

HERBAL REMEDIES FOR HIV-INFECTIONS

Shashikant R Pattan*¹ Nachiket.S Dighe¹, Ravi.S Jadhav², Vijay.D Tambe² and Pradip.D. Ghule¹

¹-Department of Pharmaceutical Chemistry, Pravara Rural College of Pharmacy, Pravaranagar, M.S India- 413736

²-Department of Pharmacognosy, Pravara Rural College of Pharmacy, Pravaranagar, M.S India- 413736

Summary

The treatment for AIDS is the difficult task. Investigations and research are still in progress to get the effective anti HIV agents. As a result Zidovudine, Lamivudine, Ritonavir, Amprenavir and others are the drugs for HIV treatment. But they have high toxicity and patient cannot tolerate the adverse effects. Our review highlights the herbal drugs, which are effective for treatment of HIV. The present review gives the target of action, compounds and plants. It is necessary to explore the herbal drugs for anti HIV on present situation for future prospects.

Key words: Herbal drugs, HIV, Treatment of AIDS.

***For Correspondance:**

Dr.Shashikant R. Pattan,

M. Pharm, PhD

Principal,

Pravara Rural College of Pharmacy,

Pravaranagar,MS, India-413736

E-mail- shashipattan@yahoo.com

Introduction

Historically, the occurrence of AIDS-like illnesses in population has closely followed the appearance of HIV. The first cases of AIDS in homosexual men in San Francisco were detected in 1981 and retrospective examination of frozen blood samples from a cohort of gay men showed the presence of HIV antibodies as early as 1978 but not before then. Over the past decade, the global epidemic of HIV infection has become a major focus of preventive, therapeutic and community health care in all parts of the world. The importance of the problem cannot be overstated when we consider the situation in developing country like ours where that major route of transmission is heterosexual. Sexually Transmitted Disease (STD) remains a public health problem of major significance in most part of world and South – East Asia is no exception. In this Region, the incidence of acute STD is believed to be high in many countries, although the precise magnitude of the problem is still not clear. However, it is well known that failure to diagnose and treat STD at an early stage result in serious complications and sequelae, including infertility, fetal wastage, ectopic pregnancy, cancer and death. STD also account for massive expenditure, both in terms of the cost of providing care and in terms of the economic burden due to work – days lost as a result of the associated morbidity.

In addition, antimicrobial resistance of several sexually transmitted pathogens is increasing, rendering some low-cost treatment regiment ineffective. New agents (e.g. third generation cephalosporin and fluroquinolones) capable of treating infections caused by resistant strain are available but are expensive. However, their initial high cost must be weighed against the cost of inadequate therapy, which may lead to complications and relapses resulting in the emergence and further spread of antimicrobial resistance.

In the light of above problems and complications, our efforts in making the review on “Herbal remedies with anti HIV- activity” will weightage the scope, potency and clinical significance in preventing transmission of dreadful disease AIDS.

Our review summarizes the current status of knowledge of relatively undefined herbal products. It is encouraging to grow, cultivate and collect such rare herbal drugs which can solve many complications of this disease.

Table no 1: Herbal drugs with anti HIV activity.

Target	Compound	Class	Plant	References
Reverse Transcrip tase	A	Protein	<i>Cactys(Opuntia streptacantha)</i>	1
	Amentoflavone, scutellarein	Flavonoid, flavones	-----	19,36,42,43,49,54,55,48,54
	Betulinic acid, platonic acid	Terpenids	<i>Syzigium claviflorum</i>	13
	Caffeic acid	Tannin	<i>Hyssop officinalis</i>	28
	Catechin	Polyphenol	-	37
	Coriandrin	Coumarin	<i>Coriander(coria ndrum sativum)</i>	22
	Cornusin, others	Condensed	<i>(Cornus</i>	26

