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Research Paper

Quantification of trade in medicinal and aromatic plants: In and from Kashmir Valley of India

Danish Muzaffar Charoo, Ishtiyak Ahmad Peerzada*, Malik Masroor, Sabreena Shabir, P.A. Sofi, Tahir Mushtaq, Nazir A.Pala, A.R. Malik, Bilkees Ayoob, Jauhar Rafeeq

Faculty of Forestry, Sher-e-Kashmir University of Agricultural Sciences of Technology of Kashmir, Benhama, Ganderbal, 191 201, Jammu and Kashmir (India)
*e-mail: *drishtiyak@skuastkashmir.ac.in*

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ABSTRACT

This study aims to enhance comprehension regarding the volume and value of trade in medicinal and aromatic plants (MAPs) originating from the Kashmir valley. The study was conducted through a structured survey employing meticulously crafted questionnaires. The study gathered data on various aspects including the number of traders engaged in MAPs trade, types of plant parts traded, sources of collection, quantities imported and exported, rates per kilogram, and the revenue generated from these transactions. A total of 12 traders were found to be engaged in the trade of twenty medicinal and aromatic plant species, facilitating the trade of 79.33 tons of MAPs valued at 887.52 Lakhs. Notably, Atees (*Aconitum heterophyllum*), Kutki (*Picrorhiza kurroa*), and Wanwagun (*Podophyllum hexandrum*) were among the most traded species, accounting for 9.9, 6.94, and 6.3 tons, respectively. The trade's cumulative value peaked with guchii (*Morchella esculenta*) and Atees (*Aconitum heterophyllum*), generating revenues of 456.5 and 208.2 Lakhs, respectively.

Key words: NTFPs, Botanicals, Export, Import, Kashmir, Traders

The global health care paradigm is shifting from focusing solely on treating illness to emphasizing wellness and prevention, along with early diagnostics, and transitioning from a generalized approach to personalized medicine. Alternative medicines are gaining prominence in the global health market, driven by the increasing popularity of nature-based products. These products are believed to have fewer side effects compared to modern medicines and are perceived as more cost-effective, contributing to the growth of this market segment (Ekor, 2014). Medicinal and aromatic plants (MAP's), a subset of non-timber forest products (NTFPs), are offered in a wide variety of products, from crude materials to processed and packaged products like pharmaceuticals, herbal remedies, teas, spirits, cosmetics, sweets, dietary supplements, varnishes and insecticides (Shackleton and Shackleton, 2004). The use of botanical raw material is in many cases much cheaper than using alternative chemical substances. As a consequence, there is an enormous demand in botanicals – for domestic use and for commercial trade – resulting in a huge trade on local, regional, national and international levels. According to the International Union for Conservation of Nature (IUCN) and the World Wildlife Fund (WWF), there are between 50,000 to 80,000 flowering plant species used for medicinal purposes worldwide. Among these, about 15,000 species are threatened with extinction from overharvesting and habitat destruction and 20 % of their wild resources have already been nearly exhausted with the ever increasing human population and consequent plant consumption (Gautam *et al*., 2020). This threat has been known for decades, but in recent times the fast paced loss of species and habitat destruction worldwide has increased the risk of extinction of medicinal plants, especially in China, India, Kenya, Nepal, Tanzania and Uganda (Chen *et al*., 2016). A study conducted by Goraya and Ved, (2017) revealed that nearly 90% of the medicinal plants used by local communities in India are sourced from the wild. This study also revealed that approximately 72% of the medicinal plant species and 50% of the annual quantities consumed as herbal raw drugs by the domestic herbal industry are also sourced from the wild. This high demand for herbal drugs has led to rampant collection of MAPs from the wild, leading to depletion of biodiversity. For instance, the western belt of the Himalayas (in India and Nepal) has seen

