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A rewiew on Antidiabetic Angiospermic plants from the regions of Uttarakhand, India

Razia Parveen, Namita Singh
Patanjali Herbal Research Department, Patanjali Research Institute, Patanjali Yogpeeth Haridwar

Abstract :- Among world-wide problematic health issues that are increasingly diabetes in human beings. Diabetes is caused by metabolic disorder of the body systems as a result of chronic hyperglycaemia. This is problematic health challenge is often associated with disturbances in the metabolism of fat, carbohydrate and protein thereby causing defects in insulin activities and secretion due to the inability of the pancreas to produce enough insulin. This can also be as a result of the failure of the body cells to respond to already-produced insulin. This health condition has led to several mortalities and morbidities with highest cases recorded over all worlds. Uttarakhand is characterized by a rich diversity of ethno-medicinal plants as well as a rich heritage site in traditional medicine system in the Himalayan region. In present study exploring of identification and ethno-medicinal and pharmacological knowledge of plant species which are associated with antidiabetic activity about their uses in local peoples by in Uttarakhand .These data were collected during field survey participatory rural appraisal method review and literature. Total 131 antidiabetic plants species belonging to 59 families were collected on the basis of direct circle of local peoples which are used of these plants . The average density of antidiabetic herbs, shrubs, climber and trees ranged forest area of 34,651 km2 which constitutes 65% of the total area of the state respectively in. We identified plant species and their parts that have been used by local people to treat diabetes through their traditional use system and pharmacological aspect.

Keywords: *Anti-diabetic activity; Pharmacological activity; Hyperglycaemia*.

I. INTRODUCTION

The Indian physician Sushruta in 400 B.C. described the sweet taste of urine from affected individuals, and for many centuries to come, the sweet taste of urine was key to diagnosis, around 250 B.C., the name "diabetes" was firstly used recognized on the basis thousands of years old, in Ancient time documents how black ants and flies were attracted to the urine of diabetics. It is a Greek word that means "to syphon", reflecting how diabetes seemed to rapidly drain fluid from the affected individual. The Greek physician Aretaeus noted that as affected individuals wasted away, they passed increasing amounts of urine as if there was "liquefaction of flesh and bones into urine". The complete term "diabetes mellitus" was coined in 1674 by Thomas Willis, personal physician to King Charles II. Mellitus is Latin for honey, which is how Willis described the urine of diabetics as if imbued with honey and sugar[153]. Diabetes is a disease which is characterized by abnormally hyperglycemia or elevated blood glucose. In peoples affected with diabetes, blood sugar levels remain high. This may be because insulin is not being produced at all, is not made at sufficient levels, or is not as effective as it should be. Diabetes is the name of the condition where the blood sugar level consistently runs too high. Diabetes is classified by underlying cause. The categories are: type 1 diabetes an autoimmune disease in which the body's own immune system attacks the pancreas, rendering it unable to produce insulin; It is most common forms of diabetes are 1 diabetes 5%, type 2 diabetes in which a resistance to the effects of insulin or a defect in insulin secretion may be seen; gestational diabetes; Type 2 diabetes commonly occurs in adults who are obese. There are many underlying factors that contribute to the high blood glucose levels in these individuals. An important factor is the body's resistance to insulin in the body, essentially ignoring its insulin secretions. A second factor is the falling production of insulin by the beta cells of the pancreas. Therefore, an individual with type 2 diabetes may have a combination of deficient secretion and deficient action of insulin and type 2 diabetes (95%) peoples affected that occurs in pregnancy, and other forms of diabetes are very rare and are caused by a single gene mutation[155, 153].

Warning Signs of Diabetes

Figure A. [154].Table.1Anti-diabetic plants of Uttarakhand regions

Sr. No	Anti- diabetic plant	Local/ Vernacular Name	Family name	Part used	Habit	Flowering & Fruiting	Anti-diabetic activity
1.	*Abelmoschus moschatus* Medik.[13].	Muskadana [7]	Malvaceae	-	Herb or under shrub[7]	Aug. - Oct.[7].	Myricelin is a primary active compound isolated from *A. moschatus* which improve insulin sensitivity this resultant post receptor of insulin signalling mediated by enhancements in IRS-1-associated PI3- kinase and GLUT 4 activity in muscles of obese Zucker rat[29].
2.	*Abrus precatorius* L. .[1].	Gunj, Ratti[1]	Fabaceae	Leaves[2], Root, seed[1]	Climber[7]	Aug. - Dec.[7].	Aqueus extact of leaves reduces glucose level in body [28].
3.	*Abutilon indicum* (L.) Sweet.[17, 28].	Kanghe[1].	Malvaceae		Under shrub[7]	Aug.- Dec.[7].	Experimental data is not present .
4.	*Acacia nilotica* (L.) Delile(Syn. *Acacia arabica* (Lam.) Willd.) .[45].	Baboor, Babool[7].	Leguminosae	Whole plant[27]	Tree[10]	Aug. - Apr[10].	Ethanolic extract of plant contain flavanoid which reduces blood sugar level after one week[27].
5.	*Achyranthes aspera* L. [13].	Bang, Latjeera, Ultukuru, Apamarga, Ultakura, Utta - charchita, Chirchira , Latjira[1].	Amaranthaceae	Whole plant[27]	Herbs[7]	Mar.- Nov.[7].	Aqueus and methanolic extracts of the whole plant exhibited significant hypoglycaemic effect in normal as well as in alloxan diabetic rabits with out any acute toxicity[27].
6.	*Achyrocline satureioides* (Lam.) DC. [13].	Macela, marcela, birabira, marcela-da-mata[156]	Asteraceae	Aerial parts[13]	Herb[156]	-	A new prenylated dibeniofuran, achyrofuran, a compound derived from *A. satureioides* significantly lowered blood glucose levels when administered orally (20 mg/kg) to type 2 diabetic db/db mouse[30].
7.	*Aegle marmelos* (L.)Correa. [13,1,5,18].	Bel, Bael[15]	Rutaceae	Fruit[27], Root[13, 15]	Tree[7]	Mar–Jun.[7].	Aqueous extract of fruits shows hypoglycaemic and anti-diabetes actions in streptozotocin diabetic rats. In other experiment alloxan diabetic rats in ethanolic extracts of the fruits significantly lowers blood glucose levels. The methanol extract effectively reduces the oxidative stress induced by alloxan and there by causes a reduction in blood sugar in alloxan diabetic rats.The extract of the plant leaf exhibits hypoglycaemic activity in male mice without altering the serum cortisol concentration. Alcoholic leaf extract has been reported to show glucose tolerance in glucose loaded hyperglycemic rats, and mechanism of action is either by direct stimulation of glucose uptake or via the mediation of enhanced insulin secretion. The aqueous decoction of the plant exhibited significant hypoglycaemic effect in laboratory animals [27].
8.	*Agrimonia eupatoria* L.[13]	-	Rosaceae	Whole plant[30]	Herb[13]	-	*A. eupatoria* used as a diet in 62.5 g/kg and drinking water (2.5 g/L) countered the weight Joss, polydipsia, hyperpbagia, and hyperglycemia of streptozotocin-induced diabetic mice. Moreover, its water extract stimulated 2-deoxyglucose transport, glucose oxidation, and incorporation of glucose into glycogen in mouse abdominal muscle and evoked stimulation of insulin secretion from the BRlN-BDl l pancreatic β-cell line. The effect of the extract on insulin secretion was glucose independent and was not evident in the cells exposed to a depolarizing concentration of KCI [30] .

9.	*Allium cepa* L. [2,13,4].	Piyaz [13, 5,4], Piyaj, Pyaj, Pyaz, Piaj[1].	Alliaceae	Bulb[27]	Herb[4]	Oct-Apr[27]	The onion juices shows anti-hyperglycemic effects in alloxan induced diabetic rats by alloxan[27].
10	*Allium sativum* L. . [1,13,7].	Lahsan, Lahsun [1].	Alliaceae	-	Herb[4]	Oct-Apr[27]	Garlic juice contain S-allyl cystine sulphoxide exhibited anti-diabetic activity alloxan-induced diabetic rats[27].
11	*Aloe vera* L. [13,23].	Ghikawar, gwarpatha or ghritkumari [13, 23], Gheekwanr, Patkwanr[1].	Xanthorrhoeaceae	Leaf[27]	Herb[27]	-	*A. vera* leaf pulp extract showed hypoglycaemic activity on IDDM and NIDDM rats, the effectiveness being enhanced for type II diabetes in comparison with glibenclamide. On the contrary, *A. vera* leaf gel extract showed hyperglycaemic activity on NIDDM rats. It may therefore be concluded that the pulps of *Aloe vera* leaves devoid of the gel could be useful in the treatment of non-insulin dependent diabetes mellitus [27].
12	*Anacardium occidentale* L. [13].	-	Anacardiaceae	dried nuts, stem bark[27]& Leaves[13]	Tree[30].	-	Ethanol extract of dried nuts and stem bark extracts of the plant shows hypoglycaemic activity in both normal and streptozotocin diabetic rats. Stigmast-4-en-3-one, an isolate from the bark of the plant shows glucose lowering activity in normal[27].
13	*Annona muricata* L. [13].	Soursop[13].	Annonaceae	Leaves[13]	Tree[13]	-	The methanol extract of *A. muricata* leaf (100 mg/kg, i.p., daily for 2 weeks) reduced the blood glucose level of streptozotocin-induced diabetic rats. The treatment increased body weight compared to untreated diabetic control rats , *A. muricata* leaf (water extract) treatment has beneficial effects on pancreatic tissues subjected to streptozotocin induced oxidative stress by directly quenching lipid peroxides and indirectly enhancing the production of endogenous anti-oxidants. The extract protected and preserved pancreatic β-cell integrity as judged from histological observations .The regeneration of the β-cells of the streptozotocin-destrucled islets is probably due to the fact that the pancreas contains stable (quiescent) cells that have the capacity to regenerate. Therefore, the surviving cells can proliferate to replace the lost cells. Treatment with the extract showed a significant antihyperglycemic activity in diabetic rats at the end of the experiment [30].
14	*Annona squamosa* L. [13].	Custard apple, sharifa[13], Sitaphal, Sharifa[1].	Annonaceae	seeds, leaves & aerial parts[13]	Shrub or medium sized tree[7]	May–Sep.[7].	Aqueous leaf extract of the plant show antidiabetic activity in streptozotocin nicotinamide type 2 diabetic rats. Hypoglycemic and antidiabetic effects of ethanol extracts of leaves in experimental animals have been reported [13].
15	*Areca catechu* L. [13].	Supari[1].	Arecaceae	Fruits [28]	Tree[13]	Throughout the year[28]	The hypoglycemicand hypolipidemic, properties of the areca nut extract was evaluated in alloxan-induced diabetic rats. Oral administration of the nut extract (25 mg/kg) to diabetic animals decreased the elevated levels of serum glucose and lipids to near normal levels in alloxan-induced diabetic rats. The study indicates that the nut extract possesses anti-DM and antilipidemic activity in diabetic rat.Subcutaneous administration of an alkaloid fraction of the nut to alloxan-induced diabetic rabbits showed significant hypoglycemic effect lasting up to 6 h. Arecoline, an alkaloid, has been reported to have hypoglycemic activity in the animal model of DM upon subcutaneous administration . Ethanol extract of areca nut showed *in- vitro* inhibitory activity of intestinal α -glucosidase enzymes maltase and

							surcease with an IC50 value of 12 µg/m fo maltase and 30 µg/mLfor surcease. The ethanol extract (250 and 500 mg/kg) reduced postprandial elevation in blood glucose levels at 30 and 60 min after administration of maltose. Thus, areca nut extract inhibits α-glucosidase and is effective in the suppression of blood glucose level elevation after oral maltose loading to rats [30].
16	*Artemisia herba-alba* Asso. [13].	-	Asteraceae	Aerial parts[31, 32]	Shrub[13]	-	Aqueous extract of aerial parts of *A. herba* alba was evaluated for anti-diabetic activity in rats and rabbits. It showed significant reduction in blood glucose level, prevents elevation of glycosylated haemoglobin level and possesses hypoliposis effect, in addition to protection against body weight loss of diabetic animals [31, 32].
17	*Artemisia pallens* Wall. Ex DC. [13].	-	Asteraceae	Aerial parts[27]	Shrub[13]	-	Oral administration of the methanolic extract of the aerial of the parts of this plant results in significant blood glucose lowering in glucose-fed hyperglycaemic and alloxan induced diabetic rats [27].
18	*Artemisia roxburghiana* Wall ex Besser .[9].	Kunju[9], Kunjaa, Chamur[1].	Asteraceae	Leaf[9] & Aerial parts[36]	Herb[157]	Sept-Nov[9]	*A. roxburghiana* having anti-diabetic potential for protein tyrosine phosphatase 1B (PTP1B) as a validated target for management of diabetes. Various compounds were isolated as active principles from the crude methanolic extract of aerial parts of *A. roxburghiana*. All compounds were screened for PTP1B inhibitory activity. Positive control, ursolic acid. Betulinic acid, betulin and taraxeryl acetate were the active PTP1B principles with IC50 values 3.49 ± 0.02, 4.17 ± 0.03 and 87.52 ± 0.03 µM, respectively. Molecular docking studies showed significant molecular interactions of the triterpene inhibitors with Gly220, Cys215, Gly218 and Asp48 inside the active site of PTP1B. The antidiabetic activity of *A. roxburghiana* could be attributed due to PTP1B inhibition by its triterpene constituents, betulin, betulinic acid and taraxeryl acetate[36].
19	*Asparagus adscendens* Roxb. [1].	Kairu[1]	Liliaceae	Root[1]	Shrub[7]	Aug.-Dec. [7].	The water extract of *A. adscendens* exhibited antidiabetic potentials and it stimulated both the secretion and action of insulin as well as inhibition of starch digestion in clonal pancreatic β- cell line[30]. Recent studies have clearly demonstrated the importance of medicinal plants in the treatment of experimental diabetes, where oxidative stress induced apoptosis or β –cell death[18,19]. Oral administration of EEAR showed significant hypoglycemic effects against STZ-induced diabetes in rats. The extract significantly lowered the levels of blood glucose, and TBARS and significantly increased the levels of GSH, SOD and CAT[37].
20	*Asparagus curillus* Buch.Ham ex Roxb. [1].	Shatavar, Jhiran, Jhirni, Karua, Karu[1]	Liliaceae	Root[1]	Stout shrub[10]	Apr-Dec.[10].	No pharmacological activity is found
21	*Asparagus filicinus* Buch.-Ham. ex D.Don,. [6,25].	Kairua, Sharanoi[6, 25], Jhirni, Satava[1].	Liliaceae	Root[1]	Climber[6, 25]	May-Aug.[10].	No pharmacological activity is found
22	*Astragalus propinquus* Schischkin (Syn.*Astragalus membranaceus* (Fisch.)[13].	-	Fabaceae	Root[30]	Herb[158]	Jun.-Sept.[158]	A polysaccharide-enriched extract from *A. membranaceus* showed hypoglycemic effect in diet induced insulin-resistant C57BL/6j mice. Extracts of *A. rnembranaceus* significantly activated PPAR-α and PPAR-γ. Bioassay-guided fractionation resulted in the isolation of

