

LOCALITYWISE SURVEY OF *EPHEDRA NEBRODENSIS* var. *PROCERA* IN BALUCHISTAN TO JUDGE THE HIGHER EPHEDRINE YIELDING PLANTS FOR EXPLOITATION

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Introduction

Ephedra nebrodensis var. *procera* F.M. is the main source of income of the Forest Department of Baluchistan. The plant is being used in medicine from very ancient times and its curing properties are because of the presence of an alkaloid ephedrine ($C_{10}H_{15}NO$). Ephedra plants are a good remedy for curing bronchial asthma, cold, cough, urticaria, renal colic, itching, typhoid, hey fever and body pains. It can also be used as a tanning material for curing goats and lamb skins. This natural resource is exploited on large scale to the tune of 2.2 million kg. per annum for the manufacture of ephedrine which is exported to different countries of the world and is also used in the medicines prepared by the pharmaceutical concerns of Pakistan.

The plant occurs throughout the hilly area of Baluchistan but is mainly confined to the "Juniper tract" and the elevation varies from 2,000 to 3,000 meters above mean sea level. Ephedra bushes are quite hardy but are getting scarce because of over cutting and poor regeneration as the plants are not allowed to bear seeds due to over exploitation. Further the areas around Quetta, where "Marker Alkaloids" factory is situated are getting devoid of ephedra bushes as it is easier for the contractors to collect the twigs from the area. During a discussion with Company officials it came to light that the firm is facing stiff competition with synthetic ephedra produced by Japan and the firm can compete easily with synthetic products if ephedra twigs having higher ephedrine contents are supplied to the factory at a cheaper rate.

It was also observed during the previous quantitative surveys that some of the areas like Shinghar, Raud Mulazai, Hindu Bagh and some parts of Zhob district have higher frequency of ephedra bushes as compared to the areas like Ziarat and Kachmangi.

Keeping all these aspects in view, a localitywise qualitative survey of *Ephedra nebrodensis* var. *procera* plants was conducted during the year 1971 in the months of May and October for the collection of twigs from different localities of Baluchistan to judge the variations in the ephedrine contents. Results achieved are presented in this paper.

Review of Literature

Qazalbash (11) stated that the history of Ephedra is very old, and the plant is mentioned

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even in ancient Hindu literature. Ephedra represents the Soma plant of Rigveda and Homa plant of the Avesta. Taylor (12) reported that Birgham Tea or Morman tea made from Ephedra twigs was used by the Maxican Indians, who used it for only one purpose – the reputed control or cure for syphilis. The author further stated that Ephedra plants are among the most primitive of all the world flowering plants. Chen (5) reported that Ephedra plants were used by the Chinese since fifty centuries by making an infusion of green twigs as a tea for improving circulation by increasing blood pressure, promoting perspiration, reducing fever and as sedative for those afflicted by persistent coughing. Nagai and Hari (1) isolated for the first time the pure alkaloid and appropriately enough called it "Ephedrine". According to Chopra (6) ephedrine contents in samples collected from July to September from different localities of Baluchistan varies in ephedrine percentage from 0.9–1.12%. Maximum ephedrine percentage were found in samples collected from Shingar during the month of October or November.

Qazalbash (11) reported that *Ephedra nebrodensis* growing abundantly in Baluchistan on hills under the partial shade of Juniper trees at an altitude of 2100 – 2700 meters contain higher percentage of Ephedrine. The author further stated that Ephedra twigs collected at proper time of collection, exact altitude, definite locality and correct method of drying, storage and packing showed a high yield of alkaloids about 2.5% of total alkaloid. Chaudhry (4) reported that altitude has very profound effect on the growth of *Ephedra nebrodensis*. At an elevation of 6500 feet it is normal to find shrubs five to six feet tall but at higher altitude the plants are usually between one to two feet in height with more slender branches due to short growing period and excessive cold.

Burkill (3) reported that *E. nebrodensis* is widely distributed throughout the hilly areas of Baluchistan. Wright (13) reported that Quetta factory process each year between 25,000 to 30,000 maunds of Ephedra herb and further stated that an average 20,000 pounds of ephedrine hydrochloride is exported per annum, also small quantities of ephedrine alkaloid and sulphate and apart from Pseudo – ephedrine for which there is an increasing demand.

