Tinea Versicolor - An Epidemiology
Mahendra Kumar Rai¹, Sonali Wankhade*²
Department of Biotechnology, SGB Amravati University, Amravati 444 602, Maharashtra, India

Abstract
Dermatophytic infections have been one of the major crises prevalent all over the world. Dermatophytes feed on skin, hair and nail thus causes infection, popularly known as ‘Tinea infections’. Due to yeast Malassezia furfur multihued patches occurs on skin and causes infection known as Tinea versicolor (T.versicolor), which worsens if neglected. It has global occurrence and is prominent in hot and humid region. It predominantly affects late teens and young adults of both sexes. Customarily Tinea versicolor, is treated by systemic drugs in oral as well as topical mode. Despite adequate remedy, recurrence is common with major side effects. For overcoming adverse consequences, need arises to go naturewide and seek the solution through herbs. With the help of essential oils, this stubborn infection can be eradicated effectively, averting the side effects.

Keywords: Tinea versicolor; Dermatophytes; Malassezia furfur; Essential oils

Introduction
Tinea versicolor (pityriasis versicolor or PV) is a superficial fungal infection, characterized by changes in skin pigment due to colonization of the stratum corneum by a dimorphic lipophilic fungus of the normal flora of the skin, known as Malassezia furfur (Adamski, 1995; Sunenshine et al., 1998b; Zaitz, 2000; Moniri et al., 2009). The organism’s yeast phase shows two morphologically distinct forms, one ovoid, the other spherical, in which the fungus is named Pityrosporum ovale and Pityrosporum orbiculare respectively. PV is also known as tinea versicolor, dermatomycosis furfuracea and tinea flava. Although it may be distributed globally, it is more commonly found in the tropics. Often considered a post-pubescent disease, evidence shows that PV is common in children (Sunenshine et al., 1998b).

Historical considerations
T. versicolor was first recognised as a fungal disease by Eichsedt in 1846 (Ashbee and Evans, 2002). In 1853, Robin described the fungus in scales, naming it Microsporum furfur (Gordon, 1951a). In 1853, Malassez observed “spores” (Gordon, 1951b). Baillon, (1889) used the name Malassezia furfur in his text to commemorate Malassez (Ashbee et al., 2002). The genus name Pityrosporum was proposed by Labouraud in 1904 (Inamadar and Palit, 2003) that were then named Pityrosporum ovale by Castellani and Chalmers in 1913 (Gupta et al., 2002). In 1951, Gordon isolated other yeast, micromorphologically distinct from P. ovale, and named it Pityrosporum orbiculare (Gordon, 1951a; Adamski, 1995; Sunenshine et al., 1998b; Zaitz, 2000; Ashbee et al., 2002). Clínico-epidermiological studies on T. versicolor were done by Rao et al., (2002).

Keywords: Tinea versicolor; Dermatophytes; Malassezia furfur; Essential oils

Background
The lipophilic yeasts are associated with various human diseases, especially pityriasis versicolor, a chronic superficial scaling dermatomycosis (Gupta et al., 2002). High temperatures and humidity favour the occurrence of pityriasis versicolor (Muhammad et al., 2009). Accordingly, tropical areas can have prevalence as high as 40% and the frequency is higher during summer months in temperate climates (Sunenshine et al., 1998a).

Multiple macules and/or patches of variable appearance (hypopigmented, hyperpigmented, dark brown or erythematous) surrounded by normal skin are the typical lesions of pityriasis versicolor. Affected areas include the back, chest, abdomen, neck, and upper limbs. However, classically the back carries more lesions. The face is an area commonly affected in children and it is the forehead showing mostly hypopigmented fur (Terragni et al., 1991). Uncommon but possible locations include axilla, popliteal fossa, fore arms, lower limbs and penis/genitalia (Terragni et al., 1991; Sunenshine et al., 1998a; Sunenshine et al., 1998b; Moniri et al., 2009). Although PV had been described at the beginning of nineteenth century (Ashbee et al., 2002), until recently classification of its etiologic agent was a matter of doubt. This controversy may be caused by various morphological features and fastidious growth requirements of Malassezia yeasts in vivo.

Modes of infection
Tinea versicolor occur worldwide more frequently in areas with higher temperatures and higher relative humidities (Maheswari, 1978; Mellen et al., 2004).

Although pityriasis versicolor has worldwide occurrence, its frequency is variable and depends on different climatic, occupational and socio-economic conditions (Borelli et al., 1991; Sunenshine et al., 1998a). This disease is prevalent in Iran, in which almost 6% of all dermatosis and approximately 30% of dermatomycoses are due to these lipophilic yeasts (Borelli et al., 1991). Hereditary factor play the role in transmission of the disease (Maheswari, 1978; Sunenshine et al., 1998b).

