ANTI-HYPERGLYCEMIC EFFECT OF KUNDRU (COCCINIA INDICA) ON PATIENTS OF DIABETES MELLITUS TYPE-2

Mohd Junaid1*, Bhavna Singh2, Sahana vats3, Sanandan Thapliyal4, Shalini Thapliyal5

*1PG final Year Student, 2Professor and HOD, 3Associate Professor, Department of Dravyaguna, Uttranchal Ayurvedic College & Hospital, Dehradun, Uttrakhand, India.

4Associate Professor, Department of Kayachikitsa, Uttranchal Ayurvedic College & Hospital, Utrakhand, India.

5Associate Professor, Department of Swasthvritta, Uttranchal Ayurvedic College, Dehradun, Uttrakhand, India.

ABSTRACT

The disease Diabetes or Madhumeha is well documented in all perennial sources of Ayurvedic wisdom. The present study was done to evaluate the efficacy of Bimbi (Coccinia indica) in the patients of Diabetes mellitus type-2 through single blind study. Total 30 patients were selected and divided into two groups, 15 patients in each group i.e., A (Bimbi) & B (Barley). In this study it has been found that Madhumeha affects not only in elderly people but in adults too with slight female preponderance. The present study confirmed that after the treatment of 60 days, Bimbi (Coccinia indica) was found effective in treatment of Madhumeha and reduced majority of the symptoms of illness that including Prabootha mootrata (Excessive urination), Atitrushna (Excessive thirst), Avila mootrata (Turbid urine) and Dourbalya (Weakness). There was significant improvement in all the laboratory parameters in patients of Bimbi (Coccinia indica) treated group. The outcome showed that mean reduction in fasting blood sugar level was 19.86%, in PP blood sugar level was 24.52% and in HbA1c level was 8.4%. These outcomes suggest that the results of trial drug i.e., Coccinia indica (Bimbi) powder was highly significant at p-value <0.001. The drug Bimbi showed effectiveness in reducing FBS, PPBS and HbA1c, as results were highly significant. barley powder used as placebo didn’t showed reduction in FBS, PPBS and HbA1c.

KEYWORDS: Diabetes, Madhumeha, Bimbi, Coccinia indica.

INTRODUCTION

The recent reports of International Diabetes Federation (IDF) shows that, all over the world there are 415 million people suffering from diabetes mellitus, between the age of twenty to seventy nine years, with 8.8% of global prevalence, and it is expected that by 2040 it will grow up to 642 million, with a prevalence of 10.4%. Environmental conditions also play significant role, most of the sufferer live in the urban area, and very less come from the rural area.[1]

Many drugs are available in the market to control diabetes. In most instances these are expensive and may also have adverse effects like hypoglycemia and obesity. Ayurveda has mentioned many plants useful for pre-diabetes and diabetes condition like Berberis aristata, Pterocarpus marsupium, Tinospora cordifolia, Azadirachta indica, Trichosanthes dioica and Trigonellafoenum graecum. Bimbi is botanically identified as Coccinia indica, belongs to Cucurbitaceae family. [2] Bimbi is mentioned in various Samhitas and Nighontus and has been used for treating various disease conditions. As per Ayurvedic pharmacopoeia of India [3] Bimbi is having Tikta, Madhura-Rasa, Guru, Ruksa-Guna, Sita-Virya, & Katu-Vipaka. In reference of diabetes, it was first mentioned by Acharya Bhavaprakash [4] as Mutra-sangrahaninya and described beneficial in Madhumeha. Acharya Priyavrata Sharma [5] in Dravyaguna vigyan mentioned its effect on Mutravaha-sansthana, especially beneficial in Madhumeha, Ojomeha & Puyameha.

Aim & Objective

To evaluate therapeutic efficacy of Coccinia indica (Bimbi) in Madhumeha (type 2 diabetes mellitus).

Material and methods

Study was approved by the research development committee (RDC) of Utrakhand Ayurved University, Harrawala, Dehradun and clinical study also approved by Institional Ethical
Committee (IEC), Uttaranchal Ayurvedic Collage on 11 May 2019.

The clinical trial was also registered in CTRI, Govt. of India on 17 July 2019 with reference no. REF/2019/07/026977 and trial registration number CTRI/2019/07/020228. The study was commenced thereafter.