							the isoliavones, formononetin, and calycosin from *A. membranaceus* as the PPAR-activating compound. Formononetin, an isoflavone isolated from the ethanol extract of this plant, activated PPAR-γ. *A. membranaceus* root exhibited protective effect against diabetic nephropathy in animal models [30].
23	*Averrhoa bilimbi* L. [13].	-	Oxalidaceae	Leaf[27]	Tree[27]	-	*A. bilimbi* leaf extract lowers blood glucose and lipids in streptozotocin-diabetic rats. An active fraction from the alcohol extract of the leaves ameliorates hyperglycaemic and associated complications in STZ-diabetic rats [27].
24	*Azadirachta indica* A.Juss. [1, 3, 8, 13].	Nim, Neem[1]	Meliaceae	Leaf[27]	Tree[7]	Mar.-Aug.[7].	The leaf extract and seed oil administration results in hypoglycaemic effect in normal as well as alloxan diabetic rat. The water extract of root and leaves also lowers blood glucose in alloxan diabetic rats. Petrolium ether extract of kernel and husk of neem seeds protects rats from streptozotocin induced diabetes. The leaf extract blocks the inhibitory effect of serotonin and epinephrine on insulin secretion mediated by glucose [27].
25	*Bauhinia forficata* Link. [13].	Pata de vaca, casco de vaca, mororó, pata de boi[156]	Fabaceae	Leaves[13]	Tree[156]	-	STZ diabetic rats treated with decoction of plant showed a significant reduction in serum and urinary glucose and urinary urea [28].
26	*Bauhinia forficata* subsp. *pruinosa* (Vogel) Fortunato & Wunderlin (Syn.*Bauhinia candicans*). [13].	-	Fabaceae	Leaves [13]	Shrub or small tree[14]	Jun-Nov.[14].	The effectsof *B. forficata* Link subsp. *pruinosa* (BF) tea on oxidative stress and liver damage in streptozotocin (STZ)-induced diabetic mice. Diabetic male mice have remained 30 days without any treatment. BF treatment started on day 31 and continued for 21 days as a drinking-water substitute.Evaluated following parameters (1) BF chemical composition (2) glucose levels; (3) liver/body weight ratio and liver transaminases; (4) reactive oxygen species (ROS), lipid peroxidation, and protein carbonylation in liver; (5) superoxide dismutase (SOD) and catalase (CAT) activities in liver; (6) δ-aminolevulinate dehydratase (δ-ALA-D) and nonprotein thiols (NPSH) in liver; (7) Nrf2, NQO-1, and HSP70 levels in liver and pancreas. Phytochemical analyses identified four phenols compounds. Diabetic mice present high levels of NQO-1 in pancreas, increased levels of ROS and lipid peroxidation in liver, and decrease in CAT activity. BF treatment normalized all these parameters. BF did not normalize hyperglycemia, liver/body weight ratio, aspartate aminotransferase, protein carbonyl, NPSH levels, and δ-ALA-D activity. The raised oxidative stress seems to be a potential mechanism involved in liver damage in hyperglycemic conditions. Our results indicated that BF protective effect could be attributed to its antioxidant capacity, more than a hypoglycemic potential [38].
27	*Bauhinia variegata* L. [6].	Kwairal[6], Kwairare Kwarau, Quairal, Kachnar Katral[1]	Fabaceae	Roots [27], Bark[6]	Tree[6]	-	Ethanol extracts of *B. variegata* showed insulin releasing effects at 20 microg/ml from INS-1 cells in the presence of 5.5 Mm glucose [27].

28	*Berberis asiatica* Roxb.ex D.C. [6,8,25].	Rasanjana, Daruhaldi, Kilmora, Kilmor [6,8,24,25]. Kashmoi. Kingor, Kingora. Kilmora, [1].	Berberidaceae	Root[40]	Shrub[7]	Feb. - Jun.[7].	The root extract of *B. asiatica* presents a very strong and even greater antidiabetic activity than obtained by glibenclamide. Hypoglycemic activity in rats was also reported, however, at the studied concentration, no significant effect was observed when compared to *B. aristata*, suggesting that *B. asiatica* should be applied in higher doses [40]. The extract shows a stronger anti diabetic action then the standard drug, Glibenclamide. Regarding morphological changes rats are supposed to get fungal infections and reddening of tail. Loco motor activity slows down. Sometimes body wt. Decreases in case of diabetic rats [41]. It also shows anti-diabetic effect in presence berberine alkaloid whicxh are extracted by this plant [42].
29	*Berberis lycium* Royle. [16,4,5].	Kamble, Simblu, Kashmoee [16,45], Chu th ar, Kingore. Rasaut, Chatroi[1].	Berberidaceae	Root[43, 44, 45]	Shrub[4] or Undershrub[7]	Mar. - Jun.[7].	The ethanolic extract of root of *B. lyceum* was compared with pure berberine in normal and alloxan-diabetic rats using similar doses of each. The concentration of berberine in the extract was determined to be 80% dry weight with only trace amounts of other alkaloids present. The purpose of the study was to investigate the effects of berberine and a whole extract of *B. lyceum* on blood glucose and other parameters associated with diabetes, to compare the effects of the crude extract with those of pure berberine and thus validate its use as a therapeutic agent, and finally to identify any contribution of the other components of the extract to these effects. Oral administration of 50 mg/kg of Berberis extract and berberine to normal and experimental diabetic rats produced a significant ($p < 0.05$) reduction in blood glucose levels from days 3-7 days of treatment. Significant effects were also observed on the glucose tolerance, glycosylated haemoglobin, serum lipid profiles and body weight of experimental animals [43]. Hypoglycemic effect of powdered root bark of BlR (250, 500 mg/kg body weight) was evaluated in both normal and diabetic rabbits. Gliclazide was used as positive control. Antidiabetic effects of different extracts were also determined [44]. *B. lycium* and various extracts from its roots lower the glucose level significantly. Oral glucose tolerance test showed that plant extracts reduced serum glucose level in a dose-dependent manner. The observed mechanism involved in hypoglycemia is insulin like effect, possibly through the peripheral glucose consumption. The applied doses were devoid of any behavioral changes or acute toxicity in experimental animals. Antidiabetic activity of pure berberine was compared with ethanolic root extract of *B. lycium* in normal and alloxan-induced diabetic rats using similar doses (50 mg/kg) of each. Plant extract and berberine reduced blood glucose level significantly and demonstrated significant effects on glycosylated hemoglobin, glucosetolerance, serum lipid profiles and body weight [45].
30	*Bergenia ciliata* (Haw.)	Silphodi [9], Pashan-	Saxifragaceae	Root, Leave	Herb[159]	Mar.-Jul.[10]	The roots and leaves extract viz ethanol, hexane, ethyl acetate, chloroform, butanol and

	Sternb. [9].	bhed, Pathar-chat, Pashanbed. Ghipat, Ghyo-pati, Silpara. Ghcepati[1].		s [46]		.	aqueous of *B. ciliata* were used to test of hypoglycemic activity. All the extracts except chloroform extract of root and leaves of *B. ciliata* were found to possess hypoglycaemic activity in Streptozotocin (STZ) treated rats. Therefore the plant can be classified as hypoglycemic activity in experimental diabetes ranging from 40-70% of its onset to reduce blood glucose level [46]. The extracts except chloroform extract of root and leaves of *B. ciliata* were found to possess hypoglycemic activity in Streptozotocin (STZ) treated rats. Therefore the plant can be classified as hypoglycemic, hypoglycemic activity in experimental diabetes ranging from 40-70% of its onset to reduce blood glucose level [47].
31	*Biophytum sensitivum* (L.) DC. [13].	-	Oxalidacea e	Leave s[49]	Herb13]	Oct.-Mar. [7].	*B. sensitivum* shows hypoglycemic activity. In alloxan-diabetic rabbits, initial dose–response studies showed that a dose of 200 mg/kg body weight (b.wt.) was optimum for hypoglycemia. A single administration of this dose to 16-h fasted non-diabetic rabbits brought about a 16.1% fall in fasting plasma glucose (FPG) level at the end of 1 h and 2 h, and the hypoglycemic effect persisted at the end of 6 h (13.8% fall [48]. Subdiabetic (Alloxan recovered; AR), mild diabetic (MD) and severely diabetic (SD). Assessment of activity of the extract, prepared from the plant leaves, was done by fall in fasting plasma glucose (FPG) and improvement in the oral glucose tolerance test (OGTT), followingsingle dose and prolonged administrations. Following single dose administration there was fall in 1 hour and 2.5 hour glucose values by 25.9% and 27.4% respectively in the subdiabetic rabbits, and by 36.9% and 37.7% in the mild diabetic rabbits. Improved GTT response is shown by fall in area under curve (AUC) from 16138 mg/dl to 12355 mg/dl (23.4%) in the subdiabetic rabbits, and from 19258 to 12238 mg/dl in the MD rabbits [49].
32	*Bixa orellana* L. [13].	-	Bixaceae	Aerial parts[28]	Shrub or small tree[13]	-	An infusion of *B. orellana* was found to lower blood glucose level when administered 45 min before glucose load was found to lower blood glucose level when administered 15 min after glucose load The antidiabatic activity was evaluated in alloxan induced diabetic model of wistar rats. All the extracts were able to reduce sugar level in blood. Ethyl acetate and n-butanol extracts of this plant were found to have good antidiabetic activity in comparison to other extracts [51]. The antidiabatic activity was evaluated in alloxan induced diabetic model of wistar rats. All the extracts were able to reduce sugar level in blood. Ethyl acetate and n-butanol extracts of this plant were found to have good antidiabetic activity in comparison to other extracts [50].
33	*Boerhavia diffusa* L.	Punryaru, Punarn ava, Puneru, Biskhaparia, Patharchana[1].	Nyctaginac eae	Leaf[27]	Creeping herb [13]	Major part of the year [7].	*B. diffusa* leaf extract 200 mg/kg for 4 weeks resulted in a significant reduction in reactive substances and hydro peroxides with an increase in reduced glutathione super oxide dismutase catalase etc in diabetic rats [27].

34	*Bombax ceiba* L. [13, 18].	Semal[13].	Bombaceae	Leaves, root[13,18], flower & stem bark[28]	Trees[7]	Jan.-May[7].	*B.ceiba* bark extract was evaluated for its hypoglycemic and hypolipidemic potential through normal and streptozotocin-induced diabetic rats administered with graded oral doses (200, 400, 600 mg/kg/day) for 21 days. The results showed that a dose of 600 mg/kg of B. ceiba extract is the most effective to cause significant ($p<0.001$) hypoglycemic and/or hypolipidemic effects on streptozotocin-induced diabetic rats. This dose also significant-ly ($p<0.001$) lowered the total cholesterol and triglyceride level in severely diabetic rats [52]. A dose of 600 mg/kg of *B. ceiba* extract is the most effective to cause significant ($p<0.001$) hypoglycemic and/or hypolipidemic effects on streptozotocin-induced diabetic rats. This dose also significant-ly ($p<0.001$) lowered the total cholesterol and triglyceride level in severely diabetic rats. Phytochemical and GC-MS studies confirmed the presence of the triterpenoid compounds in the extract, which may account for its significant hypoglycemic activity [53].
35	*Brassica juncea* (L.) Czern.	-	Brassicaceae	-	Herb [7]	Feb.-Apr.[7].	*B. juncea* shows significant hypoglycemic action in rats. Hepatic glycogen and glycogenesis increases as a result increased activity of glycogen synthetase, and hepatic glycogenolysis and gluconeogenesis devrease .*B. juncea* shows both hypoglycemic and anti-hyperglycemic activities in rats [27].
36	*Brassica nigra* (L.) K.Koch [13].	-	Brassicaceae	Seeds [29]	Herb[160]	Jun.-Sept.[160]	With providing 200 mg/kg body weight of aquous extract for one month in diabetic animal have ability to reducing the activity of fasting serum glucose level, where the untreated group of fasting serum glucose level remains higher value.Glycosylated hemoglobin and serum lipids level were so less if compared to treated and untreated animals[13]. Have ability to reducing the activity of fasting serum glucose level [29].
37	*Bridelia ndellensis* Beille.[13].	-	Euphorbiaceae	Leaf & stem bark[13]	Tree[63]	-	The effects of the ethanol extract (1.25 g/kg) and fractions (1 g/kg) of *B. ndellensis* stem bark on the blood glucose levels in streptozotocin-induced types 1 and 2 diabetic rats at different prandial states were studied. The ethanol extract of *B. ndellensis* had no hypoglycemic effect in type 1 diabetic rats in fasting and postprandial glucose load conditions and, in type 2 diabetic rats in fasting condition. However, the extract, and its ethyl acetate and dichloromethane fractions significantly lowered blood glucose levels in type 2 diabetic rats when fed simultaneously with glucose. The active principles responsible for the antihyperglycaemic effect are concentrated in the ethyl acetate and dichloromethane fractions of the extract. The ethanol extract of *B. ndellensis* had no hypoglycemic effect in IDDM and NIDDM rats on fasting condition. However, glibenclamide showed a significant ($P<0.05$) decrease of blood glucose levels in NIDDM rats on fasting state (36% and 38% reduction respectively 60 and 120 min after administration) shows the effect of *B. ndellensis* 80% ethanol extract on postprandial blood glucose levels of IDDM rats when fed simultaneously with glucose (2.5 g/kg body weight)[57].

							The antidiabetic activity of *B. ndellensis* ethanol extract and its fractions in type 2 model diabetic rats. After 28 days repeated oral feeding, the ethanol extract (50 mg/kg) significantly ($p<0.05$) reduced the levels of blood glucose, total cholesterol and triglycerides levels in NIDDM rats. ADP-induced platelet aggregation in vitro was also inhibited by the parent ethanol extract in a concentration-dependent manner. All concentrations (4, 8, 12 and 16 mg/ml) of the extract produced significant inhibitory effects, the more pronounced effect (93.31% inhibition) was observed with the highest concentration (16 mg/ml). Ethyl acetate, butanol and water fractions from the 80% ethanol extract of *B. ndellensis* also significantly ($p<0.001$) inhibit platelet aggregation. The water part is the most active extract with an inhibitory effect of 85.97%. These results suggest that *B. ndellensis* ethanol extract possesses antidiabetic effects in type 2 model diabetic rats [58].
38	*Bryonia alba* L. [13].	-	Cucurbitaceae	Roots [13]	Herbaceous climber[161]	-	Powdered roots 1.5 kg were extracted for 24 hrs with alcohol at 60-80°C and dried under reduced pressure and tested on alloxanised hyperglycaemic animals.Wistar rats (200-225 g) of either sex were employed in this study. The rats were maintained under standard laboratory conditions at 25 ± 2°C, relative humidity 50 ± 15% and normal photo period [12 h dark/12 h light] were used for the experiment. Experimental studies revels that the ethanolic extracts from *B. alba* roots (200 mg/kg) orally administered for 7 days produced a significant decrease in the blood glucose level in the model of alloxan-induced diabetes in rats [59]. Administration of trihydroxyoctadecadienoic acids obtained from the roots of *B. alba* L. (0.05 mg/kg/day for 15 days) restores the disordered lipid metabolism of alloxan-diabetic rats. Metabolic changes induced in diabetes significantly restores towards their normal values with the exception of diminished triglyceride content of muscle which does not restores. Thus, they can influence the profile of the formation of stable prostaglandins by actions downstream of prostaglandin endoperoxides [60].
39	*Caesalpinia bonduc* (L.) Roxb.(syn. *Caesalpinia bonducella*). [13].	Fever-Nut; Physic-Nut[14].	Fabaceae	Seed[27]	Shrub[14]	Aug.-Cold season. [14].	*C. bonduc* seed has hypoglycaemic effect in normals as well as type 1 and 2 diabetic rats. The seed fractions have insulin secretagogue property on isolated and this could be one of the mechanisms of its action [27].
40	*Cajanus cajan* (L.) Millsp. [13].	Arhar[1] Pigeon pea[27]	Fabaceae	Seeds [27]	Shrub or subshrub [162]	Throughout the year[162].	In form of pulse from the seeds of this plant is recommended in diabetes[27] .
41	*Capparis decidua* (Forssk.) Edgew. [13].	-	Capparaceae	Fruit[13]	Shrubs[163]	Mar-Jul.[163]	Fruit powder extract is used for diabetic patients[27].