Causal agent
- M. furfur is now the most commonly accepted name for the organism causing tinea versicolor. Thus, P. orbiculare, P. ovale and M. ovalis are synonyms for M. furfur.

*Corresponding author: Sonali Wankhade, Department of Biotechnology, SGB Amravati University, Amravati 444 602, Maharashtra, India, E-mail: sonaliwankhade@rediffmail.com

Received December 07, 2009; Accepted December 24, 2009; Published December 24, 2009

Citation: Rai MK, Wankhade S (2009) Tinea Versicolor - An Epidemiology. J Microbial Biochem Technol 1: 051-056. doi:10.4172/1948-5948.1000010

Copyright: © 2009 Rai MK, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.
Despite disagreement about the names, tinea versicolor results from a shift in the relationship between a human and a resident yeast flora.

Yeasts of the genus *Malassezia* are known to be members of the skin microflora of human and other warm-blooded vertebrates (Leeming et al., 1989; Moniri et al., 2009). These lipophilic yeasts are associated with various human diseases, especially pityriasis versicolor, a chronic superficial scaling dermatomycosis (Gupta et al., 2002). The genus of *Malassezia* has undergone several taxonomic revisions (Ingham and Cunningham, 1993). Later, Guهو et al., (1996) discovered that there were indeed multiple species which they reclassified and named the genus as *Malassezia* with several distinct species. Currently there are 11 recognised species viz, (1) *M. furfur*, (Crespo-Erchiga and Florencio, 2006; Krisanty et al., 2009), (2) *M. pachydermatis*, (3) *M. sympodialis* (Makimura et al., 2000; Arzumanian, 2001; Crespo et al., 2006), (4) *M. globosa* (Nakabayashi et al., 2000; Aspiroz et al., 2002; Dutta et al., 2002; Crespo et al., 2000; Crespo et al., 2006; Moniri et al., 2009), (5) *M. obtusa*, (6) *M. restricta*, (7) *M. slooffiae* (Gueho et al., 1996), (8) *M. dermatis*, (9) *M. equi* (10) *M. nana* (Sugita et al., 2002; Hirai et al., 2004) and (11) *M. japonica* (Sugita et al., 2005).

**Mortality, race, sex and age**

Morbidity results primarily from the discolouration. The adverse cosmetic effect of lesions may lead to significant emotional distress, particularly in adolescents. Tinea versicolor frequently recurs despite adequate initial therapy. Even with adequate therapy, residual pigmentary changes may take several weeks to resolve. Although tinea versicolor usually is more apparent in darker-skinned individuals, the incidence of tinea versicolor appears to be the same in all races.

The role of sex in propensity to development of *T.* versicolor is still unclear. Some studies found that PV is more common in men than women (Belec et al., 1991; Nakabayashi et al., 2000; Muhammad et al., 2009), while others indicated that the incidence of this infection is higher in women (Nikpoor and Leppard, 2000; Arzumanian, 2001; Belec et al., 1991; Nakabayashi et al., 2000; Muhammad et al., 2009). No differences in development of PV among both sexes are also reported (Belec et al., 1991; Nakabayashi et al., 2000; Gupta et al., 2002).

T. versicolor becomes more noticeable with a suntan and is more common in teenagers and young adults than in older people (Lesher, 1994). However, children are not excluded from suffering this fungal infection (Terragni et al., 1991; Elewski, 1996; Gupta et al., 2002; Jena et al., 2005). Similar to other investigations the highest prevalence of PV was observed in 20-30 year-old group, suggesting that the peak of the infection is coincided with ages when the sebum production is in the highest level (Crespo et al., 2000; Gupta et al., 2002; Moniri et al., 2009). Very few cases of PV in a child with the age less than 10 years are found. Moreover, it is rarely seen in older adults (Bhargava et al., 1997; Rajashekhar, 1997).

**Clinical symptoms**

The main symptom is persistent patches of discolored skin with sharp borders (edges) and fine scales. The patches are often dark reddish-tan in color. Affected areas do not darken in the sun (skin may appear lighter than surrounding healthy skin):

- Increased sweating
- Itching

**Physical symptoms**

**Lesion characteristics**

- Lesions occur in a variety of colors and shapes, as the name implies (versi means several).
- Lesions are either macules or very superficial papules with fine scale that may not be evident except on close examination.
- Even when scale is not apparent, when the skin is wiped with a wet cloth and scraped for examination, it will yield a surprising amount of dirty brown keratin. If not, the areas of dyschromia may represent residual effects of previously treated T. versicolor.
- Occasionally, it is difficult to determine whether the lighter or darker skin is affected.
- Lesions have relatively sharp margins and may be lighter or darker than the normal skin color. The lesions are frequently a light orange or tan color in light-skinned individuals.
- Small lesions are usually circular or oval.
- Lesions are usually asymptomatic but may be mildly pruritic. The pruritus is more intense when the patient is excessively warm.
- Residual hypopigmentation, without overlying scale, may remain for many months following effective treatment. These areas may become more apparent following sun exposure, causing the patient to suspect incorrectly that the infection has recurred.

