



***Urginea indica* and its role in psoriasis: A Review**

M.N. Shiva Kameshwari and G. Paramasivam

Department of Botany Biosystematics Laboratory, Bangalore University, Bangalore, (Karnataka) - India

Abstract

Psoriasis an inflammatory disease of the skin, non-infections. It is an increased proliferation of the skin layers due to excessive division of the cell in the basal layers of the skin. The disease is characterized by well defined plaques with large adherent silvery scales, associated with sever itching. Dryness of skin and silvery scaling are symptoms. It is one of the most common skin disorders in humans, treatments are not available in English Medicine it is available in Ayurveda using *Urginea indica* (Liliaceae) and Chinese Herbal Medicine (CHM) has been used for treating psoriasis and systematic administration of one such CHM is effective in psoriasis. Ayurveda treatments have no side effects reported so far when compared to English Medicine. The present study is a review of earlier work and explored the currently used and the historically, used herbal remedies in the treatment of psoriasis.

Key-Words: Psoriasis, Herbal, Ayurveda, CHM, *Urginea indica*

Introduction

Psoriasis is a common chronic inflammatory dermatosis. Person of all ages may develop the disease. It frequently affects the skin of the elbow, knees, scalp, lumbosacral areas, intergluteal cleft and grans penis. The most typical lesion is a well demarcated, pink coloured plaque covered by loosely adherent scales that are characteristically silver white in colour person of all ages may develop the disease. Disease onset in early admitted due to genetic transmission and more than a dozen immune modifying biological agents.

Internet

Psoriasis is a chronic immune mediated disease that appears on the skin. It occurs when the immune system sends out faulty signals that speed up the growth cycle of skin cells. There are 5 types of psoriasis plaque, guttate, inverse, pustular and erythrodermic.

Psoriasis and Psoriatic arthritis (PSA) are complex genetic disease with environmental stimuli & genetic components. There has been approximately 10-30% of Psoriasis & patients develop PSA, since this case suggests that which susceptibility factor for Psoriasis are also susceptibility factor for Psoriasis arthritis.

The most common form, plaque psoriasis, is commonly seen as red and white hues of scaly patches appearing on the top first layer of the skin.

Plaque psoriasis frequently occur on the skin of the elbows and knees, but can affect any area, including the scalp, palms of hands and soles of feet and genitals. Psoriasis can also cause inflammation of the joints, which is known as psoriatic arthritis 10 to 40% of all people with psoriasis have psoriatic arthritis.¹

The cause of psoriasis is not fully understood, but it is believed to have a genetic component and local psoriatic changes can be triggered by an injury to the skin known as the Koebner Phenomenon. Various environmental factors have been suggested as aggravating psoriasis. There are many treatments available but because of its chronic recurrent nature, psoriasis is a challenge to treat.

Materials

Bulbs of *Urginea indica* growing in Wellengiri hills Coimbatore collected by the tribals and prepare the medicine in the following way. Roots of bulbs are removed since the roots are poisonous to psoriasis *Ayurved, Medicine.*

Ingredients

Bulbs, Gingelly oil, Kasturi Manjal, Garlic, White Brassica, Castor Seeds. 2 Kg bulbs grinded to make it a paste, 2 litre Gingelly oil are boiled to the boiling oil add mixture of garlic ½ kg to this add grinded bulbs boil after boiling remove the vessel and add 250 gms of Kasturi Manjal powder cover it with Aluminium foil for 1 hr and after 1 hr filter the gel and expiry date is

* Corresponding Author

Email: mn.shivakameshwari@gmail.com

180 days (6 months) and this gel has to be applied to the patient for 49 days. (Data collected from the tribals).

English Medicine for the treatment of Psoriasis

Current drugs available in the market for the treatment of Psoriasis are corticosteroids. These drugs reduce inflammation and the turn over of skin cells, and they suppress the immune system. Available in different strengths, topical corticosteroids are usually applied to the skin twice a day. Topical steroid medications are one of the most common treatment for mild to moderate psoriasis. They reduce redness and itching and stop the rapid build up of dead skin cells.²

Tar Compounds

Crude coal tar is a by product of oil production. It makes the skin more sensitive to light. In its natural state it is a thick, brownish black substance that is messy to apply to the skin. Refine coal tar preparation, many of which are available over the counter, may be more cosmetically acceptable, coal tar has been used for more than 100 years to treat psoriasis and it has few side effects (3 – 4).