		and hydrolysed tannin	<i>officinalis and other)</i>	
	Costalolide, inophyllum P., calanolide B.,	Coumarin	<i>Calophyllum cerasiferum</i>	50
	Ellagitannin	Tannin	-----	40
	Faicalin, quercetin, myricetin, baicalin	Flavonoids	<i>Quercus rubra, others</i>	43,49,53
	Glycyrrhizin	Flavonoids	<i>Licorice (Glycyrrhiza rhiza)</i>	24,56
	Hydroxymaprounic acid., hydroxybenzoate	Terpenoids	<i>Maprounea africana</i>	47
	Methyl nordihydroguaiaretic acid,	Lignan	<i>Many tress</i>	14
	Michellamine B	Alkaloid	<i>Ancistrocladus korupensis</i>	35
	Nigranoic acid	Terpenoids	<i>Schisandra sphaerandra</i>	51
	Protoberberine	Alkaloids	-	54
	Psychotrines	Alkaloids	<i>Ipecac(cephaelis ipecacuanha)</i>	54
	Salasprenic Acid	flavonoids	<i>Trypterygium wilfordii</i>	5
	Suksdorfina	Coumarins	<i>Lomatium suksdorfii</i>	29
	Swertifrancheside	Flavonoid	<i>Swertia franchetiana</i>	46
	Thuja polysaccharide	Lignin-polysaccharides complexes	<i>Thuja occidentalis Japanese white pine (pinus parviflora)</i>	41,29
	7-methoxydesoxymorrellin, 2-isoprenyl forbesione	Xanthone	<i>Garcinia hanburyi (Guttiferae)</i>	59
	Trinorbornane triterpenoid, Lancefodilactone	Triterpenoid	<i>Schisandra lancifolia</i>	60
	1,3,7-trihydroxy-6-	Xanthone	<i>Cratoxylum</i>	61

	methoxy,4,5-diisoprenyl xanthone		<i>arboresens</i> (<i>Gutifereae</i>)	
	TripfordineaA-C	Sesquiterpene pyridine alkaloid	<i>Tripterygium wilfordii</i> (<i>Celastraceae</i>)	62
		Tannin	<i>Acacia nitotica</i> (<i>Mimocaceae</i>)	63
	3-epi-papyriogenin C, papyriagenin A	Triterpenes	<i>Tetrapanax papyriferus</i> (<i>Araliaceae</i>)	64
	18-hydroxy aylythonic acid	tetranorcleodanes	<i>Dicranopteris dichotona</i>	65
			<i>Callophlum inophyllum</i> (<i>Asclepidaceae</i>)	66
	Rubriflorins A-C	Nortripenoids	<i>Schisandra rubriflora</i> (<i>Schisandraceae</i>)	67
Protease	Carnosolic acid	Terpenoids	<i>Rosemary(Rosmarinus officinalis)</i>	45
		Terpenoids. Flavonoids, flavones.	<i>Geum japonicum</i>	57
Adsorption	Mannose-specific lecthins	Lectins	<i>Snowdrop (Galanthus), doffodil (Narcissus), amaryllis (Amaryllis), Gerardia.</i>	38
	Schumannificine 1 ,	Alkaloid	<i>Schumanniophyton mangificicum</i>	18
	Prunellin	Polysaccharide	<i>Prunella</i>	18
Viral fusion	Mannose and N-acetyl-glucosamine specific lectins	Lectins	<i>Cymbidium hybrid, Epiactic helleborine, Listeria ovata, Urtica diocia</i>	3
Syncytium formation	MAR-10	Polysaccharide	<i>Hyssop officinalis</i>	15
	Michellamine B	Alkaloid	<i>Ancistrocladus korupensis</i>	35
	Propolis	Mixture	<i>Various trees</i>	2, 9