**Lesion distribution**

- The upper trunk is affected most commonly, but spread to the upper arms, antecubital fossae, neck, abdomen, and popliteal fossae often occur.
- Lesions in the axillae, groin, thighs, and genitalia may occur but are less common.
- Facial, scalp, and palmar lesions occur in the tropics but rarely in temperate zones.
- In some patients, *T*. versicolor primarily affects the flexural regions, the face, or isolated areas of the extremities. This unusual pattern of *T*. versicolor is seen more often in immunocompromised hosts and can be confused with candidiasis, seborrhoeic dermatitis, psoriasis, erythema or dermataphyte infections.
- Lesions that are imperceptible or doubtful are more visible using a wood lamp in a darkened room.

**Treatment**

Questioning the patient about skin or systemic diseases, current therapy and drug allergies provides guidance in selecting an appropriate therapy (Okuda et al., 1998; Crowson and Magro, 2003). Topical therapy alone is indicated for most patients (Gupta et al., 1998; Gupta et al., 2004b; Gupta and Kohli, 2003b). Systemic treatment is indicated with extensive involvement, recurrent infections or when topical therapy has failed (Gupta et al., 2003a). Because treatment is relatively easy and recurrence is common, it is imperative that therapy be as safe, inexpensive and convenient as possible. A plan for prophylactic therapy should be discussed with all patients to reduce the high rate of recurrence (Drake et al., 1996; Gupta et al., 2004a).
### Topical medication

- Effective topical agents include selenium sulfide (eg, Selsun shampoo), azole antimonycotics, ciclopirox olamine, piroctone-olamine, zinc pyrithione, propylene glycol lotions, lamisil derm gel (Faergemann et al., 1997), benzoyl peroxide, sodium sulfacetamide and allylamine antifungals (Vermeer and Staats, 1997). Treatment with selenium sulfide may result in irritant dermatitis. Patients may require emollient or mild topical steroid application for a few days following therapy.

- The topical azole antifungals work well, but no significant difference in results is achieved by different compounds. Topical azole and allylamine antifungals are applied every other night for 2 weeks. The weekly applications of any of the topical agents for the following few months may help prevent recurrence. The main problem with the use of azole antifungals in T. versicolor is the inconvenience of applying creams to a wide body surface area. The shampoo form of the antifungal can be used for extensive disease.

### Drug category

**Topical selenium sulfide products** - Selenium sulfide inhibits *M. furfur*, the primary cause of T. versicolor. Selenium sulfide has cytostatic effect on epidermis and follicular epithelium, which reduces corneocyte production.

Selenium sulfide (Selsun Blue, Exsel, Head and Shoulders) - Available as shampoo or lotion in 1% or 2.5% concentrations. It is a safe and effective therapy that has been used for years (Albright and Hitch, 1966; Bamford, 1983; Katsambas et al., 1996; Hull and Johnson, 2004). However, it is an irritant, and some patients complain of itching or eczema after overnight applications. It also may stain clothes and bedding. Lotion is not preferred in children and patients with sensitive skin.

**Over the counter and prescription creams**

Products include clotrimazole (Lotrimin-AF) and ketoconazole (Nizoral) creams. Prescription alternatives for T. versicolor include ketoconazole (Nizoral shampoo), ciclopirox (Loprox), butenafine (Mentax), naftifine (Naftin) (Meinicke, 1984), econazole (Spectazole), oxiconazole (Oxistat) and sulconazole (Exelderm).

### Oral medication

Some patients prefer oral therapy. It is recommended to take the oral drug with an acidic drink (e.g. orange juice, Coke) to improve absorption may enhance this therapy. Next, the patient should wait an hour and then exercise to the point of sweating. The patient then cools off, allowing the perspiration to dry on the skin, and showers after a few hours.

Oral therapy does not prevent the high rate of recurrence, and treatment with oral ketoconazole may need to be repeated on an intermittent basis throughout the year (Gan et al., 1987; Hickman, 1996; Fernandez-Torres et al., 2000; Gupta et al., 2003a; Gupta et al., 2003b; Rincon et al., 2006). Oral itraconazole and fluconazole also have been proven effective (Faergemann, 1992; Gupta et al., 1994; Kose, 1995; Leyden, 1998; Balachandran et al., 1999; Fernandez-Torres et al., 2000; Matar et al., 2003; Partap et al., 2004; Karakas et al., 2005) but rarely are required. Some sub-groups of *M. furfur* apparently are not clinically responsive to oral terbinafine (Tosti et al., 1996; Leeming, 1997; Fernandez-Torres et al., 2000). Griseofulvin is not an effective therapy for T. versicolor.

