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Ethnobotany of Plants Used to Cure Diabetes by the People of North East India

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ABSTRACT

Northeast India is considered as an ecological hot spot and has a wide variety of flora and fauna. Diverse ethnic communities inhabit the area, each having their own traditional medical cures for different diseases. During the course of present studies it was found that 52 species of plants belonging to 36 families are used as antidiabetic agents in folk medicinal practice. Leaves and bark were found to be the two major plant parts used for making hypoglycemic herbal preparations. Around 26 treatments involve administration of decoction to the diabetic patient. These decoctions are either prepared from leaves, bark, fruit, root, seeds or from whole plants. Out of the 52 plants 12 are also reported to have antidiabetic properties in the Diabetes Medicinal Plant Database. The remaining plants could be a potential source of new and efficient cures for diabetes.

Keywords: medicinal plant, traditional medicine

INTRODUCTION

Diabetes is a major metabolic disorder responsible for 9% of the total number of deaths in the world. At present around 171 million people are affected by this disorder and the number is likely to be doubled by 2030 (WHO 2008). As a very common chronic health problem, diabetes is the third "major killer" after cancer and cardiovascular diseases because of its high prevalence, morbidity and mortality (Li *et al*. 2004). According to the WHO (2008) India has the highest number of diabetics in the world with more then 31.7 million followed by 20.8 million in China and 17.7 million in US. With transition to the more sedentary life-style of industrialized nations, the prevalence of diabetes is expected to increase among all age groups. Due to the chronic nature of diabetes and the complications related to it treatment for the disorder has become very costly. A low-income family in India spends as much as 25% of the family earnings for taking care of an adult with diabetes thereby causing grave socioeconomic imbalances as well. Therefore cheaper remedies are needed for developing countries like India. The available synthetic drugs for treating diabetes also have many limitations and undesirable side effects like hepatotoxicity, cardiomegaly, hemotoxicity (Akhtar and Iqbal 1991; Watkins and Whitcomb 1998) and have high rates of secondary failures (Chang *et al*. 2006). Medicinal herbs with anti-hyperglycemic activities are being increasingly used as an alternative approach in the treatment of diabetes due to their low cost, effectiveness and little or no adverse effects (Xie *et al.* 2003). The modern drug metformin (a biguanide) is a derivate of an active natural product galegine which was used in medieval times to relieve the intense urination in diabetic people (Andrade-Cetto and Heinrich 2005); galegine is a guanidine isolated from the plant *Galega officinalis* L. (Witters 2001).

Northeast India consists of the states of, Assam, Arunachal Pradesh, Meghalaya, Manipur, Mizoram, Nagaland and Tripura. The study area extends between 21.57-29.30° N latitude and 88-97.30° E longitude, is mostly covered by the hills of Himalayan range with the valley of Brahmaputra River running through the middle. The region is rich in floral diversity and many endemic elements (Myers *et al.* 2000) and the people of this region have rich ethnomedicinal traditions.

In the present study we report 52 species of plants used as anti diabetic agents in the traditional treatment of diabetes in Northeast India and some of the diabetic symptoms known to common people of this region.

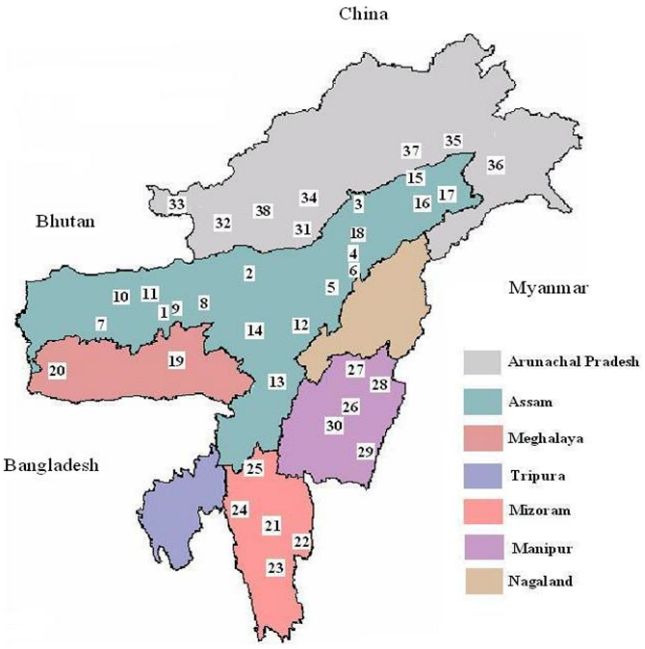

Fig. 1 Different locations of NE India (as mentioned in Table 1 with Site No.) where traditional healers ware interviewed