Source of the drug: The plant material was purchased from Rudrapur, Uttarakhand and authenticated (with ref.no.-NISCAIR/RHMD/consult/2018/3219-20) by Dr. Sunita Garg (Emeritus Scientist, CSIR-NISCAIR, New Delhi). The authenticated sample i.e., Coccinia indica, Bimbi leaves were powdered and passed through the sieve no.14 and stored in an air tight container for further studies.

Preparation of the drug for clinical trial: Bimbi powder and Barley powder was made under hygienic condition.

Dosage: 6 gm of Bimbi powder twice daily to be taken with water, 30 minutes before food, by the patients of group-A. 6 gm of Barley powder twice daily to be taken with water, 30 minutes before food, by the patients of group-B i.e. placebo group.

Source of the patients: A free medical camp was organised in the premises of Uttaranchal Ayurvedic hospital, Rajpur road, Dehradun, dated on November 2, 2019 and again rescheduled on November 12, 2019. During this period, many patients were enrolled while more patients enrolled themselves from November 2019 to January 2020. A total of 41 patients were selected randomly for the study irrespective of sex, caste, race and religion. Out of 41 patients, 11 couldn't complete the study.

Study design: 30 selected patients were divided into two groups, 15 patients in each group i.e A & B.

Group A-(Trial group of 15 patients) A pack of 180 gms was given to each patient of trial group A on visit-1 (day-0) and visit-2 (day-15). Further on visit-3 (day-30) two packets each of 180 gms Bimbi powder were given (for next 30 days).

Groups B- (Placebo group of 15 patients) A pack of 180 gms of Barley flour was given on visit-1 (day-0) and visit-2 (day-15) to every patient enrolled in this group. On visit-3 (day-30) two packets each of 180 gms were given (for next 30 days intake).

Type of study: Single blind study

Number of patients: Total 30 Patients completed the study.

Duration of treatment: Total duration of treatment was 60 days

Follow up: Patients were advised to visit for follow-up on day 0, 15th, 30th, & 60th for testing of the objective parameters and to ascertain the adverse effects of the treatment if any.

Inclusion criteria

- Patients presenting with or without symptoms like polyuria, excessive thirst, turbid urine and weakness.
- Patients of either sex between the age group of 30 to 60 years.
- Patients of type 2 diabetes mellitus with the FBS ranging between 120 mg per dl to 180 mg per dl and PPBS ranging between 160 mg per dl to 300 mg per dl.
- Established cases of type 2 diabetes mellitus without complications.

Exclusion criteria

- Juvenile diabetes mellitus.
- Patients below the age of 30 years and above the age of 60 years.
- Patients suffering from diabetes mellitus due to secondary causes, pregnancy and other systemic disorders which interferes with course of treatment.

Assessment

Subjective parameters

The subjective parameters include for the assessment criteria are as below-

- Excessive urination (Prabootha mootrata)
- Turbid urine (Avila mootrata)
- Excessive thirst (Atitrushna)
- Weakness (Dourbalya)

Scoring has given to all the signs and symptoms from grade 0-3 according to the severity and has documented properly before the treatment, after 15 days, 30 days and 60 days of the treatment.

Prabootha mootrata (polyuria or excessive urination): quantity of urine

| 1.50 to 2.00 liters /24 hrs. | : 0 |
| >2.00 to 2.50 liters /24 hrs. | : 1 |
| >2.50 to 3.00 liters /24 hrs. | : 2 |
| >3.00 liters /24 hrs. | : 3 |

Frequency of urine

| 3-5 times per day, no or rarely at night | : 0 |
| 6 - 8 times per day, 1-2 times per night | : 1 |
| 9-11 times per day, 3-4 times per night | : 2 |
| >11 times per day, > 4 times per night | : 3 |

Atitrushna (polydipsia or excessive thirst)

Feeling of thirst 7-9 times/24 hr, : 0
either/or intake of water 5-7 times/24 hr with quantity
Feeling of thirst 9 - 11 times/24 hr, either : 1
or intake of water 7 - 9 times/24 hr with quantity 2.0 - 2.50 liter/24 hr

Feeling of thirst 11-13 times/24 hr, either : 2
/or intake of water 9-11 times/24 hr with quantity 2.50 -3.00 liter/24 hr

Feeling of thirst >13 times/24 hr, either:/or intake of water >11 times/24 hr with quantity >3.00 liter/24 hr