42	*Casearia esculenta* Roxb. [13].	Chilla, kakkaipilai, malampavatta[27]	Flacourtiaceae	Root[27]	Shrub[27]	-	The plant root extract exhibited anti-hyperglycemic and antidiabetic properties in rats [27].
43	*Catharanthus roseus* (L.) G. Don (Syn. *Vinca rosea* L.) [13, 1, 8, 3].	Sada-bahar[1]	Apocynaceae	Whole plant[13]	Herb[7]	Throughout the year mainly during Aug. – Jan [7].	In normal and streptozotocin-diabetic rats treated with the plant extracts exhibit potent blood sugar-lowering activity. The leaf juice of *C. roseus* shows and the mechanism may be by enhancing secretion of insulin from beta-cells of Langerhans or through extrapancreatic mechanism. In streptozotocin induced diaboric rats the extract stimulates carbohydrate metabolism and reduces oxidative stress [27].
44	*Cheilocostus speciosus* (J.Koenig) C.D.Specht(Syn. *Costus speciosus* (J.Koenig) Sm.). [15].	Kewati[7]	Zingiberaceae	Rhizome[27]	Herbs[15, 7]	Jul.-Nov.[7].	Rhizome of *C. speciosus* show hypoglycemic activity in normal and diabetic [27].
45	*Cinnamomum tamala* (Buch.-Ham.) T.Nees & Eberm. [18,24].	Tejpatta[18]	Lauraceae	Bark[24] & Leaves[27]	Tree [10]	Feb.-Aug.[10].	*C. tamala* leaves possess hypoglycaemic and hypolipidemic effects in rats shows some level of blood glucose lowering effect within 2 weeks of treatment in alloxin diabetic [27].
46	*Cissampelos pareira* L. [1].	Kali-bel, Nirbishi, Musbhyol, Pari, Jal-jamni, Nirwisi, Madrachi, Nirwisi, Padi, Pahari, Paatha, Harjori, Dakhnirbasi [1].	Menispermaccae	Leaf & Root[1]	Climber[7]	Jul.-Dec.[7].	The antidiabetic activity of hydro-alcoholic extract of *C. pareira* linn. Leaveswas evaluated by using normal and Streptozotocin-induced diabetic rats. After the oral administration of hydro-alcoholic extract at doses of 200 mg/kg and 400 mg/kg body weight, blood glucose levels and body weights were monitored at specific intervals. In chronic model of diabetic, hydro-alcoholic extract of *C. pareira* linn. Leaves at a dose of 200 mg/kg, 400 mg/kg and glibenclamide (5 mg/kg) were administered for 21 days. In our study, both glibenclamide and HAECP significantly decreases fasting blood glucose and increases the body weight in Streptozotocin induced diabetic rats as compared to the animals in the diabetic control group. The antidiabetic activity of HAECP was comparable to that of standard drug glibenclamide at a dose of 5 mg/kg. *C. pareira* Linn. having potent antidiabetic property [64]. Oral administration of water-methanol (1:1) extract of the leaves (100mg and 300mg/kg body weight/day) for 6 weeks and 12 weekssignificantly reduced the level of blood glucose, percent glycosylated haemoglobin (%HbA1c), and triglyceride and cholesterol levels in the diabetic rats in a dose-dependent manner. The standard drug, Pioglitazone (Pioz, 3mg/kg body wt) was used to compare the results. Determination of serum insulin levels revealed no significant differences in the insulin levels of the extract-treated and untreated diabetic animals in the fasted state although significant reduction in the % HbA1c levels were observed in the CLE-treated rats. However, significant increase in the insulin levels was observed in the fed-state in the diabetic CLE-treated rats. Light microscopic studies using Aldehyde-

							fuchsin staining technique showed significant higher islet volume and β-cells granulation scores in the CLE -treated diabeticrats compared to diabetic control rats [65].
47	*Citrullus colocynthis* (L.) Schrad. [13].	Chota-tarbooj [1].	Cucurbitaceae	Fruit & Seeds [27]	Herb[13]	-	Aqueous extract of the seeds on oral administration can ameliorate some toxic effects of streptozotocin in STZ diabetic rat. Aqueous extract of *C. colocynthis* fruit exhibits hypoglycaemic and antihyperglycaemic effect in normal and alloxan diabetic rabbits. Different *C. colocynthis* seed extracts have an insulinotropic effect which could at least partially account for the antidiabetic activity of the seed [27].
48	*Clematis montana* Buch.-Ham. ex DC[15].	Kauniabali[15], Kujju, Kaunia-bali, Konia, Kounja, Kania [1].	Ranunculaceae	Flower, [15], Leaf ,root[66]	Herb[15] & climber [10]	Jun.-Dec.[10].	The antidiabetic potential of *C. montana* leaf and root extracts. On the basis of toxicity studies a dose of 200 mg/kg body weight was selected for antidiabetic activity. Diabetes was induced by the administration of streptozotocin at a dose of 50 mg/kg, intra peritoneal. Among all the extracts, ethanolic extract (EtOH) of *C. montana* (183.8±3.79) have shown significant reduction in blood glucose level in SZT induced diabetic Wister rats as compared to control and the standard drug glipizide (5 mg/kg body weight) [66].
49	*Coccinia grandis* (Linn.) Voigt. [13, 20].	Kaduri, Eng. Ivoy Gourd. [7,20].	Cucurbitaceae	Leaves & root [7,20]	Herbs[7, 20], climber[13]	Aug.-Nov. [7].	Graded doses of the aqueous extract were administered to normal and experimental diabetic rats for 10 days. Significant ($p < 0.05$) reduction in fasting blood glucose levels were observed in the normal as well as in the treated diabetic animals. Serum insulin levels were not stimulated in the animals treated with the extract. The changes in body weight, serum lipid profiles, liver glycogen levels were assessed in the extract treated diabetic rats and compared with diabetic control and normal animals [67]. Aqueous leaf extract of *C. grandis* on serum/blood glycemic parameters and regenerative potential of islet cells in the pancreas of streptozotocin induced diabetic rats. Diabetes was induced in rats by injecting them with streptozotocin (65 mg/kg, ip). Group one and two served as the healthy untreated, diabetic untreated control rats and received distilled water. Group three and four were diabetic rats, received the optimum effective dose of *C. grandis* (0.75 gm/kg) and glibenclamide (0.50 mg/kg) daily for 30 days. There was a statistically significant decrease in the percentage of glycosylated hemoglobin together with a concomitant increase in the concentrations of serum insulin and C-peptide in plant extract and glibenclamide treated diabetic rats ($p<0.05$). The β-cell regeneration in *C. grandis* extract treated diabetic rats was noted through an increase in the percentage of insulin secreting β-cells and an increase in islet profile diameter ($p<0.05$) [68].
50	*Cocculus hirsutus* (L.) W.Theob. [13].	Jal-jamini [1].	Menispermaceae	Leaves[13]	Shrub[13],Twining herb or under shrub[7]	Jan.-Mar.[7].	The antihyperglycemic activity of aqueous extract of leaves of *C. hirsutus* (L.) Diels in alloxan-induced diabetic mice. Alloxan-induced (70 mg/kg, i.v.) diabetic mice were given aqueous leaf extract (250, 500, and 1000 mg/kg, p.o., n= 6) of C. hirsutus or vehicle (distilled water, 10 ml/kg, p.o.) or standard drug glyburide (10 mg/kg, p.o.) for 28 days. Blood samples were withdrawn by retro-

							orbital puncture and were analyzed for serum glucose on 0th, 7th, 14th, 21st, and 28th days by glucose oxidase/peroxidase method. In oral glucose tolerance test, glucose (2.5 g/kg, p.o.) was administered to nondiabetic control, glyburide (10 mg/kg, p.o.), and aqueous extract of *C. hirsutus* (1000 mg/kg, p.o.) treated mice. The serum glucose level was analyzed at 0, 30, 60, and 120 min after drug administration. The aqueous leaf extract of *C. hirsutus* (250, 500, and 1000 mg/kg, p.o.) showed significant (P< 0.01) reduction of serum glucose level in alloxan-induced diabetic mice at 28th day. In oral glucose tolerance test, aqueous extract of *C. hirsutus* increased the glucose tolerance. It is concluded that *C. hirsutus* has significant antihyperglycemic activity as it lowers serum glucose level in diabetic mice and significantly increases glucose tolerance [69]. Anti-diabetic effect was eveluated with *C. hirsutus* when given as an aerial part extract in normal as well as diabetic rats. The effect, however, was more pronounced in diabetic animals in which administration for 15 days after streptozotocin (STZ)-induced diabetes, significantly reduced blood glucose levels. After STZ-induced diabetes, it was observed that both standard drug (glibenclamide) and methanolic extract of *C. hirsutus* were significantly superior to control in reducing blood sugar on long treatment (15 days) [70].
51	*Combretum micranthum* G.Don. [13].	Geza'in Hausa[13]	Combretaceae	Leaf[71]	Small tree, shrub or liana[164]	Nov.-Dec.[164]	Three doses (100mg/kg, 200mg/kg and 400mg/kg) of the aqueous leaf extract of *C. micranthum* were administered to normal glucose loaded, subdiabetic and diabetic rats. Of the doses tested, 100mg/kg of the extract was the most effective. It produces a significant hypoglycaemic and antidiabetic activity comparable to the effect of standard drug 0.6 mg/kg glibenclemide [71]. Piperidine flavan alkaloids isolated from the leaves of *C. micranthum* (kinkeliba) possess anti-diabetic properties [72].
52	*Coriandrum sativum* L. [17].	Dhanyiya, Dhania, Dhani [1].	Apiaceae	Seeds [28]	Herb[28]	Nov.-Dec.[28].	Aqueous extract of coriander increased 2-deoxy glucose transport, glucose oxidation and incorporation of glucose into glycogen. Coriander has anti-hyperglycemic insulin-releasing and insulin like activity [28].
53	*Cynodon dactylon* (L.) Pers. [3].	Dub grass[3]	Poaceae	Leaves[3]	Herb[3], Grass[7].	Throughout the year [7].	Petroleum ether (60o-80oC), chloroform, acetone, ethanol, aqueous and crude hot water extracts of the whole plant of *C. dactylon* and the two fractions of aqueous extract were tested for anti-hyperglycaemic activity in glucose overloaded hyperglycemic rats and in alloxan induced diabetic model at two-dose levels, 200 and 400 mg/kg (po) respectively. The aqueous extract of *C. dactylon* and the non polysaccharide fraction of aqueous extract were found to exhibit significant antihyperglycaemic activity and only the non polysaccharide fraction was found to produce hypoglycemia in fasted normal rats. Treatment of diabetic rats with aqueous extract and non polysaccharide fraction of the plant decreased the elevated biochemical parameters, glucose, urea, creatinine, serum cholesterol, serum triglyceride, high density lipoprotein, low density lipoprotein, haemoglobin and glycosylated haemoglobin significantly [73]. Blood glucose, cholesterol, urea and triglycerides level. The solvent extracts were found to exhibit qualitative difference in phytochemical constituents There was a steep

							decline in blood glucose, cholesterol and triglycerides level when in methanolic extract of *C.dactylon* was given to experimental animals when compared with negative control. Moreover, petroleum ether and chloroform extracts also reduced the elevated plasma cholesterol and urea level in diabetic rats. It may be concluded that *C. dactylon* might be used in the treatment of diabetics [74].
54	*Daucus carota* L. [18].	Gajar[18]	Apiaceae	Seeds [75, 76] & Root[18]	Herb[10]	Late spring in hills[11].	The methanol extract of *D. carota* seeds on the serum levels of lipids and biochemical indices of kidney and liver function in streptozocin-induced diabetic rats. Diabetes mellitus (type I) was induced using intraperitoneal injection of streptozotocin (65 mg/kg). Fasting blood samples were collected one week later and rats with their serum glucose level exceeding 300 mg/dl were considered diabetics. These diabetic animals were divided into 5 groups and received various doses of *D. carota* seeds extract (100, 200 and 300 mg/kg body wt.), glibenclamide (600 g/kg) and distilled water (0.5 ml) for 6 days using gavage. After tratment, fasting blood samples were collected again and total cholesterol, triglycerides, urea, uric acid, creatinine, aspartate amino transferase (AST), alanine aminotransferase (ALT), high density lipoprotein cholesterol (HDL-C) and Low density lipoprotein cholesterol (LDL-C) levels were determined using spectrophotometry technique by respective kits. Administration of *D. carota* seeds extract in diabetic rats for six days, at all doses significantly decreased serum levels of total cholesterol, triglycerides and creatinine. Furthermore, oral administration of extract (200 and 300 mg/kg) significantly decreased serum levels of LDL-C, AST and urea. Also, extract (300 mg/kg) decreased ALT serum levels ($P < 0.05$) [75]. The effect of the methanolic extract of *D. carota* seeds on carbohydrate metabolism and morphology of pancreas was investigated in type I diabetic male rats. Diabetic rats were divided to 5 groups that received 100, 200 and 300 mg/kg of the extract, glibenclamide and distilled water daily for 6 days. Administration of all doses of *D. carota* seeds extract and glibenclamide for 6 days significantly decreased serum glucose levels, however, only 300 mg/kg of the extract as well as glibenclamide significantly increased insulin serum levels. *D. carota* seeds extract has hypoglycaemic effect by increasing insulin secretion and improvement of the pancreas [76].
55	*Dillenia indica* L.	-	Dilleniacea e	Leave s[78]	Tree[10]	May-Dec.[1 1].	The antidiabetic and hypolipidemic activities of bioactive fraction (ethyl acetate fraction) of *D.indica* methanolic extract in experimental diabetic Wistar rats. Type-1 diabetes was induced by single intraperitoneal injection of streptozotocin (60 mg/kg body weight), and type-2 diabetes was induced by single intraperitoneal injection of streptozotocin (60 mg/kg body weight), 15 min after the intraperitoneal injection of 120 mg/kg nicotinamide. The rats were treated by administering graded oral doses of isolated ethyl acetate fraction of methanolic extract of *D. indica* (DIEE), 200 and 400 mg/kg body weight, respectively, for 21 d. The blood glucose level was estimated at weekly intervals by glucometer. Serum cholesterol, triglycerides and high-density lipoprotein

							cholesterol (HDL-C) were also evaluated in normal and diabetic rats by an autoanalyzer. In both experimental models, daily oral treatment with DIEE for 21 d resulted in a significant reduction in blood glucose ($P<0.01$), serum cholesterol ($P<0.05$) and triglycerides ($P<0.05$) levels whereas HDL-C level was found to be increased ($P<0.05$) as compared with the diabetic control group [77]. The leaves of *D. indica* were extracted with methanol and subjected to fractionation and chromatographic separation, which led to the isolation of seven compounds which are betulinic acid (1), n-heptacosan-7-one (2), n-nonatriacontan-18-one (3), quercetin (4), β sitosterol (5), stigmasterol (6), and stigmasteryl palmitate (7). Among these isolates, compounds 1, 4, 5, and 6 were evaluated for in vitro enzyme inhibition and compounds 4, 5 and 6 were evaluated for antidiabetic activity in streptozotocin-nicotinamide induced diabetic mice. Results. Compounds 1, 4, 5, and 6 showed 47.4, 55.2, 48.8, and 44.3% α-amylase inhibition, respectively, and 52.2, 78.2, 52.5, and 34.2% α-glucosidase inhibition, respectively, at the dose of 50 µg/kg . Compounds 4, 5 and 6 also showed significant antidiabetic activity in streptozotocin-nicotinamide induced diabetic mice at the dose of 10 mg/kg [78].
56	*Dioscorea bulbifera* L. [18].	Genthi[18]	Dioscoreaceae	Tuber [80]	Herb[7]	Aug.-Sept.[18].	An antidiabetic effect of ethanolic tuber extract of *D. bulbifera* on alloxan-induced mdiabetic rats was studied. The median lethal dose (ld50) of the extract was determined to be 3800.0 mg/kg and a single dose of 380.0, 760.0 and 1140.0 body weight of the extract were intraperitoneally administered as the treatment dose and the blood glucose levels (bgl) examined for 7 hours and 15 hours (prolonged) at 2 and 4 hours intervals respectively. The extract exhibited significant ($p<0.05$and $p<0.01$) reduction in the blood glucose levels of the albino rats [79]. The antihyperglycemic and antidyslipidemic activity of the aqueous extract of *D. bulbifera* tubers, DBEA003, was performed. DBEA003 showed a dose dependent antihyperglycemic effect in glucose primed rats at 500 and 1000 mg/kg p.o. doses at both points of measurement at 30 and 90 min post glucose administration. In the STZ treated Wistar rats, the 6- week treatment with DBEA003 prevented blood glucose increase. The two higher doses of DBEA003 significantly ($P<0.001$) lowered the level of blood glucose [80].
57	*Dioscorea dumetorum* (Kunth) Pax[13].	-	Dioscoreaceae	Tubers[81]	Herb[13]	-	Dioscoretine isolated from the aqueous fraction of the methanol extract of *D. dumetorum* tubers when administered intra-peritoneally to normal and alloxan diabetic rabbit produces significant hypoglycaemic effects at a dose of 20 mg/kg. The fasting blood sugar in normoglycaemic rabbits was reduced from 112 mg/100 ml to 55 mg/100 ml after 4 hours. In alloxan diabetic rabbits, the blood sugar was lowered from 520 mg/100 ml to 286 mg/100 ml at the same time interval. The aqueous fraction of the methanol extract produced comparable effects at 100 mg/kg. The chloroform fraction of the same extract raised the fasting blood sugar of normal rabbits to 196 mg/100 ml after 6 h. The acute toxicity studies gave LD50 values of 1.4 g/kg for the aqueous fraction and 0.58 g/kg for