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Research Note

EXPERIMENTAL

Method of database preparation

The study was carried out by regular field trips to different locations of the Himalayan hilly regions (**Fig. 1, Table 1**) conducted between July 2004 and February 2008 to gather data. Various traditional healers, village elders and diabetic patients were interviewed, in different locations in the study area. Age, experience and reputation were taken into consideration while selecting the interviewers. Structured forms in local languages were prepared and filled in with the information received from the respondent (both healer and patients). The interviewees were aware about the objective of the study, which was to compile traditional knowledge of ethnomedicine among the people of North East India. The collected plant species were submitted to taxonomists in Assam State Zoo *cum* Botanical Garden Guwahati, for botanical identification. The data obtained was tabulated to include the botanical name, local name, family name, plant part(s) used, followed by the mode of preparation and administration.

RESULTS AND DISCUSSION

Northeast India is considered as an ecological hot spot and is inhabited by diverse tribal communities each having its own traditional medicinal cure for different diseases. Our group has been involved in documenting the richness of this folklore medicine as modernity is slowly wiping out this knowledge from public memory. Earlier we have reported the use of different herbal remedy by the people of Assam and Northeast India for treating skin infections (Saikia *et al.* 2006) and malaria (Bora *et al.* 2007).

In the present study, 52 species of plant belonging to 36 families were found to be used as anti-diabetic agents by the people of Northeast India (**Table 2**). The plant parts used range from roots, shoots, leaves, stems, barks, seeds, flowers to fruits and in some cases the whole plant (**Fig. 2**). It has been observed that water is used as the medium in most preparations. Around 26 treatments involve administration of a decoction to the diabetic patient. These decoctions are either prepared from leaves, bark, fruit, root, seeds or from whole plants. Other preparations are administered in the form of soup, infusion, juice, powder or whole plant extract. Some of the plant parts are eaten either raw or cooked. We found that leaves and bark were used more frequently for making anti-diabetic preparations (**Table 2**). In the case of the preparation from *Inula cappa*, two other herbs, *Plantago asiatica* and *Lobelia angulata* were combined to form a multi-herbal formulation.

The efficacy of these ethno-medicinal plants needs to be subjected to pharmacological validation. Some antidiabetic plants may exert their action by stimulating the function or number of β-cells of pancreas and thus increasing insulin release (Persaud *et al.* 1999). In some other plants, the effect is due to decreased blood glucose synthesis due to decreased activity of enzymes like glucose-6-phosphatase and fructose 1,6-bisphosphatase (Chhetri *et al.* 2005). In many other plants, the activity is due to slow absorption of carbohydrate and inhibition of glucose transport (Madar 1984). However, these products may interact with conventional medicines for diabetes (Shane-McWhorter 2001). Therefore a cautious approach should be adopted before administering these drugs.

Out of the 52 plants 12 are also reported to have anti-diabetic properties in the Diabetes Medicinal Plant Database (2008). These plants are *Allium sativum*, *Catharanthus roseus*, *Emblica officinalis*, *Ficus benghalensis*, *Mangifera indica*, *Scoparia dulcis*, *Syzygium cumini*, *Tamarindus indica*, *Terminalia chebula*, *Tinospora cordifolia*, *Tragia involucrata*, and *Trigonella foenum-graecum.* The remaining plants are a potential source of investigation for novel therapies.

In this study we observed that most preparations are derived from a single plant source suggesting the presence of potential anti-diabetic compounds in them. Isolation of these compounds will lead to the development of clinically useful medicines and especially phytomedicines or adequate nutritional supplements, which would be of direct benefit to patients. On the other hand, the ever-increasing demand, particularly in view of world-wide shift for drugs of herbal origin over synthetic counterparts, has led to over-exploitation of medicinal plants. In addition, the lack of organized cultivation has resulted in many of these plants finding place in the list of vulnerable, endangered or threatened categories. Thus, there is an immediate need for mass multiplication of many of these species to make available the planting material for taking up organized cultivation.

Table 1 Number of traditional healers interviewed in different places of NE India.