### Ketoconazole (Nizoral)

A single dose of oral ketoconazole (400 mg) is very effective (Fernandez-Nava et al., 1997). Imidazole broad-spectrum antifungal agent; inhibits synthesis of ergosterol, causing cellular components to leak, resulting in fungal cell death. This drug achieves excellent skin levels with minimal dosing. *M furfur* is eradicated by the presence of ketoconazole in the outer skin layers (Rausch et al., 1984; Gan et al., 1987; Hickman, 1996). Children less than 10 year are not being treated with oral ketoconazole.

### Combination

Various regimens use both topical and oral therapies. The most common is varying regimens of selenium sulfide shampoo or lotion and oral therapy with ketoconazole (Rausch, 1984).

### Disadvantages

#### Disadvantages of topical treatment

Although topical drugs can provide immediate reductions in infectivity, are free of systemic adverse effects. These drugs have some disadvantages e.g. the time needed and difficult application of the drug over large affected areas, especially on the trunk, can not use in broken/open skin as well as the unpleasant odour of certain agents. For these reasons, patient adhesion is inadequate, which increases the rate of recurrence. Effectiveness of topical agents is lower, and rate of recurrence varies form 60 to 80% (Savin, 1996). It is found difficult to continue treatment or to know where to apply the cream, once the inflammatory signs have settled. Topical drugs may be difficult to use in certain areas e.g. on the hair, nails, nipples and in some more sensitive areas. Along with this some adverse reactions are most common such as increase in hypersensitivity and irritation occurs, mild dryness of the skin and itching etc. (Gupta and Summerbell, 2000).

#### Disadvantages of oral drugs

Drugs taken orally affect both diseased and normal tissues, thus increasing the chance of side effects. Inspite of short term treatment they bring lot of side effects. Shows hypersensitivity, not recommended for children, nausea, headache, vomiting. Hepatotoxicity may be associated with some oral antifungal medications (Sunenshine, 1998b). Conventional skin disease treatments such as the drugs ketoconazole, ciclopirox, naftifine and tolnaftate can irritate the skin, causing stinging, itching, redness, drying or allergic reactions (Gupta et al., 1998; Gupta and Summerbell, 2000).

### Prevention

- T. versicolor has a high rate of recurrence and may require frequent prophylactic treatment with topical or oral therapy on an intermittent basis.

- Good personal hygiene may be helpful in limiting recurrences. Specifically, patients should shower as soon as possible after participating in activities or exercise that produce significant perspiration.
Medical/legal pitfalls

- Routine evaluation of hepatic function before therapy is seldom warranted for young healthy patients. However, patients at extra risk for preexisting hepatic dysfunction need assessment before treatment. Hepatotoxicity has been associated with the use of ketoconazole tablets, including rare fatalities. Several cases of hepatitis have been reported in children.

- In patients taking terbinafine concurrently with ketoconazole tablets and other serious venricular dysrythmias (in rare cases, leading to fatality) have been recorded.

- Pharmacokinetic data indicate that oral ketoconazole inhibits the metabolism of astemizole, resulting in elevated plasma levels of astemizole and its active metabolite desmethylastemizole, which may prolong QT intervals.

- Ketoconazole may enhance the anticoagulant effect of coumarin like drugs.

Future aspect

The existing treatments have lot of limitations and hence prove to be less effective. The factors contributing to its ineffectiveness are lengthy treatment, costly drugs and sometimes inability to cure the disease. This spawns the need of deriving an appropriate technology. The stepwise study is to be carried out in which foremost thing is the proper diagnosis. Effects of essential oils of various herbs are to be categorically studied on various factors such as sex, age, group, natural inhabitants, geographical conditions etc. Pathogenicity of dermatophytes is also to be studied. The above factors need a concurrent study and reasons for infections, remedies and effectiveness of the drugs are to be evaluated.

Now a day the importance of herbal drugs is reinstated and the world is turning towards safer drugs with no side effects. Thus the exploration of newer drugs from plants is most sought after, which will prove to be cheaper, safer and more effective. Historically, essential oils have been used for therapeutic purposes. In recent years, much research has been devoted to investigate such plant extracts, their active components, modes of action and synergistic effects with other antimicrobial compounds (Baris et al., 2006; Chuang et al., 2007; Zilda et al., 2008; Santos et al., 2006). Ademar et al., 2008; Barrera et al., 2009; Mahboubi and Kazempour, 2009; Mahboubi et al., 2009). These findings of researchers stimulate to explore other plant products, which could be exploited as effective antifungal, especially against T. Versicolor.