**Avila mootrata** (turbid urine)

Crystal clear fluid : 0

Faintly cloudy or hazy with slight turbidity : 1

Turbidity clearly present and newsprint easily read through test tube : 2

Newsprint not easily read through test tube : 3

**Dourbalya** (Weakness)

Very active : 0

Active : 1

Moderate active : 2

Dull : 3

### Age wise distribution

| Age in year | Group-A (Bimbi) | Group-B (Barley) | No. of patients | Percentage (%) |
|-------------|-----------------|-----------------|-----------------|----------------|
| 20-30       | -               | 1               | 1               | 3.4            |
| 31-40       | 2               | 4               | 6               | 20.0           |
| 41-50       | 7               | 9               | 16              | 53.3           |
| 51-60       | 6               | 1               | 7               | 23.3           |
| Total       | 15              | 15              | 30              | 100            |

### Sex wise distribution

| Sex       | Group-A (Bimbi) | Group-B (Barley) | No. of patients | Percentage (%) |
|-----------|-----------------|-----------------|-----------------|----------------|
| Male      | 5               | 9               | 14              | 46.7           |
| Female    | 10              | 6               | 16              | 53.3           |
| Total     | 15              | 15              | 30              | 100            |

### Marital status wise distribution

| Marital status | Group-A (Bimbi) | Group-B (Barley) | No. of patients | Percentage (%) |
|----------------|-----------------|-----------------|-----------------|----------------|
| Married        | 15              | 15              | 30              | 100            |
| Un-married     | -               | -               | 0               | 0              |
| Total          | 15              | 15              | 30              | 100            |

### Habitat wise distribution

| Habitat status | Group-A (Bimbi) | Group-B (Barley) | No. of patients | Percentage (%) |
|----------------|-----------------|-----------------|-----------------|----------------|
| Rural          | 4               | 5               | 9               | 30             |
| Urban          | 11              | 10              | 21              | 70             |
| Total          | 15              | 15              | 30              | 100            |

### Family history wise distribution

| Family History | Group-A (Bimbi) | Group-B (Barley) | No. of Patients | Percentage (%) |
|----------------|-----------------|-----------------|----------------|----------------|
| Positive       | 8               | 5               | 13              | 43.3           |
| Negative       | 7               | 10              | 17              | 56.7           |
| Total          | 15              | 15              | 30              | 100            |

### Objective parameters

**Investigations of blood**
- Fasting blood sugar (FBS)
- Post-prandial blood sugar (PPBS)
- HbA1c.

**Urine**
- Fasting urine sugar (FUS)
- Post prandial urine sugar (PPUS)

### Statistical design

**Statistical analysis** was done by paired student “t” test. The evaluation was done on the statistical analysis of the results obtained (as per American Diabetes Association) and it was compared before and after treatment.

### Observations

The findings of data obtained at the start of study have been organized as mentioned below:
Weight wise distribution

Table 6: Distribution of patients according to Weight in Kg

| Weight in kgs | Group-A (Bimbi) | Group-B (Barley) | No. of patients | Percentage (%) |
|---------------|-----------------|------------------|-----------------|----------------|
| 50-60         | 2               | 2                | 4               | 13.3           |
| 61-70         | 5               | 4                | 9               | 30.0           |
| 71-80         | 5               | 6                | 11              | 36.7           |
| 81-90         | 3               | 2                | 5               | 16.7           |
| 91-100        | -               | 1                | 1               | 3.3            |
| Total         | 15              | 15               | 30              | 100            |

Educational Status wise distribution

Table 7: Distribution of patients according to Educational status

| Education       | Group-A (Bimbi) | Group-B (Barley) | No. of patients | Percentage (%) |
|-----------------|-----------------|------------------|-----------------|----------------|
| Graduates       | 4               | 7                | 11              | 36.7           |
| Intermediate    | 7               | 7                | 14              | 46.6           |
| Uneducated      | 4               | 1                | 5               | 16.7           |
| Total           | 15              | 15               | 30              | 100            |

Occupation wise distribution

Table 8: Distribution of patients according to Occupational status

| Occupation     | Group-A (Bimbi) | Group-B (Barley) | No. of patients | Percentage (%) |
|----------------|-----------------|------------------|-----------------|----------------|
| Service        | 4               | 6                | 10              | 33.3           |
| Businessman    | 2               | 3                | 5               | 16.7           |
| Housewife      | 7               | 6                | 13              | 43.3           |
| Retired        | 2               | 0                | 2               | 6.7            |
| Total          | 15              | 15               | 30              | 100            |

