SHORT COMMUNICATION

Collection and Characterization of *Allium* Species from Himachal Pradesh

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A total of 56 accessions including 12 wild and cultivated *Allium* species were collected from Lahaul & Spiti, Kinnaur, Chamba and Shimla districts of Himachal Pradesh and were characterized using IBPGR descriptors. Poor establishment was noticed in *A. humile*, *A. carolinianum* and *A. auriculatum* indicating their poor adaptation to changed habitat. Collected population of wild *Allium* species showed genetic variation within the species for characters such as bulb shape, pungency, 100-seed weight etc.

Key Words: *Allium*, Wild species, Collection, Characterization, Himachal Pradesh

The genus *Allium* considered under the family Alliaceae, is one of the largest genera of more than 700 species distributed throughout the world (Kim *et al*., 2001). Nearly all *Allium* crops originate from the main centre of *Allium* species diversity which stretches from the Mediterranean basin to Central Asia and beyond. Indian gene centre is fairly rich in wild species (about 30) mostly confined to Himalayas. Negi and Pant (1992) and Pandey and Pandey (2005) reported occurrence of wild *Allium* species in Himalayas.Wild *Allium* species are the good source of flavonols (Horbowicz and Kotlinska, 2000). Many are used in Western Himalaya as spice/condiment in curries, as vegetable and bulbs for seasoning salads since time immemorial. Knowledge on biosystematic relationship of wild *Allium* species occurring in Himalaya is sparse, which is a thrust area since wild relatives can offer novel traits for crop improvement. Apart from this, few species have potential as new crops of culinary, therapeutic and medicinal value. Hence, efforts were made to collect and characterize the *Allium* germplasm.

A total of 56 accessions of wild and cultivated *Allium* species were collected from Lahaul & Spiti, Kinnaur, parts of Chamba and Shimla (Churdhar Peak) districts of Himachal Pradesh in two explorations at seed maturity stage, *i.e.* during August-September 2005 and 2006 (Fig.1). These comprised 11 species namely, *Allium schoenoprasum* L. (10), *A. fistulosum* L. (3), *A. carolinianum* DC. (syn. *A. blandum*) (11), *A. griffithianum* Boiss (6), *A. tuberosum* Rottl. ex Spreng (2), *A. consanguineum* (syn. *A. stracheyi* Baker) (4), *A. przewalskianum* Regel (syn. *A. jacquemontii* Baker) (4), *A. humile* Kunth (syn. *A. govanianum* Wall. ex Baker) (1), *A. auriculatum* Kunth (2), *A. sativum* L. (12) and *A. ampeloprasum* L. (1). Their occurrence, vernacular name and biological status are furnished in Table 1. The cultivated species *A. sativum*, *A. schoenoprasum*, *A. fistulosum* and *A. ampeloprasum* were found in kitchen garden and farmers' fields and wild species at acute slopes of dry rocky mountains. One accession, namely, serpent garlic, botanically *A. sativum* var. *ophioscordon* (Link) Doll. was also collected from kitchen gardens in Koksar (Lahaul & Spiti). Sympatric association of different wild *Allium* species was observed, but no hybrid derivatives/ swarms, indicating their cross-incompatible nature.

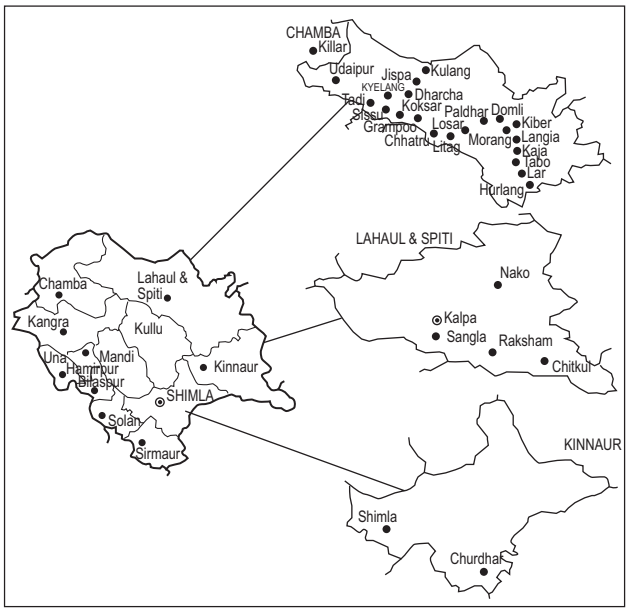

Fig. 1: Collection of wild *Allium* species in Shimla, Kinnaur and Lahaul and Spiti