							dioscoretine when tested on mice. The hypoglycaemic effects were compared to those of tolbutamide [81]. At a dose of 20 mg/kg methanol extract, the fasting blood sugar in normoglycemic rabbits reduces from 112 mg/100 mL to 55 mg/100 mL after four hours. In diabetic rabbits, the blood sugar lowers from 520 mg/100 mL to 286 mg/100 mL at the same time interval. The aqueous fraction of the methanol extract produces comparable effects at 100 mg/kg. Whereas, chloroform fraction rises the fasting blood sugar of normal rabbits to 196 mg/100 mL after six hours [82].
58	*Elephantopus scaber* L. [13].	Elephant's foot[13]	Asteraceae	Root & leaf[84]	Herb[7]	Sept.-Nov. [7].	Acetone extract of *Elephantopus scaber*, an ethnomedicnal plant, reduced the blood glucose levels in streptozotocin-induced diabetic rats significantly. Fractionation of the acetone extract yielded a new steroid, 28Nor-22(R) Witha 2,6,23-trienolide. Biological testing of the compound demonstrated a significant antidiabetic activity by reducing the elevated blood glucose levels and restoring the insulin levels in streptozotocin-induced diabetic rats. This compound can be a useful candidate to treat diabetes [83]. The antidiabetic activity of the aqueous extract of *E. scaber* (Linn) root and leaf was evaluated in normal and alloxan-induced hyperglycemic rats. Oral administration of *E. scaber* root and leaf extracts (0.3 g kg⁻¹ body weight) for 12 weeks resulted in significant reduction in the glucose levels. The effect of these extracts on triglycerides, HDL, cholesterol, serum urea and creatinine were also assessed to evaluate their activity in controlling diabetes related metabolic alterations. The biochemical estimations were complemented with the immunocytochemical staining to localize pancreatic islets cells secreting insulin. Though treatment with humulin (0.6 g kg⁻¹ body weight) is more effective in normalizing blood glucose levels, regeneration of islet β-cells was mediated only by the extract treatment [84].
59	*Eucalyptus globulus* Labill.[13].	-	Myrtaceae	Leaves[13]	Tree[13]	-	Aqueous extract of eucalyptus represents an effective anti hyperglycaemic activity [28].
60	*Eugenia uniflora* L. [13].	-	Myrtaceae	Leaves[13, 85]	Bushy Shrub[13]	-	Oral feeding of ethanol extract of the leaves of *E. uniflora* to mice has been shown to contain plasma glucose levels during OGTT and plasma triglyceride level in oral corn oil tolerance test. Few fractions isolated on the basis of polarity and molecular size from the ethanolic extract of the leaves of *E. uniflora* has shown positive effects in OGTT conducted in mice [60]. In addition, the incidence of diabetes, degree of insulitis, serum insulin, hepatic glutathione and tolerance test glucose in non-obese diabetic (NOD) mice. The aqueous extract presents high total phenols, which were used as a type 1 diabetes mellitus (DM-1) treatment in NOD mice. We verified that the chronic consumption of aqueous extract reduces the inflammatory infiltrate index in pancreatic islets, maintaining serum insulin levels and hepatic glutathione, and reducing serum lipid peroxidation as well as the risk for diabetes [85].
61	*Ficus auriculata* Lour [1].	Timma, Timul, Timla[1]	Moraceae	Whole plant[87]	Trees [7]	Apr.-Dec.[7].	Diabetes was induced in swiss albino mice by administration of streptozotocin (70 mg/kg, i.p.). Normal as well as diabetic albino mice were divided into groups (n = 6) receiving

							different treatments: vehicle (control), methanol extract (300 and 600 mg/kg b.w), and standard antidiabetic drug glibenclamide (10 mg/kg b.w.). Blood samples were collected from tail for blood glucose analysis on (0th, 5th, 10th and 15th day) and animals were sacrificed on 15th day and blood sample were collected by cardiac puncture and analyzed for lipid profile. Histological studies were done on pancreas and liver respectively. The methanol extract of Ficus auriculata Lour. produced significant reduction ($P < 0.001$) in blood glucose and also had beneficial effects ($P < 0.05$) on the lipid profile in streptozotocin induced diabetic mice at the end of the treatment period (15th day)[86]. The total extracts of *F. auriculata* induced 8.2% reduction of blood glucose level of diabetic rats as compared to the values before treatment. Diamicron as standard induced 39.8% reduction of blood glucose level of diabetic rats. This effect may be mainly due to the presence of flavonoids and phenolic compounds. Concerning the hepatoprotective and antidiabetic activity the results showed slightly effect of the ethanolic extract [87].
62	*Ficus benghalensis* L. [13, 18].	Bar[18]	Moraceae	Barks [13]	Tree[7]	Jun.-Mar.[7].	Bengalenoside, glycoside of pelargonidin, leucopelargonin, leucocyanidin derivative have been isolated from this plant bark showing antidiabetes properties of leucopelargonin derivatives have been shown in rats and dogs [27].
63	*Ficus carica* L. [25].	Anjir[25]	Moraceae	Fruits [25] & Stem barks[25, 88]	Tree[25]	-	The antidiabetic effect of the methanolic extract of *Ficus carica* (MEFC) in alloxan induced diabetic rats. The LD50 determination was done in mice as per OECD guidelines 423. The rats were divided into five groups. Diabetes was induced using alloxan and the treatment was continued for 21 days using Metformin (500 mg/kg p.o) as a standard drug. Blood glucose level, bodyweight, biochemical parameters and histopathological observation were done. The methanolic extract (200 mg/kg p.o) had shown significant ($p < 0.01$) antidiabetic activity than (100 mg/kg p.o) by showing a reduction in blood glucose levels and triglycerides compared to pretreatment levels [89]. The methanolic extract of *Ficus carica* L. (Moraceae) stem bark on fasting blood sugar levels and serum biochemical analysis in streptozotocin-induced diabetic rats were investigated. The resulted extract had shown significant protection and lowered the blood glucose levels to normal in glucose tolerance test. In long term treatment of streptozotocin-induced diabetic rats, the degree of protection was determined by measuring blood glucose, triglycerides,total cholesterol and serum insulin levels [88].
64	*Ficus hispida* L.f. [13].	Daduri[13]	Moraceae	Barks [13]	Tree[7, 13]	Most part of the year.[7]	Albino rats were divided into groups (n=6) receiving different treatments consisting of vehicle, water-soluble portion of the ethanol extract of *F. hispida* bark (FH) (1.25 g/ kg) and standard antidiabetic drugs, glibenclamide (0.5 mg/kg) and 0.24 units of insulin (0.62 ml of 0.40 units/ml). Blood glucose was estimated by the glucose oxidase method in both normal and alloxan-induced diabetic rats before and 2 h after the administration of drugs. To find out the probable mechanism of action of FH as a hypoglycemic agent, i) the glycogen content of the liver, skeletal muscle and cardiac muscle, and ii) glucose uptake by isolated rat hemi-

							diaphragm were estimated. FH showed significant reduction of blood glucose level both in the normal (P<0.01) and diabetic (P<0.001) rats. However, the reduction in the blood glucose level was less than that of the standard drug, glibenclamide. FH also increased the uptake of glucose by rat hemi-diaphragm significantly (P<0.001). There was a significant increase in the glycogen content of the liver (P<0.05), skeletal muscle (P<0.01) and cardiac muscle (P<0.001)[90]. Albino rats were divided into groups receiving different treatments consisting of vehicle, water-soluble portion of the ethanol extract of Ficus hispida bark (FH) (1.25 g/kg) and standard antidiabetic drugs, glibenclamide (0.5 mg/kg) and 0.24 units of insulin (0.62 ml of 0.40 units/ml). Blood glucose was estimated in both normal and alloxan-induced diabetic rats before and 2 h after the administration of drugs. To find out the probable mechanism of action of FH as a hypoglycemic agent, i) the glycogen content of the liver, skeletal muscle and cardiac muscle, and ii) glucose uptake by isolated rat hemi-diaphragm were estimated. FH showed significant reduction of blood glucose level both in the normal and diabetic rats [91] .
65	*Ficus lacor* Buch.-Ham.[1].	-	Moraceae	-	Tree[165]	-	No pharmacological activity is found
66	*Ficus microcarpa* L.f. [1].	-	Moraceae	Leaves[92]	Tree[7]	Apr.-May[7].	The ethanolic extract of *F.microcarpa* L. leaves (EEFML) was evaluated for its hypoglycemic activity against alloxan-induced diabetic rats. EEFML was administered at 100 and 200 mg/kg body weight orally for 14 days. The blood glucose was estimated on 0, 7 and 15 days treatment. Glibenclamide serve as positive control. Administration of 200 mg/kg of EEFML significantly reduced the amount of blood glucose when compared to diabetic control. These results reveal the beneficial role of Ficus microcarpa leaves as potential hypoglycemic agent against alloxan-induced diabetes mellitus in rats [91]. The anti-diabetic activity on alloxan was administered as a single dose (120mg/kg, b.wt) to induce diabetes. Administration of pet ether extracts from leaves of *F.microcarpa* L. (200 &400mg/kg body weight/day) for 14 days, to alloxan-induced diabetic rats. The fasting blood sugar levels and serum biochemical analysis in alloxan-induced diabetic rats were investigated. Oral administration of PFM (200 & 400 mg/kg) for 14 days exhibited a significant reduction in serum glucose, total cholesterol, LDL, VLDL and triglycerides in alloxan diabetic rats. The anti-diabetic activities of the pet ether extract of *Ficus microcarpa* L. (PFM) were similar to those produced by glibenclamide at 2.5mg/kg (positive control, $p < 0.05$)[92].
67	*Ficus religiosa* L. [15, 25].	Peepal[25]	Moraceae	Leaves, fruits, seeds[25] & barks[25, 27]	Tree[7, 25]	Apr.-Sept.[7]	The bark extract of this plant shows antidiabetic property [27].
68	*Garcinia kola* Heckel. [13].		Clusiaceae	Seeds [93]	Tree[94]	-	Diabetes was induced in albino rat models with alloxan monohydrate. *G.kola* seeds, has been to possess antidiabetic propertie. The

							hypoglycemic activityof ethanol extract, the fraction and compounds of *G. kola* seeds. The results showed thatthe extract, fraction, compounds and the reference drug (glibenclamide) showed different levels of antidiabetic effect [93]. Diabetes was induced in rats by single intraperitonial injection of alloxan (150mg/kg body weight). Three days after alloxan induction, the hyperglycemic rats were treated with 200mg/kg of metformin, a standard antidiabetic drug and saponin from the root of *G. kola* orally at the dose of 100, 200 and 400 mg/kg body weight daily for 7 days[94].
69	*Garuga pinnata* Roxb. [1].	Titmar[1].	Burseraceae	Bark[96]	Tree[7]	Apr.-Nov.[1]	*G. pinnata* having significant increases in the liver glycogen and serum insulin level and a significant decrease in fasting blood glucose and glycated hemoglobin levels [95]. The antihyperglycemic activity of aqueous extract of bark of *G. pinnata* Roxb. (Burseraceae). The various parameters studied included fasting blood sugar levels, serum lipid levels, liver glycogen content, serum insulin level and glycated hemoglobin in diabetic and normal rats. Streptozotocin-nicotinamide was used to induce type-II diabetes mellitus. Treatment with the extract at two dose levels showed a significant increase in the liver glycogen and serum insulin level and a significant decrease in fasting blood glucose and glycated hemoglobin levels. The total cholesterol and serum triglycerides levels were also significantly reduced and the HDL cholesterol levels were significantly increased upon treatment with the extract thus proving the potent antidiabetic property of the plant [96].
70	*Glycine max* (L.) Merr. L. [24].	Kala Bhatt[24]	Fabaceae	Seeds [24, 98]	Herb[24]	-	Antidiabetic potential of soybean extracts chloroform and alcohol has been evaluated in alloxan-induced diabetic rabbits. Twelve healthy, male rabbits were divided into four different groups including, Normal control, Diabetic control, treated with soybean chloroform extract and soybean alcohol extract, with 3 rabbits in each group. The extracts were given orally for 24 days, 50ml extract per rabbit per day. At every 3 day blood sample was collected, serum separated and glycemic level, total cholesterol rd level, urea level, uric acid level were determined by kit method. The body weight was recorded on every 6 day's interval. The data obtained revealed that soybean chloroform and alcohol extracts reduced the glucose th level, 42.53% and 49.78% respectively [97]. The present extract of *G. max* seed as hypoglycemic agent in streptozotocin induced diabetic wistar mice models. Extract of *G. max* at (200 and 500 mg/kg) exhibited a dose dependent significant anti-hyperglycemic activity on 21st day of post treatment. The serum urea and serum creatinine decreased significantly with increase in the dose. Treatment with extract for 3 weeks showed a significant reduction in levels of Total Cholesterol, Triglycerides, Low density lipoprotein and very low density Lipoprotein. Restoration of normal cells of islets and enlarged size of endocrine islets with hyperplasia was evidenced by administering 200mg/kg and 500 mg/kg of Glycine max seed extract. The study concluded that seed extracts of *G. max* possess significant antidiabetic activity as well as antihyperlipidemic activity