Anthralin

Anthralin reduces the increases in skin cells and inflammation. Anthralin is a synthetic medication that has an effect on enzymes in the skin cells of people with psoriasis. It comes in a variety of strengths and in the form of an ointment, cream or paste.

Vitamin – D

Synthetic Vitamin D is also called calcipotriol it is a chemical. Cousin of vitamin D.³ It is odorless and non-staining.⁵ It can be used alone but often works best in combination with other topical agents or phototherapy.⁶

Retinoids

These prescription medications are chemical cousins of Vitamin A and are used to treat a variety of skin conditions.⁷⁻⁸ Topical retinoids are synthetic forms of vitamin A. Tazarotene is a synthetic retinoid introduced to treat mild to moderate plaque psoriasis and psoriasis of the scalp and nails. Tazarotene clears skin more slowly than topical steroids, but has fewer side effects.⁹⁻¹⁰

Traditional Chinese Medicine for the Treatment of Dermatologic Disorders

Traditional Chinese Medicine (TCM) is an alternative method of therapy that can be administered in oral, topical or injectable form.¹¹ It emphasizes the importance of using many herbs that are combined in different formulations for each individual patient. Herbal medicine uses any plant part such as the root, bark, stem, seeds, flowers or leaves as a means for treatment.¹²⁻¹³ Herbal Medical Practitioners can create

many different formulas for different types of applications. Traditional Chinese Medicine (TCM) is of particular significance because it is a common choice of patients. TCM has been used to treat a variety of skin diseases, of particular interest to us is psoriasis. Both topical and systematic use of herbs has been administered to treat psoriasis, as well as a combination of herbal medications with UA-A. This method is similar to psoralen – UV – A Phototherapy. Although TCM's are commonly found in topical, oral and photochemotherapeutic modalities some of them are also injectable.¹⁴ Sometimes the injectable agent yields better results than when used in the other forms. According to TCM psoriasis is subtyped into three main categories. "blood-heat" type "blood deficiency – dryness" type and "blood stasis" type. According to the subtype of psoriasis the patient has, a different mixture of herbs is suggested. For eg: when inflicted with blood stasis psoriasis the lesions are indurate and have little tendency to resolve spontaneously.

The principle of treatment of this type of psoriasis is to activate the blood and eliminate the stasis. To treat blood stasis psoriasis the lesions are indurate and have little tendency to resolve spontaneously.

There is also purplish or dark red colour of the tongue with occasional petechia. The principle of treatment of this type of psoriasis is to activate the blood and eliminate the stasis. To treat blood deficiency dryness a different set of herbs is considered more suitable.¹⁵ Among the physical manifestation, of this type is the appearance of the tongue characterized by pinkish colour with a thin coating. TCM and acupuncture. It is highly doubtful as to whether acupuncture has any efficacy in a skin disorder such as psoriasis. After interacting with prominent academic and clinical dermatology, pioneers in China, the general consensus was that acupuncture is not considered efficacious for treatment of skin diseases.¹⁶

Natural medications such as herbal medicine are a safer mode of therapy because of its presumed lack of adverse effects. The herbal medicine used in TCM has adverse systemic effects such as hepatotoxicity. In addition, hyper sensitivity, hepatic toxicity and renal damage have all been reported in China, some of which have been fatal.

Medicinal Plants with anti Psoriasis Activity

1. *Aloevera* (Liliaceae) Leaves
2. *Urginea indica* (Liliaceae) bulbs
3. *Capsicum annum* (Solanaceae) Fruits
4. *Mahonia aquifolium*
5. *Glycyrrhiza glabra* (Leguminosae)

6. *Matricaria recutita* (Asteraceae)
7. *Calendula officinalis* (Compositae)
8. *Arctium lappa* (Asteraceae)
9. *Azadirachta indica* (Meliaceae)
10. *Momordica charantia* (Curcubitaceae)

Classification

1. Nonpustular
 - a. Psoriasis vulgaris
 - b. Psoriasis erythroderma
2. Pustular
 - a. Generalized pustular psoriasis
 - b. Pustulosis palmaris
 - c. Annular pustular psoriasis
 - d. Acrodermatitis continua
 - e. Impetigo herpetiformis