Interference with cellular factors	Comptothecin	Alkaloid	-----	44
	Chrysin	Flavone	<i>Chrysanthemum morifolium</i>	8
	Hypericin	Anthraquinone	<i>St. John's (Hypericum)</i>	6, 22
	29000-mol-wt. Protein	protein	<i>Pokeweed (phytolacca)</i>	6
	Suberosol	C- 31, Lanostane Triterpine	<i>Polyalthia suberosa</i>	23
	Tripterifordin	Kauranoid diterpene	<i>Tripterygium wilfordii</i>	27
	Trichosanthin, momorcharins	Ribosome inactivating	<i>Cucurbitaceae family</i>	34
	Quercetin	Flavonoid	<i>Quercus rubra</i>	11
HIV replication in T cell inhibitor	Arzanol		<i>Helichrysum italicum spp microphyllum</i>	68
Unknown	-----	Sulphated polysaccharide	<i>Prunella vulgaris</i>	52
	-----	Sulfonated Polysachharide	<i>Viola yedonensis</i>	39
	Jacali	Lectin	-----	7,10
	Zingibroside R-1	Terpenoids	<i>Panac zingiberensis Wu et Feng</i>	16
	Thiarubrines	Terpenoids	<i>Asteraceae</i>	21
	Chrysin	Flavonoid	<i>Chrysanthemum morifolium</i>	19
	O-Demethylbuchena vianine	Flavonoid-alkaloid	<i>Buchenavia capitata</i>	25

Conclusions

Effective therapies for AIDS, HIV infection is being sought far and wide, in the Laboratories and in the natural worked. Glycyrrhiza, which constitutes Glycyrrhizin (Source of licorice) found to be very effective in vivo HIV studies. Infection in mice has been studied, which extended the life of retrovirus from 14 to 17 weeks (56).

A crude extract of the Cactus (*Opuntia streptacantha*) had marked antiviral effects in vitro and toxicity studies performed in mice, horses and human found the extract to be safe (1). Flavones, biflavonoids, terpenoids, polyphenol, tannins, alkaloids, lectins and others are found to be very useful in the treatment of HIV infection. In this review compounds are arranged alphabetically and this review explains the specific action of the compounds on the target. AIDS-the dreadful disease has to be controlled by a wide variety of plant extract, mixtures and single plant compounds, which are available with different pharmacopoeial standards. Scientist, medicinal chemists, and others from different field are keen in investigating plant for their effective anti-HIV activities. More of these herbal drugs and chemical constituents should be subjected to animal and human studies to determine their effectiveness in whole organism system, including toxicity studies as well. Herbal drugs should be incorporated and be used along with chemotherapeutic agents.

References

1. Ahmad, A., J.Davoies, S. Randall, and G.R.B. Skinner. 1996. Antiviral properties of extracts of *Opuntia streptacantha*. *Antiviral Res.* 30:75-85
2. Amoros, M., f. Saubvagrner, L. Girre, and M. Cormier. 1992 .In vitro antiviral activity of propolis. *Apidologie.* 23:231-240
3. Balzarini, J., D Schols, J, Neyts, E. Van Damme, W. Peumans, and E.De Clercq. 1991. (1,3) and (1,6) D-mannose –specific plant lectins are markedly inhibitory to human immunodeficiency virus and cytomegalovirus infection in vitro. *Antimicrob. Agents Chemother.* 35:410-416
4. Brinkwoth, R.I., M.J. Stoermer, and D.P. Fairlie . 1992. Flavones are inhibitors HIV-1 proteinase. *Biochem. Biophys. Res. Commun.* 188:631-637
5. Chen. K., q. Shi, Y. Kashiwada, D.C. Zhang. C. Q. Hu, j.Q. Jin, H. Nozaki; R.E.Kilkuskie, E. Tramontanto Y.C.cheng , et al. 1992. Anti-AIDS agents. 6. Salaspermic acid, an anti HIV principle from *Tripterygium wilfordii*, and the structure – activity correlation wuith its related compounds. *J. Nat.Prod.* 55:340.346.
6. Chessin, M., D. DeBorde, and A. Zipf (ed.) 1995. Antiviral proteins in higher plants. CRC Press, Inc., Boca Raton, fla
7. Corbeau, P., M.Haran, H. Binz, and C. Devaux. 1994. Jacalin, Alectin with anti-HIV-1 properties and HIV-1 gp120 envelope protein interact with distinct regions of the CD4 molecule. *Mo. Immunol.* 31:569-575.
8. Critchfield, J.W., S.T. Butera, and T. M. 1996. Inhibition of HIV activation in latently infected cells by flavonoid compounds. *AIDS Res. Hum. Retroviruses.* 12:39
9. De Clercq, E. 1992. New perspectives for the chemotherapy of chemoprophylaxis of AIDS (acquired immunodeficiency syndrome). *Verhandelingen* 54:57-89
10. Favero , J., P. Corbeau , M. Nicolas , M. Benkirane, GL. Trave ,. J.F.P. Dixo. P. Aucouturier, S. Rasheed, and J.W.Parker, .1993. Inhibition of human immunodeficiency virus infection by the lectin jacalin and by a derived peptide showing a seqence similarity with GP120. *Eur. J. Immunol* 23:179-185.
11. Fesen, M.R., K.W. Kohn, F. Leteurtre , and Y. Pommoier. 1993. Inhibitors. Of human immunodeficiency virus integrase. *Proc. Nat.Prod.* 57:243-247.