Socio-economical status wise distribution

Table 9: Distribution of patients according to Socio-economical status

| Socio-economical Status | Group-A (Bimbi) | Group-B (Barley) | No. of patients | Percentage (%) |
|-------------------------|-----------------|------------------|-----------------|----------------|
| Poor                    | 4               | 5                | 9               | 30.0           |
| Lower Middle Class      | 5               | 3                | 8               | 26.7           |
| Upper Middle Class      | 6               | 7                | 13              | 43.3           |
| Total                   | 15              | 15               | 30              | 100            |

Addiction wise distribution

Table 10: Distribution of patients according to Addiction

| Addiction                | Group-A (Bimbi) | Group-B (Barley) | No. of patients | Percentage (%) |
|--------------------------|-----------------|------------------|-----------------|----------------|
| Alcoholics               | -               | 2                | 2               | 6.7            |
| Smoking                  | 2               | 3                | 5               | 16.7           |
| Alcohol+Smoking          | 1               | 3                | 4               | 13.3           |
| Alcohol+Smoking & Tobacco| 2               | 2                | 4               | 13.3           |
| No Addiction             | 10              | 5                | 15              | 50             |
| Total                    | 15              | 15               | 30              | 100            |

Duration of illness wise distribution

Table 11: Distribution of patients according to Duration of illness

| Duration of Illness | Group-A (Bimbi) | Group-B (Barley) | No. of patients | Percentage (%) |
|---------------------|-----------------|------------------|-----------------|----------------|
| 0-5 Years           | 4               | 3                | 7               | 23.4           |
| 5-10 Years          | 4               | 6                | 10              | 33.3           |
| >10 Years           | 7               | 6                | 13              | 43.3           |
| Total               | 15              | 15               | 30              | 100            |
Dietary habits (Ahara) wise distribution

Table 12: Distribution of patients according to Ahara

| Diet       | Group-A (Bimbi) | Group-B (Barley) | No. of patients | Percentage (%) |
|------------|----------------|----------------|----------------|---------------|
| Veg.       | 9              | 5              | 14             | 46.7          |
| Mixed      | 6              | 10             | 16             | 53.3          |
| Total      | 15             | 15             | 30             | 100           |

Sleep pattern (Nidra) wise distribution

Table 13: Distribution of patients based on Nidra

| Nidra     | Group-A (Bimbi) | Group-B (Barley) | No. of patients | Percentage (%) |
|-----------|----------------|----------------|----------------|---------------|
| Sound     | 2              | 2              | 4              | 13.3          |
| Moderate  | 9              | 6              | 15             | 50.0          |
| Disturbed | 4              | 7              | 11             | 36.6          |
| Total     | 15             | 15             | 30             | 100           |

Symptoms wise distribution

Table 14: Distribution of patients based on Symptoms

| Symptoms                        | Group-A (Bimbi) | Group-B (Barley) | No. of patients | Percentage (%) |
|---------------------------------|----------------|----------------|----------------|---------------|
| Excessive urination             | 15             | 15             | 30             | 100           |
| Excessive thirst                | 15             | 15             | 30             | 100           |
| Turbid urine                    | 14             | 15             | 29             | 96.6          |
| Weakness                        | 12             | 9              | 21             | 70.0          |

Fasting Blood Sugar (Day-0) wise distribution

Table 15: Distribution of patients according to fasting blood sugar (Day-0)

| FBS (mg%) | Group-A (Bimbi) | Group-B (Barley) | No. of patients | Percentage (%) |
|-----------|----------------|----------------|----------------|---------------|
| <200      | 8              | 7              | 15             | 50.0          |
| 200-250   | 3              | 3              | 6              | 20.0          |
| 250-300   | 3              | 1              | 4              | 13.3          |
| >300      | 1              | 4              | 5              | 16.7          |
| Total     | 15             | 15             | 30             | 100           |

Post-Prandial blood Sugar (Day-0) wise distribution:

Table 16: Distribution of patients according to Post-prandial blood sugar (Day-0)

| PPBS (mg%) | Group-A (Bimbi) | Group-B (Barley) | No. of Patients | Percentage (%) |
|------------|----------------|----------------|----------------|---------------|
| <200       | 5              | 3              | 8              | 26.6          |
| 200-250    | 3              | 3              | 6              | 20.0          |
| 250-300    | 4              | 3              | 7              | 23.3          |
| >300       | 3              | 6              | 9              | 30.0          |
| Total      | 15             | 15             | 30             | 100           |