Additional types of psoriasis

1. Drug induced psoriasis
2. Inverse psoriasis
3. Napkin psoriasis
4. Seborrheic – like psoriasis

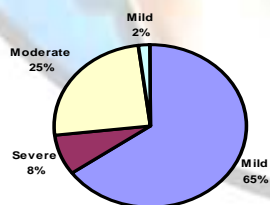
Guttate psoriasis – due to streptococcal infection

Nail psoriasis – Finger and toe nails

Psoriatic arthritis – joints and connective tissue inflammation

Severe cases of psoriasis have been shown to affect health related quality of life to an extent similar to the effects of other chronic diseases. Individuals with psoriasis many also feel self conscious about their appearance and have an poor image that stems from fear of public rejection and psychosexual concerns. Psychological distress can lead to significant depression and social isolation. In a 2008 National Psoriasis foundation survey of 426 sufferers, 71% reported the disease was a significant problem in everyday life.

A 2009 study looked at the impact of psoriasis by using interviews with dermatologists and exploring patients view point. It is found that in cases of mild and severe psoriasis, itch contributed most of the diminished health related quality of life (HRQOL).¹⁷

Distribution of Psoriasis Severity

Psoriasis is usually graded as mild, moderate or severe. Several scales exist for measuring the severity of psoriasis. The Psoriasis Area Severity Index (PASI) is the most widely used measurement tool for psoriasis.¹⁸

Genetics

Many genes are associated with psoriasis but it is not clear how those genes work together, the main value of genetic studies is they identify molecular mechanism and pathways for further study and potential drug targets. Classic genome wide linkage analysis has identified nine locations (loci) on different chromosomes associated with psoriasis, within those loci are genes. Mutations of those genes are commonly found in psoriasis.

Immunology**Diagnosis**

A diagnosis of psoriasis is usually based on the appearance of the skin, there are no special blood tests or diagnostic procedures. A skin biopsy, or scraping may be needed to confirm the diagnosis. Skin from a biopsy will show clubbed rete pegs if positive for psoriasis. Another sign is that when the plaques are scraped, one can see pinpoint bleeding from the skin below.

There are a number of different treatments for psoriasis. Typically topical agents are used for mild disease. Phototherapy, for moderate disease, and systemic agents for severe disease.²⁵

Topical Agents

Bath solutions and moisturizers, mineral oil and petroleum jelly may help soothe affected skin and reduce dryness of skin. Medicated creams and ointments applied directly to psoriatic plaques can help reduce inflammation, remove built up scale, and clear affected skin of plaques. Ointments and creams containing coal tar, dithranol corticosteroids fluocinonide, vitamin D₃ for Eg. Calcipotriol and retinoids are routinely used. Apricus biosciences is currently developing psoriava, a topical cream for the treatment of psoriasis. It contains calcipotriol and betamethasone as the active ingredients and a permeation enhancer DPAIP which facilitates the delivery of the drug into the blood stream.²⁶

Phototherapy

Phototherapy (PUVA) in the form of sunlight has long been used. Effectively for treatment²⁷. wavelength of 311 – 313 nm are most effective and special lamps have been developed for this applications. The amount of light used is determined by a persons skin type.

Systematic agents

Psoriasis that is resistant to topical treatment and phototherapy is treated by medications taken internally by pill or injection (systemic) and the patient are required to have regular blood and liver function tests because of the toxicity of the medication.

There are main types of treatments

1. Methotrexate
2. Cyclosporine
3. Retinoids

In the United Kingdom in 2005 the British Association of Dermatologists (BAD) published guidelines for use of biological interventions in psoriasis.²⁶ In 2008, the FDA approved three new treatment options (28) available to psoriasis patients

1. Taclonex scalp, (Scalp psoriasis)
2. Xtrae velocity excimer laser system to treat moderate to severe psoriasis.
3. The biologic drug adalimumab. (brand name Humira) to severe psoriasis.

Alternative Therapy

Psoriasis symptoms can be relieved by changes in diet and lifestyle, low energy diets and vegetarian diets have improved psoriasis symptoms (4) diets supplemented with fish oil (Vitamin A and D). The severity of psoriasis symptoms may also be influenced by lifestyle habits related to alcohol, smoking, weight, stress and exercise (29).

Another treatment is Ichthyotherapy, which is practiced at some spas in Turkey, Croatia, Ireland, Hungary. Doctor fish living in outdoor thermal pools are encouraged to feed on psoriasis skin, only consuming affected area. This treatment has given positive results. Hypnotherapy may be effective for psoriasis (30).

