Antidiabetic Activity of Stems of Hemipararsite *Dendrophthoe falcata* Linn. Parasitic Growing on *Mangifera indica*

S.J. Anarthe[1], R.D. Bhalke[1], R.B. Jadhav[2] and S. J. Surana[2]

[1]Sanjivani College of Pharmaceutical Education and Research, Department of Pharmacognosy, Post : Shingnapur, Kopragaon (M.S.)
[2]Bioecology laboratory, Department of Pharmacognosy, R.C. Patel College of Pharmacy, Shirpur.

ABSTRACT: In the present investigation, we tested the possible cytoprotective and oral hypoglycemic effects of methanolic extract of stems of *Dendrophthoe falcata*. Besides, total phenolics and total flavonoids were also investigated. The methanolic extract of *D. falcata* at 200 mg/kg has also shown significant cytoprotective activity ($p < 0.05$) in alloxan-induced diabetic rats. In addition the extract significantly reduced the elevated level of blood cholesterol ($p < 0.01$) and triglyceride ($p < 0.05$). At the same dose level, the extract significantly improved the alloxan-induced reduction of blood protein level ($p < 0.01$) to normal value.

Key words: Antidiabetic activity, Hemiparasite, *Dendrophthoe falcata*

INTRODUCTION

Dendrophthoe is genus of evergreen, shrubby, partial parasites, that is distributed in the tropical and sub-tropical regions of the old world. It is hemiparasite that grows on the mengo tree, *Mangifera indica*. The whole plant is used in indigenous system of medicine as cooling, bitter, astringent, aphrodiasic, narcotic and diuretic, and is useful in pulmonary tuberculosis, asthma, menstrual disorders, swelling wounds, ulcers, renal and vesical calculi and vitiated conditions of kapha and pitta. Also decoction of plant is used by women as an antifertility agent, also have anticancer activity.[1] *Dendrophthoe falcata* is branched hemiparasite. Barks are grey, leaves are thick, coriaceous, very variable in shape with stout flowers.[2] The genus *Dendrophthoe* comprises of 20 species and about 7 species are found in India. Members of genus *Dendrophthoe* are reported to have anti-oxidant, anti-microbial, anticancer, antidiabetic,[3] anti-lithiatic, antihypertensive.[4]

Angiospermic parasitic plant *Dendrophthoe falcata*, reported to contain biologically active substances such as flavonoid, quercetin[5], tannins, β-sitosterol, β-amyrin, oleanolic acid.[6, 7]

Study was undertaken to investigate the antidiabetic activity of stems of *D. falcata*.

MATERIALS AND METHODS

Plant material and preparation of extract. The stems of *Dendrophthoe falcata* (Loranthaceae) a parasite on *Mangifera indica*, (Anacardiaceae) were collected in February 2005 from Western Ghat region of Maharashtra (India). The plant specimen was

Correspondence to: S.J. Anarthe
Email- sneha.pharma@yahoo.co.in

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authenticated from Botanical Survey of India, Pune (Voucher specimen no. PSH-1). The air-dried stems of *D. falcata* were pulverized and the powdered material was extracted with methanol (80 %) by cold maceration. The extract was concentrated on a rotary vacuum evaporator, which gave a yellowish-brown yield (3.65% w/w). The proximate phytochemical analysis of methanol extracts shows presence of flavonoids, proteins and carbohydrates.

Animals. Wistar rats, of either sex, weighing 150-250 g were used. They were housed under standard conditions of temperature (23 ± 2 °C), humidity and dark–light cycle. They were given standard diet and water ad libitum. All the animals were carefully monitored and maintained in accordance with CPCSEA guidelines on control and supervision of experimental animals. The ethical clearance was obtained from the Institutional Animal Ethics Committee (Approval no.651/02/c/CPCSEA) before the experiment.

Study of the *D. falcata* extract on normal rats.[8] Fasted rats were divided into four groups each carrying six animals. Group I, served as a control and received distilled water. Groups II–IV received the methanolic extract of *D. falcata* at doses of 100, 200 and 400 mg/kg as an aqueous solution. After 1 h of extract administration, blood samples were collected from the retro-orbital plexus at 30, 60, 90, 120 min. after extract loading. Serum was separated and blood glucose levels were measured immediately by the glucose oxidase method.

