

Antidiabetic plants used by the tribes and settlers of Andaman & Nicobar Islands, India

Vinod Maina¹✉, Ravi Prasad¹ and T. Chakrabarty²

¹Botanical Survey of India, Arid Zone Regional Centre, Pal Canal Link Road, Jodhpur, 342014, India

²Botanic Garden Lane, Howrah 711 103, India

✉Corresponding author : mainabsi@yahoo.co.in

भारत के अंडमान एवं निकोबार द्वीप समूह की जनजातियों एवं निवासियों के द्वारा प्रयुक्त मधुमेह रोधी पादप

विनोद मैना, रवि प्रसाद एवं टी. चक्रवर्ती

सारांश

अंडमान एवं निकोबार द्वीप समूह 306 द्वीप समूहों के साथ देश का समृद्ध जैव संसाधन वाला क्षेत्र है, जो विभिन्न पारितंत्रों एवं आनुवांशिकीय भिन्नताओं के उच्च परिमाण के साथ ही समान रूप से धनी नृ-वानस्पतिक औषधीय परम्पराओं के साथ जैव विविधता का एक उत्पन्न स्थल भी है। आवृतबीजीय पौधों की लगभग 2500 जातियाँ यहाँ से 8249 वर्ग कि.मी. के छोटे से भौगोलिक भाग से ज्ञात की गई हैं, जिनमें से लगभग 13 प्रतिशत स्थानिक हैं। प्रस्तुत शोध पत्र अंडमान निकोबार द्वीप समूह में प्रयुक्त किये जाने वाले उन 50 मधुमेह रोधी पादपों का विवरण देता है, जो प्रभावी रूप से मधुमेह के उपचार में प्रयोग किये जाते हैं। इस पारंपरिक ज्ञान का संरक्षण उन्नत एवं नयी औषधियों के अन्वेषण का मार्ग प्रशस्त करेगा।

ABSTRACT

The Andaman and Nicobar Islands with c. 306 islands and islets are one of the richest bioresource areas of India that constitute one of the hotspots of biodiversity with a variety of ecosystems and high degree of genetic variations and equally rich ethnomedicinal tradition. About 2500 Angiosperm species are known to occur within a small land area of 8,249 sq. km of which about 13 % are endemic. This paper deals with 50 antidiabetic plants used in Andaman and Nicobar Islands, which can be effectively used in the treatment of diabetes. Conservation of this Traditional Knowledge will open pathways for new drug discoveries.

Keywords: Andaman & Nicobar Islands; Diabetes; Antidiabetic plants; Traditional healers

INTRODUCTION

Busy life, over burden of work, stress, over eating, lazy and sedentary life keeps on adding more and more diabetic patients. There are over 347 million people worldwide suffering from diabetes (Danaei & al., 2011). Diabetes is fast gaining the status of a potential epidemic

even in India with more than 62 million diabetic individuals currently diagnosed with the disease (Kaveeshwar & Cornwall, 2014). In 2014 the global prevalence of diabetes was estimated to be 9% among adults aged 18+ years (Anonymous, 2014a). In 2012, an estimated 1.5 million deaths were directly caused by diabetes (Anonymous, 2014b). More than 80% of diabetes deaths occur in

low- and middle-income countries (Anonymous, 2014b). WHO projects that diabetes will be the 7th leading cause of death in 2030 (Mathers & Lonkar, 2006). Healthy diet, regular physical activity, maintaining a normal body weight and avoiding tobacco use can prevent or delay the onset of type 2 diabetes (Anonymous, 2011). Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. Insulin is a hormone that regulates blood sugar. Hyperglycemia, or raised blood sugar, is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's systems, especially the nerves, heart, kidneys, eyes and blood vessels.

(*Diabetes: fasting glucose ≥ 7.0 mmol/L or on medication -WHO).

Type 1 diabetes (previously known as insulin-dependent or childhood-onset diabetes) is characterized by a lack of insulin production.

Type 2 diabetes (formerly called non-insulin-dependent or adult-onset diabetes) is caused by the body's ineffective use of insulin. It often results from excess body weight and physical inactivity.