In UK, the Psoriasis and Psoriatic Arthritis Alliance (PAPAA) has funded research, carried out by the University of Manchester to develop a symptom management programme called Electronic Targeted Intervention for psoriasis (CTIP's) using a modified cognitive behaviour therapy model.

Cannabis

Might treat psoriasis due to anti-inflammatory properties of its cannabinoids (32).

Researchers led by Yin-KU Lin of Chang Gung Memorial Hospital Taiwan reported that Indigo naturalis, a dark blue plant used in traditional Chinese medicine appears to be effective in treating psoriasis and the ointment treated lesion showed 81% improvement (33). Around one third of people with psoriasis report a family history of the disease and researchers have identified genetic loci associated with the conditions. Studies of monozygotic twins suggest a 70% chance of a twin developing psoriasis if the other twin has

psoriasis. The concordance is around 20% for dizygotic twins. These findings suggest both a genetic predisposition and an environmental response in developing psoriasis (34).

History

Psoriasis is probably one of the longest known illnesses of humans. Some scholars believe psoriasis to have been included among the skin conditions called tzaraat in the Bible (56). In more recent times psoriasis was frequently described as a variety of Leprosy. The Greeks used the term lepra for scaly skin conditions. They used the term psora to describe itchy skin conditions. It became known as Willan's lepra in the late 18th century when English dermatologists Robert Willan and Thomas Bateman differentiated it from other skin diseases.

Viennese dermatologist Ferdinand Von Hebra gave the name psoriasis in 1841 and it is derived from the Greek word psora which means to itch (35).

Historical Treatment

The application of cat faeces to red lesions on the skin for Eg: was one of the earliest topical treatments employed in ancient Egypt. Onions, sea salt, urine, goose oil and semen, wasp droppings in sycamore milk and soup made from vipers have all been reported as being ancient treatments.

Fowler's solution which contains a poisonous and carcinogenic arsenic compound was used by dermatologists as a treatment for psoriasis in 18th and 19th century.

Green rays (also called ultrasoft X-ray or Bucky rays) were a popular treatment of psoriasis during the middle of 20th century. Sulphur was fashionable as a treatment for psoriasis in the Victorian and Edwardian Eras.

Current novel therapeutic agents are designed for a better understanding of the immune processes involved in psoriasis for eg: the use of biologics, which target T-cells and TNF inhibitors.

Clinical research has demonstrated the integral role of Janus Kinase (JAK) proteins in the pathogenesis of psoriasis. In 2010 two new oral JAK inhibitor drugs ruxolitinib and tofacitinib have shown rapid and promising efficacy in phase I / II trials with patients showing significant skin clearing within one week of beginning treatment (35, 36).

Causes

The cause of psoriasis is not fully understood. There are two main hypotheses about the process that occurs in the development of the disease. The first considers psoriasis as primarily a disorder of excessive growth and reproduction, of skin cells. The second hypothesis sees the disease as being an immune mediated disorder

in which the excessive reproduction of skin cells is secondary to factors produced by the immune system. T cells (which normally help protect the body against infection) become active, migrate to the dermis and trigger and release of cytokines (tumour necrosis factor alpha TNF which cause inflammation and the rapid production of skin cells. It is not known what initiate the activation of the T-cells.

Medicines, including lithium salt, beta blockers and the antimalarial drug chloroquine, have been reported to trigger or aggravate the disease. Excessive alcohol consumption, smoking and obesity may exacerbate, psoriasis.^{20, 21} Hairspray, some face creams and hand lotions, can also cause psoriasis.

Individuals suffering from the advanced effects of the human immunodeficiency virus, or HIV, often exhibit psoriasis.²²

CD4-T-Cell counts decrease with the progression of HIV, psoriasis Worsens.²³ In addition, HIV is typically characterized by a strong Th2 Cytokine profile, whereas psoriasis is characterized by a strong Th 1 secretion pattern.²⁴ It is hypothesized that the diminished CD4-T –Cell presence causes an overactivation of CD8-T cells which are responsible for the exacerbation of psoriasis in HIV positive patients. Psoriasis occurs more likely in dry skin than oily or well moisturized skin.

The immune system is thought to play a major role. The “Master Switch” that turns on psoriasis is still a mystery. Oral medications available are

1. Acitretin
2. Cyclosporine
3. Methotrexate

Injections

Psoriasis drugs are called biologics alefacept (amevive) adalimumab (Humira) infliximab (Remicade) Etanercept (Enbrel) and Ustekinumab and these are expensive medications. Some of the biologics manufacturers have patient assistance programme to help with financial issues.