12. Fesem. , /R/. U/ [p,,oer , F. Leterute, S. Hiroguchi, J. Yung, and K.Kohn. 1994. Inhibition of HIV-1 integrase by flavones, caffeic acid phenethyl ester (CAPE) and related compounds. *BIOCHEM. Pharmacol.* 48:595-608
13. Fujioka, T., and Y. Kashiwada. 1994. Anti-AIDS agents. 11. Betulinic acid and platonic acid as anti-HIV principles from *Syzygium claviflorum*, and the anti-HIV activity of structurally related triterpenoids. *J. Nat. Prod.* 57:243—247
14. Gnable, J.N., Brady, D.J. Clanton, Y .Ito J.Dittmer, R.B. Bates, and R.C.C. Huang. 1995. Inhibition of human immunodeficiency virus type 1 transcription and replication by DNA sequence-selective plant lignans. *Proc. Natl. Acad. Sci. USA* 92:11239-11243.
15. Gollapudi, S., H.A. Sharma, S. Aggarwal, L.D. Byers, H.E. Ensley, and S. Gupta. 1995. Isolation of a previously unidentified polysaccharide (MAR-10) from *Hyssop officinalis* virus type 1. *Biochem. Biophys. Res. Commun.*210:145-151.
16. Hasegawa. H., S. Matsumiya . M.Uchiyama, T. Kurikawa , Y. Inouye, R . Kasai, S. Ishibashi, and K. Yamasaki. 41994. Inhibitory effect of some triterpenoid saponins on glucose transport in tumor cells and its application to in vitro cytotoxic and antiviral activities. *Planta Med.* 6:240- 243.
17. Ghayashi, K., M. Kamiya, and T. Hayashi.14995. Virucidal effects of the steam distillate from *Houttuynia cordata* and its components on HSV-1 influenza virus and HIV *Planta Med.* 61:237-241.
18. Houghton, P. J., T. A. Woldemariam,. A. Burke and N. Mahmood. 1994. Antiviral activity of natural and semi-synthetic chromosome alkaloids. *Antiviral Research.* 25: 235-244
19. Hu , C. Q., K. Chen , Q. Shi, R. E. Kilkuskie , Y.C. Cheng., and K. H. Lee. 1994 , Anti-AIDS agents. 10. Acacetin-7-O-B-D – galactopyranoside, and anti-HIV principle from *Chrysanthemum morifolium* and a structure-activity correlation with some related flavonoids. *J.Nat. Prod.* 57:42-51
20. Huang, P. L., H. C. Chen, H. F. Kug , P. L. Huang, H. I. Huang, ad s. Lee-Huang . 1992. Anti-HIV plant proteins catalyze topological changes of DNA into inactive forms. *Biofactors.* 4:37-41.
21. Hudson, J. B., B. Balza , L. Harris, and G.H.N. Towers. 1993. Light-mediated activities of thiarubins against human immunodeficiency virus *Photochem. Photobiol.* 57:675-680.
22. Hudson, J. B.,. E. A. Grhaham, L. Harris, and M. J. Ashwood-Smoith. 1993. The unusual UVA-Dependent antiviral properties of the furoisocoumarin, coriandrin. *Photochem. Photobiol.* 57:491-496.
23. Hui, Y. L., Nan, J. S., Y. Kashiwada, L. Sun, J.V. Snider, L. M. Cosentino, Kuo, H. L., 1993. Anti-AIDS Agents 9. Suberosol a new C-31 lanostane triterpene and anti-HIV principle from *polyalthia suberosa*, *J. Nat. Prod.* 56:1130-113.
24. Ito, M., H. Nakashima, M. Baba, R. Pauwels. E. De Clercq, Shigeta and M. Cosentino, Kuo, H. L., 1993. Anti-AIDS Agents 9. Suberosol, a new C-31 lanostane triterpene and anti-HIV principle from *polyalthia suberosa* , *J. Nat . Prod.* 56:1130-1133.
25. John. B., Hohn, H. C. II., James, B. M., Michael, R.B. Gordonm, C., 1993 Anti-HIV and cytotoxic alkaloids from *Buchenavia capitata* , *J. Nat. Prod.* 55:207-213
26. Kaul, T. N. Middletown, Jr., and P. L. Ogra. 1985. Antiriral effect of flavonoids on human viruses. *J. Med. Virol.* 15:71-79.