Gestational diabetes is hyperglycemia that is first recognized during pregnancy.

Diabetes mellitus is now talked at molecular levels when human insulin gene has been expressed in *Escherichia coli* and has been approved for clinical use for treatment of diabetic patients. In modern medicine, oral intake of amino acid and anti-diabetic medicines are prescribed. But the hypoglycemic medicines are expensive and have their side effects too. In this situation the herbs and the herbal medicines offer a very good alternative to fight against diabetes mellitus.

The Andaman and Nicobar Islands are one of the richest bioresource areas of the country that constitute one of the hotspots of biodiversity with a variety of ecosystems, viz. tropical evergreen forests, wetlands, coastal vegetation, mangroves and coral reefs. The phytodiversity of these islands is one of the unique and richest in the country with remarkably high degree of genetic variations. They are the largest archipelago system locally known as “green emerald” in the Bay of Bengal, consisting of 306 Islands (only 37 Islands; 24 in Andamans and 13 in Nicobars are having some human population) and 206 rocks & rock outcrops (islets), and situated between the latitudes of $6^{\circ} 45'$ to $13^{\circ} 41'$ N and longitudes of $92^{\circ} 12'$ to $93^{\circ} 57'$ E.

Pandey & Diwakar (2008) presented a comprehensive list of the flora of the Andaman & Nicobar Islands. Publications on the ethnobotany and traditional usage of plants of the Islands include Bhargava (1981, 1983), Chakrabarty & Rao (1988, 1990), Balakrishnan & al. (1989), Dagar & Singh (1991), Sinha & al. (1996), Rao & al. (2001), Chakrabarty (2003), Chakrabarty & Balakrishnan (2003), Chakrabarty & al. (2006, 2008), Sharief (2007), Sharief & Rao (2007), Tigga & al. (2007) and Maina & Chakrabarty (2012).

Papers on the Indian plants having antidiabetic properties include Grover & al. (2002), Saxena & Vikram (2004), Chhetri & al. (2005), Mukherjee & al. (2005), Jeyachandran & Mahesh (2007), Modak & al. (2007), Wadker & Makdem (2008), Ayodhya & al. (2010), Chauhan & al. (2010), Khan & Yadava (2010), Malaviya & al. (2010), Meghani & al. (2010), Singh (2011), Umashanker & Srivastava (2011), Murthy & al. (2012), Saravanamuttu & Sudarsanam (2012), Gulsan & Rao (2013) and Mukesh & Namita (2013).

A review of the available literature reveals that no studies have been carried out so far on the knowledge of the traditional healers, settlers and the aborigin tribes (the Nicobarese tribe in particular who are in the mainstream now) of the Andaman & Nicobar Islands on the indigenous plants used and applied by them for controlling diabetes.

MATERIALS AND METHODS

Frequent field surveys were conducted throughout the study area between 1994 and 2002. Ethnomedicinal information practiced by different traditional healers, settlers and tribals were recorded following the methodology proposed by Jain & Rao (1976). The plants parts used were identified with correct botanical names and deposited in the herbarium of Botanical Survey of India, Port Blair (PBL).

In the enumeration, data on the plants used as hypoglycemic agents are presented with botanical name, family, habit, local name, plant parts used and mode of use/administration procedure, as given in Table 1.

RESULTS AND DISCUSSION

The present paper deals with total of 50 species of plant belonging to 30 families utilized as antidiabetic agents by the tribals, settlers and traditional healers of Andaman &

