

# The alien flora of Kashmir Himalaya

Anzar Ahmad Khuroo · Irfan Rashid ·  
Zafar Reshi · G. H. Dar · B. A. Wafai

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**Abstract** Compilation of alien flora from phyto-geographically distinct regions is of immediate relevance not only for better understanding the patterns of plant invasion but also for explicating the processes promoting invasion at local, regional or global scales. Despite being at higher risk of invasion by plants because of its European colonial past, south Asia has received very little attention in respect of characterization of its alien flora. This paucity of baseline data necessitated compilation of the first catalogue of alien flora from the Kashmir Himalaya—a phyto-geographically distinct south Asian region nestled in the northwestern folds of Himalayan biodiversity hotspot. Total alien flora of the region is represented by 571 plant species, belonging to 352 genera and 104 families. It constitutes a relatively higher (29%) proportion of the total flora of the region. Families with largest number of alien representatives are Poaceae (60 species), Asteraceae (54 species), and Brassicaceae (30 species). However, families such as Amaranthaceae (83%)

and Chenopodiaceae (71%) show higher percentage of aliens relative to their total number of plant species in the region. Most of the alien plant species (38%) trace their origin to Europe, followed by Asia (27%) and Africa (15%). Present study also reports, for the first time, occurrence of seven plant species in this region. Each alien plant species is provided with information on the origin, habit, mode/purpose of introduction, current invasion status, altitudinal range and the primary published source.

**Keywords** Plant invasion · Alien flora · Invasive plants · Kashmir Himalaya

## Introduction

Globalisation of the Earth's biota, due to drastic breaching of the biogeographic barriers that isolated continental biotas for millions of years, is transforming local and regional floras and faunas (Davis 2003). Such biotic homogenisation is a result of increasing global trade and transport because of which the number of plant and animal species translocated by humans, either deliberately or by accident, has drastically increased (Drake et al. 1989; Williamson 1996; Mack et al. 2000; Kowarik 2003; Perrings et al. 2005) and such invasions have the potential of altering the composition of the Earth's biodiversity (Vitousek

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A. A. Khuroo · I. Rashid · Z. Reshi (✉) ·  
B. A. Wafai  
Department of Botany, University of Kashmir,  
Srinagar 190006 J&K, India  
e-mail: zreshi@yahoo.com

G. H. Dar  
Centre of Plant Taxonomy, University of Kashmir,  
Srinagar, J&K, India

et al. 1996; Mack et al. 2000). Besides ethical and aesthetic concerns, the altered biodiversity can severely impair the life-sustaining ecosystem goods and services which in turn can adversely jeopardize the human welfare (Kaiser 1999). Habitat destruction, an inevitable consequence of the modern land use, renders ecosystems vulnerable to invasion by the species that are transported intentionally or unintentionally by humans (Moore 2000). In fact, biological invasion by aliens has been widely recognized as the second greatest threat (after direct habitat destruction) to the global biodiversity (Drake et al. 1989). Though addressed by Charles Elton in his seminal treatise way back in 1958 yet the public and scientific concern about biological invasion is a recent phenomenon. With the fast wave of globalization sweeping the nations and increased movement of goods and people around the world, Elton's prophecy of an imminent ecological explosion of invasive species has almost come true (Moore 2004). In fact, the economic globalization is aiding and abetting the 'biotic globalization' of the world, sometimes infamously referred to as 'biological pollution', with catastrophic economic and ecological ramifications (McNeely 2001; Carey 2002; Gurevitch and Padilla 2004; Pimentel et al. 2005). Alarmed by the harmful fallout of alien invasive plants, efforts all over the world are directed at inventorizing the alien floras of different affected region at the earliest possible (Clement and Foster 1994; Pysek et al. 2002) and the same demands active collaboration between taxonomists and ecologists (Pysek et al. 2004).