depletion of medicinal herbs like *Nardostachys grandiflora* that is profusely harvested for extraction of sesquiterpenes found to exhibit anti-malarial, antinociceptive, and cytotoxic activity and enhance the action of nerve growth factor (Cheng *et al*., 2013). Similarly, numerous other critically endangered MAP's including *Aconitum heterophyllum*, *Taxus wallichiana*, *Dactylorhiza hatagirea*, *Polygonatum verticillatum*, *Gloriosa superba*, *Arnebia benthamii*, and *Megacarpoea polyandra* are overexploited for their therapeutic potential (Padalia *et al*., 2015; Maikhuri *et al*., 2017). As the production of botanicals still relies to a large degree on wild-collection, profound knowledge of trade, size, structure and streams as well as of commodities, traded quantities and their origin is essential for assessing its impact on the plant populations concerned. However, there are very few studies that quantify the volume and value of medicinal and aromatic plants (MAP's) traded from Kashmir valley. The in-depth trade studies conducted at the district level in the Kashmir valley aid in comprehending the livelihood implications, assessing the economic contribution of medicinal and aromatic plants to the local economy, and crafting targeted strategies for local development and conservation efforts.

MATERIALS AND METHODS

Description of study area: The study was conducted in the Kashmir division of UT J&K, which is located in the northwestern part of the Himalayan mountain arc in India, between altitudinal ranges of 220 to 8611 m (amsl). Geographically the division lies between 32° 16′to 34° 49′ latitude and 73° 44′-76° 46′ longitude. It has a total population of 1226701 and a geographic area of 42,241 km^2. Owing to its characteristic climate, altitudinal variations and conductive growing environment, the region is endowed with rich and spectacular diversity of medicinal and aromatic herbs of promising health and economic benefits.

