



Premature harvesting of wild Musli (*Chlorophytum borivillianum*, Baker) and its impact on raw material quality: A case of Katni forest division, Madhya Pradesh

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Abstract : Katni is a major raw medicinal plant market of Central India. An attempt has been made to find out prevalent harvesting method of Musli (*Chlorophytum borivillianum*) and visual inspection of raw (dry) market samples collected from Katni market. Musli tubers were found adulterated both intentionally and unintentionally by various stakeholders in the market. The stakeholders adopted malpractices like selling similar looking *C. tuberosum*, *C. arundinaceum* species of musli along with genuine (*C. borivillianum*) material and occasionally dried roots of different species. Major reasons for poor quality in the study area are premature root harvesting, mis-identification of species, mixing of similar looking species etc. The study recommends that harvesting should be done after maturation (November) and awareness about species identification, processing among various stakeholders is required.

Keywords: Harvesting, Musli, *Chlorophytum borivillianum*, Adulteration, Raw material

INTRODUCTION

Musli (*Chlorophytum borivillianum*) belongs to family Liliaceae, is a herb naturally occurs in forests of Gujarat, Madhya Pradesh and Maharashtra States, and listed in the endangered species of India. Roots are used for the preparation of nutritive tonic used in general sexual weakness. These roots contain 25 alkaloid, vitamins, saponins, steroids and proteins. It is also used in cough, piles, arthritis jaundice, diabetes and urinary diseases (Kirtikar and Basu,1984). Hundreds of species are now threatened with extinction because of over-harvesting, unscientific collection techniques, and conversion of traditional plant habitats to crop-based agriculture. Several studies have been made regarding quantitative and qualitative reduction of medicinal plants due to their over exploitation (Mishra, 2000;Mishra and Kotwal, 2003; Mishra *et al.*,2003 and Mishra and Kotwal, 2007). Premature collection, uprooting of whole plant before fruiting and competition among villagers to collect entire produce are the main reasons for sharp decline in the availability and production of few medicinal plants in the natural forests. It has been recommended that the collection before maturation should not be permitted so as to maintain the raw material quality (Prasad *et al.*,2002 and Prasad *et al.*, 2003).

At present most herbal raw materials are still harvested or wild crafted under completely uncontrollable conditions

(Lange,2004). It has been observed that not only the various species of particular genus but entirely different taxa are being sold under the same vernacular name (Vasudevan *et al.*,1983; Puri and Jain,1988; Tewari, 1991; Rawat *et al.*,1996 and Saraswathy,2001). Adulteration in market samples is one of the greatest drawbacks in promotions of herbal products from India (Dubey *et al.*, 2004). The means of adulteration and substitution may be deliberate or sometimes unintentional (Mitra and Kannan,2007). Owing to various problems related with quality of raw produce, an attempt has been made to examine the current harvesting practices of musli, impacting raw material quality and prevalent malpractices adopted by different stakeholders in the Katni market.

MATERIALS AND METHODS

Survey of Gatherers (collectors): A field survey of Katni forest division was done during the year 2007-08 with the help of semi structured questionnaire. Method adopted by plant collectors to harvest roots from the natural forest was closely examined at the time of harvesting. Total of three forest ranges were selected for collecting data. Persons involved (15% House Holds) in each forest range were interviewed about the time, methods and the tools used in harvesting.