Authentic identification, documentation and characterization of alien floras are of paramount importance for future studies that would help formulate strategies for their management. Particularly important is to recognize natives and aliens separately in the modern floras as the same would enhance their utility, broaden their 'clientele' and solve, to a large extent, the problem of 'taxonomic inflation' in the inventories of native plant biodiversity. In addition, comparison of alien flora of phytogeographically distinct regions is an indispensable methodological approach for identifying the distinguishing patterns of invasion (Pysek 1998) and determinants of invasiveness

and invasibility (Crawley et al. 1995; Lonsdale 1999). In fact, the problem of plant invasion needs global coordination for its effective monitoring and management (McNeely et al. 2001; Simberloff et al. 2005). Although a belated beginning has been made in the compilation of alien floras (Rejmanek and Randall 1994; Weber 2003; Kuhn et al. 2004) but no such activity is visible as yet in the developing world where incidentally most of the biodiversity exists (Richardson 2004) except for works of Li and Xie (2002), Pallewatta et al. (2003), Wu et al. (2004a), Liu et al. (2005). Such studies in the south Asian region are of particular importance because of its past history of European colonization (di Castri 1989; Crosby 1993). Also, the region has three entries of Western Ghats, Indo-Burma and Himalayas on the global list of biodiversity hotspots (Mittermeier et al. 2005), and studies on plant invasion in the Indian subcontinent are need of the hour (Sharma et al. 2005).

Kashmir Himalaya, a picturesque south Asian region, is located in the northwestern extreme of the Himalayan biodiversity hotspot. Himalayas spanning over an area of 7,50,000 km<sup>2</sup> harbour about 10,000 plant species; interestingly, the Kashmir Himalaya alone contributes nearly 2,000 (20%) of the plant species within just 2.15% (15,948 km<sup>2</sup>) of the total land area (Dar et al. 2002). Being at the crossroads of the Eurasian and Palaeotropical bio-realms, the region has been a crucible of floristic diversity. The breathtaking landscape of this biodiversity rich region has attracted people of all walks of life, and also from far off regions of the world. Due to its proximity with the erstwhile Silk route and promotion as a global tourist destination, the region has witnessed intentional or unintentional introduction of varying floral elements from different phytogeographical regions of the world which have been supported by diverse bio-climates, broad elevation range and habitat heterogeneity. In fact, the region has been an important stopping point for the historical trade caravans starting from the far east Asia passing through the central Asia to reach the Mediterranean coast and vice versa (Kachroo 1995). Such anthropogenic influences along with wanton axing of virgin conifer forests, unregulated grazing of verdant alpine meadows, pollution of freshwater ecosystems, burgeoning

urbanization, etc, have promoted invasion of these disturbed habitats by non-native species (Oza 2003).

Taking note of the importance of studies on the alien plants (Pysek et al. 2004), particularly in areas of high anthropogenic interference, present study was aimed at compiling the first authentic catalogue of the alien flora of Kashmir Himalaya along with supplementation of each plant species with information on origin, habit, mode/purpose of introduction, invasion status, altitudinal range and the primary published source. Such baseline information would act as the foundation stone for the advanced studies in the invasion ecology and would serve a benchmark for future assessment of extent of invasion in this biodiversity rich region.

## Materials and methods

### Study area

Kashmir Himalaya, being located at the bio-geographically pivotal position, represents a unique biospheric unit in the northwestern Himalayas (Rodgers and Panwar 1988). The region has an area of about 15,948 km<sup>2</sup>, with nearly 64% of the total area being mountainous. Human population of the region during the last decade of 1991–2001 increased from 4 million to 5.4 million, showing an explosive 35% decadal growth rate (Anonymous 2002). The region lies between coordinates of 32°20′ to 34°50′ North latitude and 73°55′ to 75°35′ East longitude (Hussain 2002). Topographically, the region mainly comprises of a deep elliptical bowl-shaped valley bounded by the Pir Panjal range of Lesser Himalaya in the south and south-west, and the Zaskar range of the Greater Himalaya in the north and north-east. The altitude of the valley plain at Srinagar is 1,600 m above mean sea level (amsl) and the highest peak among its surrounding mountains is that of the ‘Kolahoi’ with an altitude of 5,420 m (amsl). The valley of Kashmir has been formed by folding and faulting during uplift of the Himalaya between the Indian subcontinent and the rest of Asia. A conspicuous geological feature of the region is the ‘Karawas’, which are plateau-like tablelands formed during the Pleistocene Ice age and are composed of clay,

sand and silt of lacustrine origin (de Terra 1934). The valley is traversed by the river Jehlum and its tributaries which feed many world famous freshwater lakes, such as the Wular, Dal and Anchar lakes. Climate of the region, marked by well-defined seasonality, resembles that of mountainous and continental parts of the temperate latitudes. The temperature ranges from an average daily maximum of 31°C and minimum of 15°C during summer to an average daily maximum of 4°C and minimum of – 4°C during winter. It receives annual precipitation of about 1,050 mm, mostly in the form of snow during the winter months.