27. K. Chen, Qian, S., T. Fujioka, D. C. Zhang, Chang, Q. H., Ji-Qinjin, R.E. Kilkusie, Kuo H. L., 1992. Anti-AIDS AGRENTS, 4' Tripteriforadin, Anovel anti-HIV principle from *Tripterygium wilfordii*. Isolation and structural elucidation, *J Nat. Prod.* 55:88-92
28. Kreis, W., M. H. Kaplan, J. Freeman, D. K. Sun, and P. S. Sarin. 1990 Inhibition of HIV replication by *Hyssop officinalis* extracts. *Antiviral Res.* 147:323-337.
29. Lai, P. K., J. Donovan, H. Takayama, H. Sakagami, A. Tanaka, K. Konno, and M. Nonoyama. 1990 Modification human immunodeficiency viral replication by pine cone extracts. *AIDS Res. Hum. Retroviruses* 6:205-217.
30. Lee-Huang, S., h. f. Huang, H.C.Chen, P.l. Huang, A. Bourinabaiar, H. I. Huang, and h.f. Kung. 1995. Anti-HIV and anti-tumor activities of recombinant MAP30 from bitter melon. *Gene (Amsterdam)* 161:151156.
31. Lee-Huang, S., h. f. Kung, P.L. Huang A.S.Bourinabaiar, J.L.Morell, J. H.Brown, P.L. Huang, W. P. Tsai, A. Y. Chen, H. I. Huang, and H. C. Chen. 1994. Human immunodeficiency virus type 1 (HIV-1) inhibition. DNA-binding, RNA-binding and ribosome inactivation activities in the N-terminal segments of the 3 plant anti-HIV protein. *Proc. Natl. Acad. Sci. USA* 91:12208-12212.
32. Lee-Huang, S., P. L. Huang, A. S. Bourinabaiar, H.C. Chen, and H. F. Kung. 1995 Inhibition of the integrase of human immunodeficiency virus (HIV). Type 1 by anti-HIV plant proteins MAP30 and GAP31. *Proc. Natl. Acad. Sci. USA* 92:8818-8822.
33. Mazumder, A., D. Cooney, R. Agbaria, and Y. Pommier. 1994. Inhibition of human immunodeficiency virus type 1 integrase by 3'-azido-3' deoxythymidylate. *Proc. Natl. Acad. Sci. USA* 91:5771-5775.
34. McGRATH, m.s., k. m. Hwang, S.E. Caldwell, I. Gaston, K.C.Luk, P. Wu, V.L.Ng, S.Crowe, J. Danels, J. Marsh, et al 1989 GLQ 223: an inhibitor of human immunodeficiency virus replication in acutely and chronically infected cells of lymphocyte and mononuclear phagocyte lineage. *Proc. Natl. Acad. Sci. USA* 86:2844-2848.
35. McMahon, J. B., M. J. Currens, R. J. Gulakowski, R. W J Buckheit, C. Lackman-Smith, Y.F. Hallock, and M. R. Boyd. 1995. Michellamine B, a novel plant alkaloid, inhibits human immunodeficiency virus – induced cell killing by at least two distinct mechanisms. *Antimicrob. Agents Chemother.* 39:484-488.
36. Moerman, D.E. 1996. An analysis of the food plants and drug plants of native North America *J. Ethnopharmacol.* 52:1-22.
37. Moore, P.S., and C. Pizza. 1992. Observation on the inhibition of HIV-1 reverse transcriptase by catechins. *Biochem. J.* 288: 717-719.
38. Muller, W.E G., K. Renneisen, M. H. Kreuter, H. C. Schroder, and I. Winkler. 1988. The D-mannose-specific lectin from *Gerardia savaglia* blocks binding of human immunodeficiency virus type I to H9 cells and human lymphocytes in vitro. *J. Acquired Immune Deficiency Syndr.* 1:453-458.
39. Ngan, F., R.S. Chang, H.D. Tabba, and K. M. Smith. 1988. Isolation, purification and partial characterization of an active anti-HIV compound from the Chinese medicinal herb *Viola yedeensis*. *Antiviral Res.* 10:107-116.
40. Nonaka, F. I., I. Nishioka, M. Nishizawa, T. Yamagishi, Y. Kashiwada, G. E.Dutschman, A. J. Bodner, R. E. Kilkuskie, Y. C. Cheng, and K. H. Lee. 1990. Anti-AIDS agents. 2. Inhibitory effects of tannins on HIV reverse transcriptase and HIV replication in H9 lymphocyte cells. *J. Nat. Prod.* 53:5897-595.