Table 1: Antidiabetic medicinal plants used in Andaman and Nicobar islands

Sl. No.	Botanical name, local name and habit	Part(s) used	Method of use/ administration procedure
1	<i>Abelmoschus esculentus</i> (L.) Moench. (Malvaceae); <i>Bhindi</i> ; Shrub	Fruit	Chopped fruits soaked in water over night – mashed by hands and filtrate taken in morning
2	<i>Abrus precatorius</i> L. (Fabaceae); <i>Ratti, Gunja, Gumchi</i> ; Climber	Leaves and seeds	4 – 5 fresh leaves chewed with betel; about 10 g seeds soaked in water for 10-12 hours, seed coat removed, boiled in milk, rinsed with water, dried, ground and pills made. Dose = 1 pill/day
3	<i>Aegle marmelos</i> (L.) Correa (Rutaceae); <i>Bael, Bel</i> ; Tree	Leaves	Paste of sandalwood coated on leaves. Dose = one or two leaves in morning, in empty stomach
4	<i>Aglalia elaeagnoides</i> (A. Juss.) Benth. (Meliaceae); Tree	Bark	Decoction of bark taken orally
5	<i>Ailanthus triphysa</i> (Dennst.) Alston (Simaroubaceae); Tree	Seed	Powdered seeds taken with water once in a day
6	<i>Alstonia kurzii</i> Hook.f. (Apocynaceae); <i>Chhatian</i> ; Tree	Bark	Decoction taken orally
7	<i>Amomum aculeatum</i> Roxb. (Zingiberaceae); <i>Uiwaw</i> ; Shrub	Whole plant	Paste of seed, leaves and rhizome used
8	<i>Annona reticulata</i> L. (Annonaceae); <i>Ramphal</i> ; Tree	Leaves	Decoction of fresh leaves
9	<i>Annona muricata</i> L. (Annonaceae); <i>Kantaphal</i> ; Tree	Leaves	Decoction of fresh leaves
10	<i>Annona squamosa</i> L. (Annonaceae); <i>Sitaphal</i> ; Tree	Leaves	Decoction of fresh leaves
11	<i>Areca triandra</i> Roxb. (Arecaceae); <i>Tulu, Jangli supari</i> ; Tree	Nut, stem	Nuts and tender stem chewed after food
12	<i>Argyreia nervosa</i> (Burm.f.) Bojer (Convolvulaceae); <i>Samandar ka pat</i> ; Climber.	Root	Powder of dried root. Dose = one tea spoon in morning with water. It cures nervous weakness due to hyperglycemia
13	<i>Asparagus racemosus</i> Willd. (Asperagaceae); <i>Satavari</i> ; Shrub	Root	One tea spoon of powdered root administered orally for controlling diabetes
14	<i>Avicennia officinalis</i> L. (Avicenniaceae); <i>Tivar</i> ; Tree	Bark, flower	Decoction of half cup of bark & juice of flowers given for diabetes
15	<i>Azadirachta indica</i> A.Juss. (Meliaceae); <i>Neem</i> ; Tree	Flower, fruit, leaves	Flowers and leaves boiled in water and half cup of decoction taken orally; fresh raw leaves & pulp of ripe fruit also chewed directly
16	<i>Bombax insigne</i> Wall. (Bombacaceae); <i>Didar</i> ; Tree	Flower buds, bark	One tea spoon of dried powder of flower buds and half cup decoction of bark taken orally
17	<i>Catharanthus roseus</i> (L.) G.Don (Apocynaceae); <i>Sadabahar</i> ; Herb or undershrub	Leaves	Two fresh leaves are chewed daily in morning in empty stomach
18	<i>Coccinia grandis</i> (L.) Voigt (Cucurbitaceae); <i>Kundru</i> ; Climber	Fruits	Tender and ripe fruits eaten raw and as vegetable
19	<i>Datura metel</i> L. (Solanaceae); <i>Datura</i> ; Shrub	Root	One tea spoon of powdered dried roots are taken with milk at night
20	<i>Derris scandens</i> (Roxb.) Benth. (Fabaceae); Climber	Bark	Half cup decoction of bark is administered orally in morning