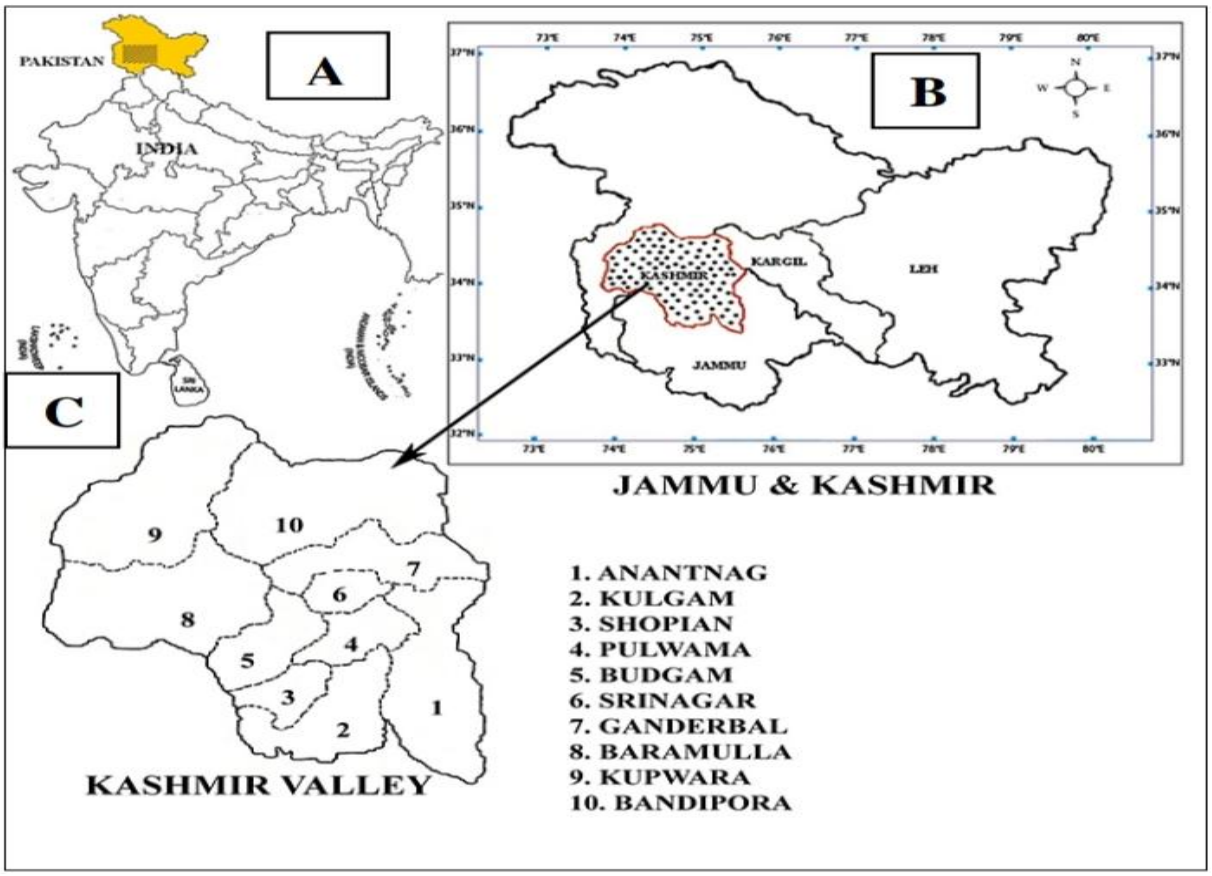


Fig. 1: A-C: (A) Map of India indicating the UT of Jammu and Kashmir, (B) Map of Jammu and Kashmir indicating Kashmir valley and (C) Map of Kashmir valley indicating the sampled districts (Source: Sharma and Sharma, 2018)

The present study was carried out in ten districts (Shopian, Anantnag, Pulwama, Bandipora, Baramulla, Srinagar, Budgam, Kulgam, Kupwara and Ganderbal) of Kashmir division during 2021-22. The districts were surveyed to collect the data from traders who are in direct trade with medicinal and aromatic plants. The study involved

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interaction with traders and with the help of well structured questionnaires, the actual export and import of medicinal plants; rate/kg and revenue generated in the Kashmir valley were obtained.

RESULTS AND DISCUSSION

An overview of the volume of trade in medicinal and aromatic plants in and from Kashmir valley is provided in Table 1. The annual total trade is estimated at 79.33 tons from twenty medicinal and aromatic plant species. The roots of *Picrorhiza kurroa* were traded in highest volume (9.9 tons), followed by *Aconitum heterophyllum* (6.94 tons), *Podophyllum hexandrum* (6.3 tons), *Morchella esculenta (5.7 tons), Valeriana jatamansi* (5.48 tons), *Cuscuta reflexa* (5.33 tons) and *Brassica nigra* (5.2 tons). These species together make up 57% of total volume (Fig. 1). Earlier study of Peerzada *et al*. (2021) reported the trade and economics of around 20 medicinal plants including *Morchella esculenta, Aconitum heterophyllum,* and *Trillium govanianum,* and *Saussurea lappa* from Kashmir valley etc. Gangoo *et al*. (2017) also reported *Podophyllum hexandrum* as the highly traded species in Kashmir valley.