41. Offergeld, R., C. Reinecker, E. Gumz, S. Schrum, R. Treiber, R. D. Neth. And S.H. Gohla. 1992. Mitogenic activity of high molecular polysaccharide fraction isolated from the cupressaceae *Thuja occidentalis* L. enhanced cytokine-production by thapsigargin, g-fraction (TPSg) *Leukemia* 6 (Suppl.3):189S-191S.
42. Ono, K., H. Nakane, M. Fukushima, J. C. Chermann, and F. Barre-Sinoussi. 1989. Inhibition of reverse transcriptase activity by a flavonoid compound, 5, 6, 7-trihydroxyflavone. *Biochem. Biophys. Res. Commun.* 3:982-987.
43. Ono, K., H. Nakane, M. Fukushima, J. C. Chermann, and Barre-Sinoussi. 1990. Differential inhibitory effects of various flavonoids on the activities of reverse transcriptase and cellular DNA and RNA polymerases. *Eur. J. Biochem.* 190:469-476
44. Pantazis, P., 1996. Camptothecin: a promising antiretroviral drug. *J. Biomed. Sci.* :14-19.
45. Paris, S, B. Strukelj, M. Renko, and V. Truk. 1993. Inhibitory effects of carnosolic acid on HIV-1 Protease in cell-free assays. *J. Nat. Prod.* 56:1426-1430.
46. Pengsuparp, T., L. Cai, H. Constant, H. H. Fong, L. A. Lin, A. D. Kinghorn, J.M. Pezzuto, G. A. Cordell, K. Ingold, and H. Wagner. 1995. Mechanistic evaluation of new plant-derived compounds that inhibit HIV-1 reverse transcriptase. *J. Nat. Prod.* 58:1024-1031.
47. Pengsuparp, T., L. Cai, H. H. S. Fong, A. D. Kinghorn, J. M. Pezzuto, M. C. Wani, and M. E. Wall. 1994. Pentacyclic triterpenes derived compounds that inhibit HIV-1 reverse transcriptase. *J. Nat. Prod.* 58:1024-1032.
48. Sethi, M. L. 1979. Inhibition of reverse transcriptase activity by benzo-phenanthridine alkaloids. *J. Nat. Prod.* 42:187-110.
49. Spedding, G., A. Ratty, and E. J. Middleton. 1989. Inhibition of reverse transcriptases by flavonoids. *Antiviral Res.* 12:99-110.
50. Spin, C., Dodier, M., Sontheeswaran, S. et al., 1998. Anti-HIV coumarins from *Calophyllum* seed oil. *Bioorg. Med. Chem. Lett.* 8(24) : 3475-3478.
51. Sun, H. D., S. X. Qui, L.Z. Y. Wang, Z. W. Lin, T. Pengsuparp, J. M. Pezzuto, H. H. Fong, G. A. Cordell, and N. R.; Farnsworth. 1996. Nigranoic acid, a triterpenoid from *Schisandra sphaerandra* that inhibits HIV-1 reverse transcriptase. *J. Nat. Prod.* 59:525-527.
52. Tabba, H. D., R. S. Chang and K. M. Smith. 1989. Isolation, Purification, and partial characterization of prunellin, an anti-HIV component from aqueous extracts of *Prunella vulgaris*. *Antiviral Res.* 11:263-270
53. Tan, G. T., J. F. Miller, A. D. Kinghorn, S. H. Hughes, and J. M. Pezzuto 1992. HIV-1 and HIV-2 reverse transcriptases: a comparative study of sensitivity to inhibition by selected natural products. *Biochem. Biophys. Res. Commun.* 185:370-378.
54. Tan, G. T., J. M. Pezzuto, and A. D. Kinghorn. 1991. Evaluation of natural products as inhibitors of human immunodeficiency virus type 1 (HIV-1) reverse transcriptase. *J. Nat. Prod.* 54:143-154.
55. Tang, R., K. Cheng, Consentino, and K. H. Lee. 1994. Apigenin-7-O-β-D-glucopyranoside, an anti-HIV principle from *Kummerowia striata*. *Bioorg. Med. Chem. Lett.* 4:455-458.
56. Wantanbe, H., C. Miyaji, M. Makino, and T. Abo. 1996. Therapeutic effect of glycyrrhizin in mice infected with LP-BM5 murine retrovirus and mechanisms involved in the prevention of disease progression. *Biotherapy* 9:209-220