							[98].
71	*Gymnema sylvestre* (Retz.) R.Br. ex Sm. [13,16,18] .	Gurmar[18]	Asclepia-daceae	Leaves[13]	Woody climber[166]	-	*G. sylvestre* has shown hypoglycemic and anti hyperglycemic activity in animal experiments. The stimulatory effects of *G. sylvestre* on insulin release have been reported. Studies suggest that the beta cells may be regenerated / repaired in Type 2 diabetic patients on *G. sylvestre* supplementation. Its does not improve insulin. Gymnemic acid, a mixture of triterpene glycosides extracted from the leaves of *G. sylvestre*. Inhibits The intestinal absorption of glucose in human and rats [27].
72	*Haldina cordifolia* (Roxb.) Ridsdale (Syn. *Adina cordifolia* (Roxb)). [1].	-	Rubiaceae	Root, Leaf & Bark[1]	Tree[7]	Jun.-Apr.[7] .	The antidiabetic activity of hydro-alcoholic extract of *Adina cordifolia* (Roxb.) leaves (HAEACL) in alloxan induced diabetic rats at 250 and 500 mg/kg doses. The blood glucose levels of experimental animals were determined at 0, 2, 4 and 6 h after treatment with the plant extract by using glu-oxidase peroxidise reactive strips and glucometer. Treatment with HAEACL at 500 mg/kg dose decreased the blood glucose level significantly. However, the lower doses (250 mg/kg) of HAEACL produced a little decrease in blood glucose level. It showed that there was a dose dependent decrease in blood glucose level in the alloxan induced diabetic rats as compared to the control group.The present study shows that HAEACL possessed significant antidiabetic activity [99].
73	*Helicteres isora* L. [13].	Marorphali, Bendu[1].	Sterculiaceae	Root & Fruit[13]	Shrubs or small tree[7]	Apr.-Oct.[7].	*H. isore* root extracts improved glucose tolerance in glucose-induced hyperglycaemic rats. Study suggests that the extract of *H.isora* has insulin sensitizing and hypolipidemic activity and has the potential for use in the treatment of type 2 diabetes [27].
74	*Hemidesmus indicus* (L.) R. Br. ex Schult. [16].	Anant-mool, Sariba[1], Dudhibel[7]	Asclepia daceae	Root[100]	Undershrubs [1]	Aug.-Sept.[7].	*H. indicus* root extract (HiRe) on the blood glucose level in alloxan (150mg/kg b.w, ip) induced diabetic rates was evaluated. Blood was collected from the tail vein in rats at zero time and after drug administration in 1st, 2nd and 4th hour and 24 hour to examine the effect. HiRe at 250 and 1000mg / kg was used for the study. Glibenclamide (3mg / kg, p.o) was used as the standard drug. The study clearly showed that single dose of HiRe had significantly protected the glucose level in alloxan induced diabetic rates at 1st, 2 nd and 4th hour and even after 24hr, with respect to that of control animals. The effect was partly ascribed to the free radical scavenging activity of HiRe. Thus, we conclude that *H.indicus* possesses profound beneficial effects in preventing diabetic related abnormalities by lowering the sugar level as normal [100]. 2-Hydroxy 4-methoxy benzoic acid (HMBA) isolated from the roots of *H. indicus* was evaluated for its anti-diabetic activity on streptozoticin (STZ)-induced diabetic rats. HMBA, the active principle of *H. indicus*, was administered (500μg/kg body weight) orally to STZ-induced diabetic and non diabetic rats. The effect of HMBA on plasma glucose, insulin, glycosylated hemoglobin, liver glycogen and serum total cholesterol, HDL-cholesterol, LDL-cholesterol and triglycerides, alkaline phosphatase (ALP), aspartate transaminase (AST), alanine transaminase (ALT), γ-glutamyl transferase (γ-GT) and creatine kinase (CK). After administration of HMBA, the levels of glycosylated

							hemoglobin, total cholesterol, triglycerides, LDL-cholesterol were normalized in diabetic rats. It also reversed the elevated levels of AST, ALT, ALP, γ- GT and CK to near normal level. The levels of plasma insulin, glycosylated hemoglobin and liver glycogen were also restored after HMBA treatment. Thus the results of our study suggested that HMBA could help in controlling DM owing to their hypoglycemic and hypocholesterolemic effects[101].
75	*Hibiscus rosa-sinensis* L. [13].	Gurhal. [1].Chinese Rose, Common Garden Hibiscus, Chinese Shoe-flower [14].	Malvaceae	Leaves[28]	Shrub [16]	Apr.-Sept.[14].	Leaf extract 250 mg/kg/bw showed significant (37%) glucose lowering effect in glucose induced hyperglycemic rats [28].
76	*Hordeum vulgare* L. [24].	Jau[24]	Poaceae	Fruits [29]	Herb[24]	-	The germinant fruits of *H. vulgare* perform hypoglycemic and hyperinsulinemic effects in non-insulin dependent diabetic mellitus [29].
77	*Hypoxis hemerocallidea* Fisch, C.A.Mey. & Avé-Lall. [13].	-	Hypoxidaceae	Whole plant[102]	Herb[102]	-	The hypoglycemic effect of aqueous extract of *H. hemerocallidea* corm in normal (normoglycemic) and in streptozotocin (STZ)-treated, diabetic rats. Young adult, male Wistar rats weighing 250-300 g were used. Diabetes mellitus was induced in the group of diabetic test rats by intraperitoneal injections of STZ (90 mg/kg). In one set of experiments, graded doses of the aqueous extract of African Potato (100-800 mg/kg p.o.) were administered to 12-h fasted normal and diabetic rats. In another set of experiments, 800 mg/kg of African potato extract, a dose of the plant extract that produced maximal hypoglycemic effects in fasted normal and diabetic rats in our pilot experiments, was used. The hypoglycemic effect of this single dose was compared with those of insulin (5 micro U/kg s.c.) and glibenclamide (5 mg/kg p.o.) in 12-h fasted normal and diabetic rats. Following acute treatment, relatively moderate to high doses of African potato extract (100-800 mg/kg p.o.) produced dose-dependent, significant reductions ($p < 0.05$-0.001) in the blood glucose concentrations of fasted normal and diabetic rats. Similarly, insulin (5 micro U/kg s. c.) and glibenclamide (5 mg/kg p.o.) produced significant reductions ($p < 0.01$-0.001) in the blood glucose concentrations of the fasted normal and diabetic rats. At a dose of 800 mg/kg, the plant extract caused 30.20% and 48.54% reductions in the blood glucose concentrations of fasted normal and STZ-treated diabetic rats, respectively [102].
78	*Indigofera latifolia* Micheli. [45].	-	Fabaceae	-	Herb[168]	-	No pharmacological activity is found
79	*Indoneesiella echioides* (L.) Sreem. [1].	Kakjhanga[1]	Acanthaceae	Leaf & whole plant[1]	Herbs [7]	Aug.-Feb.[7].	No pharmacological activity is found
80	*Inula racemosa* Hook.f. [16].	-	Asteraceae	Roots [27]	Herbs [10]	Jul.-Nov.[11].	*I. racemosa* (root extract) exhibits antiperoxidative, hypoglycaemic and cortisol lowering activities; it is suggested that hypoglycaemic effect of this plant is mediated through inhibition in coticoteriod concentration. The extract acts mainly by

							potentiation of insulin sensitivity in an animal model [27].
81	*Ipomoea batatas* (L.) Lam. [13].	-	Convolvulaceae	Tuberous roots[13] & Leaf[104]	Herb[13]	-	Twenty two male *Rattus norvegicus* rats were divided into 6 groups (4 treatment groups and 2 control groups). Streptozotocin was injected intraperitoneally at a single dose of 60 mg/kg BW for induction of diabetes in treatment groups and diabetic control group. White-skinned sweet potato's flour suspension (100, 200, 400 and 800 mg/kg BW/day) were administered orally to treatment groups for 4 weeks. Blood samples were collected from retro-orbital puncture before treatment, 2 weeks and 4 weeks after treatment and were analyzed for blood glucose by GOD-PAP method. At day 29 after treatment rats were killed by decapitation and pancreas were removed for immunohistochemical staining using anti-insulin antibody. White-skinned sweet potato had a significant blood glucose lowering effect and increased the number of pancreatic beta cells and insulin expression in a dose dependant manner in diabetic condition [103]. The hypoglycemic effects of graded quantities (200mglkg, 300 mg/kg and 400mglkglday) of lpomeabatatas leaf extracts at a dose of once daily for fourteen days on the blood glucose level of 20 rats whose glucose level exceeded 200mg/dl after alloxan induction were studied. Qualitative and quantitative analysis of phytochemical ingredients of *I.batatas* leaf were also carried out. Data obtained were subjected to Analysis of variance (ANO VA) with probability set at $p<0.05$. The results showedthat oral treatment with 2ml of 200 mg/kg/day of Ipomoea batatas aqueous extract did not produce significant ($p>O. 05$) alterations in the blood glucose concentration level when compared with basal value. Also, there was no significant difference ($p>0.05$) in the sugar level of rats treated with 300mglkg/day and 400mg/kg/day of the extracts but the hypoglycaemic effect significantly differ ($p<0.05$) from non-diabetic and rats treated with oral administration of 200mg/kgldayof lpomeabatata extracts. Thehighest percentage blood sugar reductions of 69. 67% was recorded in rats treated with 300 mg/kg/day, followed by 59.24% (400niglkg/day extract) while the least percentage sugar reduction of 52.18% was observed in 200mgl kg day extract. The non-diabetic induced rats exhibited steady increase (8. 03%) in their normal glucose level. It was revealed that alloxan induced rats treated with 200mglkg/day, 300niglkg/day and 400mg/kglday sustained percentage weight loss of 48.91, 28.66 and 31.11 percent respectively compared with non-diabetic induced rats. [104].
82	*Kydia calycina* Roxb. [1].	Phuilau, Pulao, Pula, Tumari[1]	Malvaceae	Root, Leaf & Bark[1]	Tree[7]	Aug.-Jan.[7].	No pharmacological activity is found
83	*Lantana camara* L. [13].	Kuri-ghas, Kurri[1].	Verbenaceae	Leaves juice	Shrub[13, 7]	Round the year [7].	Once administration of *L. camara* leaves juice for 14 days showed significant hypoglycemic effect [27].
84	*Lepidium sativum* L . [13].	Chandrasur, Chamsuru	Brassicaceae	Seeds [105]	Herb[13]	-	The hypoglycaemic effect of an aqueous extract of *L. sativum* L. (LS) seeds was investigated in normal and streptozotocin

							(STZ)-induced diabetic rats. After a acute (single dose) or chronic (15 daily repeated administration) oral treatments, the aqueous LS extract (20 mg/kg) produced a significant decrease on blood glucose levels in STZ diabetic rats ($p < 0.001$); the blood glucose levels were normalised 2 weeks after daily repeated oral administration of aqueous LS extract (20 mg/kg) ($p < 0.001$). Significant reduction on blood glucose levels were noticed in normal rats after both acute ($p < 0.01$) and chronic treatment ($p < 0.001$) [105]. Antidiabetic profile of LSTA (50, 150 and 250 mg kg-1, ip.) was assessed on alloxan induced diabetic rats upon 21 days continuous treatment. Biochemical parameters viz., glucose, total cholesterol, triglycerides, low density lipoprotein, high density lipoprotein, urea and creatinine were determined along with b. wt. and relative organ weight. LTSA at 250 mg kg- 1 showed 1.94% b.wt. gain on 21th day relative to 6.14 and 8 .94% of control and diabetic group. LSTA at 250 mg kg-1 dose significantly ($p<0.001$) suppressed blood glucose, cholesterol, triglyceride and urea level in diabetic rats. The r esults revealed that LSTA at dose 250 mg kg- 1 showed potent hypoglycemic activity. The *L. sativum* have potential antidiabetic effect against alloxan-incluced [106].
85	*Liriope spicata* Lour. (Syn. *Liriope spicata* var. *prolifera*)[13].	-	Liliaceae	Tuberous roots[107, 108]	Herb[108]	-	The antidiabetic effect and the potential mechanisms of two new polysaccharides (LSP1, LSP2) and the total polysaccharides (TLSP), isolated from the tuberous roots. Upon the intragastric administration in obese insulin-resistant diabetic KKAy mice for 28 days, TLSP, LSP1, and LSP2 all caused a remarkable decrease of fasting blood glucose and significant improvement of insulin resistance and serum lipid metabolism in diabetic mice. In addition, liver histological analysis showed that TLSP, LSP1, and LSP2 significantly ameliorated the hepatocyte hypertrophy and decreased the lipid accumulation in the mice liver. Further experiments suggested that TLSP, LSP1, and LSP2 effectively inhibited hepatic gluconeogenesis and increased hepatic glycolysis and hepatic glycogen content. Furthermore, the mechanistic analysis showed the increased expression of insulin-receptor α subunit, insulin-receptor substrate-1, phosphatidylinositol 3-kinase, and peroxisome proliferators-activated receptors γ. These results suggested that TLSP, LSP1, and LSP2 manifest strong antidiabetic activity [107]. The aqueous extract of *L. spicata* tuberous roots was prepared by using 500 gm of powdered material and it was boiled in distilled water for three times (1:4, 1:4, 1:2, w/v), 0.5 ltered,□hr each time. After that the extract was combined, and then concentrated by using rotary evaporator at 45ºC under reduced pressure. In previous reports, STZ-induced type 2 diabetic studies were made by using prescribed methods in C57BL/6J and ICR mice.68, 69 The aqueous extract was administered at dose of 100mg/kg and 200gm/kg to both the groups i.e., control and diabetic rats, after 28 days of treatment it shows significant decrease in the blood glucose level in streptozotocin induced diabetic rats [108].

86	*Madhuca longifolia* (J.Koenig ex L.) J.F.Macbr. [1].	Mahawa[1].	Sapotaceae	Leaf, Bark & Flower[1]	Tree[28]	May-Jun.[28].	The antihyperglycemic effects of methanolic extract of *M. longifolia* bark in normal, glucose loaded and streptozotocin induced diabetic rats. All three animal groups were administered the methanolic extract of M. longifolia at a dose of 100 and 200mg kg-1 body weight and the standard drug glibenclamide at a dose of 500 µg kg-1. Serum glucose level was determined on days 0, 7, 14 and 21 of treatment. The extract exhibited a dose dependent hypoglycemic activity in all three animal models as compared with the standard antidiabetic agent glibenclamide. The hypoglycemia produced by the extract may be due to the increased glucose uptake at the tissue level and/or an increase in pancreatic β-cell function, or due to inhibition of intestinal glucose absorption [109, 110].
87	*Mangifera indica* L. [13,5].	Aam[7]	Anacardiaceae	Leaves[27]	Tree[7]	Mar.-Jul.[7].	The aqueous extract of the plant leaf produces a reduction of blood glucose level in normoglycaemic and glucose-induced hyperglycaemia mice. Experiments demonstrate that mangifer in isolated from the plant leaves possesses significant antidiabetic properties in streptozotocin -induced diabetic rats [27].
88	*Melia azedarach* L. [15].	Bakain[7]	Meliaceae	Leaves[111] & Flower[112]	Tree[7]	Mar.-Dec.[7].	The ethanolic extract of leaves of *M. azedarach* in alloxan induced diabetic rat shows marked decrease in the blood glucose level in the two different doses of 300 mg/kg and 600 mg/kg for 21 days and the effect was compared with diabetic control. The effect of extract also shows significant reduction in blood glucose level in glucose tolerance test [111]. The anti-hyperglycemic effect of ethanolic flower extract of Melia Azedarach L (200mg/kg) against Streptozocin (STZ, 60mg/kg, i.p) induced diabetes in rats. Glibenclamide (0.25mg/kg) was used as reference control. The test drugs were administered for 15 days once daily. The mean blood sugar levels were determined at different time intervals. The result showed that, there was a significant reduction in the blood sugar after the administration of ethanolic flower extract of *M. azedarach* L. in STZ induced diabetic animals. From the result it was concluded that, ethanolic flower extract of *M. azedarach* L. possess antidiabetic activity against STZ induced diabetic in rats [112].
89	*Momordica charantia* L. [13, 15,19,17,24].	vegetable insulin[13], Jangali kareli[7] & Karela[24]	Cucurbitaceae	Fruit[27], Leaf, seed & root [19]	Climber herb [7]	May-Sept.[7].	The fruit has exhibited antidiabetic activity in streptozotocin diabetic rats. The plant seed aqueous extract also has antidiabetic activity .The fruit squeous extract lowers blood glucose and prevents cataractogenesis in alloxan diabetic rats. Hypoglycemic action of the fruit and fruit pulp has been shown in a few animal diabetic models and the water extract of the fruit is most effective compared to other extracys and as per one report the fruit pulp is active in type 1 diabetic model and not in type 2 modeI. A hypoglycemic polypeptide has been isolated from the fruit and it is descried as plant insulin. Dietary inclusion of 0.5% freeze dried bitter gourd does not significantly influence glucose levels in diabetic rats. The level of bitter gourd the diet may be insufficient to exert an effect[27]. In clinical studies also *M. charentia* treatment improves glucose tolerance and in type 2 diabetic patients the fruit extract reduces serum glucose levels .More than one active principle and mechanism of actions are