Site No. in Fig. 1	Place name	No of traditional healers interviewed
1	Guwahati	6
2	Tezpur	4
3	Lakhimpur	8
4	Jorhat	20
5	Golaghat	24
6	Mariani	3
7	Goalpara	12
8	Mayang	2
9	Sunapur	2
10	Barpeta	8
11	Nalbari	10
12	Diphu	13
13	Haflong	22
14	Hojai	1
15	Demaji	9
16	Dibrughar	12
17	Tinsukia	13
18	Majuli	3
19	Shillong	20
20	Tura	4
21	Aizwal	7
22	Champhai	2
23	Lunglei	3
24	Mamit	4
25	Kolasib	8
26	Imphal	6
27	Senapati	6
28	Ukhrul	9
29	Chandel	8
30	Bishnupur	3
31	Itanagar	9
32	Bomdila	10
33	Tawang	12
34	Ziro	14
35	Roing	10
36	Tezu	9
37	Pasighat	20
38	Seppa	4
	Total	340

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REFERENCES

Akhtar MS, Iqbal J (1991) Evaluation of the hypoglycemic effect of *Achyranthes aspera* in normal and alloxan diabetic rabbits. *Journal of Ethnopharmacology* **31**, 49-57

Andrade-Cetto A, Heinrich M (2005) Mexican plants with hypoglycaemic effect used in the treatment of diabetes. *Journal of Ethnopharmacology* **99**, 25-348

Bora U, Sahu A, Saikia AP, Ryakala VK, Goswami P (2007) Medicinal plants used by the people of Northeast India for curing malaria. *Phytotherapy Research* **21**, 800-804

Table 2 Medicinal plants used for curing Diabetes in Northeast India.