Survey of market traders: These were surveyed to get

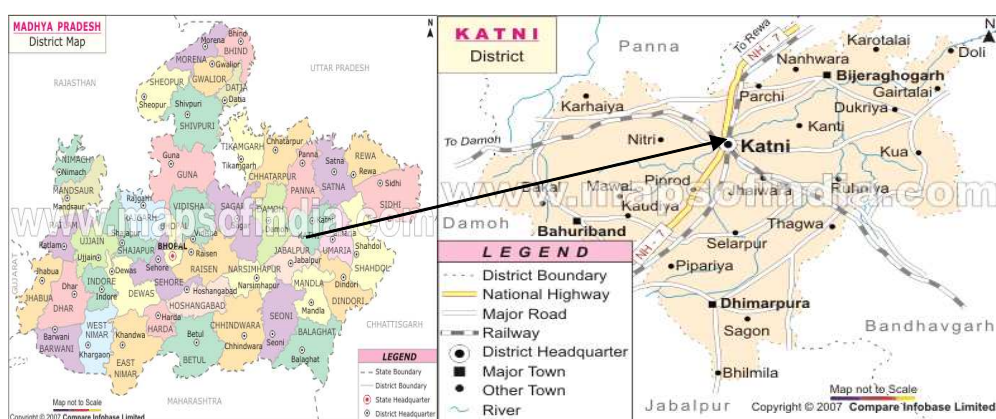


Fig. 1. Map of study area. (Source: www.mapsofindia.com//mp/katni)

an idea of quality of raw material, the substituted species, their name, different malpractices adopted by the traders/stakeholders in the local market etc. Traders exclusively selling raw medicinal plants in the local market were chosen randomly for present study. Out of total twelve (12) traders, four (04) were surveyed (33%) with the help of pre designed questionnaires.

cleaning, peeling of root skin etc. was done. Drying was done under open sunlight conditions by spreading roots on plastic sheet. The raw (dry) material was then packed in polybags and kept under room condition till further analysis. Ocular evaluation was done by using scientific weighing balance, power lens etc.

Table 1. Grading criteria of musli (*C. borivilianum*) dry root sample.

S No.	Sorting under different categories / grades	Details of grades, specifications.
1.	Good quality (Grade- I)	White, bright in color, thick, more hardy, even shape, size is long, light sweet taste, no fungal spot.
2.	Average quality (Grade- II)	Dull white, yellowish, soft, thin, small size, some skin is attached with fingers, fungal/black spots.
3.	Species infected by fungus, insect	Roots affected by fungus, insect, microbial contamination etc.
4.	Other species/ Adulterants found	Totally different species from genuine species.

Visual (Organoleptic) inspection of dry forest and market samples: Visual inspection was done on one kilogram raw roots (dry) procured from trader as well as forest on the basis of different morphological parameters or grades. Their average values were given in the corresponding tables. After sorting of the raw (dry) material, various grades were made (Table-1).

Method of sample collection

Forest (Master) sample: Out of total five forest ranges in Katni forest division, three ranges namely- Bahuriband, Dhimarpura and Bijayraghogarh were selected for master (control) sample collection. Musli plants in each forest range were identified and protected against anthropogenic factors like cattle, immature harvesting by locals etc. Fresh tubers were collected manually (1-2 kilogram in each range), after maturity time i.e. in the month of November. They were collected by the team members with the help of forest department staff, villagers etc. Thorough washing of roots,

Market sample: Traders selling raw Musli tubers were identified through local market survey of the district. One kilogram of raw (dried) roots was procured from four selected traders. At the time of purchase, the traders were asked to provide fresh and good quality roots, preferably collected from the native forest areas. The material (dry) was purchased during the harvesting season, to minimize error like old stocked material etc.

The identification and documentation of adulterated species and other chaff material was done with the help of taxonomist, botanists and consulting flora, secondary literature etc. Besides this, local Vaidyas, forest department officials and medicinal plant experts were also consulted.

RESULTS AND DISCUSSION

Prevalent harvesting practice of musli : The harvesting process begins when the middlemen comes and distribute the advance as loan before the first shower (June). The tuber harvesting starts in 3rd week of August in the forest

and completed in the first week of September. After collection, the gatherers used to sell the wet material to middleman. The gatherers were reluctant to process the wet musli due to laborious processing method. Value addition, processing etc. was done mostly by the traders/middleman. Wet musli tubers were thoroughly washed by water to remove soil etc. After boiling of water the disc with fingers were dipped (for 1 to 2 second) to detach skin from the fingers. Each finger was removed from disc and rubbed on the rough surface or on the gunny bags. After removal of skin the musli is dried on the roof of their houses (semi built). The drying process and storage conditions were prone to the fungal attack.