Sl. No.	Botanical name, local name and habit	Part(s) used	Method of use/ administration procedure
21	<i>Dioscorea alata</i> L. (Dioscoreaceae); Climber	Tuber	Boiled slices consumed as vegetable
22	<i>Entada rheedii</i> Spreng. (Mimosoideae); Cheeng; Climber	Kernel/seeds	Two roasted seeds are consumed after removing seed coat in the morning.
23	<i>Ficus benghalensis</i> L. (Moraceae); Bargad; Tree	Prop roots	Pieces of the tips of fresh prop roots chewed in morning empty stomach with water
24	<i>Ficus racemosa</i> L. (Moraceae); Gular, Umar; Tree	Figs	Cooked young figs taken as vegetable and ripe ones consumed directly
25	<i>Ficus hispida</i> L.f. (Moraceae); Tree	Figs	Boiled figs are consumed.
26	<i>Gymnema latifolium</i> Wall. ex Wight (Asclepiadaceae); Mera-singhi; Climber	Leaves	Four to five leaves chewed daily to stimulate insulin secretion
27	<i>Helicteres isora</i> L. (Sterculiaceae); Marorphali; Shrub	Root	One tea spoon of juice of root administered orally in morning for controlling blood sugar level
28	<i>Kandelia candel</i> (L.) Druce (Rhizophoraceae); Kandelia; Tree	Bark	Half cup decoction of bark taken in morning.
29	<i>Mimosa pudica</i> L. (Mimosoideae); Chui-mui; Herb	Seeds	One tea spoon of powdered seeds taken with milk/ water twice a day
30	<i>Momordica dioica</i> Roxb. ex Willd. (Cucurbitaceae); Kankoda, Kantola; Climber	Fruits, seeds, root	Fruits as a vegetable; fried seeds or powder; juice of boiled roots
31	<i>Momordica cochinchinensis</i> (Lour.) Spreng. (Cucurbitaceae); Uree; Climber	Fruits, seeds, root	Fruits as a vegetable; fried seeds or powder; juice of boiled roots
32	<i>Moringa oleifera</i> Lam. (Moringaceae); Saijna; Tree	Leaves, fruits	Leaves & fruits eaten as vegetable
33	<i>Mucuna gigantea</i> (Willd.) DC. (Fabaceae); Janglikaunch; Climber	Seeds	Boiled seeds dried, and powdered and added with powder of <i>Gymnema</i> leaves and <i>Momordica</i> seeds and administered once in a day, one tea spoon
34	<i>Mucuna pruriens</i> (L.) DC. (Fabaceae); Kaunch; Climber	Seeds	Same as <i>Mucuna gigantea</i>
35	<i>Murraya koenigii</i> (L.) Spreng. (Rutaceae); Herb	Leaves	Half cup juice of fresh leaves taken in morning
36	<i>Phyllanthus emblica</i> L. (Phyllanthaceae); Amla; Tree	Fruits and leaves	One tea spoon of powdered & dried fruits twice a day
37	<i>Pongamia pinnata</i> (L.) Pierre (Fabaceae); Karanj, Aichum; Tree	Tender stem bark	Half cup decoction taken orally in morning
38	<i>Pterocarpus dalbergioides</i> Roxb. ex DC. (Fabaceae); Padauk; Tree	Heart wood	Half cup decoction of boiled heart wood administered orally
39	<i>Rhizophora mucronata</i> Lam. (Rhizophoraceae); Kandeil; Tree	Bark	Bark is astringent and about 10 g is prescribed in diabetes twice a day.
40	<i>Salacia chinensis</i> L. (Celastraceae); Saptrangi; Climbing shrub	Whole plant	Half cup decoction of bark in morning is known to reduce glucose level in blood
41	<i>Senegalia pennata</i> (L.) Maslin ssp. <i>insuavis</i> (Lace) Maslin (Mimosoideae); Babul; Tree	Pods	One tea spoon of powder of dried tender pods administered in morning.