Glycosylated haemoglobin (Day-0) wise distribution

Table 17: Distribution of patients according to HbA1c (Day-0)

| HbA1c  | Group-A (Bimbi) | Group-B (Barley) | No. of patients | Percentage (%) |
|--------|----------------|----------------|----------------|---------------|
| <7     | 2              | 2              | 4              | 13.3          |
| 7-8    | 3              | 5              | 8              | 26.7          |
| 8-9    | 4              | 3              | 7              | 23.3          |
| >9     | 6              | 5              | 11             | 36.7          |
| Total  | 15             | 15             | 30             | 100           |
Results of Clinical Study

The patients were analyzed statistically and results obtained were mentioned below:

Table 18: Results of laboratory parameters in group-A (Trial group)

| Lab Tests | Mean B.T | Mean A.T | Mean Dif. | % Mean Reduction | ±S.D | ±S.E | T value | P Value | Result | P value Summary |
|-----------|----------|----------|-----------|------------------|------|------|---------|---------|--------|----------------|
| FBS       | 186.3    | 149.3    | 37        | 19.86            | 8.23 | 2.12 | 6.58    | <0.001  | H.S.   | ***            |
| PPBS      | 249.9    | 188.6    | 61.3      | 24.52            | 10.31| 2.66 | 5.90    | <0.001  | H.S.   | ***            |
| HbA1c     | 8.64     | 7.91     | 0.73      | 8.44             | 2.84 | 0.73 | 8.46    | <0.001  | H.S.   | ***            |
| FUS       | 0.28     | 0.17     | 0.11      | 39.28            | 7.06 | 3.23 | <0.01   | S       | H.S.   | ***            |
| PPUS      | 0.36     | 0.20     | 0.16      | 44.44            | 38.56| 9.95 | 5.53    | <0.001  | H.S.   | ***            |

Table 19: Results of laboratory parameters in group-B (Placebo group)

| Symptoms | Mean B.T | Mean A.T | Mean Dif. | % Mean Reduction | ±S.D | ±S.E | T value | P Value | Result | P value Summary |
|----------|----------|----------|-----------|------------------|------|------|---------|---------|--------|----------------|
| FBS      | 229.4    | 226.9    | 2.5       | 1.09             | 5.66 | 1.46 | 0.87    | >0.05   | N.S.   | -              |
| PPBS     | 269.9    | 263.2    | 6.67      | 2.48             | 23.02| 5.94 | 0.96    | >0.05   | N.S.   | -              |
| HbA1c    | 8.49     | 8.45     | 0.04      | 0.47             | 1.38 | 0.35 | 1.24    | >0.05   | N.S.   | -              |
| FUS      | 0.36     | 0.33     | 0.02      | 7.5              | 35.19| 9.08 | 1.46    | >0.05   | N.S.   | -              |
| PPUS     | 0.38     | 0.36     | 0.02      | 5.26             | 12.10| 3.23 | 1.46    | >0.05   | N.S.   | -              |

Table 20: Results of symptomatic parameters in group-A (Bimbi)

| Symptoms | Mean B.T | Mean A.T | Mean Dif. | % Mean Reduction | ±S.D | ±S.E | T value | P Value | Result | P value Summary |
|----------|----------|----------|-----------|------------------|------|------|---------|---------|--------|----------------|
| Excessive urination (Prabootha Mootrata) | 2.20     | 1.00     | 1.20      | 54.54            | 26.33| 6.79 | 11.22   | <0.001  | H.S.   | ***            |
| Excessive thirst (Atitrushna) | 2.20     | 1.07     | 1.13      | 51.36            | 26.33| 6.79 | 12.47   | <0.001  | H.S.   | ***            |
| Turbid urine (Avila Mootrata) | 1.87     | 0.87     | 1.00      | 53.47            | 32.65| 8.431| 10.25   | <0.001  | H.S.   | ***            |
| Weakness (Dourbalya) | 1.20     | 0.33     | 0.87      | 72.5             | 39.94| 10.31| 1.46    | <0.001  | H.S.   | ***            |

Table 21: Results of symptomatic parameters in group-B (Barley)

| Symptoms | Mean B.T | Mean A.T | Mean Dif. | % Mean reduction | ±S.D | ±S.E | T value | P value | Result | P value Summary |
|----------|----------|----------|-----------|------------------|------|------|---------|---------|--------|----------------|
| Excessive urination (Prabootha Mootrata) | 2.00     | 1.86     | 0.14      | 7.00             | 15.00| 3.87 | 1.46    | >0.05   | N.S.   | -              |
| Excessive thirst (Atitrushna) | 1.93     | 1.86     | 0.07      | 3.62             | 8.60 | 2.22 | 1.00    | >0.05   | N.S.   | -              |
| Turbid urine (Avila Mootrata) | 1.66     | 1.60     | 0.06      | 3.61             | 12.91| 3.33 | 1.00    | >0.05   | N.S.   | -              |
| Weakness (Dourbalya) | 0.73     | 0.66     | 0.07      | 9.58             | 25.82| 6.66 | 1.00    | >0.05   | N.S.   | -              |