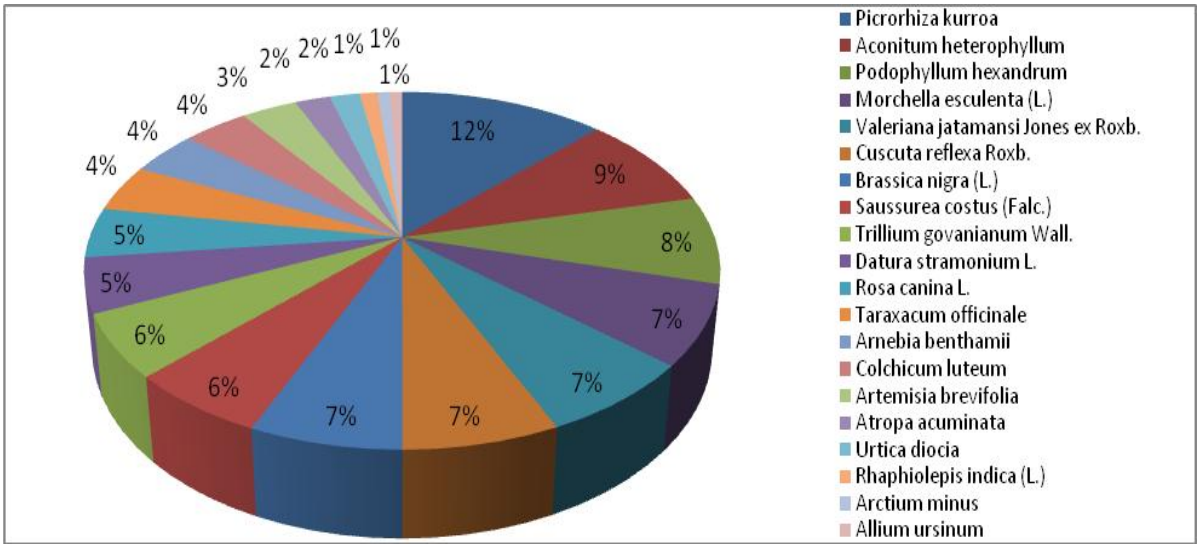


Fig. 1: Medicinal plants traded in Kashmir valley during 2021-22

In 2021/22, the cumulative value of trade recorded was 887.52 Lakhs. The trade value was highest for *Morchella esculenta* (456.5 Lakhs) followed by *Aconitum heterophyllum* (208.2 Lakhs) and *Picrorhiza kurroa (64.35 Lakhs). Morchella esculenta* was the most expensive MAP (8000/Kg) traded in and from Kashmir valley (Table-2; Fig-2). Pyakurel *et al.* (2017) also found highest trade value for Morchella esculenta in western Nepal.

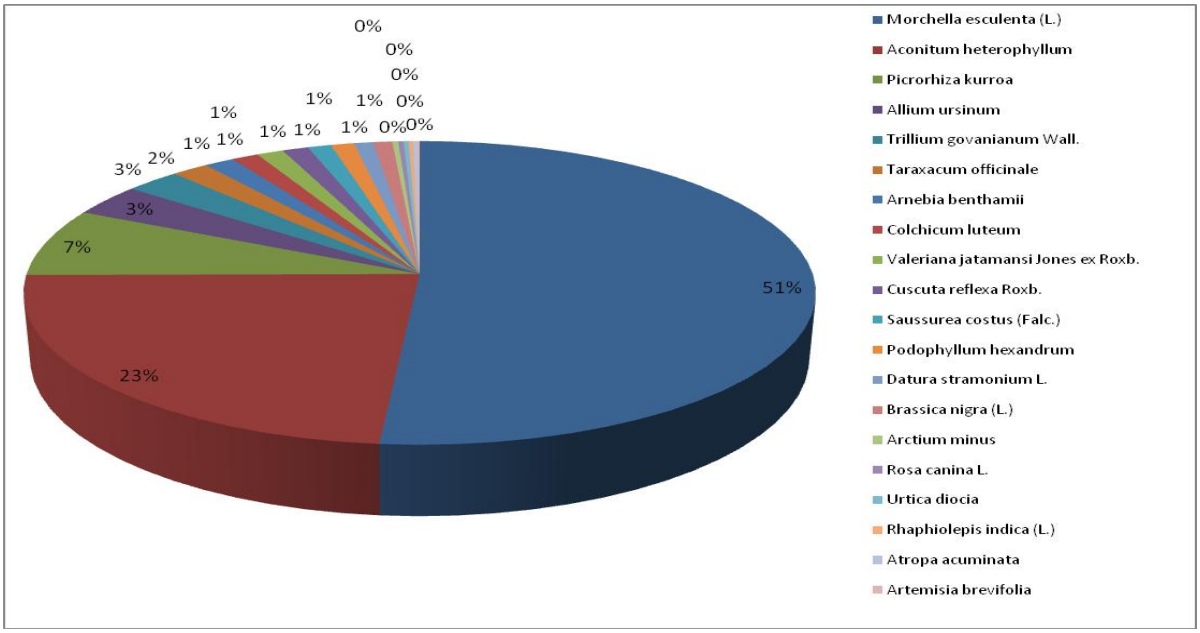


Fig. 2: Revenue generation from trade of medicinal plants during the year 2021-2022

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Table 1: Medicinal plants traded in Kashmir valley during 2021-22