Qazalbash (11) compared the ecological, external and morphological characters and chromosome numbers of *Ephedra nebrodensis* and *E. gerardiana* and proved that *E. nebrodensis* is a distinct specie bearing higher alkaloidal contents as compared to *E. gerardiana*. He confirmed the findings of Bassier, Stapf, Fischer, Mayer, Florin, and Andreanszky, Mehra, Gupta, Ball, Shah and Nasir. The author further stated that the two main species growing in Baluchistan are *E. nebrodensis* Tino var *procera* Stapf and *E. intermedia* Scherenk and Meyer. Qazalbash disputed Hocking contention that Baluchistan Ephedra is *E. gerardiana*. The author further reported that the best time of collection of Ephedra twigs is from October to middle of December when the alkaloidal contents are high and suggested a rotation of five years for harvesting the ephedra twigs as the plant requires time and energy for synthesizing and storing the accumulated surplus as a reserve.

Khattak (8) stated that Ephedra is harvested on a three years rotation which is fixed empirically because the silviculture of the plant has not been thoroughly studied so far. Zaman *et al* (14) reported that 0.18 million kg of Ephedra is being collected by the Forest

Department of Baluchistan.

In a recent publication E. Nasir, (10) has recorded nine species of Ephedra from Pakistan and mentioned that *E. nebrodensis*, *E. procera* F & M previously known as *E. nebrodensis* Tineo var *procera* F & M. Stapf while Indian authors call it *E. major*. Qazalbash (11) reported that all the species of Ephedra found in Pakistan contains ephedrine except *E. foliata* which is usually found in plains. Malik & Imam (9) reported that *E. nebrodensis* contain 0.8 – 2.0% ephedrine. Hu (7) described the salient features of new Chinese materia medica and reported the entire plant of Ephedra including the roots is used. However, the medicinal properties of aerial portion and those of the roots are said to be opposite to each other. Taylor (12) reported it is now almost routine to inject with procaine a certain amount of ephedrine and in prolonged operations where the fall in blood pressure might become dangerous, another injection of ephedrine may be obligatory. Ephedrine has beneficial effect upon spasm of asthma and is widely used in these emergencies.

Method of Survey

1. The natural habitat of *E. nebrodensis* is dry temperate zone and the plants generally grow at an elevation from 2100 – 2700 meters in five forest divisions of Baluchistan i.e., Quetta, Sibi, Zhob, Loralai and Qalat forest divisions.
2. *E. nebrodensis* yields more ephedrine contents as compared to other species of ephedra, therefore the collection of twigs was confined to *E. nebrodensis* species only.
3. Before collection, altitude, aspect, colour of twigs, condition of soil and date of collection were noted on the tags of individual samples.
4. Three samples each of 300 – 400 gm. of green twigs were collected during the year 1971 from plants selected at random from the same locality in the months of May and October in different Forest divisions of Baluchistan.
5. The samples were tagged and dried in shade to record the loss of moisture from the twigs, weight of dry matter was recorded to compare the ratio of dry matter and ephedrine contents.
6. The dried samples were sent to Marker Alkaloid, Quetta and Chemistry Branch, Pakistan Forest Institute, Peshawar for chemical analysis. The samples collected in the month of May were analysed by the Chemistry Branch, Pakistan Forest Institute, Peshawar and the samples collected in the month of October were analysed by Marker Alkaloid, Quetta.

Presentation of Data

Data of chemical analysis and information collected on the altitude, aspects, colour of twigs and conditions of soil are presented in Table I and II.

Discussion

Table I and II reveal that samples having highest ephedrine contents were obtained from Batsargi, Koshki, Hindu Bagh, Surghund and Raud Mulazai areas. Ephedra twigs on drying lost moisture to the extent of 30 percent in samples collected in May, while the loss of moisture was 21 – 24% in samples of twigs collected in the month of October. It was also observed that ephedrine contents were higher in the samples which were collected from humous soil as compared to stony and dry soil. Colour of the twigs had no significant effect on the ephedrine contents of the samples. Samples collected from altitute ranging between 2300 – 2400 meters and having Northern and North Western aspects and from hill tops gave higher percentage of ephedrine contents. Results of chemical analysis revealed that samples of Ephedra twigs collected in the month of October were found to have higher ephedrine contents. It was observed that Shingar, Raud Mulazai, Hindu Bagh area have higher frequency and more vigorous plants of Ephedra. Keeping in view the importance of psudo-ephedrine it would be advisable to exploit these far flung areas. The transportation cost can be reduced considerably if the bulk of the raw material is minimised by supplying ephedra in well pressed bales or better still in powdered form as suggested by Qazalbash.