It was observed that mostly gatherers collect *C. tuberosum* and *C. arundinaceum* species in the name of musli (*C. borivilianum*) from the natural forests. Both the species were found profusely growing in this district. It was also noted that the density of commercial variety *C. borivilianum* is almost negligible in the study area. The gatherers usually collect immature and small sized tubers from the nearby forests before fruiting. Mostly they uproot whole plant from the ground without leaving seed for future regeneration. The immature extraction of fruits, rhizomes, tubers etc has drastically reduced the quality as well as quantity of the raw product to the below critical level. Prasad *et al.* (2002) while working in the forest of central India found that due to increasing demand, high rate and unscientific harvesting, musli (*C. borivilianum*)

has fallen into critically endangered category and restricted to limited patches. The unripe harvesting, poor regeneration, low density and tuber yield and competition among collectors lead to extinction of this species in the forest. A number of studies on sustainable harvesting, value addition, processing of important medicinal plants also revealed that due to unripe collection, the yield per plant and quantity and quality of raw material was declining (Prasad *et al.*, 2002; Prasad *et al.*, 2003; Mishra, *et al.*, 2003 and Mishra and Kotwal 2007). Later on Mishra and Kotwal (2004) in a study suggested that musli (*C. borivilianum*) should be allowed to mature (November) and thereafter disc with few tubers should be left for future regeneration. Also, organized and scientific collection through Joint Forest Management Committees (JFMCs) can reduce the pressure on natural forests thereby increasing the raw material quality.

Prevalent malpractices in the local market : The data depicted in Table-2 shows results of visual inspection of samples collected from natural forest and traders of the study area. It is clear from the data that maximum proportion (99.0% or 990 gm./kg) of good quality roots was found in samples collected from natural forests. On the contrary, very less proportion (Avg.32.6% or 326.5 gm./kg) of good quality roots was noted in the samples collected from market traders, followed by second grade(Avg.220.5 or 22%). Trader no.2 and no.3 were selling other similar

Table 2. Visual inspection of raw (dry) musli under various grades, collected from natural forest and local market of Katni.

Sample	Good quality (Grade-I) (gms./kg)	Avg. quality (Grade-II) (gms./kg)	Root infected by fungus, insects (gms./kg)	Adulterant/ Other species* (gms./kg)	Chaff matter (gms./kg)	Soil and sand (gms./kg)
Forest/master sample collected from natural forests of Katni division, processed under lab						
Forest/ Control(Avg.)	990.00±0.22 (99.0%)	Nil	02.00 ±0.31 (0.2%)	Nil	05.00±0.11 (0.5%)	03.00±0.17 (0.3%)
Market samples collected from local traders						
Trader-1	432.00 ±0.33 (43.2%)	260.00 ±0.49 (26.0%)	108.00 ±0.34 (10.8%)	91.00 ±0.56 (9.1%)	40.00 ±0.22 (4.0%)	69.00 ±0.23 (6.9%)
Trader-2	130.00 ±0.73 (13.0%)	109.00 ±0.56 (10.9%)	28.00 ±0.73 (2.8%)	706.00 ±0.71 (70.6%)	14.00 ±0.73 (1.4%)	13.00 ±0.73 (1.3%)
Trader-3	305.00 ±0.34 (30.5%)	115.00 ±0.76 (11.5%)	10.00 ±0.66 (1.0%)	530.00 ±0.23 (53.0%)	10.00 ±0.34 (1.0%)	30.00 ±0.45 (3.0%)
Trader-4	439.00 ±0.45 (43.9%)	398.00 ±0.67 (39.8%)	100.00 ±0.21 (10.0%)	10.00 ±0.56 (1.0%)	23.00 ±0.23 (2.3%)	30.00 ±0.26 (3.0%)
Traders Avg.	326.50 (32.6%)	220.50 (22.0%)	61.50 (6.5%)	334.25 (33.4%)	21.75 (2.2%)	35.50 (3.5%)

*=Roots of *C. tuberosum*, *C. arundinaceum*, Apamarg (*Achyranthus aspera*), Semal (*Bombex ceiba*).

species of musli hence, amount of adulterant species was recorded more (Avg.33.4% or 334.25 gm./kg.) in samples collected from local market. On the other hand, no adulterant was recorded in the samples collected from forest (control). The proportion of diseased roots was recorded more (Avg.6.5% or 161.50 gm./kg.) in market samples in contrast with very less in forest samples (Avg.0.2%). However, less amount of soil, sand was observed in forest (Avg.0.3%) in comparison with market samples (Avg.3.5%).

appearance of roots and fail to differentiate from genuine species. Major reasons for adulteration in the study area are premature root harvesting, mis-identification of species, mixing of similar looking species etc. The present paper suggests some measures to prevent adulteration in raw (dry) musli in the market.