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Table 1. *Allium* species collected from high hills and alpine region of Himachal Pradesh

Species	Vernacular name	Collection site	Biological status	Altitude (m)
Allium schoenoprasum L.	Chung, Rechong, Koche, Dhum, Keer	Koksar, Khangsar, Kuring, Udaipur (Lahaul)	Cultivated; semi wild	1890-4060
A. fistulosum L.	Japani onion, Chong, Chuwang	Chal Thang (Lahaul & Spiti), Kuring (Lahaul)	Cultivated; semi-wild	3115-3850
A. carolinianum DC. (Syn. *A. blandum* Wall.)	Laut, Arum	Shego, Kungti Gumpha, Morang, Losar (Spiti), Ranguo (Lahaul)	Wild	3540-4560
A. griffithianum Boiss.	Neolagu, Keer	Adargu (Spiti), Pangi (Chamba), Raksham (Kinnaur)	Wild	2660-3490
A. tuberosum Rottl. ex Spreng	Zimu, Jangli piaz	Bhavanagar (Kinnaur), Tabo (Spiti)	Semi-wild	1620-3300
A. auriculatum Kunth	Shillim	Chhicham (Spiti)	Wild	3850-4190
A. consanguineum Kunth (Syn. *A. strachеyi* Baker)	Keer	Kadunala, Shour (Chamba), Baspa dam, Sangla, Raksham (Kinnaur)	Wild	2420-2770
A. humile Kunth (Syn. *A. govanianum* Wall. ex Baker)	Duna	Chureshwar (Shimla)	Wild	3430
A. przewalskianum Regel (Syn. *A. jacquemontii* Baker)	Pharna	Nako, Maling (Kinnaur)	Wild	3370-3470
A. ampeloprasum L.	Chinese lahsun	Chitkul (Kinnaur)	Cultivated	3350
A. sativum L.	Gopa, Lahsun	Koksar (Lahaul), Kinnaur dt.	Cultivated	2260-3284

Present study was carried out at Experimental Farm, NBPGR Regional Station, Phagli, Shimla (31° 05' 924" N latitude, 77° 09' 580" E longitude; 1924 msl) for two consecutive years 2006 and 2007 using IBPGR descriptors (IBPGR, 1982). Nursery was raised from seeds for all species except *A. ampeloprasum* and *A. sativum* (for which cloves were used) during March in raised beds and after 45 days, the seedlings were transplanted in the field. For each accession, two rows of 2 m length with the spacing of 40 cm x 20 cm was adopted. Important qualitative and quantitative characteristics (mean and range values) of wild *Allium* species are depicted in Table 2. Collected populations of wild *Allium* species showed genetic variation within the species for characters such as bulb shape, pungency, 100-seed weight for instance, in *A. consanguineum*, 100-seed weight ranged from 0.70 to 2.83 g. All plants of *A. humile* degenerated after 35 days of transplanting under Shimla conditions. Poor establishment accompanied with poor seedling vigour was evident in *A. carolinianum* and *A. auriculatum* also indicating their poor adaptation to changed habitat. It was noticed that *A. carolinianum* was susceptible to white rot (*Sclerotium cepivorum*) while all the other species were free from disease symptoms at field level. In *A. fistulosum*, three accessions showed clear-cut differences in plant stature *i.e.*, dwarf, medium and tall. Although seed germination in wild *Alliums* was poor, *A. tuberosum* recorded nearly 70 per cent germination. High tillering capacity was noticed in *A. schoenoprasum* and *A. tuberosum*. The seeds of wild *Allium* species were conserved in National Gene Bank after characterization.

Cultivated and wild species of *Allium* possesses onion and garlic like odour, pungency and antioxidative properties in leaves and bulbs. Mostly wild *Allium* species are cold tolerant and drought resistant. In *A. fistulosum*, resistance to white rot (*Sclerotium cepivorum*) (Anon., 1985) and anthracnose (*Colletotrichum gloeosporioides*) (Galvan *et al.*, 1997) was reported. Taxonomically *A. cepa*, *A. fistulosum* and *A. schenoprasum* belong to subgenus *Rhiziriduem* while *A. ampeloprasum* and *A. sativum* under subgenus *Allium* (Hanelt *et al.*, 1992). Kim and Chae-YongAm (2003) reported that hybridization between *A. fistulosum* and *A. cepa* lead to local Korean cultivars such as Samcheung-Pa and Soekkori-Pa. Successful interspecific hybrids between *A. fistulosum* and *A. chinense* were obtained through ovary culture and pollen storage (Nomura *et al.*, 1994) and with *A. galanthum* (Yamashita *et al.*, 2000). Close taxonomic