Botanical name	Local name	Family	Plant part used	State found	Mode of use and administration
Allium sativum L.	Naharu	Alliaceae	Bulbs	Assam	3-4 cloves of a bulb is fried with mustard oil and consumed with the normal diet, daily twice or thrice for a period of 3-6 months.
Ardisia colorata Roxb.	U-thum	Myrsinaceae	Leaves	Manipur	10-12 leaves are cooked and eaten daily twice for at least 2 months.
Barleria albostellata C.B. Clarke	Hanu-khulam	Acanthaceae	Leaves	Manipur	Soup is prepared by boiling 15-20 fresh leaves in 50 ml and 20 ml of soup is taken orally, once daily for a period of 4 to 5 months.
Bryphytum sensativum (L.) DC.	Zarero	Oxalidaceae	Leaves	Manipur, Arunachal Pradesh, Mizoram	A saline extract of 10-20 ml from matured leaves is consumed daily twice for two months.
Cassia alata L.	Mongrangiangtong	Caesalpiniaceae	Leaves	Manipur, Arunachal Pradesh, Mizoram	Decoction of leaves taken orally twice for 6-8 weeks.
Cassia bicapsularis L.	Thaonam-nashangbi	Caesalpiniaceae	Shoot	Manipur	Tender shoot of about 100 g per day is cooked and eaten for 6 weeks.
Cassia occidentalis L.	Hant thenga	Caesalpiniaceae	Bark	Manipur, Arunachal Pradesh, Mizoram	50 g bark is used to make infusion and is given orally daily, for 8-10 weeks.
Catharanthus roseus (L.) G. Don	Nayantara	Apocynaceae	Roots, leaves, whole plant	Assam, Manipur, Mizoram	The decoction is prepared from leaves and roots and 20 ml is taken orally once a day, for eight to ten weeks.
Cinnamomum tamala T. Nees & Eberm.	Lappyrring	Lauraceae	Leaves	Manipur, Arunachal Pradesh, Mizoram	The powder is made from dried leaves and 5 g per day is taken orally for 5-6 weeks.
Cissampelos pareira L.	Tubukilota	Menispermaceae	Whole plant	Assam	Whole plant can be used to make decoction and is orally taken daily once for 2-3 months.
Clerodendrum viscosum Vent.	Kuthab-ukabi	Lamiaceae	Leaf	Manipur	50 g of tender leaves is cooked and eaten daily once for 1/2 months.
Coccinia grandis (L.) Voigt	Kunduli	Cucurbitaceae	Fruits	Assam	1/2 raw fruits are eaten daily and fruits are cooked and taken orally daily, for 2-3 months.
Dillenia pentagyna Roxb.	Kaihzawl	Dilleniaceae	Bark	Mizoram	The decoction is prepared from the 100g bark, is taken orally once a day for 6-8 weeks.
Diospyros malabarica Kostel.	Kendu	Ebenaceae	Bark	Assam	Decoction is made by using 50 g of bark, and is taken orally at bedtime daily, for 4-6 weeks.
Emblica officinalis Gaertn.	Amlokhi	Euphorbiaceae	Leaves	Assam	Water boiled leaf extract, 40 to 50 ml is taken orally, twice a day for 4 weeks.
Euryale ferox Salisb.	Thangjing	Nymphaeaceae	Fruit	Manipur	2-3 raw fruits are eaten daily for 2-3 months.
Fagopyrum esculentum Moench	Wakha-yendem	Polygonaceae	Shoot	Manipur	Tender shoot about 100 g is cooked and eaten, once a day, for 6-7 weeks.
Ficus auriculata Lour.	Hei-it	Moraceae	Fruit, bark	Manipur	The decoction is prepared from fruit and bark and 50 ml taken orally once a day for 3-4 months.
Ficus benghalensis L.	Bot	Moraceae	Bark	Assam	Infusion is made by using 100 g bark is taken orally, regularly once a day for 3 months.
Ficus semicordata Miq.	Theipui	Moraceae	Bark	Mizoram	The decoction is prepared from the bark and 20-30 ml is taken orally once a day, for 5-6 weeks.
Flacourtia jangomas (Lour.) Raeusch.	Heitroi	Flacourtiaceae	Fruit	Manipur	2-3 raw fruits are taken orally per day, for 4-5 weeks.
Girardinia palmata Gaudich.	Saru sorat	Urticaceae	Young inflorescence	Assam	Young inflorescence is boiled in water and taken as nettle soup alternate day for 3 months.
Hibiscus mutabilis L.	Sthalpadma	Malvaceae	Bark and leaves	Assam	Decoction is made by using stem, bark and leaves is orally taken daily morning before food for 4 weeks.
Hibiscus rosa-sinensis L.	Jaba	Malvaceae	Flowers	Assam	The flower infusion is taken orally, once a day for 2 months.
Ichnocarpus frutescens (L.) R.Br.	Dudhkuri lota	Apocynaceae	Root	Assam, Manipur, Arunachal Pradesh, Mizoram	The root powder 1 or 2 gm is administered along with milk and also; root decoction is taken orally, daily once, for 4-6 weeks.
Inula cappa (Buch.-Ham.ex D. Don) DC	Buarthau	Asteraceae	Leaves	Mizoram	Leaves are crushed with *Plantago asiatica* and *Lobelia angulata* and the 20 to 30 ml juice is taken orally once a day, for 6-8 weeks.
Kyllinga nemoralis (Forster) Dandy ex Hutch.	Keya bon	Cyperaceae	Tuber	Assam	Decoction is prepared from the roots and 20 ml per day taken orally for 2-4 weeks.
Lepionurus sylvestris Blume	Anpangthuam	Opiliaceae	Leaves	Mizoram	Leaves are boiled and the water is taken ½ cup (50 ml) once a day, for 6-8 weeks.

Table 2 (Cont.)