(A) For Plant collectors: The harvesting of Musli should be done after maturation (November onwards) and disc with few tubers should left necessarily. Time and method

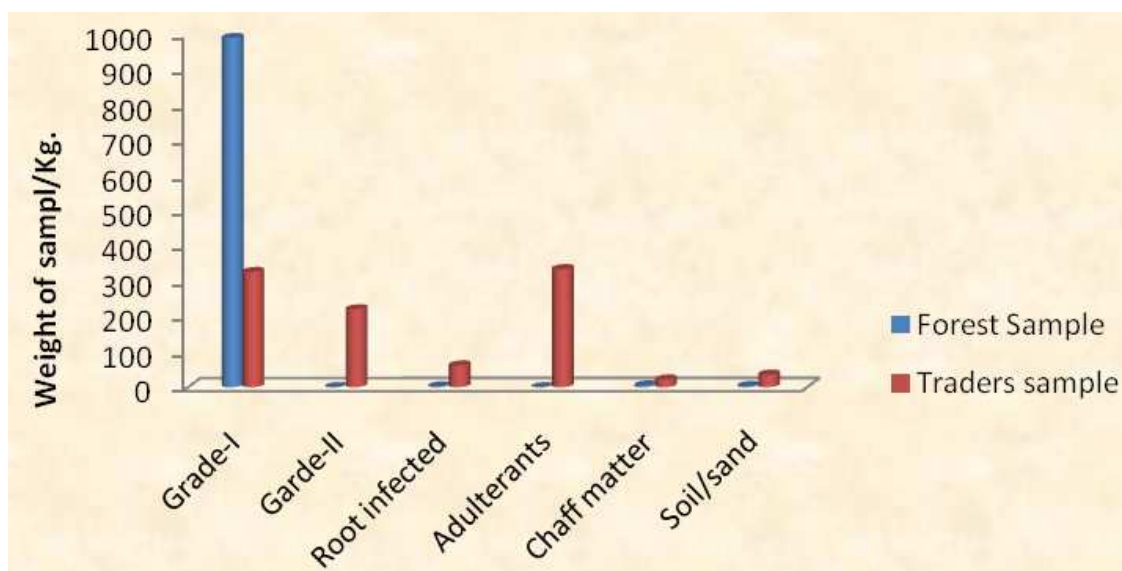


Fig. 2. Different grades found in raw safed musli root collected from forest and local market of Katni district

Market sample analysis: Few of the stakeholders in the local market mixes entirely different roots like Apamarg (*A. aspera*), Semal (*B. ceiba*) in the genuine material. Results of market samples show that traders mix roots of entirely different species and similar looking musli as adulterants. Whereas no such anomaly was observed in the samples collected from adjoining natural forest. Presence of adulterants and similar looking roots (approx.33.4%) in the market samples indicates poor raw material quality. However, two traders were found selling similar looking (*C.tuberosum*, *C. arundinaceum*) roots of Safed Musli (*C.borivilianum*). Few scientists also observed that in herbal markets of the country, two or more different species are being sold in the markets (Rawat, 2005; Mitra and Kannan, 2007).

Conclusions

Adulteration is not a common practice in all the medicinal species marketed at Katni. It was noted that Musli is the costliest among other medicinal plants in the local market. However, substitution was found more intense only during the less production and availability from the natural forests. End users are generally unaware about the similar

of harvesting should be organized by forest deptt., or through JFMCs and training should be given for proper identification of species, drying, processing etc. Besides this, systematic programs are required to be undertaken for creating awareness at field level.

(B) For Traders: Handling and processing of roots i.e. cleaning, drying and storage should be carried out by trained personnel.

