WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.074
Volume 8, Issue 5, 589-598. Research Article ISSN 2277– 7105

A STUDY OF FOLK MEDICINAL PRACTICES IN DEBASHUR VILLAGE, GOPALGANJ DISTRICT, BANGLADESH

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Article Received on
13 Feb. 2019,

Revised on 05 March 2019,
Accepted on 25 March 2019

DOI: 10.20959/wjpr20195-14691

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ABSTRACT

Background. Among the various health professionals of Bangladesh, folk medicinal practitioners possibly form the most numerous group using various forms of therapy to cure diseases. In a few words, a folk medicine practitioner (FMP) is usually a common person who practices medicine without any acknowledged degree in medicinal practice. What is an important feature of FMPs is that diverse methods but all of which for the most part use plants are used by them for treatment. These phytotherapeutic practices can form, if properly documented, a vast repository of knowledge of plant-based medicines. **Methods.** The objective of the present study was to document the phytotherapeutic practices of a FMP in Debashur village, Gopalganj district, Bangladesh. Interviews were carried out with the help of a semi-structured questionnaire. **Results.** The FMP was found to use 17 plants distributed into 15 families for treatment of diverse diseases like helminthiasis, gastrointestinal disorders, bone fracture, pain, wounds, skin infections, leucorrhea, typhoid, malaria, and cholera. **Conclusion.** The plants used by the FMP are important towards discovery of new drugs, which is more desirable in recent times considering that new drugs are needed to combat drug-resistant vectors causing diseases like malaria and typhoid.

KEYWORDS: Folk medicine, medicinal plants, Debashur, Gopalganj, Bangladesh.

BACKGROUND

Medicines have possibly been used by human beings since their advent. Possibly such use have been sporadic at first and consisted of trials and errors, but with time medicinal systems started to become formalized into specific systems. It has been said that in the beginning of the first millennium AD, three systems of medicine have become quite established, namely Ayurvedic (Indian), Chinese, and Greek systems.[1] Use of plants is practically universal in all traditional medicine systems of the world since time immemorial.[2] Even animals like gorillas have been documented to use plants as medicines, particularly to expel parasites from their body system.[3]

Although various traditional medicinal systems have developed their own philosophy and treatment of diseases, some like folk medicine and home remedies are unique in their formulations and remedies, which vary quite widely among the practitioners. This is particularly true for folk medicine practitioners (FMPs), arguably the most numerous and forming the primary tier of health care providers in Bangladesh. Since FMPs do not need any formal training to practice, their treatment methods in the choice of their formulation ingredients vary widely although phytotherapy form their primary mode of treatment. As such knowledge is passed orally from generation to generation, over time a FMP can be quite proficient in using plants for treatment. Thus documentation of folk medicinal practice is important for learning about the therapeutic uses of plants, which in turn can lead to discovery of new drugs. To document the mostly undocumented medicinal plants of Bangladesh, we had been conducting ethnomedicinal surveys among folk and tribal medicinal practitioners of the country for a number of years.[4-40] The objective of the present study was to document the phytotherapeutic practices of a FMP in Debashur village, located in Gopalganj district of Bangladesh.

METHODS

The FMP was named Kiron Chandra Mondol, male, and gave his age as 75 years. He resided at Debashur village in Gopalganj district, Bangladesh. Prior informed consent was initially obtained from the FMP. Information as to the nature of our visit was given to the FMP and consent obtained to disseminate any information provided, including his name both nationally and internationally. Actual interviews were conducted in the Bengali language, which was spoken fluently by the FMP as well as the interviewers. The interviews were conducted with the help of a semi-structured questionnaire and the guided field-walk method of Martin[41]

and Maundu.[42] In this method the FMP took the interviewers on guided field-walks through areas from where he collected his medicinal plants or plant parts, pointed out the plants, and described their uses. All plant specimens were photographed and collected on the spot, pressed, dried and brought back to Bangladesh National Herbarium at Dhaka for identification. Voucher specimens were deposited with the Medicinal Plant Collection Wing of the University of Development Alternative.