S. No.	Scientific Name	Common Name	Part Traded	Family	Habit	Rate Rs/kg	Qty. sold (Ton)	Revenue generated (Lakhs)
1.	*Aconitum heterophyllum* Wall. Ex Royle	Patrees	Roots	Ranunculaceae	Biennial herb	3000	6.94	208.2
2.	*Allium ursinum* Linn.	Ramson or Bear's garlic	Bulbs	Amaryllidaceae	Perennial herb	5000	0.6	30
3.	*Arctium minus* - (Hill.) Bernh.	Lesser Burdock	Roots	Asteraceae	Biennial herb	400	0.6	2.4
4.	*Arnebia benthamii* (Wall. ex G. Don) I.M. Johnst.	Gaozaban	Roots	Boraginaceae	Perennial herb	380	3.23	12.27
5.	*Artemisia brevifolia* Wall. Ex DC	Short leaved worm wood	Leaf & stem	Asteraceae	Subshrub	40	2.68	1.072
6.	*Atropa acuminata* - Royle. ex Lindley.	Indian Belladonna	Root	Solanaceae	Perennial herb	100	1.7	1.71
7.	*Brassica nigra*(L.) W.D.J.Koch	*Black mustard*	seeds	*Brassicaceae*	Annual herb	150	5.2	7.8
8.	*Colchicum luteum*Baker	*Suranjan*	Corms and seeds	*Liliaceae*	*Perennial herb*	350	3.15	11.025
9.	*Cuscuta reflexa*Roxb.	*Dodder/Afto moon*	Leaves	*Convolvulaceae*	*Twiner*	200	5.33	10.66
10.	*Taraxacum officinale* - Webb.	*Dandelion*	Root	*Asteraceae*	*Perennial herb*	450	3.41	15.3
11.	*Datura stramonium L.*	Thorn apple	Seed	*Solanaceae*	Annual herb	200	3.9	7.8
12.	*Morchella esculenta (L.) Pers.-Morel*	*Guchhi*	Fruits	*Morchellaceae*	Perennial fungi	8000	5.7	456.5
13.	*Picrorhiza kurroa* Royle ex Benth	*Kutki*	Root and Rhizome	*Scrophulariaceae*	Perennial herb	650	9.9	64.35
14.	*Podophyllum hexandrum* Royle	Bankakri	Roots, Fruit	*Berberidaceae*	Perennial herb	150	6.3	9.45
15.	*Rhaphiolepis indica* (L.) Lindl. ex Ker Gawl.	Indian Hawthorn	Fruit	Rosaceae	evergreen shrub	200	0.85	1.72
16.	*Rosa canina* L.	Dog rose	Fruit	*Rosaceae*	Climbing, prickly shrub	60	3.6	2.16
17.	*Saussurea costus* (Falc.) Lipschitz	Costus/Kuth	root	*Asteraceae*	Shrub	200	4.8	9.6
18.	*Trillium govanianum* Wall. ex D. Don	*Nag Chhatri*	rhizomes	*Melanthiaceae*	Perennial herb	500	4.5	22.5
19.	*Urtica diocia*	*Stinging nettle*	Root	*Urticaceae*	Perennial herb	140	1.46	2.04
20.	*Valeriana jatamansi* Jones ex Roxb.	*Muskbala, Tagar*	Dried roots and rhizome	*Valerianaceae*	Perennial Herb	200	5.48	10.96

The study (Rana *et al*., 2014) carried out in the Himachal Pradesh state of India highlights *Picrorhiza kurroa*, *Podophyllum hexandrum* and *Valeriana jatamansi* as the most demanded species, are in-consistent with the present study pattern. Furthermore Singh and Kumar, (2017) documented *Aconitum heterophyllum* as the highly traded medicinal and aromatic plant in Himachal Pradesh. In 2021/22, almost 85% of all volume traded went to various pharmaceutical companies and mandies of the country. Annual export amounts to 83380 kg (Table-2).

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The results from market survey revealed that twelve traders were engaged in the trade of medicinal plants (Table-2). According to our survey, no trader from Baramulla, Kulgam, Budgam, Bandipora and Ganderbal district of Kashmir valley were reported to be involved in the trade of medicinal and aromatic plants. However, the export and import of medicinal plants is highly concentrated in Srinagar and Anantnag district of Kashmir valley. Srinagar and Anantnag district exports 66890 and 5400 Kg of medicinal plants respectively. According to the traders of Kashmir valley, *Picrorhiza kurroa*, *Saussurea costus*, *Podophyllum hexandrum* and *Trillium govanianum* are the most demanded medicinal species from this region. Studies of Gangoo *et al*., (2017), Dawa *et al*. (2018) Khawaja *et al.* (2023) and Peerzada *et al*. (2022) supports the present study outcomes. Increased demand for raw herbal drugs may be attributed to rising awareness about the side effects of synthetic drugs.