Owing to the vast variety of edapho-climatic and physiographic heterogeneity, the region harbours diverse habitats, including lakes, springs, swamps, marshes, rivers, cultivated fields, orchards, subalpine and alpine meadows, montane slopes and terraces, permanent glaciers, etc., which support equally diverse floristic elements (Gupta 1982; Singh et al. 1998).

### Methods

The present study is based on the database compiled by the authors after perusal of the available floristic literature dealing with the vascular flora of Kashmir Himalaya and the information gathered by the authors from the field surveys conducted during the last twenty years. Although the first written record of floristic study from the region is of Moorcroft in 1822, a modern comprehensive flora of the region is still not available (Burkill 1965; Dar et al. 2002). Therefore, we had to glean out information from the vast body of relevant literature of the last century. Hooker’s *Magnum Opus* (1872–1897)—*Flora of British India*—was the first detailed publication, which described plants from the Kashmir Himalaya. After this monumental effort, several other authors also published their floristic works dealing with the region. Notable among them are Coventry (1923–1930), Blatter (1928–29), Lambert (1933), Javeid (1968), Stewart (1972), Kaul et al. (1973), Singh and Kachroo (1976, 1983), Dhar and Kachroo (1983), Polunin and Stainton (1984), Kaul (1986), Kak (1990), Singh and Kachroo (1994), Ara et al. (1995), Dar et al. (1995). While preparing the present catalogue, original publications

have been used in order to authenticate the identity of the species. For nomenclature, classification and the circumscription of plant taxa under the families, we followed Mabberly (1997). Infra-specific taxa up to the variety level have been recognized.

### Terminology

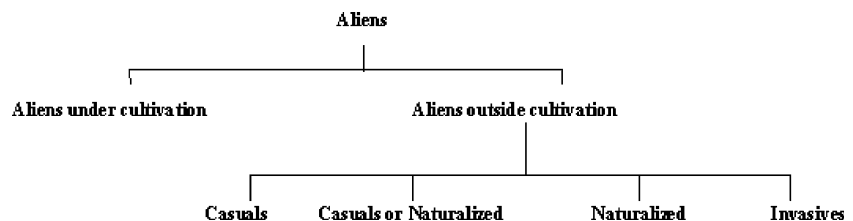
Native geographical range of the plant species has been obtained from all possible available sources (Bailey 1949; Tutin et al. 1964–1980; Randall 2002; Weber 2003), including the specialized Internet web pages ([www.efloras.org](http://www.efloras.org)) and recently published similar studies. Following Pysek et al. (2002), we recognized the origin of the species at the continental scale, viz., Asia (excluding Indian subcontinent), Europe, Africa, North America, South America, and Australia. With regard to habit, the most common growth form of the plant species in the region has been considered and a brief conspectus of the terms is given below in the box. All the alien plant species which have no past record of introduction and accidentally arrived in the region have been categorized as species with ‘Unintentional’ mode of introduction.

Other plant species deliberately introduced for different anthropocentric purposes have been categorized as Ornamentals, Food, Fodder, Plantation, Landscaping, Horticultural, and Medicinal plants. Also only those plant species have been considered as aliens, whose occurrence in the Kashmir Himalaya has been due to intentional or unintentional human involvement. We deliberately excluded those ‘alien plant species’ whose natural distribution range falls within the neighbouring regions, sharing immediate borders with Kashmir Himalaya because it is very likely that their recent report from this region may be due to increased floristic surveys or due to range expansion of the species. Under the category of aliens, however, we also included all non-native plant species which are under cultivation and as yet have not escaped into the wild. In the strict sense, such plant species may not be assigned any invasion status at present but may warrant so in the future. We strictly adopted a biogeographical approach while assigning invasion status to the aliens. Within the alien category, casual, naturalized and invasive plant species have been recognized (Fig. 1) following Richardson et al. (2000) and Pysek et al. (2004). Those alien plant

