dermatitis were neutrophilia, eosinophilia, low copper and Zinc values. Authors like Benjamin (1978); Wintrobe *et al.* (1981); Chandler *et al.* (1991) reported the occurrence of neutrophilia and eosinophilia in fungal infections of animals and man.

Ibrahim *et al.* (1984) reported low erythrocyte count, low haemoglobin and packed cell volume, marked decrease in total protein and an increase in lymphocyte count in ring worm infected buffaloes. But in the present study all these values were withinnormal range.

Wisneiewski (1984) reported subnormal values of copper and zinc in plasma of bulls with mycosis. In the present study also low copper and zinc values were observed. Bires *et al.* (1989), and Paulik *et al.* (1989) observed recovery in ringworm infection after parenteral administration of zinc in calves. Thus low zinc values in blood may be a pre-disposing factor in mycotic infection.

Wronska *et al.* (1984) recorded an increase in the proportion of gamma globulin and lymphocytes with normal values for haemoglobin, haematocrit and total protein in *Trichophyton verrucosum* infection.

But in the present study all these values were within the normal range.

Sidhu *et al.* (1992) found neutrophilia, lymphocytosis, and monocytosis along with decreased packed cell volume in mycotic dermatitis caused by *Penicillium* spp. and *Aspergillus* spp.

In fly bite/parasitic dermatitis cases eosinophilia, low copper values and slightly lower albumin value and Albumin/Globulin ratio were observed.

In animals with non-specific dermatological disorders lower values for haemoglobin, total erythrocyte count, packed cell volume, total protein, copper, zinc, albumin and globulin were observed along with eosinophilia. This indicated that theseanimals were having anaemia and poor health. Most of these animals were male calves below six months of age that were poorly looked after.

Nutritional deficiency may be the chief cause of this disease. Gowda *et al.* (1982) also observed anaemia and eosinophila in non-specific dermatitis.

Authors like Vandenbroek and Stafford (1988) and Logas *et al.* (1993) found that various dermatological diseases were associated with low serum zinc levels. Zannetti *et al.* (1992) observed that skin lesions in sheep were associated with a fall in blood zinc levels. Randhava *et al.* (1994) recorded decreased copper and zinc levels in buffaloes with skin diseases. Wisneiewski (1984) also observed subnormal amounts of copper, zinc and carotenes in the plasma of bulls with skin diseases. The reason attributed to this was that deficiency of copper caused defective melanin synthesis due to reduced Tyrosinase activity which was a copper containing enzyme (Maynard *et al.*, 1983). These observations were in agreement with present study.

Histopathological study

In the present study histopathological studies of skin of mycotic dermatitis animals revealed invasion of fungus beneath stratum corneum and hair follicles. Hyperkeratosis of epidermis and hair follicles was also noticed. These observations were in accordance with those of Scott (1988) and Muller *et al.* (1989).

A case of non-specific dermatitis revealed chronic dermatitis, with marked lymphocytic infilteration and epidermal hyperplasia. This observation was in agreement with Scott (1988). The lymphocytic infilteration may be due to

secondary bacterial infection associated with chronic dermatitis (Takur and Verma, 1984; Takur *et al.*, 1985).

Treatment

In the present study all animals treated with *Cassia alata* leaves paste (Group A) showed complete recovery out of which five animals recovered in fifteen days and three animals by 21st day. This was in agreement with various authors like Chopra *et al.* (1958); Murthy and Sirsi (1959); Ahmed *et al.* (1975); Kritikar and Basu (1975); and Fuzellier *et al.* (1982), who observed that cassia alata leaves were effective against ring worm and other skin diseases. The reduced anthraquinone compounds contained in the leaves may be responsible for this antifungal effects (Rai, 1978).

Various authors like Jungerman and Schwartzman (1972); Takur and Verma (1984); Muller *et al.* (1989), Frye *et al.* (1991); Goldston *et al.* (1992); and Abou-zaid (1995) reported theantifungal properties of various iodine preparations. The present study also agrees with it. Seven animals treated with Tr. Iodine glycerine combination showed complete recovery. But one animal did not show much improvement. The reason attributed for this failure may be because the animal was licking the medicine after removing the bandage. This animal was treated with gresiofulvin for 30 days and was cured.

In the present study all the animals treated with agricultural Bordeaux mixture 1 per cent showed complete recovery. This preparation was easily

available, very economical and easy to apply and excellent results were obtained. The results were in agreement with various workers like Fraser (1986) and Rad ostits *et al.* (1994).

Other authors like Al-Wakeel (1987) Brander *et al.* (1991) also reported the antifungal effect of copper sulphate ointment which also agrees with present study, copper sulphate being the active ingredient in Bordeaux mixture.