Table-2: Traders engaged in the trade of medicinal plants in Kashmir valley

S. No.	District	Trader Code**	Scientific Name	Part Traded	Rate/ kg	Quantity Imported (kg)	Quantity Exported (kg)
1.	Srinagar	AR	*Trillium govanianum* Wall. ex D. Don	Root	500	2000	2000
			Podophyllum hexandrum Royle	Root	150	3000	3000
			Atropa acuminata - Royle. ex Lindley	Root	100	500	500
			Saussurea costus (Falc.) Lipschitz	Root	200	1500	1500
			*Colchicum luteum*Baker	Root	350	400	250
			Urtica diocia	Root	140	250	150
			Picrorhiza kurroa Royle ex Benth	Root	650	1500	1000
			Arctium minus - (Hill.) Bernh.	Root	400	200	100
			Taraxacum officinale - Webb.	Root	450	250	250
			Valeriana jatamansi Jones ex Roxb.	Root	200	1000	500
			*Aconitum heterophyllum*Wall. ex Royle	Root	3000	500	250
			Morchella esculenta (L.) Pers.-Morel	shoot	8000	1000	600
			Artemisia brevifolia Wall. Ex DC	shoot	40	300	150
			Arnebia benthamii (Wall. ex G. Don) I.M. Johnst.	shoot	380	300	300
			Rosa canina L.	fruit	60	1000	300
			Rhaphiolepis indica (L.) Lindl. ex Ker Gawl.	berry	200	250	150
			*Cuscuta reflexa*Roxb.	leaves	200	1000	1000
		KI	*Saussurea costus* (Falc.) Lipschitz	Root	200	900	500
			*Colchicum luteum*Baker	Root	350	400	200
			Urtica diocia	Root	100	100	80
			Picrorhiza kurroa Royle ex Benth	Root	650	2000	500
			Taraxacum officinale - Webb.	Root	450	400	400
			Valeriana jatamansi Jones ex Roxb.	Root	200	1200	500
			*Aconitum heterophyllum*Wall. ex Royle	Root	3500	500	300
			Morchella esculenta(L.) Pers.-Morel	shoot	8000-12000	800	500
			Artemisia brevifolia Wall. Ex DC	shoot	40	500	300
			Arnebia benthamii (Wall. ex G. Don) I.M. Johnst.	shoot	350	500	250
			*Cuscuta reflexa*Roxb.	leaves	180	2000	1800
			Brassica nigra(L.) W.D.J.Koch	fruit	150	1200	800
		RE	*Trillium govanianum* Wall. ex D. Don	Root	500	2000	1500
			Podophyllum hexandrum Royle	Root	150	2500	1800
			Atropa acuminata - Royle. ex Lindley	Root	100	1500	800
			Saussurea costus (Falc.) Lipschitz	Root	200	3500	2000
			Colchicum luteum Baker	Root	350	1000	400
			Urtica diocia	Root	140	300	200
			Picrorhiza kurroa Royle ex Benth	Root	650	5000	2500
			Arctium minus - (Hill.) Bernh.	Root	400	500	250
			Taraxacum officinale - Webb.	Root	450	500	300
			Valeriana jatamansi Jones ex Roxb.	Root	200	1000	600
			*Aconitum heterophyllum*Wall. ex Royle	Root	3000	1000	550
			Morchella esculenta (L.) Pers.-Morel	shoot	8000	500	500