Study of the *D. falcata* extract on glucose tolerance in rats.[9] Fasted rats were divided into four groups of eight animals each. Diabetes was induced by a single intraperitoneal injection of 150 mg/kg of alloxan monohydrate in sterile saline. Group I, served as a control and received 1 ml distilled water. Groups II–IV received the extract of *D. falcata* at doses of 100, 200 and 400 mg/kg as a fine aqueous dispersion. After 1 h of extract administration, the rats of all groups were orally treated with 2.0 g/kg of glucose. Blood samples were collected from the retro-orbital plexus just prior to glucose administration and 30, 60, 90, 120 min after glucose loading. Serum was separated and blood glucose levels were measured immediately by the glucose oxidase method.

Study of the *D. falcata* extract on the alloxan-induced hyperglycemia.[3] The cytoprotective effects of extract were studied in alloxan-induced diabetic rats according to the method reported [3]. The diabetes was induced by administration of 120 mg/kg alloxan monohydrate (Sigma). The diabetic rats (glucose level > 275 mg/100 ml) were divided into six groups of six rats each. Group I served as negative control and received distilled water. Groups II served as the diabetic control, while Groups III, IV, V received the methanolic extract of *D. falcata* at doses of 100, 200 and 400 mg/kg as an aqueous dispersion, p.o. and Group-VI received Glibenclamide5mg/kg as standard drug. The administration of the extract was continued for 21 days, once daily. Blood samples were collected from retro-orbital plexus on day 1, 15 and 21 of extract administration. The blood glucose levels and triglyceride levels as well as total cholesterol and total proteins were determined.

Statistical analysis. Data are expressed as the mean ± S.E.M. The significance of the results was calculated using ANOVA and post hoc Dennett's t-test and the results were considered statistically significant when $P < 0.05$.

RESULTS AND DISCUSSION

Pharmacological investigation of plant revealed that methanolic extract of the *D. falcata* exhibited good oral antidiabetic activity in experimental animals. From the result in Table 1, 2 and 3 it is evident that the methanolic extract at 200 mg/kg significantly reduced the normal blood glucose level as compare to 100 mg/kg and 400 mg/kg dose of methanolic extract. Similarly, in oral glucose tolerance test in rats and in alloxan induced diabetic rats methanolic extract significantly reduced blood glucose level ($p < 0.01$) as shown in Table 2 and 3. The methanolic extract of *D. falcata* at 200 mg/kg also shown significant cytoprotective activity ($p < 0.05$) in alloxan-induced diabetic rats. In addition the extract significantly reduced the elevated level of

blood cholesterol ($p < 0.01$) and triglyceride ($p < 0.05$). At the same dose level, extract significantly improved the alloxan-induced reduction of blood protein level ($p < 0.01$) to normal value as shown in Table 3.

Thus, data presented here indicate that methanolic extract of *D. falcata* possesses significant oral antidiabetic activity, which is mediated through biphasic mechanism involving potent antioxidant activity and effect on blood glucose. The later mechanism however needs further support in animal models and data presented here is consistent with

Table 1. Effect of methanolic extract on normal glucose level in rats.

Groups	Treatment (Dose/kg body weight)	Blood glucose concentration (mg/dl)			
		Fasting	30 min	60 min	120 min
Group-I	Normal saline	78.78±1.948	77.77±1.788	77.9±1.523	77.42±1.261
Group-II	Methanolic extract 100mg	79.22±1.89*	78.8±1.201*	74.08±2.13*	73.05±2.12**
Group-III	Methanolic extract 200mg	82.78±3.55*	79.13±3.85*	68.12±2.64*	64.26±2.681**
Group-IV	Methanolic extract 400mg	80.73±1.218*	78.05±2.35*	65.06±1.503*	63.68±1.381**

Data expressed as mean ±SEM, n=6, Data processed by one way ANOVA followed by Dunnett's test, , P< 0.05*, P< 0.01** n-6. Group-I (Normal) is compared with Group-II, III, and IV. (Extract treated).

Table 2. Effect of methanolic extract on oral glucose tolerance test in rats.