							involved in the antidiabetic property of *M. charentin*a. Like sulfonyl urea drugs, the aqueous extract of the fruit stimulate 2-cells to release or secrete more insulin and viable 2-cells may be required for its action. It is known to protect and stimulate 2-cells cells in streptozotocin challenged rats .The insulin like peptide did not affect steroidogenesis, but ginsenoside inhibited the same. The plant insulin may act in the absence of 2-cells. Detailed studies are needed with the purified protein. In diabetic animals the fruit normalized the activities of enzymes involved in glucose metabolism. It is also reported that the fruit inhibits glucose absorption from the intestine. This activity is attributed to some other active principles [27].
90	*Morinda lucida* Benth. [13].	-	Rubiaceae	Stem bark[113] & Leaves[114]	Tree[113]	-	The hypoglycemic effect of aqueous and methanolic extracts of *M. lucida* stem bark in alloxan-induced hyperglycemia in rats. The study comprises three groups of diabetic rats administered 0.240 mg (aqueous extract) and 240 mg (methanolic extract) kg-1 body weight and a fourth group given 10 mL kg-1 body weight distilled water for 7 days. Body weight, fasting blood glucose as well as activities of some selected serum and liver enzymes were monitored before commencement of treatment and at the end of the treatment period. At the end of the 7 day treatment, fasting blood glucose of the animals were significantly ($p<0.05$) reduced by 73.5 and 39.0% of their initial values in diabetic group administered aqueous and methanolic extract, respectively. As it were before treatment, body weight was further reduced in the diabetic animal groups compared to normal rat group. Serum Alkaline Phosphatase (ALP) and liver aspartate Aminotransferase (AST) activities were not significantly ($p>0.05$) altered from their initial values after the 7 day treatment period. Serum AST and liver ALP were significantly ($p<0.05$) lowered in diabetic rats treated with aqueous and methanolic extracts compared to their initial values. Serum and liver Alanine aminotransferase (ALT) activity was significantly (serum)/non-significantly (liver) increased across the groups except for a significant decrease observed in liver ALT activity in diabetic rats administered the methanolic extract[113]. 50 - 400 mg/kg of body weight/day of 50% ethanol extract of the fresh leaves of *M. lucida* Benth. (MLE) was investigated for its hypoglycemic and antidiabetic effects in adult normal and alloxan induced diabetic male rats for 7 days. Acute oral toxicity study of MLE at the limit dose of 2000 mg/kg of body weight using Up-and-Down Procedure on statistical program, AOT425Pgm, was also conducted. Results showed that MLE significantly ($p<0.05$) lowered the fasting blood glucose (FBG) in both normal and alloxan-induced diabetic rats in dose related fashion, and its effect was higher ($p<0.001$) than that of tolbutamide (Tolb.). Results suggest that MLE could be mediating its hypoglycemic effect via enhanced peripheral glucose utilization. Also, acute oral toxicity result showed MLE to be nonlethal at 2000 mg/kg of body weight. These results suggest that MLE could be relatively safe on acute exposure when administered to suspected diabetic patients [114].

91	*Mucuna pruriens* (L.) DC. [1].	Kanchan, Kauni[1]	Fabaceae	Seed[27], Root & Stem[1]	Climber shrub[10]	-	*M. pruiriens* seeds (powder) reduce the blood glucose levels in normal and alloxan diabetic rabbits (Akhtar et al., 1990). Water extract of *M. pruriens* provides only some level of protection against experimental diabetic cataract formation in rats. The alcohol extract shows a decrease of blood glucose levels in alloxan diabetic rats, while it has no influence on the same streptozotocin diabetic rats [27].
92	*Murraya koenigii* (L.) Spreng. [13,9].	Curry patta[13]	Rutaceae	Leaf[27]	Shrubs or small tree[7]	Feb.-Apr.[9].	The leaf shows significant hypoglycemic action in rats. However, as per a report, feeding curry leaf up to 15% in the diet causes only mild reduction in blood glucose in mild alloxan diabetic rats without significant effect on glucose levels in moderately streptozotocin diabetic rats. Curry leaf supplementation to type 2 diabetic patients causes a transient decrease in blood glucose levels without significant influence on lipid parameters. A recent study shows that administration of curry leaf (water or alcohol extract) significantly reduces blood glucose levels in alloxan diabetic rats with an increase in insulin levels. A single oral administration of variable dose levels 200, 300 and 400 mg/kg of aqueous extract led to lowering of blood glucose level in normal as well as in diabetic rabbits. The maximum fall of 14.68% in normal and 27.96% in mild diabetic was observed after 4 h of oral administration of 300 mg/kg. The same dose also showed a marked improvement in glucose tolerance [27].
93	*Nanorrhinum ramosissimum* (Wall.) Betsche (Syn. *Kickxia ramosissima* (Wall.) Janchen). [1].	-	Scrophulariaceae	Whole plant[1]	Herb[157]	-	No pharmacological activity is found
94	*Nardostachys jatamansi* (D.Don) DC. [22].	Balchara, Jatamansi[22]	Caprifoliaceae	Root[116]	Herb[115]	Jul.-Nov.[11].	The antidiabetic study was carried out to estimate the anti hyperglycemic potential of Nardostachys Jatamansi rhizome's hydro alcoholic extracts in alloxan induced diabetic rats over a period of two weeks. The hydroalcoholic extract HAE1 at a dose (500mg/kg) exhibited significant antihyperglycemic activity than extract HAE2 at a dose (500mg/kg) in diabetic rats. The hydroalcoholic extracts showed improvement in different parameters associated with diabetes, like body weight, lipid profile and biochemical parameters. Extracts also showed improvement in regeneration of β-cells of pancreas in diabetic rats. Histopathological studies strengthen the healing of pancreas by hydro alcoholic extracts (HAE1& HAE2) of *N. jatamansi*, as a probable mechanism of their ant diabetic activity[115]. The hydroalcoholic extract of the roots of *N. jatamansi* DC, significantly decreased glucose level in normal, glucose loaded and alloxan diabetic (on day 15 and 30) rats as compared to respective control rats[116].
95	*Ocimum tenuiflorum* L. (*Ocimum sanctum* L.). [13].	Tulsi[13]	Lamiaceae	Leaves[27]	Herb[62]	Blooms all yea [62]	Ethanolic extract of *O.sanctum* leaves partially attenuates streptozotocin-induced alterations in blood glucose, liver glycogen content and carbohydrate metabolism in rats. Also found to be one of the most effective inhibitor of lens aldose reductase which has a role in sugar induced cataract. Alcohol extract of leaves of

							this plant lowers blood glucose levels in normal and alloxan-induced diabetic rats. The leaf powder supplementation results in significant reduction m the levels of blood sugar, serum lipids and tissue lipids in diabetic rats in a clinical trial, the plant leaf administration to type 2 diabetic patients results in significant improvement in blood glucose and cholesterol levels [27].
96	*Olea ferruginea* Wall. ex Aitch. [18].	Jaitun[18]	Oleaceae	Leaves[18]	Tree[11]	Apr.-Nov.[11].	The fresh fruit are collected in summer season, dried and recommended to diabetics in winter for reducing blood glucose level [27].
97	*Panax ginseng* C.A.Mey. [13].	-	Araliaceae	Roots [13]	Herb[28]	-	In obese diabetic C57BL/6J ob/ ob mice and their lean littermates. Animals received daily intraperitoneal injections of *P.ginseng* berry extract for 12 days. On day 12, 150 mg/kg extract–treated ob/ob mice became normoglycemic (137 ± 6.7 mg/dl) and had significantly improved glucose tolerance. The overall glucose excursion during the 2-h intraperitoneal glucose tolerance test decreased by 46% ($P < 0.01$) compared with vehicle-treated ob/ob mice. The improvement in blood glucose levels in the extract-treated ob/ ob mice was associated with a significant reduction in serum insulin levels in fed and fasting mice. A hyperinsulinemic-euglycemic clamp study revealed a more than twofold increase in the rate of insulin-stimulated glucose disposal in treated ob/ ob mice (112 ± 19.1 vs. 52 ± 11.8 µmol · kg-1 · min-1 for the vehicle group, $P < 0.01$). In addition, the extract-treated ob/ob mice lost a significant amount of weight (from 51.7 ± 1.9 g on day 0 to 45.7 ± 1.2 on day 12, $P < 0.01$ vs. vehicle-treated ob/ob mice), associated with a significant reduction in food intake ($P < 0.05$) and a very significant increase in energy expenditure ($P < 0.01$) and body temperature ($P < 0.01$)[117]. Sixty male albino rats were divided into four groups (fifteen for each group) normal control, normal treated, diabetic and treated diabetic groups. Blood glucose, serum insulin, serum lipids (cholesterol, triglycerides, HDL, LDL and VLDL-cholesterol) were estimated. Also, serum interleukin - 6 (IL- 6) and tumor necrosis factor alpha (TNF - α) were determined. Liver oxidant malondialdehyde (MDA), liver antioxidants {glutathione peroxidase (GPX) and superoxide dismutase (SOD)} were determined. The mean values of blood glucose, cholesterol, triglycerides, LDL and VLDL- cholesterol showed significant decrease in treated diabetic group as compared to their values in the diabetic group. Also, serum IL - 6 and TNF - α level were improved after treatment with ginseng [118].
98	*Phyllanthus emblica* L.(Syn. *Emblica officinalis* Geartn.). [9, 18, 3, 15].	Amla, Aonla [9,18].Awala, Anwala. Aola. Aonla [1].	Euphorbiaceae	Fruits [9,18] Leaf, Flower, Bark[1]	Tree[7]	Sep.-Nov.[9].	Oral administration of the fruit extract (100 mg/kg body weight) reduces the blood sugar levels in normal and in alloxan (120 mg/kg) diabetic rat. Hydrolysable tannoids from *E. Officinalis* inhibits rat lens Aldose reductase which is involved in the development of some of the complications of diabetes [27].
99	*Picrorhiza kurroa Royle* ex Benth. [13].	Kut, Kutki, Katuki. Karwi[1]	Scrophulariaceae	Whole plant[27]	Herb[11]	Rainy season to autumn [11].	The anti-diabetic activity of the plant extract has been shown in rats [27].
10	*Piper nigrum* L. [18].	Kalimirch [18].	Piperaceae	Leaf [18]	Climber[28]	Jun.-Apr.[28].	The effect of ethanol leaves extract of *P. nigrum* on some biochemical parameters in alloxan induced diabetic rats, was carried out.

							The graded doses of ethanol leaves extract of this plant was fed to alloxan-induced diabetic rats for a period of 21days and its effect on some biochemical parameters on the blood serum of the rats were assayed. Thirty (30) male albino rats were divided into six groups: normal rats (group I), diabetic untreated rats (group II), diabetic rats treated with glibenclamide (group III), diabetic rats treated with 100 mg/kg body weight of ethanol leaves extract (group IV), diabetic rats treated with 200 mg/kg body weight of ethanol leaves extract (group V) and diabetic rats treated with 300 mg/kg body weight of ethanol leaves extract (group VI). The result reviewed significant (p0.05) decrease in sorbitol concentration in group IV when compared to group II while the glycosylated hemoglobin also had a non significant (p>0.05) decrease in all the treated groups when compared to group II. The result of this study indicates that ethanol leaves extract of *P. nigrum* has hypoglycemic tendencies in diabetic conditions [119].
10	*Pisum sativum* L. [19].	Matar[19]	Fabaceae	Seed[120]	Herb[19]	-	Seed contain saponins, decrease blood glucose level level [120].
10	*Polygonatum cirrhifolium* (Wall). Royle. [8].	Salam-misri[1].	Liliaceae	Tea of this plant[8]	Herb[61]	Jun.-Oct.[61]	No pharmacological activity is found
10	*Primula denticulata* Sm. [1].	Jalkutra[1]	Primulaceae	Flower[121] & Leaf[122]	Herb[157]	Apr.-Jun.[1].	The anti-diabetic effect of ethanolic extract of flowers of *Primula denticulata* streptozotocin induced diabetes respectively. Dose selection was made on the basis of acute oral toxicity study (100mg/kg, 200mg/kg, 400mg/kg bodyweight) as per OECD guidelines 423. The blood glucose levels were measured by using blood glucose measuring strips based on glucose-oxidase method. The extract showed significant anti-diabetic activity when compared with standard drug [121]. A new TTS was isolated from the leaf of *P. denticulate* by column chromatography on CHCl3/MeOH (8.5:1.5) fraction. Ethanol and aqueous extracts of the leaf were also prepared. Antidiabetic study for TTS, ethanol extract, and aqueous extract was carried out in streptozotocin (STZ)-induced diabetic rats at doses of 200, 1000, and 1000 mg/kg body weight, respectively. This new TTS was found to be effective in lowering blood-glucose level in the experimental rat model, thus establishing its antidiabetic property (168.8 ± 4.58) when compared with disease control (258.8 ± 0.60). Its LD50 value was found at a dose of 2000 mg/kg. The level of insulin was restored by TTS and ethanol extract up to 31.49 µU/ml and 38.90 µU/ml, respectively, when compared with disease control (18.45 µU/ml). In conclusion, 3-O[β-d-xylopyranosyl-(1 → 2)-β-d-glucopyranosyl-(1 → 4)-α-l-arabinopyranosyloxy]-16α-hydroxy-3β,28-epoxy-olean-30-al possesses potential glucose lowering properties, i.e., antidiabetic potential against STZ-induced diabetic rats[122].
10	*Psidium guajava* L. [18].	Amrood[18]	Myrtaceae	Leaves, Bark27] & Fruits [18]	Shrub or small trees[7]	Apr.-Jan.[7].	The leaves and bark of the plant are used in diabetes [27].

10	*Pterocarpus marsupium* Roxb. [1,4].	Bijesar [4], Bijesar, Bijasar [1].	Fabaceae	Gum leaf, flower[1, 4], Wood & Bark[1]	Tree[4]	-	An aqueous infusion of the wood exhibited anti-diabetic qualities[27].
10	*Punica granatum* L. [13].	Dag-darimb, Darim, Anaar [1].	Lythraceae	Flower, Fruit & Seed[27]	A shrub or small tree[13]	May-Sept.[7].	The plant flower, fruit and seed possess anti-diabetic and anti-hyperglycemic properties. The flower extract is a potent alpha-glucosidase inhibitor which improves postpradial hyperglycemia in Zucker diabetic fatty rats. Concentrated pomegranate juice improves lipid profiles in diabetic patients with hyperhpidemia. The seed has glucose lowering effects in streptozotocin induced diabetic rats. The flower extract lowers blood glucose level in normal and alloxan induced diabetic rats [27].
10	*Raphanus raphanistrum* subsp. *sativus* (L.) Domin (Syn. *Raphanus sativus* L.). [2,9].	Muli[2]	Brassicaceae	Leaves [123] & Rhizome[2]	Herb[123]	Apr.-May[9]	The different solvent extracts of *R. sativus* L. leaves were tested for anti-diabetic activity using alloxan induced diabetic rats and compared with standard. The results expressed that aqueous extracts had shown significant protection and maximum reduction in blood glucose was observed in alloxan induced diabetic rats ($p < 0.001$). The results of this comprehensive study reveal that *R. sativus* L leaves showed statistically significant anti-diabetic activity in comparison to the standard glibenclamide **[123].** The rats were fed a diet containing 0%, 2.5% or 5% of JRS *ad libitum* for 21 days. Compared with the corresponding control groups, the JRS-fed normal rats showed lower plasma levels of total cholesterol (TC), triglycerides (TG), phospholipids (PL), fructosamine, glucose and insulin and higher plasma levels of low-density lipoprotein-cholesterol, whereas the JRS-fed diabetic rats showed lower plasma levels of fructosamine, glucose and insulin without changes in the plasma lipid parameters. JRS also decreased the hepatic TC, TG and PL levels in the normal rats and the TG level in the diabetic rats. These results showed that JRS had a hypoglycemic activity in both the normal and diabetic rats and partly improved lipid metabolism in the normal rats [124].
10	*Rhododendron arboreum* Sm. [15].	Burans[15]	Ericaceae	Bark, Leaves[15] & Flower[15, 126]	Tree[15]	-	Aqueous methanolic extract of the flower of Laligurans was found to show inhibitory activity on the rat intestinal α-glucosidase. Both the water-soluble and ethyl acetate-soluble portions from the aqueous methanolic extract showed inhibitory activities on α -glucosidase, demonstrating higher activity by the ethyl acetate-soluble portion. From the ethyl acetate-soluble portion, α -glucosidase inhibitor quercetin-3-O-?-D-galactopyranoside (hyperin) was isolated through enzyme-assay guided separation. The isolated compound showed a dose dependent α glucosidase inhibitory activity with IC50 values of 1.66 mM and 0.76 mM for sucrase and maltase, respectively [125]. Anti- hyperglycemic fraction from the ethanol extract of *R. arboreum* flowers.Normal and streptozotocin induced diabetic rats were treated with all four fractions of *R. arboreum* flowers for short term and with fraction 3 for long term study. On completion of the treatment, a range of indicators were tested