As agricultural Bordeaux mixture 1 per cent is cheap and easily available with most of the farmers it can be recommended as an ideal treatment for fungal dermatitis in cattle.

Cassia alata leaves paste is the cheapest line of treatment. This plant is available in all most all parts of Kerala. But prepartion of the paste requires a lot of labour and is time consuming.

The tincture iodine glycerine combination at 1:1 ratio was also found as an effective treatment. It is the most convenient medicine to apply as both are available ready made. But the cost of treatment is comparatively high and hence not ideal for large animals like cows. Moreover the tendency to lick the medicine is more when compared to other medicines tried.

Summary

SUMMARY

A study was conducted on various dermatological disorders affecting cattle in the Department of Clinical Medicine, College of Veterinary and Animal Sciences, Mannuthy.

The occurrence of dermatological disorders was found to be 4.49 per cent as per the records maintained in University Veterinary hospitals, Mannuthy and Kokkalai. Out of 3111 dermatological cases, 38.32 per cent had mycotic dermatitis, 31.95 per cent had fly bite/ectoparasite dermatitis and 29.73 per cent had non-specific dermatological problems.

Of the sixty animals studied, 24 had mycotic dermatitis, 23 had fly bite dermatitis/ectoparasitic dermatitis and 13 had non-specific dermatological problems.

Detailed clinical examination of cattle with mycotic dermatitis revealed scaling, itching, pruritis, alopecia, increased skin thickness of the area around lesion, hypopigmentation of hairs and reduction in elasticity of skin. Reduced feed consumption and milk production was also recorded in all cases. Presence of biting flies like stomoxys, liperosia and mosquitoes were evident in all cases. No correlation between the conditions such as watering, brand and type of feed and housing was observed.

Apart from these signs, oedema, pain, difficulty in walking, severe inflammation, cracked skin and secondary bacterial infection were noticed in animals with dermatitis caused by *penicillium* spp. and mixed infections of *Penicillium* spp., *Aspergillus* and *Trichophyton mentagrophytes*. In all these cases lesions began at pastern region of hind limbs and later on spreaded upwards and to fore-limbs.

In case of *Trichophyton verrucossum* infection raised eruptionsof one to three cm in diameter were initially noticed in head, which later spreaded to neck, shoulder, flank and perineum.

Skin scrapings collected and examined under microscope revealed ectothrix arrangement of fungal spores in all cases. Neutrophilia, eosinophilia, lower copper and zinc values were the haematological and biochemical changes noticed in animals with mycotic dermatitis.

In fly bite/ectoparasitic dermatitis eosinophilia along with slightly lower albumin and albumin/globulin ratio were found. Lower copper values were noticed in this group of animals.

In animals with other dermatological problems lower values for haemoglobin, packed cell volume, total erythrocyte count, copper, zinc, total protein and albumin with eosinophilia were found.

Fungal organisms isolated included *Trichophyton verrucosum* in eight cases, *Penicillium* spp. in seven cases, mixed infections of *Penicillium* spp. and *Trichophyton mentagrophytes* in seven cases, *Penicillium* spp. and *Apergillus* spp. in one case and *Trichophyton mentagrophytes* and *Aspergillus* spp. in another case.

Histopathological studies revealed chronic dermatitis with marked lymphocyte infiltration, epidermal hyperplasia and shedding of keratinised scales in non-specific dermatological problems.

In case of mycotic dermatitis, invasion of hair follicle by fungus and loss of hair was noticed. There was also invasion of fungus beneath the stratum corneum resulting in detachment of hairs. The crusts were composed of fungal hyphae. Epidermal hyperplasia with marked hyperkeratosis was also noticed.

All the eight animals treated with *Cassia alata* leaves paste recovered completely in three weeks time. Seven out of eight animals treated with tincture iodine-glycerine combination recovered after thirty days of treatment. All the eight animals treated with agricultural Bordeaux mixture - 1 per cent recovered in three weeks time. Thus in this study all the three therapeutic agents were effective against mycotic dermatitis.

But considering the cost of treatment availability and ease of application it can be concluded that Bordeaux mixture one per cent is the most ideal medicine for cutaneous application in mycotic dermatitis of cattle.