57. Xu, H. X ., F. Q. Zeng., M. Wan, and K. Y. Sim. 1996. Anti-HIV Triterpenene Acids form *Geum japonicum* J. Nat. Prod. 59:643-645.
58. Yao, W-J , M. A. Wainberg, and Am. A. Parniak . 1992. Mechanism of inhibition of HIV-1 infection in vitro by purified extract of *Prunella vulgaris*. Virology 178:56.
59. Reutrakul, V., Chanakul: W., Pohmakotr M. Napaswat C: Kongsqree P., 2006, *Planta Medica* , 72(15): 1433-1435.
60. Horiuch M. Murakmi C. Fukamiyan N. Zhang C. C. hu K. H. , 2007. *Med. & Aromatic plants* . 29 92): 727
61. Xi ao W. L., Tian R. R., Pu j. , Zheng Y. T., Sun H. D. 2006. 28(3) : J.Nat. Prod. , 69(2): 277-273.
62. Xj ao W. L. Tian R.R. Pu J. A. Zheng Y. T. , Sun H. D. 2007. *J. Nat. Prod.* 70 :608-612.
63. Reutrakul V., Anantachoke N. , Prhmatltr M., Santisuk T. Tuchinda P 2007. *Plant Medica* .73:33-40.
64. Khan T.A. Tatke P. A. Gabhe S. Y. Mahajan K. Kothari S. Deshmukh R. A. 2008. *J. Reaserch & Education in Indian medicine* 30: 47-53.
65. Ho J. C. Chen C. M. Row L. C. 2008, *J. Nat. Prod.* , 30: 265-268.
66. Li X. I. Yang L. M. Zhao Q. S. 2008 *Phytochemistry* 30:631-635.
67. Xiao W. L. Li, X., Wang R. R., Yang L. M. Zheng Y. T., Li R. T. Sun H. D. 2008 *J. Nat. Prod.* .30:1056-1059.