RESULTS

The FMP was found to use 17 plants distributed into 15 families for treatment of diverse diseases like helminthiasis, gastrointestinal disorders, bone fracture, pain, wounds, skin infections, leucorrhea, typhoid, malaria, and cholera. The results are shown in Table 1. Both monoherbal and polyherbal formulations were used in his treatment. Interestingly, bone fracture and pain associated with bone fracture was treated with two different plants. Also interestingly, the FMP distinguished between leucorrhea in males and leucorrhea in females. Male leucorrhea is usually thought of by FMPs as passing semen (‘dhatu’ in Bengali) in urine while female leucorrhea is considered to be a whitish discharge in urine due to urinary tract infections.

Table 1: Medicinal plants and formulations of the folk medicinal practitioner of Gopalganj district, Bangladesh.

Serial Number	Scientific Name	Family Name	Local Name	Parts used	Ailments treated
1	*Andrographis paniculata* (Burm.f.) Nees	Acanthaceae	Kolponath	Stem, Leaf	Anthelmintic. Leaves are crushed. Tablets made from the crushed leaves are orally taken twice daily. See *Azadirachta indica*.
2	*Annona squamosa* L	Annonaceae	Ata-phol	Leaf	Constipation. Seven leaves of the plant are taken and macerated. The paste is then equally divided into three portions and taken orally thrice daily for the treatment of constipation.
3	*Calotropis procera* (Ait.) R. Brown	Asclepiadaceae	Akondi	Stem, Leaf	Bone fracture. A paste of leaf and stem is applied topically to the fracture area after the broken bone(s) have been set up correctly.
4	*Mikania scandens* (L.) Willd.	Asteraceae	Bitechara	Vine	See *Tagetes erecta*.
5	*Tagetes erecta* L.	Asteraceae	Gadaphool	Leaf	Infected wounds. Leaves of *Tagetes erecta* are macerated together with leaves of *Solanum melongena* and vines of *Mikania scandens* and made into a paste with lime (calcium

					hydroxide). The paste is topically applied daily to the wounded area till the wound heals.
6	*Basella alba* L.	Basellaceae	Pui shak	Vine (stem and leaf)	Pain associated with bone fracture. Vines are collected, made into a paste and topically applied to the fracture area.
7	*Opuntia dillenii* (Ker-Gawl.) Haw.	Cactaceae	Foni-monsha	Upper part	Menstrual problem. Paste is made from the upper part of the plant and during menstruation it is taken orally on an empty stomach in the morning for 10-30 consecutive days.
8	*Vitex negundo* L.	Lamiaceae	Nishinda	Leaf, Stem	See *Azadirachta indica*.
9	*Barringtonia racemosa* (L.) Spreng	Lecyhidaceae	Moha-shomudro	Leaf, Root	Gangrene. Three leaves are macerated separately and applied topically to the affected area for three consecutive days. Leucorrhea. Macerated root of *Barringtonia racemosa* is mixed with *Piper nigrum* macerated seed. The paste is taken on an empty stomach in the morning for seven days.
10	*Asparagus racemosus* Willd.	Liliaceae	Shotomuli	Seed	Leucorrhea (male). Seeds are chewed with jaggery on an empty stomach for seven consecutive days.
11	*Azadirachta indica* A. Juss.	Meliaceae	Neem	Leaf, Stem	Typhoid. Three to four leaves of *Azadirachta indica*, *Aegle marmelos* and *Vitex negundo* are taken and macerated together to obtain juice. Juice is orally taken in the morning on an empty stomach for three days to treat typhoid fever. Malaria. Juice obtained from macerated leaves and stems of a combination of *Azadirachta indica*, *Tinospora sinensis*, *Vitex negundo*, *Aegle marmelos* and *Andrographis paniculata* is taken orally in the morning on an empty stomach for three consecutive days. Itching/tinea infection. Leaf of *Azadirachta indica*, *Vitex negundo*, *Andrographis paniculata* along with bark of *Tinospora sinensis* and *Aegle marmelos* are boiled in 5-6 liter water till the volume is reduced to one and half liter. Half cup of the juice is then taken orally on an empty stomach every morning.
12	*Tinospora sinensis* (Lour.) Merr.	Menispermaceae	Amguruj	Stem, Leaf, Bark	See *Azadirachta indica*.
13	*Piper nigrum* L.	Piperaceae	Gol morich	Seed	See *Barringtonia racemosa*.
14	*Aegle marmelos* (L.)	Rutaceae	Bel	Leaf, Stem,	See *Azadirachta indica*.