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	Artemisia brevifolia Wall. Ex DC	shoot	40	1000	650
	Arnebia benthamii (Wall. ex G. Don) I.M. Johnst.	shoot	380	500	500
	Rosa canina L.	fruit	60	1500	800
	Rhaphiolepis indica (L.) Lindl. ex Ker Gawl.	berry	200	1500	700
	Cuscuta reflexa Roxb.	leaves	200	1000	650
ME	*Trillium govanianum* Wall. ex D. Don	Root	500	1500	1000
	Podophyllum hexandrum Royle	Root	150	2500	1500
	Atropa acuminata - Royle. ex Lindley	Root	100	400	400
	Saussurea costus (Falc.) Lipschitz	Root	200	2000	1000
	Colchicum luteum Baker	Root	350	700	400
	Urtica diocia	Root	140	1000	400
	Picrorhiza kurroa Royle ex Benth	Root	650	3000	2000
	Arctium minus - (Hill.) Bernh.	Root	400	500	250
	Taraxacum officinale - Webb.	Root	450	500	500
	Valeriana jatamansi Jones ex Roxb.	Root	200	1500	1000
	Aconitum heterophyllum Wall. ex Royle	Root	3000	1000	600
	Morchella esculenta (L.) Pers.-Morel	shoot	8000	1000	600
	Artemisia brevifolia Wall. Ex DC	shoot	40	1000	700
	Arnebia benthamii (Wall. ex G. Don) I.M. Johnst.	shoot	380	700	700
	Rosa canina L.	fruit	60	4000	2500
	Brassica nigra (L.) W.D.J.Koch	seed	150	5000	4000
	Datura stramonium L.	seed	200	1500	1500
ST	*Saussurea costus* (Falc.) Lipschitz	Root	200	1000	700
	Colchicum luteum Baker	Root	350	400	200
	Urtica diocia	Root	100	100	80
	Picrorhiza kurroa Royle ex Benth	Root	650	1000	600
	Taraxacum officinale - Webb.	Root	450	100	100
	Valeriana jatamansi Jones ex Roxb.	Root	200	800	500
	Aconitum heterophyllum Wall. ex Royle	Root	3500	800	600
	Morchella esculenta (L.) Pers.-Morel	shoot	8000-12000	250	200
	Artemisia brevifolia Wall. Ex DC	shoot	40	200	150
	Arnebia benthamii (Wall. ex G. Don) I.M. Johnst.	shoot	350	500	300
	Cuscuta reflexa Roxb.	leaves	180	200	180
	Brassica nigra (L.) W.D.J. Koch	fruit	150	300	200
	Datura stramonium L.	seed	200	1500	1500
	Allium ursinum Linn.	bulb	5000	1000	600
KE	*Saussurea costus* (Falc.) Lipschitz	Root	200	1000	700
	Colchicum luteum Baker	Root	350	600	400
	Urtica diocia	Root	100	300	150
	Picrorhiza kurroa Royle ex Benth	Root	650	1000	1000
	Taraxacum officinale - Webb.	Root	450	500	400
	Valeriana jatamansi Jones ex Roxb.	Root	200	1500	800
	Aconitum heterophyllum Wall. ex Royle	Root	3500	2000	1400
	Morchella esculenta (L.) Pers.-Morel	shoot	8000-12000	800	800
	Artemisia brevifolia Wall. Ex DC	shoot	40	150	150
	Arnebia benthamii (Wall. ex G. Don) I.M. Johnst.	shoot	350	1000	800
	Cuscuta reflexa Roxb.	leaves	180	1500	1400
	Brassica nigra (L.) W.D.J. Koch	fruit	150	300	200
	Datura stramonium L.	seed	200	1000	900