Conclusion

Localitywise survey of Ephedra plants conducted to judge the higher ephedrine yielding forest areas of Baluchistan has shown that Koshki, Batsargi, Hindu Bagh, Surghund and Raud Mulazai are the localities bearing Ephedra plants having higher ephedrine contents. Quantitative survey of Ephedra plants conducted earlier has revealed that areas like Chautair, Batsargi, Koshki, Kachmangi have lesser frequency of Ephedra bushes as compared to Shingar, Raud Mulazai, Hindu Bagh due to overcutting. It would be advisable that ephedra twigs may be collected from the areas having higher percentage of ephedra bushes inspite of the fact that the ephedrine contents may be less in such bushes. This measure would provide sufficient regeneration period to the ephedra plants growing in areas where they have already become scarce.

Chemical analysis of twigs also confirmed Qazalbash findings that October and November are the best months for the collection of ephedra twigs as the plants get sufficient time for the accumulation of alkaloides, healthy growth as compared to May.

Acknowledgements

The authors acknowledge with thanks the help and facilities provided by the Conservator of Forests and Divisional Forest Officers of Baluchistan to the staff of Medicinal Plants Branch, Pakistan Forest Institute, Peshawar for carrying out this survey. We are also indebted to Marker Alkaloids and Forest Chemist, Pakistan Forest Institute, Peshawar for chemical analysis of the samples.

TABLE - I

Results of chemical analysis of *Ephedra nebrodensis* species collected from different forest blocks of Baluchistan in May, 1971

S.No.	Forest Division	Forest Blocks	Date of collection	Height	Slope	Colour	Fresh weight (grams)	Dry weight (grams)	Ephedrine percentage	Soil
1.	Zhob	(i) Shinghar (ii) Hindu Bagh	21-5-71 19-5-71	2387 m. 2420 m.	Hill top Northern	Brown Greyish	300 300	205 200	0.86 0.81	Reddish soil with little humous Stony soil with little humous.
2.	Sibi/Ziarat	(i) Khushnub (ii) Koshki (iii) Batsargi	16-5-71 16-5-71 15-5-71	2350 m. 2670 m. 2500 m.	Southern N. West Hill top	Green Green Brown	300 300 300	202 200 212	0.85 1.14 1.07	Stony Stony Stony (under complete juniper tree shade).
3.	Quetta/Pishin	(i) Northern Zarghun (ii) Raud Mulazai (iii) Wali-Tangi	14-5-71 15-5-71 14-5-71	2170 m. 2350 m. 2400 m.	Northern Northern Northern	Green Green Green	300 300 300	205 207 210	0.77 0.92 0.85	Soil stony with small humous. Stony soil with small humous. Soil stony with small humous.
4.	Loralai	Surghund	17-5-71	2350 m.	Southern	Green	300	211	0.87	Stony.

TABLE - II

Results of chemical analysis of *Ephedra nebrodensis* samples collected from different forest blocks of Baluchistan in October, 1971

S.No.	Forest Division	Forest Blocks	Date of collection	Height	Slope	Colour	Fresh weight (grams)	Dry weight (grams)	Ephedrine percentage	Soil
1.	Zhob	(i) Shinghar (ii) Hindu Bagh	27-10-71 26-10-71	2509 m. 2405 m.	Western Hill top	Green Green	400 382	304 296	0.80 1.03	Dry soil under juniper tree shade. Humous soil.
2.	Sibi/Ziarat	(i) Khushnob (ii) Koshki (iii) Batsargi	31-10-71 24-10-71 24-10-71	2225 m. 2342 m. 2400 m.	Western Hill top Northern	Green Greyish Green	380 381 399	303 303 334	0.57 0.90 1.12	Dry stony soil. Stony humous soil. Humous soil.
3.	Quetta/Pishin	(i) Northern Zarghun (ii) Raud Mulazai (iii) Wali-Tangi	22-10-71 25-10-71 22-10-71	2300 m. 2308 m. 2250 m.	Southern North Western Eastern	Brown Brown Green	381 379 370	304 308 286	0.59 1.00 0.62	Soil dry and stony. Do. Soil dry and stony.
4.	Loralai	Surghund	25-10-71	2307 m.	Northern	Green	382	296	1.03	Stony humous.

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