	Corr.			Bark	
15	*Citrus aurantiifolia* (Christm.) Swingle	Rutaceae	Lebu	Fruit	Cholera. Juice of one fruit is mixed with one pinch of salt and taken orally for once. If one dose is not sufficient for curing, one more dose is given.
16	*Solanum melongena* L.	Solanaceae	Begun	Leaf	See *Tagetes erecta*.
17	*Abroma augusta* L.f.	Sterculiaceae	Ulot-kombol	Stem	Leucorrhea. Stems are soaked overnight; a curd will form in the morning, which is taken orally on an empty stomach every morning for seven consecutive days.

There were a number of novel aspects in the FMP's formulations. For instance, he used a paste of stems and leaves of *Calotropis procera* to mend broken bones. More commonly, the plant used for mending fractured bones in Bangladesh is *Cissus quadrangularis*.[7,43] However, the plant is also known to be used in folk medicine in Rangpur district, Bangladesh to treat body pain.[44] Thus it is possible that the FMP was treating both fracture and fracture-associated pain with the same plant. The use of *Annona squamosa* leaves for treating constipation appears to be novel and previously unreported. A previous report has mentioned that seeds of the plant are used as aphrodisiac in Jessore district, Bangladesh.[45]

Leaves of *Azadirachta indica*, *Aegle marmelos* and *Vitex negundo* in combination with or without other plant parts were used by the FMP for treatment of typhoid, malaria, and tinea infection (causing itching). This combination is also to our knowledge a novel and previously unreported combination for treatment of the said ailments. For treatment of malaria, both leaves and stems of the afore-mentioned three plants were used in combination with leaves and stems of *Tinospora sinensis* and *Andrographis paniculata*. A major phytoconstituent of *Andrographis paniculata*, namely andrographolide has anti-pyretic properties and can prove useful in malarial fever.[46] *Azadirachta indica* has anti-fungal properties and is effective against dermatophytes.[47] Anti-malarial activity of *Azadirachta indica* leaf extract *in vitro* against *Plasmodium falciparum* has been reported.[48] *Tinospora sinensis* has similar uses in Ayurveda as *Tinospora cordifolia*, one of them being anti-pyretic.[49] Thus this plant can also be useful in alleviating malarial fever.

CONCLUSION

Both the monoherbal and polyherbal formulations of the FMP appear promising towards the discovery of new drugs and as readily available sources of various disease treatments.

Conflicts of interest

The author(s) declare that they have no competing interests.

REFERENCES

1. Subbarayappa BV. The roots of ancient medicine: an historical outline. J Biosci, 2001; 26(2): 135-144.
2. Sofowora A, Ogunbodede E, Onayade A. The role and place of medicinal plants in the strategies for disease prevention. Afr J Tradit Complement Altern Med, 2013; 10(5): 210-229.
3. Cousins D, Huffman MA. Medicinal properties in the diet of gorillas: An ethnopharmacological investigation. Afr Stud Monog, 2002; 23(2): 65-89.
4. Rahmatullah M, Ferdausi D, Mollik MAH, Jahan R, Chowdhury MH, Haque WM: A Survey of Medicinal Plants used by Kavirajes of Chalna area, Khulna District, Bangladesh. Afr J Tradit Complement Alternat Med, 2010; 7(2): 91-97.
5. Rahmatullah M, Khatun MA, Morshed N, Neogi PK, Khan SUA, Hossan MS, Mahal MJ, Jahan R: A randomized survey of medicinal plants used by folk medicinal healers of Sylhet Division, Bangladesh. Adv Nat Appl Sci, 2010; 4(1): 52-62.
6. Rahmatullah M, Kabir AABT, Rahman MM, Hossan MS, Khatun Z, Khatun MA, Jahan R: Ethnomedicinal practices among a minority group of Christians residing in Mirzapur village of Dinajpur District, Bangladesh. Adv Nat Appl Sci, 2010; 4(1): 45-51.
7. Rahmatullah M, Momen MA, Rahman MM, Nasrin D, Hossain MS, Khatun Z, Jahan FI, Khatun MA, Jahan R: A randomized survey of medicinal plants used by folk medicinal practitioners in Daudkandi sub-district of Comilla district, Bangladesh. Adv Nat Appl Sci, 2010; 4(2): 99-104.
8. Rahmatullah M, Mollik MAH, Ahmed MN, Bhuiyan MZA, Hossain MM, Azam MNK, Seraj S, Chowdhury MH, Jamal F, Ahsan S, Jahan R: A survey of medicinal plants used by folk medicinal practitioners in two villages of Tangail district, Bangladesh. Am-Eur J Sustain Agric, 2010; 4(3): 357-62.
9. Rahmatullah M, Mollik MAH, Islam MK, Islam MR, Jahan FI, Khatun Z, Seraj S, Chowdhury MH, Islam F, Miajee ZUM, Jahan R: A survey of medicinal and functional food plants used by the folk medicinal practitioners of three villages in Sreepur Upazilla, Magura district, Bangladesh. Am-Eur J Sustain Agric, 2010; 4(3): 363-73.
10. Rahmatullah M, Jahan R, Khatun MA, Jahan FI, Azad AK, Bashar ABMA, Miajee ZUM, Ahsan S, Nahar N, Ahmad I, Chowdhury MH: A pharmacological evaluation of