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PROFORMA AND RECORD OF INVESTIGATION FOR

DERMATOLOGIC DISORDERS IN CATTLE

1. Serial No.: Case No. of .....

2. Date : Owners name & Address

Breed: Sex: Age: Parity:

History

Feed consumption : Normal/less/Anorectic

Site of lesions

Type of lesions

Primary		Secondary
Plaque	Scales	Ulcers
Vesicle	Erosions	Alopecia
Tumour	Erythema	Callus
Pustule	Abscess	Hyperpigmentation
Patch	Scars	Hypopigmentation
		Hyperkeratosis

Clinical signs:

Skin changes	Quality of hair coat
Elasticity	Epilation - Present/Absent
Thickness	Hair coat is: Good/Poor/Rough/ Others (Broken, easily pulled off)
	Hoof overgrowth - Present/absent

Colour of lesion

Configuration of lesions - Localised/diffused

Alopecia - Present/Absent

if present - Localised/Diffused

Pruritis - Present/Absent

1. Where did the problem begin?

2. What did it look like then?

3. Has it changed or spread?

4. Whether the colour of hair changed or not?

Season : Year round/seasonal/No seasonality

If seasonal: Dry (December-April) / Rainy (May-November)

Kept - stallfed/free range

5. Whether any other contact animals affected: Yes/No

6. Whether in contact humans affected :

Feed given usually

Frequency and time of feeding

Feed given

1. Cotton seed cake
2. Groundnut cake
3. Coconut oil cake
4. Gingely oil cake
5. Rice bran
6. Wheat bran
7. Maize bran
8. Straw
9. Hay
10. Grass
11. Silage
12. Commercial feed (Brand)

Soaps/detergents used or not

Source of drinking water : Deep well / Sub-soil/ Pond / River

Type of cattle shed

Floor
Roof
Side walls

Type of bedding :

Mode of disinfecting cattle shed - washing/chemicals

Name of chemicals :

Dewormed/Not dewormed

Date of last deworming

Drug used for deworming

MEDICATION

Previously applied/Not applied/Not known

Name of the drug

Duration of treatment

Last date of previous treatment

Parasites present

1. Biting flies (name)
2. Lice

3. Ticks
4. Sarcoptes
5. Psoroptes
6. Others

Result of scrapings

1. Direct method

2. KOH

Examination of fungus

1. Direct method

2. Lactophenol cotton blue staining

3. Culture in S.D. agar

Results of culture and sensitivity tests

Remarks on histopathology

Haematology	Normal values
Hb (gm%)	8.0-15.0 g/dl
Total RBC (x 10^6/cmm)	5-10.0 millions/mm^3
Total WBC (per cmm)	4000-12000
Differential count	
Neutrophil (%)	25-30
Lymphocyte (%)	60-65
Eosinophil (%)	2-5
Monocyte (%)	5
Basophil (%)	<1
PCV (%)	24-46

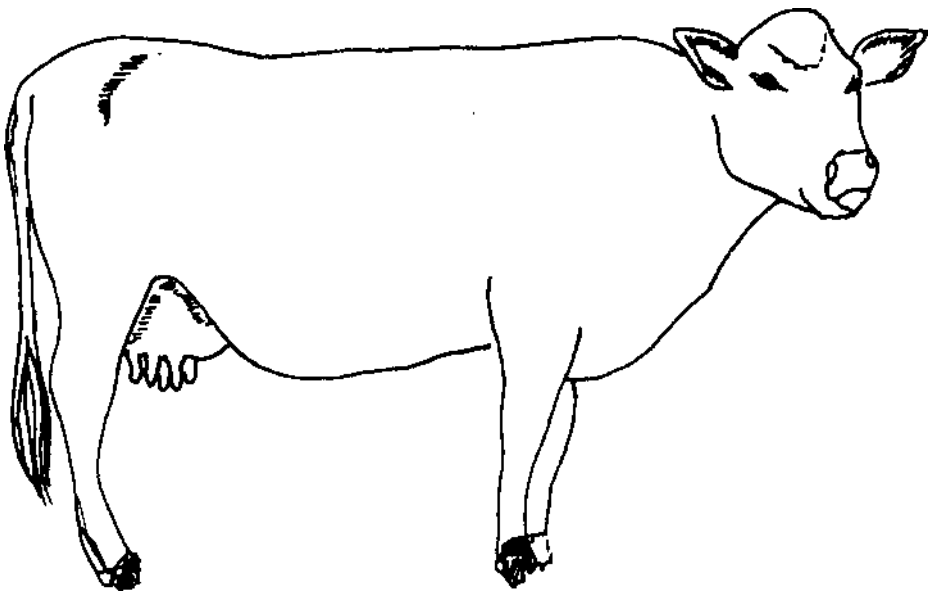
Biochemical parameters	Normal values
Total plasma protein	7.0-8.5 g/dl
Albumin	3.0-3.8 g/dl
Globulin	3.6-4.4 g/dl
Copper	70-140 µg/100 ml
Zinc	75-120 µg/100 ml