Conclusion

Tinea infection is an obstruse disease which bothered dermatologists a lot. The prime task of dermatologist is to precisely diagnose the underlying agent causing the disease. Once this is done, selection of a most favorable antifungal drug can be carried out effectively. Its spectrum of activity which covers the infecting microorganism can prove to be a potent treatment. Last decade showed some noteworthy progress in the evolution of effective and safe drugs for T. versicolor, but could not fullfill the expectations due to their negative aspects such as adverse reactions, expensesiveness and lengthy treatment. Effective therapy demands oral suspension along with the topical drugs. But benefits of these drugs are outshined by the fact that they are having a lot of side effects, such as nausea, headache, vomiting, while less common adverse reactions are abdominal discomfort, transient rash, urticaria, diarrhea and photosensitivity etc.

Diagnostic methodology and fungal susceptibility testing lag behind therapeutic advances. We should turn our attention to these problems by seeking the solutions through the essential oils of medicinal plants. Essential oils are the rich resource of drugs for traditional, folk, synthetic and modern medicines; nutraceuticals and food supplements. Due to presence of numerous chemical compounds, plants of this family possess biological activity including antibacterial, antiviral, antifungal and anti-inflammatory.

References

1. Adamski Z (1995) Studies of a role played by lipophilic yeasts Malassezia furfur (Pityrosporum ovale, Pityrosporum orbiculare) in different dermatoses. Postepy Dermatol 12: 349-454. 
2. Ademar A, Joao PB, Sandra S, Niege AJ, Marcio LA, et al. (2008) Antimicrobial Activity of the Extract and Isolated Compounds from Baccharis dracunculifolia D.C. (Asteraeaceae). Naturforsch 63: 40-46. 
3. Albright SD III, Hitch JM (1966) Rapid treatment of tinea versicolor with selenium sulfide. Arch Dermatol 93: 460-462.
4. Aspiroz C, Ara M, Varea M, Rezusta A, Rubio C (2002) Isolation of Malassezia globosa and M. sympodialis from patients with pityriasis versicolor in Spain. Mycopathologia 154: 111-117.
5. Ashbee HR, Evans EG (2002) Immunology of Diseases Associated with Malassezia Species. Clin Microbiol Rev 15: 21-57. 
6. Asproz C, M. Varea M, Rezusta A, Rubio C (2002) Isolation of Malassezia globosa and M. sympodialis from patients with pityriasis versicolor in Spain. Mycopathologia 154: 111-117.
7. Balachandran C, Thajuddin BC, Ravikumar BC (1999) Comparative evaluation of single dose regimen with two dose regimen of fluconazole in the treatment of tinea versicolor: A double blind placebo controlled study. Indian J Dermat Venereol Leprol 65: 20-22.
8. Bamford JT (1983) Treatment of tinea versicolor with sulfur-salicylic shampoo. J Am Acad Dermatol 8: 211-213.
9. Baris O, Giullice M, Sahin F, Ozar H, Kilic H, et al. (2006) Biological activities of the essential oil and methanol extract of Achillea Biersteinii Afan. (Asteraeaceae) Turk J Biol 30: 65-73. 
10. Barrera-Necha LL, Garduno-Pizana C, Garcia-Barrera LJ (2009) In vitro antifungal activity of essential oils and their compounds on Mycelial growth of Fusarium oxysporum f. sp. gladioli (Massey) Snyder and Hansen. Plant Pathology Journal 8: 17-21.
11. Belec L, Testa J, Bource P (1991) Pityriasis versicolor in the Central African Republic: a randomized study of 144 cases. J Med Vet Mycol 29: 323-329.
12. Bhargava P, Kuldeep CM, Mathur NK (1997) Tinea versicolor localized to dorsal surface of hands and feet - A rare presentation in childhood. Indian J Dermatol Venereol Leprol 63: 382-383. 
13. Borelli D, Jacobs PH, Nall L (1991) Tinea versicolor: epidemiologic, clinical and therapeutic aspects. J Am Acad Dermatol 25: 300-305.
14. Chuang PH, Lee CW, Chou JY, Munugan M, Sheh BJ, et al. (2007) Antifungal activity of crude extracts and essential oil of Moringa oleifera Lam. Bioreosur Technol 98: 232-236. 
15. Crespo EV, Osjeda MA, Vera CA, Sanchez FF (2000) Malassezia globosa as the causative agent of pityriasis versicolor. Br J Dermatol 143: 799-803.
16. Crespo-Echigua V, Florencio VC (2006) Malassezia yeasts and pityriasis versicolor. Curr Opin Infect Dis 19: 139-147. - CrossRef - PubMed - Google Scholar

17. Crowson AN, Magro CM (2003) Atrophyting tinea versicolor: a clinical and histological study of 12 patients. Int J Dermatol 42: 928-932. - CrossRef - PubMed - Google Scholar

18. Drake LA, Dinehart SM, Farmer ER, Goltz RW, Graham GE, et al. (1996) Guidelines for care of superficial mycotic infections of the skin: tinea infections. J Am Acad Dermatol 34: 282-286. - CrossRef - PubMed - Google Scholar