							including fasting blood glucose, plasma protein, haemoglobin A1C, insulin secretion, body weight, blood lipid profile and carbohydrate metabolism regulating enzymes of liver.In short term study, the fraction 3 (Active fraction) produced a significant (P<0.000 1) reduction (73.6%) in blood glucose level at a dose of 200 mg/kg after the treatment in the diabetic rats. Administration of active fraction (200 and 400 mg/kg) once daily for 30 d in streptozotocin diabetic rats resulted in a significant (P<0.001 to P<0.000 1) fall in blood glucose level, hemoglobin A1C, serum urea and creatinine with significant but a increase in insulin level similar to standard drug glybenclamide [126].
10	*Ricinus communis* L. [1].	Arandi, Dalta, Areridi[1]	Euphorbiaceae	Leaf[1, 27], Seed & Oil[1]	Shrubs [7]	Major part of the year [7].	Anti-diabetic property of *R. communis* leaf has been reported [27].
11	*Scoparia dulcis* L. [1].	Bichhu-ghas[1]	Scrophulariaceae	Leaf[1]	Herbs [7]	Most part of the year [7].	It is helpful for increasing the insulin secretion [29].
11	*Senna auriculata* (L.) Roxb. (Syn. *Cassia auriculata* L.). [13].	-	Fabaceae	Flowers[27]	Shrub or small tree[162]	Throughout the year[162]	*Cassia auriculata* flower (water extract), suppressed the elevated blood glucose and lipid levels in streptozotocin-induced diabetic rats. It is exhibited hypoglycemic effects in normal rats also [27].
11	*Senna occidentalis* (L.) Link (Syn. *Cassia occidentalis* Linn.,). [1].	Kasondi, Bamaseer, Banar[1]	Fabaceae	Seeds [27]	Herbs[7]	Jul.-Dec.[7].	The seed is bitter and is the extract is used in diabetes and the roots are used in diabetes [27].
11	*Sideroxylon obtusifolium* (Roem. & Schult.) T.D.Penn. (*Bumelia sartorum* Mart.). [13].	-	Sapotaceae	Root barks[128]	Tree[169]	Jan.-Feb.[169]	*B. sartorum* hypoglycemic activity was performed from the blood glucose level in normoglycemic mice after administration of the extract by oral gavage. The hypothesis that sarco/endoplasmic reticulum Ca(2+)-ATPase (SERCA) inhibition could prolong the increase in cytoplasmic Ca2+ concentration, thus leading to an increase of insulin release was evaluated. The enzyme inhibition was measured by ATP hydrolysis using SERCA1 isolated from rabbit skeletal muscle. The total content of phenolic compounds was determined by the Folin-Ciocalteau method. The ethyl acetate (EtOAc) partition and F5 fraction obtained from *B. sartorum*, both of them rich in polyphenolics, were shown to have a hypoglycemic effect on normoglycemic mice, more significant than that of the known anti-diabetic drug, glibenclamide used as a standard comparable compound. Both samples significantly inhibited SERCA activity [127]. Bassic acid, is an unsaturated triterpene acid isolated from an ethanol extract of *B. sartorum* rootbark, elicited significant hypoglycemic activity in alloxan-diabetic rats and altered the pattern of glucose tolerance in these animals. In addition, bassic acid treatment increased significantly the glucose uptake process and glycogen synthesis in isolated rat diaphragm. Bassic acid treatment increased plasma insulin levels significantly in alloxan-diabetic rats. It is exhibited hypoglycemia activity of bassic acid may be mediated through enhanced secretion of insulin from the pancreatic beta-cells [128].

11	*Solena amplexicaulis* (Lam.) *Gandhi (Melothria heterophylla* (Lour.) Cogn.). [1].	Gwal-kakri, Ban-kakhri[1]	Cucurbitaceae	Whole plant, Root, Leaf, Fruit & Seed[1]	Extensive vine[170]	May-Jan.[170]	Hyperglycemia was induced in rats by STZ (50 mg/kg, body weight). Twenty-four hours after STZ induction, respective groups of diabetic rats received EEMH (200 and 400 mg/kg, body weight), gallic acid (GA) (2 and 4 mg/kg, body weight), and rutin (RU) (2 and 4 mg/kg, body weight), respectively, orally daily for 15 days. Glibenclamide (0.5 mg/kg, orally) served as reference. Blood glucose levels and change in body weight were measured on every 5(th) day during 15 days of treatment. Biochemical parameters, viz., serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), alkaline phosphatase (ALP) and serum insulin, were measured. EEMH and its active constituents significantly ($p < 0.01$) normalized blood glucose levels and serum biochemical parameters as compared to those of STZ controls. Both GA (4 mg/kg) and RU (4 mg/kg) exhibited maximum glucose lowering effect (69.1 and 66.7%, respectively) in diabetic rats compared to the other dose (2 mg/kg) at the end of the study. EEMH, gallic acid and RU also showed significant increase in serum insulin, and body weight of STZ-induced diabetic rats [129].
11	*Spondias pinnata* (L. f.) Kurz[1].	Amara, Amra, Abara[1]	Anacardiaceae	Bark[130, 131]	Tree[7]	Apr.-Jun.[7].	Bark extracts of *S. pinnata* was evaluated for hypoglycemic activity on adult Wistar albino rats at dose levels of 300 mg/kg p.o. each using normoglycaemic, glucose loaded and alloxan induced hyperglycaemic rats. Glibenclamide (2.5 mg/kg) was used as reference standard for activity comparison. Among the tested extracts, the methanol extract was found to produce promising results that is comparable to that of the reference standard glibenclamide. The preliminary phytochemical examination of the methanol extract revealed presence of flavonoids, tannins, saponins and terpenoids[130]. The aqueous bark extract of *S. pinnata* showed remarkable efficacy in diabetic rats the effect of repeated administration of SPAq on glycaemic control in normal and alloxan induced diabetic rats. Wistar rats were divided into five groups (n=6). Group 1 and 2 served as untreated normoglycaemic and alloxan induced diabetic rats (150 mg/kg i.p.) respectively. Group 3 and 4 were diabetic rats treated with the SPAq (1.00 g/kg) and glibenclamide (0.5mg/kg) for 30 days respectively. Group 5 was normoglycaemic rats treated with the same dose of SPAq. Oral glucose tolerance test was performed and body weights of animals were recorded at weekly intervals. Glycosylated haemoglobin percentage (%HbA1C) was estimated on the 30th day. The SPAq and glibenclamide improved glucose tolerance by 41 o/o and 53°/o ($p<0.05$) respectively in diabetic rats. The SPAq and glibenclamide reduced HbA1c to 6.85±0.02% and 6.31±0.04% respectively ($p<0.05$). The decrease in HbA1c in SPAq treated normoglycaemic rats was found to be statistically non -significant ($p<0.05$). In contrast the administration of SPAq to diabetic rats restored the bodyweights of animals compared to untreated diabetic rats. The aqueous extract of Spondias pinnata improved the glycaemic control in alloxan induced diabetic rats [131].

11	*Syzygium cumini* (L.) Skeels(Syn. *Eugenia jambolana* Lam.). [1,8,5,9,15].	Skeels, Jamun[1,8, 5,9,15]., Black Plum, Jamun[3,2]	Myrtaceae	Bark, fruit ,Leaf, 15,18] & Seed[3, 21]	Tree[7] [5,9,	Mar.-Jul.[7].	*S. cumini* seeds fiber with water exhibited hypoglycaemic effects in alloxan diabetic rats. The seed extracts reduce tissue damage in diabetic rat brain. The seeds appear to be beneficial to type 2 diabetic patients [27].
11	*Syzygium nervosum* A.Cunn. ex DC. (Syn. *Cleistocalyx operculatus* (Roxb.) Merr. & L.M.Perry) [1].	Rai-jamun[1]	Myrtaceae	Bark, Leaf & Fruits [1]	Tree[132]	-	The anti-hyperglycemic effects of an aqueous extract from flower buds of *C. operculatus* (CO), a commonly used material for drink preparation in Vietnam, were therefore investigated in vitro and in vivo. In vitro, the CO extract inhibited the rat-intestinal maltase and sucrase activities, with IC50 values of 0.70 and 0.47 mg/ml, respectively. These values are lower than those for a guava leaf extract (GE; IC50 0.97 and 1.28 mg/ml, respectively). Postprandial blood glucose testing of normal mice and STZ-induced diabetic rats by maltose loading (2 g/kg body weight (bw)) showed that the blood glucose reduction with CO (500 mg/kg bw) was slightly less than that with acarbose (25 mg/kg bw) but was more potent than that with GE (500 mg/kg bw). In an 8-week experiment, the blood glucose level of STZ diabetic rats treated with 500 mg of CO/kg bw/day was markedly decreased in comparison with that of nontreated diabetic rats. Consequently, CO is considered to be a promising material for preventing and treating diabetes [132].
11	*Tagetes erecta* L. [18].	Genda[18]	Asteraceae	Leaves[18]	Herb[13 3]	-	The anti-diabetic effect of the two ethnomedicinally important plants, *T. erecta* and *Foeniculum vulgare* in streptozotocin induced diabetic rats. *T. erecta* and *F. vulgare* were collected from local areas, shade dried and made into powder by mechanical grinding. The powder was subjected to extraction by hot percolation method using methanol as solvent. The extract was subjected first to preliminary phytochemical screening, acute toxicity studies and pharmacological screening of anti-diabetic activity in streptozotocin induced diabetic rats. The blood samples were collected at regular intervals and assessed for the blood glucose levels. The rats from all the groups were also studied for the body weight and the lipid profiles. Plant extracts shown a significant effect on the blood glucose levels in both the individual groups and also the combined group at the two dose levels. The effect of the plant extracts was also significant at the lipid profile and the body weights of the animals from the tested groups [133]. *T. erecta*, hydro alcoholic extract of *T. erecta* was studied for its anti- diabetic activity. Diabetes was induced by single intraperitoneal injection of streptozotocin (60 mg/kg b.w). Treatment with standard drug Glibenclamide, blood glucose raised at 30 min followed by subsequent fall up to 120 min. From present study It was observed that administration of *T erecta* extracts increased the glucose levels were seen after 30 min and hypoglycaemia effect was observed only after 120 min [134].
11	*Tephrosia villosa* (L.) Pers. [45].	-	Fabaceae	Root[135]	Herb[13 6]	Jun.-Oct.[28	*T. villosa* Pers anti-hyperglycemic when given as root extract in normal as well as

				& Leaves[28, 136].		].	diabetic rats. The effect, however, was more pronounced in diabetic animals in which administration for 12 days after alloxan induced diabetes, significantly reduced blood glucose levels. After alloxan induced diabetes it was observed that both standard drug (glibenclamide) and aqueous extract of *T. villosa* were significantly superior to control in reducing blood sugar on long treatment [135]. Antidiabetic activity of ethanolic extract of leaves of *T. villosa* Pers. was studied on alloxan induced diabetic rats as two different doses were studied. It showed significant reduction in the blood glucose level. Concurrent histopathological examination of pancreas of these animals showed comparable regeneration by ethanolic extracts (lower and higher dose) which were earlier, necroses by alloxan [136].
12	*Terminalia arjuna* (Roxb ex DC.) Wight & Arn. [1].	Khorasari, Arjuna, Kowa[1]	Combretaceae	Leaf, Bark[1]	Tree[7]	Mar.-Jun.[7].	The antidiabetic effect of *T.arjuna* stembark extract and to study the activities of hexokinase, aldolase and phosphoglucoisomerase, and gluconeogenic enzymes such as glucose-6-phosphatase and fructose -1,6-diphosphatase in liver and kidney of normal and alloxan induced diabetic rats. Oral administration of ethanolic extract of bark (250 and 500mg/kg body weight) for 30 days, resulted in significant decrease of blood glucose from 302.67 ± 22.35 to 82.50 ± 04.72 and in a decrease in the activities of glucose-6-phosphatase, fructose-1,6-disphosphatase, aldolase and an increase in the activity of phosphoglucoisomerase and hexokinase in tissues. The study clearly shows that the bark extract of T.arjuna possesses potent antidiabetic activity [137]. *T. arjuna* (TA) extract on hyperglycemia activity in the liver and pancreas of type 2 diabetes mellitus (T2DM) in rats. T2DM was induced by feeding rats with high-fat diet (HFD; 40%) for two weeks followed by single dose of streptozotocin (STZ; 40 mg/kg, intraperitoneally). Control and diabetic rats were treated with TA (500 mg/kg) for four weeks. After TA treatment, blood was drawn and rats were then sacrificed, and their liver and pancreas were dissected out for biochemical assays. The level of fasting blood glucose (FBG), glycated hemoglobin (HbA1C), total cholesterol (TC), triglycerides (TG), low density lipoprotein-cholesterol (LDL-C) and very low density lipoprotein-cholesterol (VLDL-C) significantly ($P < 0.05$) increased while high density lipoprotein cholesterol (HDL-C) and hepatic glycogen decreased in the HFD/STZ group. TA treatment augmented these effects in the HFD/STZ + TA group. The HFD/STZ group showed elevated renal injury markers in serum, including blood urea nitrogen (BUN), serum creatinine (Scr) and alkaline phosphatase (ALP), which were decreased significantly ($P < 0.05$) by TA treatment. Moreover, treatment with TA significantly ($P < 0.05$) ameliorated thiobarbituric reactive substances (TBARS), malonaldehyde (MDA) and protein carbonyl (PC), and glutathione (GSH), glutathione-s-transferase (GST) and catalase (CAT) in liver and pancreas of HFD/STZ group [138].
12	*Terminalia bellirica* (Gaertn.) Roxb.	Arurh, Bahera, Barar,	Combretaceae	Bark, Fruit &	Tree[7]	Apr.-Oct.[7].	Methanolic extract of fruits of *T. belerica* suspended in water was studied in alloxan induced hyperglycemia in rats. *T. belerica*

	[1].	Behera[1]		Seed[1]			prevented alloxan-induced hyperglycaemia significantly from 6th day of administration and there was 54% reduction on 12th day. Oxidative stress produced by alloxan was found to be significantly lowered by the administration of *T. belerica* extract. This was evident from a significant decrease in thiobarbituric acid reactive substances, conjugated dienes and hydroperoxides in blood and liver respectively. Similarly, decreased glutathione level produced by alloxan was increased by the administration of the extract in blood and liver. However the increase was not significant. Superoxide dismutase which was decreased by alloxan was significantly increased from 9th day in blood and liver of drug treated group. Similarly there was significant increase in the activity of catalase in blood and liver. Decrease in glutathione peroxidase by alloxan administration was found to be increased significantly in the blood and liver from 9th day by extract treatment. Glutathione reductase also was found to be increased in blood and liver. These results suggested that *T. belerica* fruit extract possessed anti-diabetic [139]. *in -vitro* anti-diabetic activity of the fruits and leaves of *T. bellirica*. *in -vitro* alpha amylase and alpha glucosidase activity of different extracts of *T. bellirica*. was also determined. From the results, it is clear that the acetone extract of both the fruits and leaves of *T. bellirica* shows strong inhibitory activity against alpha amylase and the aqueous extract of fruits and leaves of *T. bellirica* were found to exhibit highest alpha glucosidase activity. The results obtained in the present study indicated that the *T. bellirica* could be used for treating diabetes mellitus [140].
12	*Terminalia chebula* Retz. [1, 13,5].	Hrar, Harar, Harera, Har, Had, Haira, Harad[1]	Combretaceae	Seeds [13]	Tree [7]	Apr.-Feb.[7].	Aquous and chloroform extracts of plant contain in with secondary metabolite includes Shikimic, Gallic, Triacontanoic, Palmitic acid, β-sitosterol, and Daucosterol all are reduces glucose level [29,30,31].
12	*Tinospora sinensis* (Lour.) Merr. (*Tinospora cordifolia* (Willd.) Miers) [13, 17].	Guduchi [13,17] , Gurg, Gurja, Giloi, Gureich, Gurch[1].	Menispermaceae	Roots & Stem[13, 17]	Herbaceous vine [13, 17]	Feb.-Apr.[7].	Alcohol extract of roots exhibits hypoglycaemic and hypolipidaemic actions in allaxon-induced diabetes in rats. Blood glucose levels are reduced without significant effect on total lipid by the leaf extracts in normal and alloxan-diabetic [27].
12	*Toona ciliata* M.Roem [1].	Tun, Toon[1].	Meliaceae	Leaf, Bark & Fruits [1]	Lofty tree[1]	Apr.-Jul.[7].	Anti-hyperglycemic activity of leaves of *T. ciliata* in hydroalcoholic extract in streptozotocin-induced diabetic rats its showed effect of oral administration of leaves extract (0.2, 0.4g/kg body wt.) for 15 days on the level of blood glucose, serum cholesterol, triglycerides, urea, creatinine, aspartate amino transferase (AST) and alanine amino transferase (ALT) in normal and streptozotocininduced diabetic rats were evaluated. A significant decrease in blood glucose, serum cholesterol and triglycerides levels while total protein and HDL-C level was found to be increased as compared with the diabetic control group. The extract of the plant leaves at both the doses (0.2, 0.4g/kg body wt.) showed prominent effect and the finding suggest that *T. ciliata* has significant anti-hyperglycemic activity in streptozotocin induced diabetes in rats [141].