Treatments trials conducted

Drug used

Result of treatment

SITE OF THE LESIONS



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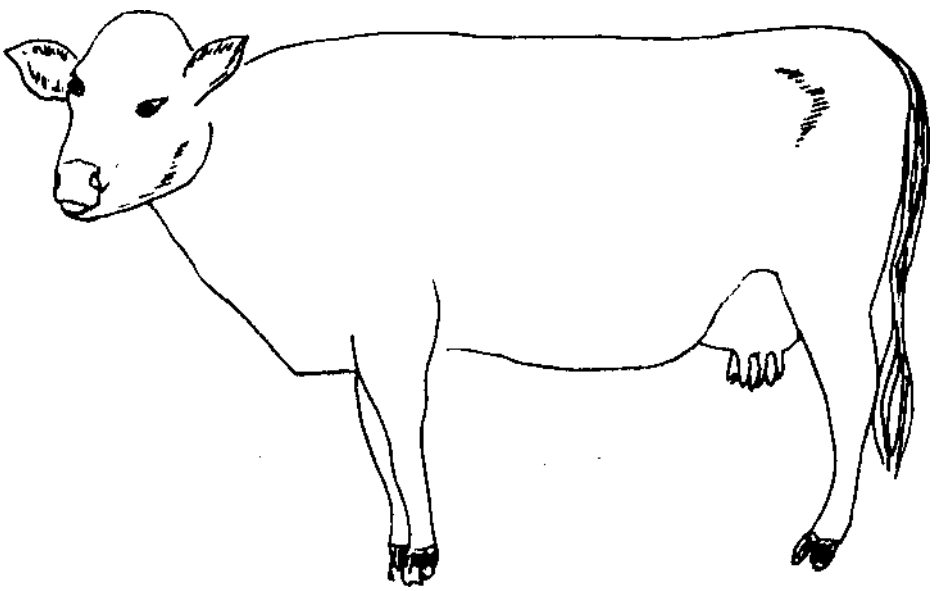

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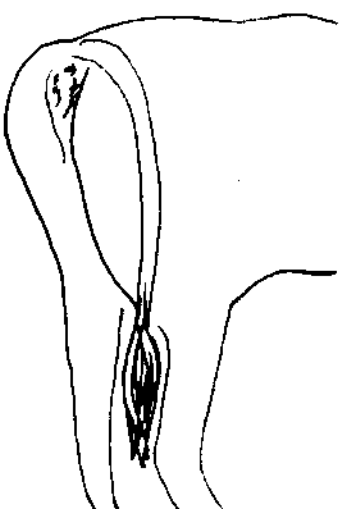

HIND QUARTERS

CLINICOTHERAPEUTIC STUDIES ON MYCOTIC DERMATITIS IN CATTLE

By

P. ARUN RAPHAEL

ABSTRACT OF A THESIS

Submitted in partial fulfilment of the requirement for the degree of

Master of Veterinary Science

Faculty of Veterinary and Animal Sciences

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ABSTRACT

A study was designed in the Department of Clinical Medicine, College of Veterinary and Animal Sciences, Mannuthy to understand the occurrence and etiology of various dermatological problems in cattle. Clinico-pathological changes and the efficacy of various lines of treatment were also investigated.

The occurrence for the period from January-1994 to December-1998 was found to be 4.49 per cent, 38.32 per cent of the cases being mycotic dermatitis, 31.95 per cent fly bite dermatitis/ectoparasitic dermatitis and 29.73 per cent non-specific dermatological disorders.

Detailed clinical examination of cattle with mycotic dermatitis revealed scaling, pruritis, alopecia, increased skin thickness and hypopigmentation of hairs. Presence of biting flies were also recorded.

Skin scrapings collected and examined under microscope revealed presence of ectothrix arrangement of fungal spores. Organisms isolated by fungal culture were *Trichophyton verrucosum T. mentagrophytes*, *Penicillium* spp. and *Aspergillus* spp.

Neutrophilia, eosinophilia, lower copper and zinc values in blood were observed in mycotic dermatitis. In fly bite/ectoparasitic dermatitis, along with lower copper values in blood, slightly lower albumin, albumin/globulin ratio and eosinophilia were detected. In animals with non-specific dermatological problems

along with eosinophilia, lower values of haemoglobin, packed cell volume, total erythrocyte count, copper, zinc, total protein and albumin were recorded.

Histopathological studies revealed chronic dermatitis, with marked lymphocytic infiltration, epidermal hyperplasia and shedding of keratinised scales in non-specific dermatological problems. In cases of mycotic dermatitis invasion of fungi beneath stratum corneum, hair follicle and hyperkeratosis, were noticed.

Complete recovery was noticed in all animals treated with *Cassia alata* leaves paste and Bordeaux mixture - 1 per cent in 21 days. Seven out of eight animals responded to topical application of tincture iodine and glycerine (1:1).