Sl. No.	Botanical name, local name and habit	Part(s) used	Method of use/ administration procedure
42	<i>Syzygium samarangense</i> (Blume) Merr. & L.M.Perry (Myrtaceae); Baral, Khari jamun; Tree	Bark, seeds	Half cup decoction of bark or one tea spoon of powdered seeds taken orally twice a day
43	<i>Terminalia catappa</i> L. (Combretaceae); Lapa, Khari badam; Tree	Bark, seeds	Boiled and half cup of the filtrate taken in the morning empty stomach to control glucose level
44	<i>Terminalia procera</i> Roxb. (Combretaceae); Kang; Tree	Bark, seeds	Boiled and half cup of the filtrate taken in the morning empty stomach
45	<i>Thottea tomentosa</i> (Blume) Ding Hou (Aristolochiaceae); Udupet; Herb	Leaves, roots	Dried leaves and roots pounded and one teaspoon taken daily in morning empty stomach with water
46	<i>Tinospora sinensis</i> (Lour.) Merr. (Menispermaceae); Giloy; Climber	Stem	Half cup decoction taken orally empty stomach in morning
47	<i>Trichosanthes tricuspidata</i> Lour. (Cucurbitaceae); Urubethe; Climber	Whole plant	Taken as vegetable
48	<i>Vachellia nilotica</i> (L.) P.J.H. Hurter ssp. <i>indica</i> (Benth.) Kyal. & Boatwr. (Mimosoideae); Kikar, Babul; Small tree	Bark and tender pods	Bark boiled in water and decoction taken orally in morning in empty stomach; one teaspoon of dried and powdered tender pods taken with water twice a day
49	<i>Ziziphus nummularia</i> (Burm.f.) Wight & Arn. (Rhamnaceae); Barari, Chaniya Bore, Jhar-bore; Shrub	Root bark	Half cup decoction orally administered in morning, empty stomach before going to toilet
50	<i>Ziziphus oenopolia</i> (L.) Mill. var. <i>oenopolia</i> (Rhamnaceae); Makoi; Shrub	Fruits	Ripe fruits are consumed

Nicobar Islands (Table 1). They include 25 tree species, 13 climbers, 9 shrubs and 3 herbs. Different plant parts are used for hypoglycemic treatment with different mode of use/ administration procedure. Out of these, 10 species viz. *Aglalia elaeagnoides*, *Ailanthus triphysa*, *Alstonia kurzii*, *Amomum aculeatum*, *Areca triandra*, *Avicennia officinalis*, *Entada rheedii*, *Gymnema latifolium*, *Mucuna gigantea* and *Syzygium samarangense* were recorded for the first time as having antidiabetic potential from the study area.

ACKNOWLEDGEMENTS

The authors are thankful to Dr. N. P. Balakrishnan, Coimbatore for kindly going through the manuscript and suggesting improvement of the text. They are thankful to the Director, Botanical Survey of India, Kolkata for the facilities provided. Grateful thanks to the Anonymous reviewer for further refining the manuscript.

REFERENCES

- ANONYMOUS 2011. World Health Organization: *Global status report on non-communicable diseases 2010*. Geneva.
- ANONYMOUS 2014a. World Health Organization: *Global status report on non-communicable diseases 2014*. Geneva.
- ANONYMOUS 2014b. World Health Organization: *Global Health Estimates: Deaths by Cause, Age, Sex and Country, 2000-2012*. Geneva.
- AYODHYA, S., S. KUSUM AND S. ANJALI 2010. Hypoglycaemic activity of different extracts of various herbal plants. *Int. J. Ayurveda Res. Pharm.* 1(1): 212-224.
- BALAKRISHNAN, N. P., D. K. HORE AND R. P. DWIVEDI 1989. *Great Nicobar Biosphere Reserve*. Project Document 11: 1 – 70. MOEF, New Delhi.
- BHARGAVA, N. 1981. Plants in folk life and folklore in Andaman and Nicobar Islands. In: S. K. Jain (ed.) *Glimpses of Indian Ethnobotany*. Oxford & IBH Publishing, New Delhi.
- BHARGAVA, N. 1983. Ethnobotanical studies of the tribals of Andaman & Nicobar Islands, India, I: Onge. *Econ. Bot.* 37(1): 110-115.