12	*Trichosanthes tricuspidata* Lour. (Syn. *Trichosanthes bracteata* (Lam.) Voigt.) [1].	Lndrain, Ilaru, Kurari-lagul, Indrayani[11]	Cucurbitaceae	Seeds, Fruits & Roots [1]	Climbing herb[7]	Sept.-Nov.[7].	The anti-diabetic activity of ethanolic extract of *T. tricuspidata* root in alloxan induced diabetic rats and to perform the phyto- anti-diabetic activity in alloxan induced diabetic rats by oral administration of extract (200 and 400 mg/kg b.w.), the blood glucose level and biochemical parameters like cholesterol, triglyceride, serum protein, SGPT, SGOT, and ALP were estimated. Phytochemical studies shows the presence of carbohy-drates, proteins, glycosides and terpenoids and the ethanolic extract of *T. tricuspidata* root significantly lowered the blood sugar level [142]. The anti-diabetic of *T. tricuspidata* leaf extracts. On the basis of toxicity studies a dose of 200 mg/kg body weight was selected for antidiabetic activity. Diabetes was induced by the administration of streptozotocin at a dose of 50 mg/kg, intra peritoneal. Among all the extracts, ethanolic extract of *T. tricuspidata* (197.5±1.31. The results of the study concluded that *Tricosanthes* leaf and root extracts have potential anti-diabetic properties [143].
12	*Trigonella balansae* Boiss. & Reut. (Syn. *Trigonella corniculata* (L.) L.) [1].	Ban-methi[1]	Fabaceae	Whole plant[144]	Herb [157]	Mar.-Jun.[171]	Antihyperglycemic, hypoglycemic activities of methanolic extract of *Albizia lebbeck* and *T.corniculata* were studied. Hypoglycemic action of plants was investigated using normoglycemic rabbits (acute study only), whereas antihyperglycemic activity was studied using alloxan induced diabetic rabbits (acute and chronic study). Results revealed both plant extracts and their mixture having significant anti diabetic potential at dose of 200mg/kg comparable to standard drug Glibenclamide (0.5 mg/kg [144].
12	*Trigonella foenum-graecum* L. [1,3,13,18].	Methi [13, 18].	Fabaceae	Leaves[13]	Herb[13]	Jun.-Sept.[158]	No pharmacological activity found
12	*Triticum aestivum* L. [18].	Gheun[18]	Poaceae	Husk[18]	Herb(grass)[152]	Jun .-Sept.[158]	The antidiabetic potential of *T. aestivum* were evaluated by using *in- vivo* methods in normal and streptozotocin-induced diabetic rats. Diabetes was induced in the Wistar strain albino rats by injecting streptozotocin at a dose of 55 mg/kg body weight. Ethanolic extracts of *T. aestivum* at doses of 100 mg/kg body weight were administered orally for 30 days. Various parameters were studied and the treatment group with the extract showed a significant increase in the liver glycogen and a significant decrease in fasting blood glucose, glycosylated hemoglobin levels, and serum marker enzyme levels. The total cholesterol and serum triglycerides levels, low density lipoprotein, and very low density lipoprotein were also significantly reduced and the high density lipoprotein level was significantly increased upon treatment with the *T. aestivum* ethanol extract. *T. aestivum* exhibited significant anti-hyperglycemic, hypolipidemic, activities in streptozotocin-induced diabetic rats [145]. A mixture of *L. speciosa* (Linn.) Pers. fruits squash (FSLS), with the insulin (INS) and fresh etiolated wheat grass juice (FEGJ) exhibited hypoglycemic and biochemical activities of or this study, rats were divided into five groups (n=6), Group I (NC): Rats

							kept as normal control. Group II (DC): Injected with alloxan monohydrate (180 mg/kg b.w.) and kept as diabetic control. Group III (DC +INS): These diabetic rats were subcutaneously injected with 1 unit of bovin protamine zinc insulin (INS) half an hour prior to feeding twice a day. Group IV (DC+FEGJ): Instead of INS, this group of rat were orally administrated with fresh etiolated wheat grass juice (FEGJ) at the dose of 30 ml/kg b.w. half an hour prior to feeding twice a day. Group V (DC+FSLS): This group of diabetic rat orally administrated with fruit squash of *L. speciosa* (FSLS) at the dose of 30 ml/kg b.w. half an hour prior to feeding twice a day.Rats of INS, FEGJ (30ml/kg) and FSLS (30mg/kg) treated groups show significant (P<0.001) decrease in blood glucose as well as liver glycogen compared to DC. AST and ALT enzyme significantly (P<0.001) lowered in DC+FEGJ while it is not significantly change in DC+ INS andDC+FSLS compared to DC. Hypoglycemic activity of FSLS is better than FEGJ and it is quite equivalent to the insulin [146].
12	*Urtica ardens* Link. [6].	Bichchhu ghas[6]	Urticaceae	Leave s[148]	Tree[6]	-	*U. dioica* exhibited anti-hypertensive, anti-hyperlipidemic and anti-diabetic activity in hydroalcoholic extract of *U. dioica* on fructose-induced insulin resistance rats. Forty male Wistar rats were randomly divided into five groups including control, fructose, extracted 50, extract 100 and extract 200. The control rat received vehicle, the fructose and extract groups received fructose 10% for eight weeks. The extract groups received single daily injection of vehicle, 50, 100 or 200 mg/kg/day for the two weeks. Blood glucose, insulin, last fasting insulin resistance index (FIRI), serum triglyceride (TG), low-density lipoprotein (LDL), very low-density lipoprotein (VLDL), high-density lipoprotein (HDL), alanin trasaminase (AST) and alkaline phosphatase (ALP), leptin and LDL/HDL ratio were determined. Compared to control group, daily administration of fructose was associated with significant increase in FIRI, blood glucose and insulin, significant decrease in lepin, and no significant change in TG, HDL, LDL, LDL/HDL ratio, VLDL, ALT, and ALP. The extract significantly decreased serum glucose, insulin, LDL and leptin, and LDL/HDL ratio and FIRI. It also significantly increased serum TG, VLDL, and AST, but did not change serum ALP. We suggest that *U. dioica* extract, by decreasing serum glucose, and FIRI, may be useful to improve type 2 diabetes mellitus. Also, by positive effect on lipid profile and by decreasing effect on leptin, it may improve metabolic syndrome [147]. The anti-diabetic activity of *U. dioica* L. in type 2 diabetic model rats. The mature and fresh leaves of *U. dioica* was collected from the mountain range of Assam in India and the leaves extract was used at a dose of 1.25 g-kg body weight. Type2 diabetes was induced by a single intraperitoneal injection of STZ to 48 hours old pups of Long Evans. Experiments for semi-chronic effects were done with continuous feeding of aqueous extract for 14 days at a dose of 1.25 g-kg body weight type 2 diabetic male rats. Serum glucose was estimated by GOD-POD method, serum triglyceride and cholesterol by enzymatic-colorimetric methods. Water

							extract showed significant effect on lowering fasting serum glucose levels in type 2 diabetic model rats on 14th day (14.05 ± 3.4 mmol/l in control vs 8.3 ± 1.4 mmol/l in treated group, p = 0.04). There was significant increase in the body weight of treated group in comparison to the control group (175 ± 8 g in control vs in 168 ± 9 g in treated group on 0 day, p = ns; 193 ± 26 g in control vs in 185 ± 25 g in treated group on 14th day, p=0.002 [148].
13	*Vitis vinifera* L. [24].	Angoor[24]	Vitaceae	Stem bark[150]	Climber[24]	-	The Ethanolic extract of *V. vinifera* L. leaves exhibited acute and subacute anti-diabetic activitie. The acute effect was studied on the normoglycaemic, glucose hyperglycaemic and streptozotocin-induced diabetic rats; and the subacute effect was studied on same diabetic rats for 15 days. The blood glucose levels were measured by using blood glucose measuring strips based on glucose-oxidase method. After the subacute administration, the antioxidant activity of the extracts was investigated on the liver, kidney and the heart tissues of the experimental animals by measuring the tissue GSH and MDA levels. All of the antioxidant parameters were compared with the diabetic control group. According to the obtained data, the ethanolic extract of *V. vinifera* leaves at 250 mg/kg dose was found to possess a high antidiabetic and antioxidant activity [149]. The anti-diabetic activities of the chloroform and ethanolic extract of *V. vinifera* L. stem bark were investigated and also estimated the plasma levels of different lipids and anti-oxidant enzyme activity in the serum of control and experimental groups of rats. Blood glucose levels, estimated in 16 h fasting diabetic rats (FBG) was reduced significantly upon treatment with the stem bark extracts. The levels of Total serum cholesterol (TC), Low density lipoprotein cholesterol (LDLc), Very Low density lipoprotein cholesterol (VLDLc) and Triglycerides (TG) were significantly ($p < 0.05$) increased, whereas the High density lipoprotein cholesterol (HDL-c) was markedly ($p < 0.05$) decreased in rats induced with alloxan when compared with control rats. In diabetes induced group of rats, there was a decreased superoxide dismutase (SOD), catalase and peroxidase and increased lipid peroxidation. Pretreatment with plant extracts improved the SOD, catalase and peroxidase levels significantly and reduced lipid peroxidation comparable to standard drug treated group of animals. Chloroform and ethanol extracts could effectively normalize the enzyme activities; the values were high for ethanolic extract treated group. The extracts were effective in a dose dependent manner with highest activity at 200 mg/kg body weight concentration [150].
13	*Withania somnifera* (L.) Duna. [24].	Ashwagandha [24]	Solanaceae	Leaf & root[26]	Herb[24]	Feb.-Apr.[12].	Flavonoids were isolated in the extracts of *W. somnifera* root (WSREt) and leaf (WSLEt). The amounts of total flavonoids found in WSREt and WSLEt were 530 and 520 mg/100 g dry weight (DW), respectively. Hypoglycaemic and hypolipidaemic effects of WSREt and WSLEt were also investigated in alloxan-induced diabetic rats. WSREt and WSLEt and the standard drug glibenclamide were orally administered daily to diabetic rats for eight weeks. After the treatment period, urine sugar, blood glucose, haemoglobin (Hb), glycosylated haemoglobin (HbA1C), liver

							glycogen, serum and tissues lipids, serum and tissues proteins, liver glucose-6-phosphatase (G6P) and serum enzymes like aspartate transaminase (AST), alanine transaminase (ALT), acid phosphatase (ACP) and alkaline phosphatase (ALP) levels were determined. The levels of urine sugar, blood glucose, HbA1C, G6P, AST, ALT, ACP, ALP, serum lipids except high density lipoprotein-bound cholesterol (HDL-c) and tissues like liver, kidney and heart lipids were significantly ($p < 0.05$) increased, however Hb, total protein, albumin, albumin: globulin (A:G) ratio, tissues protein and glycogen were significantly ($p < 0.05$) decreased in alloxan-induced diabetic rats. [151]. *W. somnifera* leaf and root extracts increased glucose uptake in myotubes and adipocytes in a dose dependent manner, with the leaf extract more active than the root extract. Six withanolides isolated from *W. somnifera* were tested for anti-diabetic activity based on glucose uptake in skeletal myotubes. Withaferin A was found to increase glucose uptake, with 10μM producing a 54% increase compared with control, suggesting that withaferin A is at least partially responsible for *W. somnifera* anti-diabetic activity. Elicitors applied to the root growing solutions affected the physiological state of the plants, altering membrane leakage or osmotic potential. Methyl salicylate and chitosan increased withaferin A content by 75% and 69% respectively, and extracts from elicited plants increased glucose uptake to a higher extent than non-elicited plants, demonstrating a correlation between increased content of withaferin A and anti-diabetic activity[26].

Table -2Catagories of plant associated with Uttarakhand

Habit	No. of plant
Herbs	50
Shrubs	26
Climbers	13
Trees	42

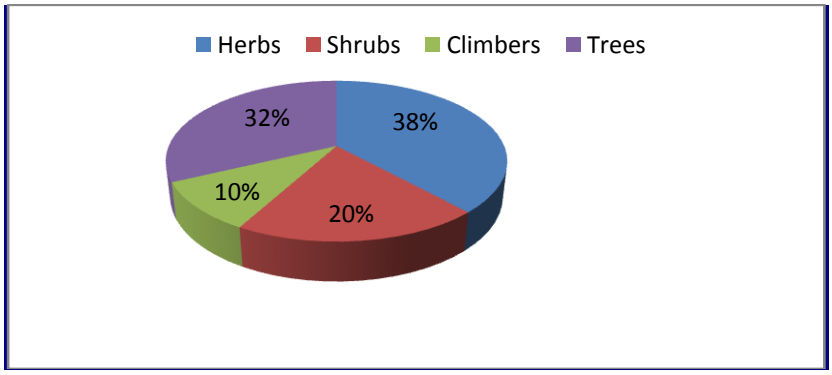

Fig.B.Total plants category involve in diabetes

II. CONCLUSION

Although our ancient times through hit, trial and pharmacological basis these plants are usesful for the diabetes, these plant species do not certify efficacy on the basis of herbal and pharmacological evidences support all are diabetic plant.The present preliminary report cover ethnomedicinal uses of all plant species. The study provides information on 131 plant species under 109 genera belonging to 59 families, family Fabiaceae contributed maximum species. 8 species described, are monocotyledons, 101 are dicotyledons, 50 species are herbs, 26 are shrubs, 42 are trees and 13 are climbers. It is helpful for observation & that importance for further advanced study are related to herbal medicine to treat diabetes. In certain cases, dietary restriction was strictly observed during the treatment. In the area, most of the medicines are prescribed in the form of decoction and paste. The study area is rich in medicinal plant resources. An attempt was made to collect information on the traditional medicinal knowledge present with the local tribes; however, more in-depth information may be explored from the tribes residing in the remote parts of the district. This type of study will given new impetus to the traditional system of medicine and will play a great role in primary healthcare. In view of the importance of traditional medicine which provides health service to 75-80 % of world population, increased demand of herbal drugs by the pharmaceuticals and depleting natural plant resources, it is high time to document the medicinal utility of less known plants available in remote areas of the country. The study enumerates the ethnomedicinal knowledge of indigenous peoples of the Uttarakhand in India.

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