Future Target

Ongoing research is needed to decipher the ultimate underlying of botanicals in psoriasis treatment is needed.

Conclusion

Drug discovery in ancient times was largely based on clinical practices. Many drugs presently described by physicians are either directly isolated from plants or are artificially modified versions of natural products. Scientists are looking for lead compounds with specific structures and pharmacological effects often from natural sources. The transition from traditional to

empirical and to molecular screening will certainly increase probability of discovering new leads and drug candidates from natural products. So natural products are beneficial for the treatment of psoriasis without any side effects and plants are used for the search of new antipsoriatic drug development and formulations.

High intake of quercetin and other flavonoids from wild onion and cultivated onion has been shown to decrease risk of atherosclerosis in a epidemiologic study in the united states.

References

1. “Committee for Medicinal Products for Human Use (CHMP) (18 November 2004). “Guideline on Clinical Investigation of Medicinal Products indicated for the treatment of Psoriasis” (PDF). European Medicines Agency. <http://www.ema.europa.eu/pdfs/human/ewp/245402en.pdf>.
2. Globe D, Bayliss M.S. Harrison D.J. (2009) “The impact of itch symptoms in psoriasis: results from physician interviews and patient focus groups”. *Health Qual Life Outcomes* 7. 62. doi:10.1186/1477-7525-7-62. PCM 2717072. PMID 19580674 <http://www.hqlo.com/content/7/62>.
3. “Gottlieb A. Feng. J. Harrison D.J., Globe D (October 2010) “Validation and response to treatment of a pruritus self-assessment tool in patients with moderate to severe psoriasis”. *J. Am. Acad. Dermatol.* 63 (4): 580-6.
4. “Psoriasis Update – Skin and Aging” <http://www.skinandaging.com/article/5394>. Retrieved 2007-07-28.
5. ZAENZ r., Eferl R., Kenner L., et al., (2005). “Psoriasis – like skin disease and arthritis caused by inducible epidermal deletion of Jun proteins”. *Nature* 437 (7057): 369-75. doi:10.1038/nature03963.PMID 16163348.
6. de Cid R., Riveira – Munoz E. Zeeuwen P.I. et al., (February 2009). “Deletion of the late cornified envelope LCE3B and LCE3C genes as a susceptibility factor for psoriasis”. *Nat. Genet.* 41 (2): 211-5.
7. Psoriasis Triggers at psoriasis Net. *SkinCarePhysicians.com* 9-28-05. American Academy of Dermatology, 2008.
8. Behnam S.M. Behnam S.E., Koo Jy (2005). “Smoking and psoriasis”. *Skinmed* 4 (3): 174-6.
9. Coleman, Lester L (November 30, 1975). “your Health”. *Boca Raton News*. <http://news.google.com/newspapers?id=d9APAA>