Botanical name	Local name	Family	Plant part used	State found	Mode of use and administration
Mallotus roxburghianus Müll.Arg.	Zawngtenawh-lung	Euphorbiaceae	Leaves	Mizoram	The decoction is prepared from leaves and is taken orally ¼ cup (25 ml) twice daily as tea, for 3-4 months.
Mangifera indica L.	Am	Anacardiaceae	Leaves	Assam	Decoction is prepared from the leaves is taken orally for 4-6 weeks.
Melothria heterophylla Cogn.	Kabomako	Cucurbitaceae	Roots	Arunachal Pradesh	The decoction is prepared from roots and consumed orally once daily, for 6-8 weeks.
Momordica charantia L.	Tita kerela	Cucurbitaceae	Fruit	Assam, Manipur, Arunachal Pradesh, Mizoram	2-3 fruits are cooked and consumed, and also raw fruit juice of 50 ml is taken orally once a day for 5-6 weeks.
Musa glauca Roxb.	Saisu	Musaceae	Seeds	Mizoram	The seeds are powdered and 5 to 10 g of powder is taken orally twice a day, for 6-8 weeks.
Paederia foetida L.	Bhedai lata	Rubiaceae	Whole plant	Assam	The decoction is made from whole plant and is taken orally for 3-4 weeks.
Phragmites karka (Retz.) Stend.	Nalkhagari	Poaceae	Roots, rhizomes	Assam	Infusion of roots & rhizomes are used once a day for 4 weeks.
Picrasma javanica Blume	Thingdamdawi	Simaroubaceae	Bark	Mizoram	Decoction is prepared from bark, and two tablespoonfuls (15 ml) of decoction are taken orally twice a day, for 6-8 weeks.
Pistia stratiotes L.	Borpuni	Araceae	Whole plant	Assam	The decoction is prepared from whole plant, and is taken orally once a day, for a period of 4-6 weeks.
Portulaca oleracea L.	Leibak-kundo	Portulacaceae	Whole plant	Manipur	Boiled soup is prepared from shoot and is taken orally once a day, for 6-8 weeks.
Primula L.	Kengoi	Primulaceae	Whole plant	Manipur	50-100 g plant parts is cooked and eaten daily once, for 8-10 weeks.
Punica granatum L.	Dalim	Lythraceae	Seeds	Assam	Decoction is prepared from seeds and is mixed with honey and taken orally, daily once for 4-6 weeks.
Saraca asoca (Roxb.) De Wilde	Asok	Leguminosae	Flowers	Assam	Infusion is made from the dried flowers is taken orally once a day, for 8-10 weeks.
Scoparia dulcis L.	Seni bon	Scrophulariaceae	Leaves, stems	Assam	The decoction is prepared from leaves and stems and is taken orally once a day, for 6 weeks.
Sesbania sesban (L.) Merr.	Chuchu-rangmei	Fabaceae	Whole plant	Manipur	Whole plant part is used to make the decoction and is taken orally once a day, for 2-3 months.
Solena amplexicaulis (Lam.) Gandhi	Belipoka	Cucurbitaceae	Leaves	Assam	Decoction is prepared from leaves and is orally taken daily for 2 months.
Syzygium cumini (L.) Skeels	Kala Jamu	Myrtaceae	Bark	Assam	The decoction is prepared from bark and is orally taken once a day, for 6 weeks.
Tamarindus indica L.	Teteli	Caesalpiniaceae	Leaves	Assam	The raw leaves are orally taken once or twice daily, and also decoction of the leaves taken orally once a day, for a period of 6-8 weeks.
Tectona grandis L. f.	Sagun	Lamiaceae	Bark	Assam	Decoction is prepared from 15g bark and is orally taken once a day, for 3-4 months.
Terminalia chebula Retz.	Silikha	Combretaceae	Fruits	Assam	3-4 raw fruits or cooked with normal daily food are consumed thrice a week, for 6 months.
Tinospora cordifolia (Willd.) Hook.f. & Thomson	Sagunilota	Menispermaceae	Stem	Assam and Arunachal Pradesh	Aqueous and alcoholic extract of dry stem is orally taken and also decoction of stem is taken orally once a day for 45-50 days.
Tragia involucrata L.	Dumuni	Euphorbiaceae	Roots	Assam	Decoction is prepared from 40-50 g of root and is taken orally once a day, for 30 to 40 days.
Trigonella foenum-graecum L.	Methi	Fabaceae	Seeds	Assam	5-10 g of seeds and also seed powder is added with food and consumed daily twice or thrice, for four to six months.
Vitex peduncularis Wall.	Thingkhawilu	Lamiaceae	Bark	Mizoram	The decoction is prepared from bark and orally taken ½ cup (50 ml) twice a day, for 2-3 months.

Chang MS, Oh MS, Kim DR, Jung KJ, Park S, Choi SB, Ko B, Park SK (2006) Effects of Okchun-San, a herbal formulation, on blood glucose levels and body weight in a model of Type 2 diabetes mellitus. *Journal of Ethnopharmacology* **103**, 491-495

Chhetri DR, Parajuli P, Subba GC (2005) Antidiabetic plants used by Sikkim and Darjeeling Himalayan tribes, India. *Journal of Ehnopharmocology* **99**, 199-202

Diabetes Medicinal Plant Data-base (2008) Available online: http://www.progenebio.in/dmp/listz.htm

Li WL, Zheng HC, Bukuru J (2004) Natural medicines used in the traditional Chinese medical system for therapy of diabetes mellitus. *Journal of Ethnopharmacology* **92**, 1-21

Madar Z (1984) Fenugreek (*Trigonella foenum-graecum*) as a means of reducing postprandial glucose levels in diabetic rats. *Nutrition Report International* **29**, 1267-1273