19. Dutta S, Bajaj AK, Basu S, Dikshit A (2002) Pityriasis versicolor: socioeconomics and clinico-epidemiological study in India. J Dermatol 41: 823-824. - CrossRef - PubMed - Google Scholar

20. Elewski BE (1996) Cutaneous mycoses in children. Br J Dermatol 134: 7-11. - CrossRef - PubMed - Google Scholar

21. Faergemann J (1992) Treatment of pityriasis versicolor with a single dose of fluconazole. Acta Derm Venereol 72: 74-75. - CrossRef - PubMed - Google Scholar

22. Faergemann J, Hersle K, Nordin P (1997) Pityriasis versicolor: clinical experience with Lamisil cream and Lamisil DermGel. Dermatology 194: 19-21. - CrossRef - PubMed - Google Scholar

23. Fernandez-Nava HD, Layda-Cuadra B, Tanco EA (1997) Comparison of single dose 400 mg versus 10-200 mg daily dose ketoconazole in the treatment of tinea versicolor. Int J Dermatol 36: 64-66. - CrossRef - PubMed - Google Scholar

24. Fernandez-Torres B, Vaquez-Vega H, Llvo X, Pereiro M Jr, Guarro J (2000) In vitro susceptibility to itraconazole, clotrimazole, ketoconazole, and terbinafine of 100 isolates of Trichophyton rubrum. Mycopathologia 142: 390-394. - CrossRef - PubMed - Google Scholar

25. Gan VN, Petruska M, Ginsburg CM (1987) Epidemiology and treatment of tinea capitis: ketoconazole vs griseofulvin. Pedr Infect Dis J 6: 46-49. - CrossRef - PubMed - Google Scholar

26. Gordon MA (1951a) Lipophilic yeast like organisms associated with tinea versicolor. J Invest Dermatol 17: 267-272. - CrossRef - PubMed - Google Scholar

27. Gordon MA (1951b) The lipophilic mycoflora of the skin. Mycologia 43: 524-534. - CrossRef - PubMed - Google Scholar

28. Gueho E, Midgley G, Guillot J (1996) The genus Malassezia with description of four new species. Antonie van Leeuwenhoek 69: 337-355. - CrossRef - PubMed - Google Scholar

29. Gupta AK, Saurer DN, Shear NH (1994) Antifungal agents: An overview. Part I. J Am Acad Dermatol 30: 677-698. - CrossRef - PubMed - Google Scholar

30. Gupta AK, Einasar TR, Summerbell RC (1998) An overview of topical antifungal therapy in dermatomycoses. A North American Perspective Drug 55: 645-675. - CrossRef - PubMed - Google Scholar

31. Gupta AK, Summerbell RC (2000) Tinea capitis. Medical Mycology 38: 255-287. - CrossRef - PubMed - Google Scholar

32. Gupta AK, Bluhm R, Summerbell R (2002) Pityriasis versicolor. J Eur Acad Dermatol Venereol 16: 19-33. - CrossRef - PubMed - Google Scholar

33. Gupta AK, Batra R, Bluhm R, Faergemann J (2003a) Pityriasis versicolor. Dermatol Clin 21: 413-429. - CrossRef - PubMed - Google Scholar

34. Gupta AK, Kohli Y (2003b) In vitro susceptibility testing of ciclopirox, terbinafine, ketoconazole and itraconazole against dermatophytes and non-dermatophytes and in-vitro evaluation of combination antifungal activity. Br J Dermatol 149: 296-305. - CrossRef - PubMed - Google Scholar

35. Gupta AK, Cooper EA, Ryder JE, Nicol KA, Chow M, et al. (2004a) Optimal management of fungal infections of the skin, hair, and nails. Am J Clin Dermatol 5: 225-237. - CrossRef - PubMed - Google Scholar

36. Gupta AK, Batra R, Bluhm R, Boekhout T, Dawson TL Jr (2004b) Skin diseases associated with Malassezia species. J Am Acad Dermatol 51: 785-798. - CrossRef - PubMed - Google Scholar

37. Hickman JG (1996) A double-blind, randomized, placebo-controlled evaluation of short-term treatment with oral itraconazole in patients with tinea versicolor. J Am Acad Dermatol 34: 785-787. - CrossRef - PubMed - Google Scholar

38. Hirai A, Kano R, Makimura K, Duarte ER, Hamdan JS, et al. (2004) Malassezia nana sp. nov., a novel lipid-dependent yeast species isolated from animals. Int J Syst Evol Microbiol 54: 623-627. - CrossRef - PubMed - Google Scholar

39. Hull CA, Johnson SM (2004) A double-blind comparative study of sodium sulfacetamide lotion 10% versus selenium sulfide lotion 2.5% in the treatment of pityriasis (tinea) versicolor. Cutis 73: 425-429. - CrossRef - PubMed - Google Scholar