- AAIBAJ&sjid=WI0DAAAIB AJ&pg=4808, 3654533&dq.
10. Ortonne J.P., Lebwohl. M, Em Griffiths C (2003). "Alefacept-induced decreases in circulating blood lymphocyte counts correlate with clinical response in patients with chronic plaque psoriasis". *Eur J Dermatol* 13 (2): 117-23.
 11. A Case Report of Severe Psoriasis in a patient with AIDS: The Role of the HIV Virus and the Therapeutic Challenges involved. Vol: 13 No. 2, 2002. National Skin Center, Retrieved 05-13-08.
 12. Images of Memorable Cases: Case 34". *Connexions*. Rice University. <http://cnx.org/content/m14956/latest/>. "This AIDS patient presented with a pruritic eruption over most of his body".
 13. Nestle FO., Kaplan D.h., Barker J (july 2009), "Psoriasis". *N. Engl. J. Med.* 361 (5): 496-509.. Review article: Mechanisms of Disease.
 14. Smith C.H., Anstey A.V., Barker J.N., et al., (September 2005). "British Association of Dermatologists guidelines for use of biological interventions in psoriasis 2005". *Br. J. Dermatol.* 153 (3): 486-97.
 15. Hueber W, Patel D.D., Dryja T et al., (October 2010). "Effects of AIN457, a fully human antibody to interleukin-17A, on psoriasis, rheumatoid arthritis, and uveitis" *Sci. Transl. Med.* 2 (52):
 16. Griffiths C.E., Strober, B.E., van de Kerkhof P. et al., (January 2010). "Comparison of ustekinumab and etanercept for moderate-to-severe psoriasis". *N. Engl. J. Med.* 362 (2): 118-28.
 17. Globe D, Bayliss M.S. Harrison D.J. (2009) "The impact of itch symptoms in psoriasis: results from physician interviews and patient focus groups". *Health Qual Life Outcomes* 7. 62.
 18. Loudon B.A. Pearce D.J. Lang W., Feldman S.R. (2004). "A Simplified Psoriasis Area Severity Index (SPASI) for rating psoriasis severity in clinic patients". *Dermatol. Online. J.* 10 (2): 7.
 19. Psoriasis Triggers at psoriasis Net. www.SkinCarePhysicians.com 9-28-05. American Academy of Dermatology, 2008.
 20. Behnam S.M. Behnam S.E., Koo Jy (2005). "Smoking and psoriasis". *Skinmed* 4 (3): 174-6.
 21. Fife D.J, Waller J.M., Jeffes E.W., Koo J.Y.M. (18 May 2007). "Unraveling the Paradoxes of HIV – associated psoriasis: A Review of T-Cell Subsets and Cytokine Profiles". *Dermatology Online Journal* 13 (2).
 22. Ortonne J.P., Lebwohl. M, Em Griffiths C (2003). "Alefacept-induced decreases in circulating blood lymphocyte counts correlate with clinical response in patients with chronic plaque psoriasis". *Eur J Dermatol* 13 (2): 117-23.
 23. Austin L.M., Ozawa M., Kikuchi T., Walters I.B., Krueger J.G. (November 1999) "The majority of epidermal T cells in psoriasis vulgaris lesions can produce type 1 cytokines, interferon-gamma, interleukin-2, and tumor necrosis factor-alpha, defining TC1 (cytotoxic T lymphocyte) and TH1 effector populations: a type 1 differentiation bias is also measured in circulating blood T cells in psoriatic patients" *J. Invest. Dermatol.* 113 (5): 752-9.
 24. Menter A, Griffiths C.E., (July 2007). "Current and future management of psoriasis". *Lancet* 370 (9583): 272-84..
 25. "PsoriaVaTM (Calcipotriene / Betamethasone and DDAIP for the treatment of psoriasis; Pre-IND)". *Apricus Bio*. <http://www.apricusbio.com/psoriava.html>. Retrieved 22 April 2011.
 26. Smith C.H., Anstey A.V., Barker J.N., et al., (September 2005). "British Association of Dermatologists guidelines for use of biological interventions in psoriasis 2005". *Br. J. Dermatol.* 153 (3): 486-97.
 27. "Psoriasis Medical Breakthroughs" *Parade.com*.
 28. Treloar V (2010). "Integrative dermatology for psoriasis: facts and controversies". *Clinics in Dermatolgy* 28 (1): 93-99.
 29. Shenefelt P.D. (March 2000). "Hypnosis in dermatology". *Arch Dermatol* 136 (3): 393-9. doi:10.1001/archderm.136.3.393.
 30. "Research Findings Register: summary number 637". <http://www.refer.nhs.uk/ViewRecord.asp?ID=637&Print=1>. Retrieved 2007-07-22.
 31. Namazi M.R. (2005). "Cannabinoids, Loratadine and allopurinol as novel additions to the antipsoriatic armamentarium" *J. Eur Acad Dermatol Venereol* 19 (3): 319-22
 32. Indigo plant may treat chronic skin disease (Reuters).
 33. Krueger G., Ellis C.N. (2005). "Psoriasis-recent advances in understanding its pathogenesis and treatment". *J. Am. Acad. Dermatol.* 53 (1 Suppl. 1): S94-100.
 34. Glickman F.S. (1986). "Lepra. Psora. Psoriasis". *J. Am. Acad. Dermatol.* 14 (5 pt. 1): 864-6.
 35. Mesa R.A. (June 2010). "Ruxolitinib, a selective JAK1 and JAK2 inhibitor for the treatment of

- myeloproliferative neoplasms and psoriasis".
IDrugs 13 (6): 394-403.
36. Boy M.G., Wang C., Wilkinson B.E., et al.,
(September 2009). "Double-blind, placebo-
controlled, dose-escalation study to evaluate the

pharmacologic effect of CP-690.550 in patients
with psoriasis". J. Invest. Dermatol. 129(9):
2299-302.