(C) For Ayurvedic Industry: The Pharmacists are advised to contact the manufacturers directly if they are in any doubt about the pharmaceutical quality of raw Musli. Certification by the authorities (like G.Os, NGOs) for raw material can immediately promote to encourage 'quality' awareness in industry and amongst consumers.

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REFERENCES

- Dubey, N.K., Kumar, R. and Tripathi, P. (2004). Global promotion of herbal medicine- India's opportunity. *Current Science*, 86(1):37-41.
- Kirtikar, K.R. and Basu, B.D. (1984). *Indian Medicinal Plants*. Vol. 1 and 2, Allahabad, (UP), India.
- Lange, D. (2004). Medicinal and Aromatic Plants: Trade, Production, and Management of Botanical Resources. In: Ed. Cracker, L. E., Simon, J. E., Tatisatieur, A and Lewinsohn, E. XXIV International Horticulture congress. The future of Medicinal and Aromatic Plants Toronto, Canada: ISHS Acta Horticulturae. pp: 177-197.
- Mishra, M. (2000). Harvesting practices and management of two critically endangered medicinal plants in the natural forests of central India. In: Harvesting of Non wood Forest Products. Publ. FAO-ECE-ILO, Menemen-Izmir, Turkey. pp. 335-341.
- Mishra, M. and Kotwal, P. C. (2003). Sustainable management of some critically endangered species of medicinal plants in central India. Draft Research Project report submitted to Indian Institute of Forest Management, Nehru Nagar, Bhopal (M.P.) India. pp. 1-105.
- Mishra, M. and Kotwal, P. C. (2004). Ecological status of rare and important medicinal plant Kali musli (*Curculigo orchoides*) in the tropical forests of central India. *Vaniki Sandesh*. 28 (2 & 3):16-23.
- Mishra, M. and Kotwal, P. C. (2007). Harvesting decline and economics of Baichandi (*Dioscorea daemonia*) in the natural forests of central India. *Flora and Fauna*. 13(2):243-248.
- Mishra, M., Teki, S. and Mishra, R., P. (2003). Sustainable harvesting, value addition and marketing of selected Non timber forest products: A case study of Koraput, Malkangiri Districts, Orissa. Project report submitted to RCNEAB, Regional center, Indian Institute of Forest Management, Bhopal (M.P). pp:1-120.
- Mitra, A. and Kannan, R. (2007). *A note on unintentional adulterations in Ayurvedic herbs*. Retrieved December, 2007 from www.siu.edu/~ebl/leaflets/kannan.htm.
- Prasad, R., Kotwal, P.C. and Mishra, M. (2002). Harvesting practices of Safed musli (*Chlorophytum spp.*) and its ecological impact on the natural forests of central India. *Journal of Tropical Forestry*, 18(1):9-24.
- Prasad, R., Kotwal, P.C. and Mishra, M. (2003). Harvesting practices of *Buchanania lanzan* fruits and its impact on the fruit and seed quality. *Vaniki Sandesh*. 27(4):9-24.
- Puri, H.S. and Jain, S.P. (1988). *Ainsliaea latifolia*: an adulterant of *Podophyllum*. *Planta Medica*, 54:269.
- Rawat, A.K.S., Mehrotra S. and Shome, U. (1996). Comparative pharmacognostic studies of *Abies spectabilis* and *Taxus wallichiana*. *International Journal of Pharmaceutics*. 34 (5): 378-383.
- Rawat, R. K. S. (2005). Importance of quality control of raw material in Ayurvedic medicine. In Proceed. of Herbal medicine, phytopharmaceuticals and other natural products: Trends and advances. Held at I.O.C., Ceylon, Sri Lanka on 15-17, June 2005.
- Saraswathy, A. (2001). Adulterants and substitutes in Ayurveda. *Sachitra Ayurved*. 54(1): 63-66.
- Tewari, N.N. (1991). Some crude drugs: source, substitute and adulterant with special reference to KTM crude drug market. *Sachitra Ayurved*. 44(4): 284-290.
- Vasudevan, N., Yoganarasimhan, K.R., Kehava, M. and Shanta, T.R. (1983). Studies on some south Indian market samples of Ayurvedic drugs II. *Ancient Science of Life*, 3(2): 60-66.