Annual herb	A non-woody plant that completes its life cycle within a single year.
Biennial herb	A non-woody plant that completes its life cycle within two years, producing only vegetative growth in the first year, and flowering in the second year.
Perennial herb	A non-woody plant that lives for more than two years, producing herbaceous stems anew every year. Such plants usually die down aboveground in the dry or cold season and persist belowground until the next growing season.
Parasitic herb	A non-woody plant that lives on another plant and derives its nourishment from it.
Aquatics	Plants growing in water or water-logged environment.
Shrub	A woody, perennial plant, generally smaller than a tree, and with several stems arising from ground level.
Sub-shrub	A low shrub, often creeping over the ground, usually with partially herbaceous stems.
Tree	A woody, perennial plant, usually tall with a single bole or trunk that bears crown of branches.
Climber	A plant that grows upwards by twining around nearby plants and other supports, or by clinging them with tendrils.
Liana	A woody climber that grows from the ground into the stem canopy.

Modified from Hickey and King (2000)

**Fig. 1** Terminology adopted in the present study



species about which adequate field information was not available have been categorized as ‘casual or naturalized’ as suggested by Wu et al. (2004b).

## Results

Present inventorization reveals that the alien flora of Kashmir Himalaya is comprised of 571 plant species belonging to 352 genera and 104 families. Dicotyledons contribute maximum number (425) of alien plant species distributed in 261 genera and 74 families; where as monocotyledons share 133 plant species grouped under 81 genera and 23 families. Gymnosperms are represented by 11 plant species belonging to 8 genera and 5 families, which include Cupressaceae, Ginkgaceae, Pinaceae, Taxaceae and Taxodiaceae. Pteridophytes comprise of two monotypic families, Marsiliaceae and Salviniaceae (Table 1).

Of all the alien plant species, only seven were distinguished at variety level. Largest number of alien plant species belongs to families of Poaceae (60 species), Asteraceae (54) and Brassicaceae (30) and the 3 together account for 25% of the total alien flora (Table 2). Relative to their total number in the region, Amaranthaceae and Chenopodiaceae include the highest percentage of 83 and 72 of alien species, respectively. The genera with highest number of alien species are *Amaranthus* and *Prunus* (8 each), *Chenopodium*, *Galium*, *Polygonum* and *Rumex* (7 each), *Artemisia*, *Cyperus* and *Ranunculus* (6 each) and *Hibiscus*, *Ipomoea*, *Mentha*, *Nymphaea*, *Papaver*, *Poa*, *Populus*, *Potamogeton*, and *Trifolium* (5 each).

While estimating the contribution of source floras to the aliens of Kashmir Himalaya, present study revealed that European flora contributes maximum percentage of species (38%) followed by Asia (excluding south Asia), Africa, North

America, South America and Australia which contribute 27, 15, 10, 8 and 2% to the total alien flora, respectively. Annual and perennial herbs predominate the alien flora and are represented by 181 (32%) and 155 (27%) species, respectively. About 332 (58%) species have been introduced intentionally for various purposes. Among these, 119 (36%) plant species have been introduced as ornamentals; 72 (22%) as food plants, 50 (15%) as fodder plants, 32 (10%) for the plantation, 22 (6%) for landscaping, 20 (6%) for their medicinal value and 17 (5%) for horticultural purposes. In addition, 239 (42%) plant species have unintentionally arrived in the region.

Of the 571 aliens, 121 (21%) plant species have not as yet escaped to the wild in the region. The remaining 450 (79%) plant species belong to categories, such as casuals, represented by 90 (20%) species, naturalized which includes 185 (41%) species while as invasive category is represented by 96 (21%) species. A total of 79 (18%) species have been included in the category of casuals or naturalized because their exact status could not be established due to paucity of information at the present stage of inquiry.

The present study also reports seven plant species for the first time from this region. These include: *Lavendula officinalis* Chaix and *Rosmarinus officinalis* L. (Lamiaceae), *Godetia amoena* Den. (Onagraceae), *Digitalis grandiflora* Mill. (Scrophulariaceae), *Nigella sativa* L. and *Ranunculus asiaticus* L. (Ranunculaceae), and *Petunia hybrida* Vilm. (Solanaceae).