Myers N, Mittermeier RA, Mittermeier CG, da Fonseca GAB, Kent J (2000) Biodiversity hotspots for conservation priorities. *Nature* **403**, 853-858

Persaud SJ, A1-Majed H, Raman A, Jones PM (1999) Gymnemasylvestre stimulates insulin release *in vitro* by increased membrane permeability. *Journal of Endocrinology* **163**, 207-212

Saikia AP, Ryakala VK, Sharma P, Goswami P, Bora U (2006) Ethnobotany of medicinal plants used by Assamese people for various skin ailments and cosmetics. *Journal of Ethnopharmacology* **106**, 149-157

Shane-McWhorter L (2001) Biological complimentary therapies: A focus on botanical products in diabetes. *Diabetes Spectrum* **14**, 199-208

Watkins PB, Whitcomb RW (1998) Hepatic dysfunction associated with trog-

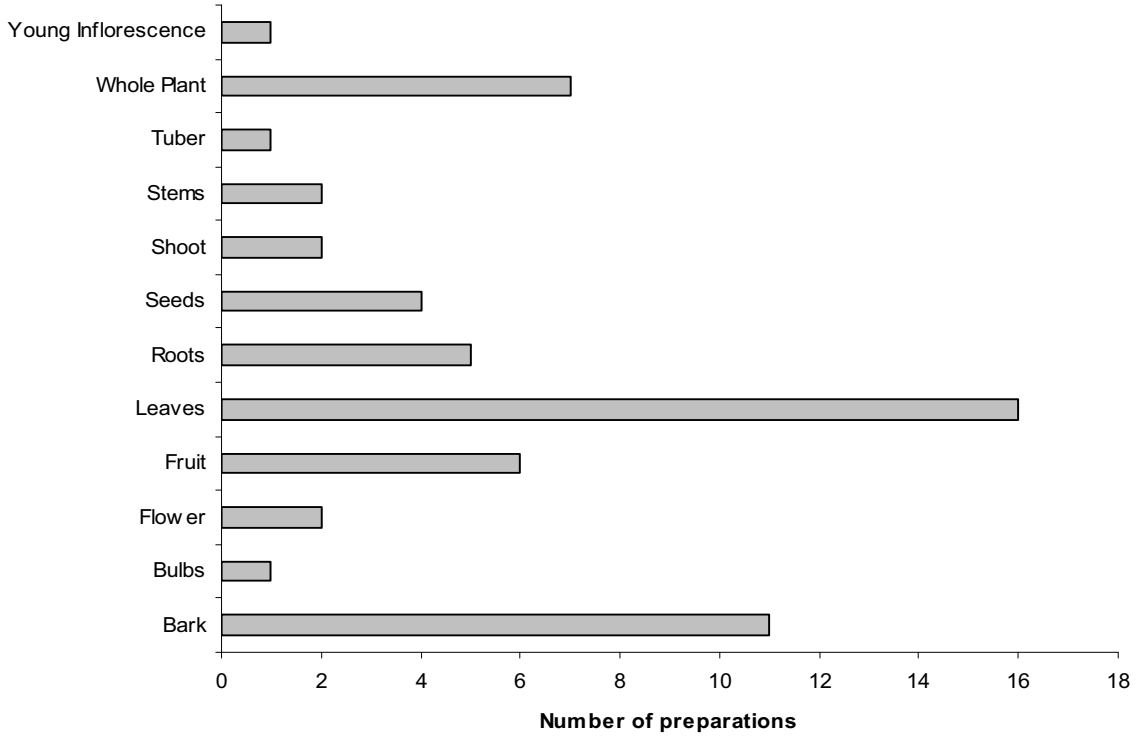

Fig. 2 Number of preparations obtained from various plant parts.

litazone. *New England Journal of Medicine* **338**, 916-917

WHO (2008) Diabetes: the cost of diabetes. Available online: http://www.who.int/mediacentre/factsheets/fs312/en/index.html

WHO (2008) Title required. Available online: http://www.who.int/diabetes/actionnow/en/mapdiabprev.pdf

Witters L (2001) The blooming of the French lilac. *The Journal of Clinical Investigation* **108**, 1105-1107

Xie JT, Wang A, Mehendale S, Wu J, Aung HH, Dey L, Qiu S, Yuan CS (2003) Anti-diabetic effects of *Gymnema yunnanense* extract. *Pharmacological Research* **47**, 323-329