40. Inamadar AC, Palit A (2003) The genus Malassezia and human disease. Indian J Dermatol Venereol Leprol 69: 265-270. - CrossRef - PubMed - Google Scholar

41. Ingham E, Cunningham AC (1993) Malassezia furfur. Med Mycol 31: 265-288. - CrossRef - PubMed - Google Scholar

42. Jena DK, Sengupta S, Dwari BC, Ram MK (2005) Pityriasis versicolor in the pediatric age group. Indian J Dermatol Venereol Leprol 71: 259-261. - CrossRef - PubMed - Google Scholar

43. Karakas M, Durdu M, Menisoglu HR (2005) Oral fluconazole in the treatment of tinea versicolor. J Dermatol 32: 19-21. - CrossRef - PubMed - Google Scholar

44. Katsambas A, Rigopoulos D, Antoniou C (1996) Eczemol 1% shampoo versus selenium in the treatment of tinea versicolor: a single-blind randomized clinical study. Int J Dermatol 35: 667-668. - CrossRef - PubMed - Google Scholar

45. Kose O (1995) Fluconazole versus itraconazole in the treatment of tinea versicolor. Int J Dermatol 34: 498-499. - CrossRef - PubMed - Google Scholar

46. Krisanty RI, Bramono K, Made WI (2009) Identification of Malassezia species from pityriasis versicolor in Indonesia and its relationship with clinical characteristics. Mycoses 52: 257-62. - CrossRef - PubMed - Google Scholar

47. Leeming JP, Sansom JE, Burton JL (1997) Susceptibility of Malassezia furfur subgroups to terbinafine. Br J Dermatol 137: 764-767. - CrossRef - PubMed - Google Scholar

48. Leeming JP, Notman FH, Holland KT (1989) The distribution and ecology of Malassezia furfur and cutaneous bacteria on human skin. J Appl Bacteriol 67: 47-52. - CrossRef - PubMed - Google Scholar

49. Lesher J (1994) Fungal skin infections: common but stubborn. Patient Care 28: 16-31. - CrossRef - PubMed - Google Scholar

50. Leyden J (1998) Pharmacokinetics and pharmacology of terbinafine and itraconazole. J Am Acad Dermatol 38: S42-47. - CrossRef - PubMed - Google Scholar

51. Mahboubi M, Kazempour N (2009) The antimicrobial activity of essential oil from Perovskia abrotanoides karei and its main components. Indian J Pharm Sci 71: 343-347. - CrossRef - PubMed - Google Scholar

52. Mahboubi M, Feizabad MM, Safari M (2008) Antifungal activity of essential oils from Zataria multiflora, Rosmarinus officinalis, Lavandula stoechas, Artemisia sieberi Besser and Pelargonium graveolens against clinical isolates of Candida albicans. Pharmagognosy Magazine 4: 15-18. - CrossRef - PubMed - Google Scholar

53. Maheswari AS (1978) Clinical and epidemiological studies on tinea versicolor. J Dermatol 32: 19-21. - CrossRef - PubMed - Google Scholar

54. Malpass G, Montagnac L, MacNeil J, Meunier D (1981) Studies on Malassezia furfur and human disease. Mycoses 24: 219-222. - CrossRef - PubMed - Google Scholar

55. Matin MJ, Ostrosky-Zeicher L, Paetznick VL, Rodriguez JR, Chen E, et al. (2003) Correlation between E-test, disk diffusion, and microdilution methods for antifungal susceptibility testing of fluconazole and voriconazole. Antimicrob. Agents Chemother 47: 1647-1651. - CrossRef - PubMed - Google Scholar
Citation: Rai MK, Wankhade S (2009) Tinea Versicolor - An Epidemiology. J Microbial Biochem Technol 1: 051-056. doi:10.4172/1948-5948.JMBT.1000010

56. Meinicke K, Striegel C, Weidinger G (1984) Treatment of dermatomycoses with naltin. Therapeutic effectiveness following once and twice daily administration. Mycosen 27: 608-614. » CrossRef » PubMed » Google Scholar

57. Mellen LA, Vallee J, Feldman SR (2004) Treatment of pityriasis versicolor in the United States. J Dermatolog Treat 15: 189-192. » CrossRef » PubMed » Google Scholar

58. Moniri R, Nazeri M, Amiri S, Asghari B (2009) Isolation and identification of Malassezia spp. In pityriasis versicolor in Kashan, Iran. Pak J Med Sci 25: 837-840. » CrossRef » PubMed » Google Scholar

59. Muhammad N, Kamal M, Islam T, Islam N, Shafiquzzaman M (2009) A study to evaluate the efficacy and safety of oral fluconazole in the treatment of tinea versicolor. Mymensingh Med J 18: 31-35. » CrossRef » PubMed » Google Scholar