Groups	Treatment (Dose/kg body weight)	Blood sample concentration (mg/dl)			
		Fasting	30 min	60 min	120 min
Group-I	Glucose treated	79.19±2.593	95.42±3.57	102.2±3.128	102.3±3.143
Group-II	Methanolic extract 100mg + glucose	80.04±2.134**	90.064±2.124**	85.33±2.53*	81.95±3.0112*
Group-II	Methanolic extract 200mg + glucose	83.53±1.931**	91.52±1.433**	83.8±1.794*	78.74±2.31*
Group-III	Methanolic extract 400mg + glucose	86.12±3.219**	93.2±3.45**	83.14±3.635*	79.28±3.455*

Data expressed as mean±SEM, n=6, Data processed by one way ANOVA followed by Dunnett's test, P< 0.05*, P< 0.01**, n-6, Group-I (Normal) compared with Group-II. (Glucose induced) and Group-III (Extract treated)

Table 3. Effect of the methanolic extract of the *D. falcata* stem in alloxan-induced diabetic rats.

Groups	Day	Glucose (mg/dl)	Triglycerides (mg/dl)	Total cholesterol (mg/dl)	Total proteins (g/dl)
Normal group	0	87.8 ± 5.269	89.30 ± 0.4462	72.93 ± 3.46	6.672 ± 0.050
	15	86.51 ± 3.829	89.66 ± 0.6783	72.95 ± 3.502	6.787 ± 0.100
	21	84.5 ± 3.671	88.76 ± 0.7515	71.52 ± 3.38	6.685 ± 0.167
Diabetic control	0	304.4 ± 5.27*	195.6 ± 1.605*	130.2 ± 4.07**	5.296 ± 0.146**
	15	296.6 ± 3.103*	195.7 ± 2.732*	123.7 ± 2.193**	5.212 ± 0.187**
	21	299.2 ± 3.262*	194.9 ± 3.304*	118.5 ± 2.108**	5.1 ± 0.0707**
Test Group-I	0	295.1 ± 2.163*	200.31 ± 2.34*	135.4 ± 1.68**	4.78 ± 0.2878**
	15	178.4 ± 4.211*	183.2 ± 3.27*	115.2 ± 6.92**	5.34 ± 0.286**
	21	154.3 ± 3.82*	165.7 ± 2.87*	110.8 ± 4.69**	5.68 ± 0.251**
Test Group-II	0	295 ± 3.061*	201.9 ± 2.072*	136 ± 1.596**	4.808 ± 0.2796**
	15	176.05 ± 4.106*	179.4 ± 3.743*	113.2 ± 7.491**	5.87 ± 0.169**
	21	150.92 ± 3.4*	163.4 ± 2.99*	109.76 ± 5.579**	5.985 ± 0.2455**
Test Group-III	0	298.7 ± 1.102*	197.5 ± 5.076*	133.2 ± 0.7533**	4.696 ± 0.298**
	15	180.79 ± 1.043*	173.7 ± 6.147*	124.1 ± 0.989**	5.581 ± 0.2265**
	21	150.02 ± 4.38*	161.2 ± 5.181*	106.2 ± 4.52**	5.565 ± 0.183**
Glibenclamide mg/kg	0	295.24 ± 1.9*	200.03 ± 1.5*	138.9 ± 1.45**	4.95 ± 1.31**
	15	163.7 ± 1.5*	168.21 ± 1.77*	123 ± 1.54**	5.05 ± 1.29**
	21	117.35 ± 2.6*	123.4 ± 0.9*	94.59 ± 2.07**	6.321 ± 1.54**

Data expressed as mean±SEM, n=6, Data processed by one way ANOVA followed by Dunnett's test, P< 0.05*, P< 0.01**, n-6, Normal group, Diabetic control, Test Group-I, Test group-II, Test group- III, Standard group (Glibenclamide 5mg/kg).

inhibitory effects of phenolics on plant glucan phosphorylase (Total Phenolic content and total flavonoid content of *D. falcata* was estimated and which was found to be 1.03 %w/w and 0.024 mg/g).[10-11] It is also considered to be an important enzyme in the degradation of starch in plants.

In conclusion, data presented here rationalize that the methanolic extract have potential to emerge as a new remedy for treatment of type-II diabetes mellitus.

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