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02	Pulwama	SA	*Saussurea costus* (Falc.) Lipschitz	Root	200	1500	1000
			Colchicum luteum Baker	Root	350	400	200
			Urtica diocia	Root	100	100	80
			Picrorhiza kurroa Royle ex Benth	Root	650	1000	800
			Taraxacum officinale - Webb.	Root	450	100	100
			Valeriana jatamansi Jones ex Roxb.	Root	200	800	800
			Aconitum heterophyllum Wall. ex Royle	Root	3500	800	600
			Morchella esculenta (L.) Pers.-Morel	shoot	8000-12000	250	250
			Artemisia brevifolia Wall. Ex DC	shoot	40	200	150
			Arnebia benthamii (Wall. ex G. Don) I.M. Johnst.	shoot	350	500	300
			Cuscuta reflexa Roxb.	leaves	180	200	180
03	Anantnag	MIP	*Urtica diocia*	Root	100	1000	600
			Picrorhiza kurroa Royle ex Benth	Root	650	1500	800
			Taraxacum officinale - Webb.	Root	450	800	600
			Valeriana jatamansi Jones ex Roxb.	Root	200	1000	800
			Aconitum heterophyllum Wall. ex Royle	Root	3500	2000	1500
			Morchella esculenta (L.) Pers.-Morel	shoot	8000-12000	1000	1000
			Artemisia brevifolia Wall. Ex DC	shoot	40	100	100
04	Kupwara	ARG	*Urtica diocia*	Root	100	100	80
			Picrorhiza kurroa Royle ex Benth	Root	650	100	100
			Taraxacum officinale - Webb.	Root	450	150	120
			Valeriana jatamansi Jones ex Roxb.	Root	200	100	60
			Aconitum heterophyllum Wall. ex Royle	Root	3500	200	180
			Morchella esculenta (L.) Pers.-Morel	shoot	8000-12000	400	350
			Artemisia brevifolia Wall. Ex DC	shoot	40	80	80
		BK	*Urtica diocia*	Root	100	100	80
			Picrorhiza kurroa Royle ex Benth	Root	650	100	100
			Taraxacum officinale - Webb.	Root	450	150	120
			Valeriana jatamansi Jones ex Roxb.	Root	200	100	60
			Aconitum heterophyllum Wall. ex Royle	Root	3500	200	180
			Morchella esculenta (L.) Pers.-Morel	shoot	8000-12000	400	350
			Artemisia brevifolia Wall. Ex DC	shoot	40	80	80
		BAK	*Urtica diocia*	Root	100	100	80
			Picrorhiza kurroa Royle ex Benth	Root	650	100	100
			Taraxacum officinale - Webb.	Root	450	150	120
			Valeriana jatamansi Jones ex Roxb.	Root	200	100	60
			Aconitum heterophyllum Wall. ex Royle	Root	3500	200	180
			Morchella esculenta (L.) Pers.-Morel	shoot	8000-12000	400	350
			Artemisia brevifolia Wall. Ex DC	shoot	40	80	80
05	Shopian	GQM	*Saussurea costus* (Falc.) Lipschitz	Root	200	500	300
			Colchicum luteum Baker	Root	350	200	200
			Urtica diocia	Root	100	100	80
			Picrorhiza kurroa Royle ex Benth	Root	650	500	400
			Taraxacum officinale - Webb.	Root	450	400	400
			Valeriana jatamansi Jones ex Roxb.	Root	200	400	300
			Aconitum heterophyllum Wall. ex Royle	Root	3500	800	600
			Morchella esculenta (L.) Pers.-Morel	shoot	8000-12000	200	200

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Artemisia brevifolia Wall. Ex DC	shoot	40	100	90
Arnebia benthamii (Wall. ex G. Don) I.M. Johnst.	shoot	350	100	80
Cuscuta reflexa Roxb.	leaves	180	150	120

** *The names of traders have been coded to safeguard the respondents' identities*.

CONCLUSION

Medicinal and aromatic plants from Kashmir valley have been traded for centuries and the demand will continue to rise because of global expansion of herbal market. The valley must grab this opportunity by initiating commercial cultivation of MAP's particularly highly traded species like *Picrorhiza kurroa*, *Aconitum heterophyllum*, *Podophyllum hexandrum*, *Saussurea costus*, *Trillium govanianum and Valeriana jatamansi* . More than 50% of the traded volume is occupied by seven MAP species, showing their dominancy in trade in one hand and high harvest pressure on the other. The study identifies *Picrorhiza kurroa*, *Aconitum heterophyllum*, *Podophyllum hexandrum*, *Saussurea costus* and *Trillium govanianum* as the most vulnerable MAP's of the Kashmir valley mainly because of large scale collection from wild. It is therefore, very crucial that awareness creation be undertaken so that the community is actively involved in conservation and sustainable utilization of the medicinal and aromatic plants; in order to amplify the role that they play in health care delivery, poverty alleviation and environmental protection.

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