## Discussion

Of the 104 families within which 571 alien species are distributed, 10 families account for 50% of the total alien flora. The families are, Poaceae which included 60 species, followed by Asteraceae (54),

**Table 1** Taxonomic composition of the alien flora of Kashmir Himalaya

Plant group	Number of families	Number of genera	Number of species
Dicotyledons	74	261	425
Monocotyledons	23	81	133
Gymnosperms	5	8	11
Pteridophytes	2	2	2
Total	104	352	571



Brassicaceae (30), Rosaceae (30), Fabaceae (28), Lamiaceae (23), Ranunculaceae (15), Amaranthaceae (15), Cyperaceae (15), and Polygonaceae (15). Similar taxonomic distribution of aliens within families for other floras has been reported by Pysek (1998). Families represented by single plant species in the total alien flora are 42

(Table 2). Among these species, 17 (40%) belong to the cultivated unescaped category; while as 25 (60%) represent casuals, casuals or naturalized, naturalized, and invasives. The latter includes nine species that are notorious for their invasive traits. Two among them, *Ailanthus altissima* (Simaroubaceae) and *Urtica dioica* (Urticaceae)

**Table 2** Conspectus of the alien flora of Kashmir Himalaya

Family/Name of plant species	Origin	Growth form	Mode/purpose of introduction	Invasion status	Altitudinal range (meters above sea level)	Primary published source
<b>Aceraceae</b>						
<i>Acer cappadocicum</i> Gled.	AS	T	Ld	Cl	1600–2400	Ara et al. (1995)
<i>Acer negundo</i> L.	AMN	T	Ld	Cl	1600–1800	Ara et al. (1995)
<b>Agavaceae</b>						
<i>Yucca aloifolia</i> L.	AMN	S	O	Cs	1600–1700	Ara et al. (1995)
<b>Alismataceae</b>						
<i>Alisma gramineum</i> Lej.	AF; EU	Aq	Ui	Nt	1700–2400	Kak (1984a)
<i>Alisma lanceolatum</i> With.	AF	Aq	Ui	Nt	1600–2500	Kak (1984a)
<i>Alisma plantago-aquatica</i> L.	AMN	Aq	Ui	In	1600–1800	Kaul (1986)
<i>Sagittaria latifolia</i> Willd.	AMN	Aq	Ui	Cn	1600–1900	Kak (1984a)
<i>Sagittaria sagittifolia</i> L.	AMN	Aq	Ui	In	1600–1800	Reshi (1984)
<b>Amaranthaceae</b>						
<i>Achyranthes aspera</i> L. var. <i>pubescens</i> C.C. Townsend	AMN	P	Ui	Cn	1600–1700	Kaul (1986)
<i>Achyranthes bidentata</i> Blume.	AS	P	Ui	Nt	1700–1900	Stewart (1972)
<i>Alternanthera caracasana</i> Kunth.	AMN; AMS	P	Ui	Cs	1600–2000	Naqshi (1981)
<i>Alternanthera sessilis</i> DC.	AMS	B	Ui	Nt	1600–2300	Kaul (1986)
<i>Amaranthus caudatus</i> L.	AMS	A	Fd	In	1600–2500	Reshi (1984)
<i>Amaranthus cruentus</i> L.	AMN; AMS	A	Fd	Cs	1800–2000	Stewart (1972)
<i>Amaranthus graecizans</i> L.	EU	A	Ui	Nt	1700–1900	Kaul (1986)
<i>Amaranthus hybridus</i> L.	AMN; AMS	A	Fd	In	1600–2800	Kaul (1986)
<i>Amaranthus lividus</i> L.	AS; AF; AMS	A	Ui	Cs	1800–2000	Stewart (1972)
<i>Amaranthus retroflexus</i> L.	AMN	A	Ui	Cs	1600–1800	Stewart (1972)
<i>Amaranthus spinosus</i> L.	AMS	A	Ui	In	1600–2800	Stewart (1972)
<i>Amaranthus tricolor</i> L.	AS; AF	A	Fd	Cs	1600–1900	Stewart (1972)
<i>Celosia argentea</i> L.	AMS	A	Fd	Cs	1600–1700	Reshi (1984)
<i>Deeringia amaranthoides</i> Merr.	AU	L	Ui	Cn	1600–1700	Stewart (1972)
<i>Gomphrena globosa</i> L.	AMS	A	O	Cs	1600–1800	Stewart (1972)
<b>Amaryllidaceae</b>						
<i>Allium ampeloprasum</i> L.	AS; EU	B	Ui	Cl	1600–1900	Stewart (1972)
<i>Allium cepa</i> L.	AS	B	Fd	Cs	1600–2100	Dar et al. (2002)
<i>Allium sativum</i> L.	EU	B	Fd	Cs	1600–1900	Dar et al. (2002)
<i>Allium tuberosum</i> Rott. ex Spreng.	AS	B	Fd	Cl	1600–2400	Stewart (1972)
<i>Amaryllis vittata</i> L'Herit.	AMS	B	O	Cn	1700–1900	Stewart (1972)
<i>Lycoris radiata</i> Herb.	AS	P	O	Cl	1600–1700	Stewart (1972)
<i>Narcissus pseudonarcissus</i> L.	EU	P	O	In	1600–2200	Stewart (1972)
<i>Narcissus tazetta</i> L.	EU	P	O	In	1600–2500	Stewart (1972)
<i>Zephyranthes candida</i> Herb.	AMS	B	O	Cl	1600–1700	Stewart (1972)
<b>Anacardiaceae</b>						
<i>Pistacia vera</i> L.	EU	T	O	Cl	1600–1700	Ara et al. (1995)
<b>Apiaceae</b>						
<i>Anethum graveolens</i> L.	EU	A	Fd	Nt	1700–2400	Stewart (1972)
<i>Berula erecta</i> Cov.	EU	P	Ui	Nt	1800–2600	Stewart (1972)
<i>Conium maculatum</i> L.	EU	B	Fd	Nt	1900–2400	Kaul (1986)