medicinal plants used by folk medicinal practitioners of Station Purbo Para Village of Jamalpur Sadar Upazila in Jamalpur district, Bangladesh. Am-Eur J Sustain Agric, 2010; 4(2): 170-95.

11. Rahmatullah M, Ishika T, Rahman M, Swarna A, Khan T, Monalisa MN, Seraj S, Mou SM, Mahal MJ, Biswas KR: Plants prescribed for both preventive and therapeutic purposes by the traditional healers of the Bede community residing by the Turag River, Dhaka district. Am-Eur J Sustain Agric, 2011; 5(3): 325-31.
12. Rahmatullah M, Azam MNK, Rahman MM, Seraj S, Mahal MJ, Mou SM, Nasrin D, Khatun Z, Islam F, Chowdhury MH: A survey of medicinal plants used by Garo and non-Garo traditional medicinal practitioners in two villages of Tangail district, Bangladesh. Am-Eur J Sustain Agric, 2011; 5(3): 350-7.
13. Rahmatullah M, Biswas KR: Traditional medicinal practices of a Sardar healer of the Sardar (Dhangor) community of Bangladesh. J Altern Complement Med, 2012; 18(1): 10-9.
14. Rahmatullah M, Hasan A, Parvin W, Moniruzzaman M, Khatun Z, Jahan FI, Jahan R: Medicinal plants and formulations used by the Soren clan of the Santal tribe in Rajshahi district, Bangladesh for treatment of various ailments. Afr J Tradit Complement Alternat Med, 2012; 9(3): 350-9.
15. Rahmatullah M, Khatun Z, Hasan A, Parvin W, Moniruzzaman M, Khatun A, Mahal MJ, Bhuiyan MSA, Mou SM, Jahan R: Survey and scientific evaluation of medicinal plants used by the Pahan and Teli tribal communities of Natore district, Bangladesh. Afr J Tradit Complement Alternat Med, 2012; 9(3): 366-73.
16. Rahmatullah M, Azam MNK, Khatun Z, Seraj S, Islam F, Rahman MA, Jahan S, Aziz MS, Jahan R: Medicinal plants used for treatment of diabetes by the Marakh sect of the Garo tribe living in Mymensingh district, Bangladesh. Afr J Tradit Complement Alternat Med, 2012; 9(3): 380-5.
17. Rahmatullah M, Khatun Z, Barua D, Alam MU, Jahan S, Jahan R: Medicinal plants used by traditional practitioners of the Kole and Rai tribes of Bangladesh. J Altern Complement Med, 2013; 19(6): 483-91.
18. Rahmatullah M, Pk SR, Al-Imran M, Jahan R: The Khasia tribe of Sylhet district, Bangladesh, and their fast-disappearing knowledge of medicinal plants. J Altern Complement Med, 2013; 19(7): 599-606.