- CHAKRABARTY, T. 2003. Major plant-based diet of the aborigine tribes of Andaman & Nicobar Islands. *J. Econ. Taxon. Bot.* 27(4): 933-936.
- CHAKRABARTY, T. AND M. K. VASUDEVA RAO. 1988. Ethnobotanical studies on the *Shompens* of Great Nicobar Island. *J. Econ. Taxon. Bot.* 12: 39 – 54.
- CHAKRABARTY, T. AND M. K. VASUDEVA RAO. 1990. A note on *Glochidion calocarpum* (Euphorbiaceae). *Economic Botany* 44(3): 412 – 413.
- CHAKRABARTY, T. AND N. P. BALAKRISHNAN. 2003. Ethnobotany of the Andaman and Nicobar Islands, India – a review. *J. Econ. Taxon. Bot.* 27(4): 27(4): 869-894.
- CHAKRABARTY, T., V. MAINA AND M. TIGGA, 2006. Plants used in gathering honey by the Jarawas of Andaman Islands. *Bull. Bot. Surv. India* 48: 205 – 206.
- CHAKRABARTY, T., V. MAINA AND M. TIGGA, 2008. Some unrecorded medicinal plants of the Jarawa tribe of the Andaman Islands. *Bull. Bot. Surv. India* 49: 233 – 234.
- CHAUHAN, A., P. K. SHARMA, P. SRIVASTAVA, N. KUMAR AND R. DUEHE 2010. Plants having potential antidiabetic activity: a review. *Der. Pharm. Lett.* 2(3): 369-387.
- CHHETRI, D.R., P. PARAJULI AND G. C. SUBBA 2005. Anti-diabetic plants used by Sikkim and Darjeeling Himalayan tribes, *Indian J. Ethnopharmac.* 99: 199-202.
- DAGAR, J. C. AND N. T. SINGH 1999. *Plant resources of the Andaman and Nicobar Islands –I*. Dehra Dun.
- DANAEL, G. & AL. 2011. National, regional and global trends in fasting plasma glucose and diabetes prevalence since 1980: systematic analysis of health examination surveys and epidemiological studies with 370 country-years and 2.7 million participants. *Lancet* 378(9785): 31–40.
- GROVER, J. K., S. YADAV AND V. VATS 2002. Medicinal plants of India with anti-diabetic potential. *J. Ethnopharmac.* 81(1): 81-100.
- GULSAN, M. D. AND N. RAMA RAO 2013. An Overview on Medicinal Plants with Antidiabetic Potential. *Int. J. Pharm. Sci. Rev. Res.* 23(2): 335-342.
- JAIN, S.K. AND R. R. RAO 1976. *A handbook of field and herbarium methods*. Today & Tomorrow Publishers, New Delhi.
- JEYACHANDRAN, R. AND A. MAHESH 2007. Enumeration of Antidiabetic Herbal Flora of Tamil Nadu. *Res. J. of Med. Pl.* 1(4): 144-148.
- KAVEESHWAR, S. A. AND J. CORNWALL 2014. The current state of diabetes mellitus in India. *Australas. Med. J.* 7(1): 45–48.
- KHAN, H. MD. AND P. S. YADAVA 2010. Antidiabetic plants used in Thoubal district of Manipur, Northeast India. *Indian J. Tradit. Knowl.* 9(3): 510-514.
- MAINA, V. AND T. CHAKRABARTY 2012. Some uses of plants by the Jarawa tribe of the Andaman Islands – unrecorded so far. In: A. K. Samanta & S. Panda (eds.) *Some aspects of costal vegetation in India including Andamans and Sundarbans*, pp. 170-171. Ramnagar College, Depal, West Bengal.
- MALAVIYA, N., S. JAIN AND S. MALAVIYA 2010. Antidiabetic potential of medicinal plants. *Acta Poloniae Pharmaceutica. Drug Res.* 67(2): 117-118.
- MATHERS, C. D. AND D. LONCAR 2006. Projections of global mortality and burden of disease from 2002 to 2030, 2006. *PLoS Med.* 3(11): e442.
- MENGHANI, EKTA, A. PAREEK, R. S. NEGI AND C. K. OJHA 2010. Antidiabetic Potentials of Various Ethno-Medicinal Plants of Rajasthan. *Ethnobot. Leaflet.* 14: 578-583.
- MODAK, M., P. DIXIT, J. LONDHE, S. GHASKADBI, A. PAUL AND T. DEVASAGAYAM 2007. Indian herbs and herbal drugs used for the treatment of diabetes. *J. Clin. Biochem. Nutr.* 40(3): 163-173.
- MUKESH, R. AND P. NAMITA 2013. Medicinal plants with antidiabetic potential – A review. *American-Eurasian J. Agric. & Environ. Sci.* 13(1): 81-94.
- MUKHERJEE, P. K., K. MAITI, K. MUKHERJEE AND P. J. HOUGHTON 2006. Leads from Indian medicinal plants with hypoglycemic potentials. *J. Ethnopharmacol.* 106: 1-28.
- MURTHY, K. SHANKAR AND B. R. KIRAN 2012. Medicinal plants used as an antidiabetic drug in pharmaceutical industry and their conservation: an overview. *Int. Res. J. Pharmac.* 3(10): 65-71.
- PATEL, D. K., S. K. PRASAD, R. KUMAR AND S. HEMALATHA 2012. An overview of antidiabetic medicinal plants having insulin mimetic property. *Asian Pac. J. Trop. Biomed.* 2(4): 320-330.
- PANDEY, R. P. AND P. G. DIWAKAR 2008. An integrated check-list flora of Andaman and Nicobar Islands, India. *J. Econ. Taxon. Bot.* 32(2): 403-500.
- PANDEY, R. P., L. RASINGAM. AND G. S. LAKRA 2009. Ethnomedicinal Plants of Aborigines in Andaman & Nicobar Islands, India. *Nelumbo* 51: 5-40. 2009.
- PULLAIAH, T. AND K. CHANDRASEKHAR NAIDU 2003. *Antidiabetic Plants of India and Herbal based Antidiabetic Research*. Regency Publications, New Delhi.
- RAI, M. K. 1996. A review of some antidiabetic plants of India. *Ancient Science of Life* 14(3): 168-180.
- RAMAN, B. V., A. N. V. KRISHNA, B. N. RAO, M. P. SARADHI AND M. V. B. RAO 2012. Plants with antidiabetic activity and their medicinal values. *Int. Res. J. Pharmac.* 3(3): 11-15.
- RAO, M. U., M. SREENIVASULU, B. CHENGIAH, K. J. REDDY AND C. M. CHETTY 2010. Herbal medicines for diabetes mellitus: a review. *Int. J. Pharm. Tech. Res.* 2(3): 1883-1892.
- RAO, P. S. N., V. MAINA AND M. TIGGA 2001. Plants of sustenance among the Jarwa aborigines. *Indian J. Forest.* 24(3): 395-402.