60. Nakabayashi A, Sei Y, Guillot J (2000) Identification of Malassezia species isolated from patients with seborrhoeic dermatitis, atopic dermatitis, pityriasis versicolor and normal subjects. Med Mycol 38: 337-341. » CrossRef » PubMed » Google Scholar

61. Nikpoor N, Leppard B (1978) Fungal disease in Shiraz. Pahlavi Med J 9: 27-49. » CrossRef » PubMed » Google Scholar

62. Okuda C, Ito M, Naka W, Nishikawa T, Tanuma H, et al. (1998) Pityriasis versicolor with a unique clinical appearance. Med Mycol 36: 331-334. » CrossRef » PubMed » Google Scholar

63. Partap R, Kaur I, Chakrabarti A (2004) Single-dose fluconazole versus itraconazole in pityriasis versicolor. Dermatology 208: 55-59. » CrossRef » PubMed » Google Scholar

64. Rajashekhar N (1997) Oral fluconazole in tinea versicolor. Indian J Dermatol Venereol Leprol 63: 166-167. » CrossRef » PubMed » Google Scholar

65. Rao GS, Kuruvilla M, Kumar P, Vinod V (2002) Clinico-epidemiological studies on tinea versicolor. Indian J Dermatol Venereol Leprol 68: 208-209. » CrossRef » PubMed » Google Scholar

66. Rausch LJ, Jacobs PH (1984) Tinea versicolor: treatment and prophylaxis with monthly administration of ketoconazole. Cutis 34: 470-471. » CrossRef » PubMed » Google Scholar

67. Rincón S, Cepero de García MC, Espinol-Ingraff A (2006) A Modified Christensen’s Urea and CLSI Broth Microdilution Method for Testing Susceptibilities of Six Malassezia Species to Voriconazole, Itraconazole, and Ketoconazole. J Clin Microbiol 44: 3429-3431. » CrossRef » PubMed » Google Scholar

68. Santos AO, Ueda-Nakamura T, Dias Filho BP (2008) Antimicrobial activity of Brazilian copaiba oils obtained from different species of the Copaifera genus. Mem Inst Oswaldo Cruz Maio 103: 277-281. » CrossRef » PubMed » Google Scholar

69. Savin R (1996) Diagnosis and treatment of tinea versicolor. J Fam Pract 43: 127-132. » CrossRef » PubMed » Google Scholar

70. Sagita T, Takashima M, Shinoda T, Suto H, Unno T, et al. (2002) New yeast species, Malassezia dermatis, isolated from patients with atopic dermatitis. J Clin Microbiol 40: 1363-1367. » CrossRef » PubMed » Google Scholar

71. Sagita T, Tajima M, Ito T, Saito M, Tsuopi R, et al. (2005) Antifungal Activities of Tacrolimus and Azole Agents against the Eleven Currently Accepted Malassezia Species. J Clin Microbiol 43: 2824-2829. » CrossRef » PubMed » Google Scholar

72. Sunenshine PJ, Schwartz RA, Janniger CK (1998a) Tinea versicolor: an update. Cutis 61: 65-68, 71-72. » CrossRef » PubMed » Google Scholar

73. Sunenshine PJ, Schwartz RA, Janniger CK (1998b) Review. Tinea versicolor. Int J Dermatol 37: 648-655. » CrossRef » PubMed » Google Scholar

74. Tarazooie B, Kordbacheh P, Zaini F, Zomorodian K, Saadat F, et al. (2004) Study of the distribution of Malassezia species in patients with pityriasis versicolor and healthy individuals in Tehran, Iran. BMC Dermatol 4: 5. » CrossRef » PubMed » Google Scholar

75. Terragni L, Lasagni A, Oriani A, Gelmetti C (1991) Pityriasis versicolor in the pediatric age. Pediatr Dermatol 8: 9-12. » CrossRef » PubMed » Google Scholar

76. Tosti A, Piraccini BM, Stinch C, Venturo N, Bardazzu F, et al. (1996) Treatment of dermatophyte nail infections: An open randomized study comparing intermittent terbinafine therapy with continuous terbinafine treatment and intermittent itraconazole therapy. J Am Acad Dermatol 34: 595-600. » CrossRef » PubMed » Google Scholar

77. Vermeer BJ, Staats C (1997) The efficacy of a topical application of terbinafine 1% solution in subjects with pityriasis versicolor: a placebo-controlled study. Dermatology 1: 22-24. » CrossRef » PubMed » Google Scholar

78. Zaitz C (2000) Dermatosis associated with yeasts from Malassezia genus. An Bras Dermatol 75: 129-142. » CrossRef » PubMed » Google Scholar

79. Zilda CG, Claudia MR, Sandra RF, Terezinha IES (2008) Antifungal activity of the essential oil from Calendula officinalis (Asteraceae) growing in brazil. Brazilian Journal of Microbiology 39: 61-63. » CrossRef » PubMed » Google Scholar