19. Akter S, Nipu AH, Chyti HN, Das PR, Islam MT, Rahmatullah M: Ethnomedicinal plants of the Shing tribe of Moulvibazar district, Bangladesh. World J Pharm Pharm Sci, 2014; 3(10): 1529-37.
20. Azad AK, Mahmud MR, Parvin A, Chakrabortty A, Akter F, Moury SI, Anny IP, Tarannom SR, Joy SK, Chowdhury SY, Akter S, Rahmatullah M: Medicinal plants of a Santal tribal healer in Dinajpur district, Bangladesh. World J Pharm Pharm Sci, 2014; 3(10): 1597-1606.
21. Azad AK, Mahmud MR, Parvin A, Chakrabortty A, Akter F, Moury SI, Anny IP, Tarannom SR, Joy SK, Chowdhury SY, Akter S, Rahmatullah M: Ethnomedicinal surveys in two Mouzas of Kurigram district, Bangladesh. World J Pharm Pharm Sci, 2014; 3(10): 1607-20.
22. Kamal Z, Bairage JJ, Moniruzzaman, Das PR, Islam MT, Faruque MO, Islam MR, Paul PK, Islam MA, Rahmatullah M: Ethnomedicinal practices of a folk medicinal practitioner in Pabna district, Bangladesh. World J Pharm Pharm Sci, 2014; 3(12): 73-85.
23. Anzumi H, Rahman S, Islam MA, Rahmatullah M: Uncommon medicinal plant formulations used by a folk medicinal practitioner in Naogaon district, Bangladesh. World J Pharm Pharm Sci, 2014; 3(12): 176-88.
24. Amin R, Hasan MM, Rahman MA, Nargis T, Akter MH, Islam MT, Das PR, Rahmatullah M: Home remedies of a rural housewife in Jamalpur district, Bangladesh. World J Pharm Pharm Sci, 2015; 4(10): 329-335.
25. Rahman F, Rahmatullah M: Medicinal plant formulations of the Musohor tribe of Birganj in Dinajpur district, Bangladesh. World J Pharm Pharm Sci, 2015; 4(11): 177-185.
26. Alam MS, Alamin M, Bari AN, Adhikary AC, Khatun MM, Parvin MR, Islam E, Rahmatullah M: Medicinal uses of plants by a female folk medicinal practitioner of Narayanganj district, Bangladesh. World J Pharm Pharm Sci, 2015; 4(11): 361-368.
27. Zaman T, Keya KF, Akter S, Sagar MH, Khan MS, Bhuiyan MB, Malek I, Rahmatullah M: Plants as medicines: documentation of medicinal plants used by a Khasia tribal practitioner in Habiganj district, Bangladesh. World J Pharm Pharm Sci, 2015; 4(12): 55-63.
28. Kundu MK, Alam MM, Arefin Z, Yasmin S, Yeasmin S, Islam E, Rahmatullah M: Phytotherapeutic practices of a folk medicinal practitioner of Jhenaidah district, Bangladesh. World J Pharm Pharm Sci, 2016; 5(2): 127-136.