Table 2. Important characteristics of accessions of various *Allium* species studied (based on IBPGR Descriptors)

Species**	Early seedling vigour	Leaf colour	Leaf shape	Leaf length (cm)	Leaf girth thick-ness* (mm)	Leaf habit	Leaf wax	Flower colour	Nature of umbel	Size of Flower to Head	No. of Flower to/ Umbel	Inflore-scence height (cm)	Plant hight (cm)	Effective tillers/ plant	Bulb colour	Bulb shape	Pung-ency	100-seed weight (g)
A. schoenop-rasum	Vigorous-very vigorous	Dark green	Fistular	18.17 (15.3-20.6)	3.04 (2.7-4.6)	Semi erect Eerct	Waxy	Purple	Semi-compact	Small-medium	29.9 (17.0-65.0)	18.1 (13.0-20.9	22.92 (20.3-25.6)	5.13 (3.3-6.7)	Light purple	Elongated-ovoid	Medium High	0.54 (0.44-0.74)
A. fistulosum	Very vigorous	Dark green	Fistular	22.77 (18.3-30.3)	13.63 (12.0-15.5)	Erect	Waxy	White	Semi compact	Large	132 (121-141)	25.77 (17.3-39.4)	34.07 (25.6-44.0)	3.2(2. 0-6.0)	Light whitish purple	Elongated	High	1.86 (1.76-2.02)
A. tuberosum	Vigorous	Green	Flat	22.57	2.94	Erect-semi erect	Non-waxy	White	Loose	Medium	37	47.67	57.63	4.03	Light purplish brown	Elongated	High	1.03
A. carolinianum	Poor	Light green -Green	Flat	13.16 (10.7-17.6)	1.10 (0.87-1.28)	Erect	Waxy (less intensity)	Purple	Compact	Medium	25 (21-31)	26.2 (21.7-29.6)	29.54 (24.0-36.3)	1.17 (1.0-1.6)	Brown	Ovoid	High	1.54 (1.21-1.70)
A. auriculatum	Poor	Green	Flat	24.70	1.97	Erect	Non waxy	Purple	Compact	Small-medium	30	20.65	29.66	1.95	Brown	Elon-gate	Medium	0.59
A. griffithianum	Poor	Dark green	Flat/ half rounded	24.12 (19.2-27.8)	2.03 (1.8-2.5)	Erect	Waxy	Light purple	Compact	Medium	18 (15 -21)	31.48 (19.8-38.0)	35.08 (20.3 -44.3)	1.78 (1.0 -4.6)	Light red	Elon-gate	Medium-high	0.60 (0.5-1.0)
A. przewalskianum	Vigorous	Light green	Fistular	26.63 28.6) (24.5-	2.00 (1.84-2.31)	Semi-erect	Non waxy	Light purple	Compact	Medium	38 (34-42)	37.03 (30.2 -40.0)	38.67 (31.2 -43.5)	3.53 (2.6 -5.0)	Reddish brown	Ovoid-elongated	Medium-high	0.53
A. consanguineum	Vigorous	Dark green	Flat	30.23 (27.5-34.7)	2.58 (2.50-2.66)	Erect	Non waxy	Pale yellow	Compact	Small-medium	98 (76-111)	40.02 (37.5-43.7)	53.22 (50.2-58.3)	1.10 (1.0-1.2)	Brown	Oblong	Medium	1.68 (0.70-2.83)
A. ampeloprasum	Vigorous	Light green	Flat	41.32	2.30	Erect	Non waxy	Purple	Compact	Large	66	63.5	116	Nil	Greenish white	Globose	High	—-
A. sativum	Vigorous-very vigorous	Light green	Flat	36.83 (32.6-40.1)	1.63 (0.96-2.41)	Erect	Non waxy	Pale-purple	Compact	Small	54.42 (26-72)	45.54 (42.1-50.6)	65.10 (52.5-71.6)	Nil	White-purplish white	Globose	High	—-

* Thickness in case of flat leaves; ** Range noticed only for those species having at least 4 accessions; [a-] In case of *A. sativum*, instead of flowers, bulbills were taken into account

affinity between *A. sativum* var. *ophioscorodon* and garlic's wild progenitor *A. longicuspis* was reported by Al-Zahim *et al*. (1997).

Biochemical analysis of quality-components, antioxidants, flavonols etc. in these *Allium* species and detailed characterization and evaluation for novel traits like disease resistance, cold hardiness and pungency level along with their crossability with cultivated species is the need of hour.

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