DISCUSSION

In group-A (Bimbi) after the treatment of 60 days, there was significant improvement in all the laboratory parameters in patients of this group. The outcome showed that mean reduction in fasting blood sugar level was 19.86%, in PP blood sugar level was 24.52% and in HbA1c level was 8.4%. These outcomes suggest that the results of trial drug i.e. Coccinia indica (Bimbi) powder was highly significant at p-value <0.001.

Along with the blood parameters, fasting urine sugar level also showed significant mean
reduction by 39.28% at P-value <0.01 and PP urine sugar level showed highly significant mean reduction by 44.44% at P-value <0.001.

There was also a significant improvement in all the symptomatic parameters. The mean reduction in Praboota mootrata (Excessive urination) was 54.54%, in Atitrushna (Excessive thirst) was 51.36%, in Avila Mootrata (Turbid urine) % was 53.47% and in Dourbalya (Weakness) 72.5%. Thus the improvement observed in all symptomatic parameters in treated group-A (Bimbi) was highly statistically at P-value <0.001.

In group-B after the treatment of 60 days, there was no significant improvement in all the laboratory parameters and all symptomatic parameters were non-significant statistically at P-value >0.05.

The overall outcome of the study suggests that the Coccinia indica (Bimbi) powder showed encouraging results on the patients of Diabetes mellitus Type-2. The present study supports to the use of Coccinia indica (Bimbi) as anti-diabetic medicine, as mentioned in Ayurvedic texts.[6,7]

The present study showed that there was no adverse or undesirable side effect noted in terms of clinical prevention or lab investigation post studies. It is important to note that Pathya-apathya (Dietary advices) plays an important role in the management of diabetes mellitus type-2, the patients who followed the prescribed diet & lifestyle guidelines diligently responded well & took less time to recover.

The present study illustrates that the overall effect of Coccinia indica (Bimbi), with its Rasa, Guna, Veerya, Vipaka & Karma, corrected the metabolism of blood sugar, eventually helps reduce the level of fasting blood sugar, PP blood sugar, HbA1c level, reduces the fasting urine sugar level, & PP urine sugar level & also shows significant improvement in symptomatic parameters of the diabetic patients.

CONCLUSION

The study confirmed that Bimbi was effective in treatment of Madhumeha and reduced majority of the symptoms of illness that including Praboota moortrata (Excessive urination), Atitrushna (Excessive thirst), Avila mootrata (Turbid urine) and Dourbalya (Weakness).

All the patients tolerated medicines very well and no side effects were reported by any of the patients, suggesting there by that the drugs selected for current clinical trial was absolutely safe for internal usage along with controlling the levels of blood and urine sugar effectively.

It can be concluded that Bimbi was effective in relieving symptoms of diabetes and normalizing FBS, PPBS, HbA1c and urine sugar level.

REFERENCES

1. International Diabetes Federation. IDF Diabetes Atlas–7th Edition. Accessed on 1 Feb 2016 at: https://www.idf.org/sites/default/files/E N_6E_Atlas_Full_0.pdf.

2. J.L.N.Sastry, Dravya Guna Vijana vol-2. 2nded. Varanasi: Chaukhambha Orientalia, 2005, 788-90

3. The Ayurvedic Pharmacopoeia of India, Part-1, Vol.3, First Edition, Dept. of AYUSH, Govt. of India, 2004, page 32-35

4. G.S.Pandey, editor. Bhavpraakash Nighantu of Bhava Misra. Varanasi: Chaukhambha Bharti Academy, 2010, 674.

5. P.V.Sharma, Dravya Guna Vijnana. Varanasi: Chaukhambha Bharti Academy, 2006, 2, 687-9.

6. G.S.Pandey, editor. Bhavpraakash Nighantu of Bhava Misra. Varanasi: Chaukhambha Bharti Academy, 2010, 674.

7. P.V.Sharma, Dravya Guna Vijnana.Varanasi: Chaukhambha Bharti Academy, 2006, 2, 687-9.