29. Mukti M, Rahman MA, Bashar ABMA, Hossain S, Rahmatullah M: Medicinal plants of the Khatriya and Kasya clans of the Bagdi people in Rajbari district in Bangladesh. Am.-Eur J Sustain Agric, 2013; 7(3): 170-177.
30. Kabir MH, Hasan N, Rahman MM, Rahman MA, Khan JA, Hoque NT, Bhuiyan MRQ, Mou SM, Jahan R, Rahmatullah M: A survey of medicinal plants used by the Deb barma clan of the Tripura tribe of Moulvibazar district, Bangladesh. J Ethnobiol Ethnomed, 2014; 10: 19.
31. Amin R, Hasan MM, Rahman MA, Nargis T, Akter MH, Islam MT, Das PR, Rahmatullah M: Home remedies of a rural housewife in Jamalpur District, Bangladesh. World J Pharm Pharm Sci, 2015; 4(10): 329-335.
32. Chowdhury ASMHK, Shahriar MH, Rahman MS, Uddin MP, Al-Amin M, Rahman MM, Bhuiyan MTA, Afrin S, Chowdhury S, Rahman MM, Azad AK, Rahmatullah M: Home remedies of rural folks: a study in Kadipur village of Chuadanga District, Bangladesh. World J Pharm Pharm Sci, 2015; 4(1): 171-182.
33. Mahmud MR, Parvin A, Anny IP, Akter F, Tarannom SR, Moury SI, Joy SK, Akter S, Chowdhury SY, Chakrabortty A, Azad AK, Rahmatullah M: Home remedies of village people in six villages of Dinajpur and Rangpur Districts, Bangladesh. World J Pharm Pharm Sci, 2015; 4(2): 63-73.
34. Rahman S, Rahmatullah M: Medicinal plant home remedies in several villages of Patuakhali district, Bangladesh. J Chem Pharmaceut Res, 2015; 7(6): 147-151.
35. Nahar S, Rahmatullah M: Plants, animals, birds, insects, minerals – all are medicines to a folk medicinal practitioner in Nilphamari district, Bangladesh. World J Pharm Pharm Sci, 2016; 5(4): 2422-2439.
36. Akhter J, Khatun R, Akter S, Akter S, Munni TT, Malek I, Rahmatullah M: Ethnomedicinal practices in Natore district, Bangladesh. World J Pharm Pharm Sci, 2016; 5(8): 212-222.
37. Sourav DS, Jannat K, Kamal N, Rahmatullah M. Some home remedies used in Kalindi village of Dhaka district, Bangladesh. J Med Plants Stud, 2018; 6(6) Part D: 222-225.
38. Eatimony S, Urmee KN, Ara N, Rahmatullah M. Using plants as medicines – practices of a female folk medicinal practitioner in Hatirdiya village, Bangladesh. J Med Plants Stud, 2019; 7(1 Part A): 55-57.
39. Eatimony S, Urmee KN, Sultana M, Ara N, Rahmatullah M. Folk medicinal practices in Khutmura village, Narsinghdi district, Bangladesh. J Med Plants Stud, 2019; 7(1 Part B): 86-88.

40. Haque ZB, Kamal N, Sultana M, Rahmatullah M. Two female folk medicinal practitioners of Bangladesh and evaluation of their phytotherapeutic practices. J Med Plants Stud, 2019; 7(1 Part B): 100-102.
41. Martin GJ. Ethnobotany: a 'People and Plants' Conservation Manual, Chapman and Hall, London, 1995; pp268.
42. Maundu P: Methodology for collecting and sharing indigenous knowledge: a case study. Indigenous Knowledge and Development Monitor, 1995; 3(2): 3-5.
43. Sarder MS, Afrooz T, Rohani S, Tuti MK, Rahmatullah M. Therapeutic uses of medicinal plants in Naogaon district, Bangladesh. J Med Plants Stud, 2018; 6(3): 123-126.
44. Azad AK, Mahmud MR, Parvin A, Chakrabortty A, Akter F, Moury SI, Anny IP, Tarannom SR, Joy SK, Chowdhury SY, Akter S, Rahmatullah M: Medicinal plants of a folk medicinal healer of Rangpur district, Bangladesh. J Med Plants Stud, 2014; 2(5): 46-50.
45. Rahmatullah M, Hasan MM, Ahmed M, Khan MW, Hossan MS, Rahman MM, Nasrin D, Miajee ZUMEU, Hossain MS, Jahan R, Khatun MA. A survey of medicinal plants used by folk medicinal practitioners in Balidha village of Jessore district, Bangladesh. Am.-Eur J Sustain Agric, 2010; 4(2): 111-116.
46. Jayakumar T, Hsieh C.-Y, Lee J.-J, Sheu J.-R. Experimental and Clinical Pharmacology of *Andrographis paniculata* and its major bioactive phytoconstituent andrographolide. Evid-Based Complement Alternat Med, 2013; 2013: Article ID 846740.
47. Salazar DIO, Hoyos R, Orozco-Sánchez F, Arango M, Gomez L. Antifungal activity of neem (*Azadirachta indica*: Meliaceae) extracts against dermatophytes. Acta Biol Colombiana, 2015; 20(3): 201-207.
48. Yusuf H, Suryawati, Maryatun. The antimalarial activity of the extract of the neem leaves (*Azadirachta indica*, A Juss) on *Plasmodium falciparum in vitro*. Proceedings of the Annual International Conference Syiah Kuala University, 2011. Banda Aceh, Indonesia, November 29-30, 2011.
49. Srinivasan GV, Unnikrishnan KP, Shree ABR, Balachandran I. HPLC estimation of berberine in *Tinospora cordifolia* and *Tinospora sinensis*. Indian J Pharm Sci, 2008; 70(1): 96-99.