- SARAVANAMUTTU, S. AND D. SUDARSANAM 2012. Anti-diabetic plants and their active ingredients: A review. *Int. J. Pharm. Sci. Res.* 3(10): 3639-3650.
- SAXENA, A. AND N. K. VIKRAM 2004. Role of selected Indian plants in management of type 2 diabetes: a review. *J. Altern. Complement. Med.* 10(2): 369-378.
- SHARIEF, M. U. 2007. Plants folk medicine of Negrito tribes of Bay Islands. *Indian J. Tradit. Knowl.* 6(3): 468-476.
- SHARIEF, M. U. AND R. R. RAO 2007. Ethnobotanical studies of Shompens – a critically endangered and degenerating ethnic community in Great Nicobar Island. *Curr. Sci.* 93(11): 1623-1628.
- SINGH, L. W. 2011. Traditional medicinal plants of Manipur as anti-diabetics. *J. Med. Pl. Res.* 5(5): 677-687.
- SINHA, B. K., V. MAINA AND P. M. PADHYE 1996. Ethno-medicinal plants of Bay Islands for skin care. *J. Econ. Taxon. Bot., Addit. Ser.* 12: 375-380.
- TIGGA, M., P. G. DIWAKAR AND M. U. SHARIEF, 2007. *Vanaspathion par ashrit Andaman kiadimjanajati "Jarawa"* (in Hindi). Botanical Survey of India, Kolkata.
- UMASHANKER, M. AND S. SRIVASTAVA 2011. Traditional Indian herbal medicine used as antipyretic, antiulcer, anti-diabetic and anticancer. *Int. J. Res. Pharm. Chem.* 1(4): 1152-1159.
- WADKER, K. A. AND C. S. MAGDUM 2008. Antidiabetic potential and Indian medicinal plant. *J. Herb. Med. Toxicol.* 2(1): 45-50.