**Table 2** continued

Family/Name of plant species	Origin	Growth form	Mode/purpose of introduction	Invasion status	Altitudinal range (meters above sea level)	Primary published source
<i>Coriandrum sativum</i> L.	EU	A	Fd	Cs	1600–2200	Dar et al. (2002)
<i>Daucus carota</i> L.	AF; EU	B	Ui	In	1600–3100	Kaul (1986)
<i>Eryngium billardieri</i> Del.	AF; EU	P	Ui	In	1700–2700	Kaul (1986)
<i>Foeniculum vulgare</i> Mill.	EU	P	Fd	Cs	1600–2200	Dar et al. (2002)
<i>Sanicula elata</i> Buch.-Ham.	AF; EU	A	Ui	Nt	1700–2600	Stewart (1972)
<i>Scandix pecten-veneris</i> L.	EU	A	Ui	Nt	1600–3100	Kaul (1986)
<i>Torilis japonica</i> DC.	AS	A	Ui	Nt	1800–2800	Kaul (1986)
<b>Apocyanaceae</b>						
<i>Vinca major</i> L.	EU	Ss	O	Nt	1600–1700	Reshi (1984)
<b>Araceae</b>						
<i>Zantedeschia aethiopica</i> Spreng.	AF	P	O	Cl	1600–1700	Stewart (1972)
<b>Araliaceae</b>						
<i>Fatsia japonica</i> Decne and Planch.	AS	S	O	Cl	1600–1700	Ara et al. (1995)
<i>Hedera helix</i> L.	EU	L	O	In	1600–2600	Stewart (1972)
<b>Aristolochiaceae</b>						
<i>Aristolochia elegans</i> Masters.	AMS	C	O	Cl	1600–1700	Stewart (1972)
<b>Asteraceae</b>						
<i>Achillea millefolium</i> L.	EU	P	Md	In	1600–3100	Kaul (1986)
<i>Ageratum conyzoides</i> L.	AMS	A	O	In	1600–2400	Stewart (1972)
<i>Anthemis cotula</i> L.	EU	B	Ui	In	1600–2800	Stewart (1972)
<i>Arctium lappa</i> L.	EU	P	Md	In	1600–3200	Stewart (1972)
<i>Artemisia absinthium</i> L.	EU	Ss	Md	In	1800–3000	Kaul (1986)
<i>Artemisia dracunculoides</i> L.	EU	P	Ui	Cs	1900–2500	Stewart (1972)
<i>Artemisia sacrorum</i> Ledeb.	EU	Ss	Ui	Cs	3000–4500	Stewart (1972)
<i>Artemisia scoparia</i> Waldst. and Kit.	AS; EU	P	Md	Nt	2200–2900	Kaul (1986)
<i>Artemisia tournefortiana</i> Reichb.	AS	A	Ui	Nt	1700–2100	Kaul (1986)
<i>Artemisia vestita</i> Wall. ex DC.	AS	P	Ui	Cs	1700–3000	Kaul (1986)
<i>Aster pilosus</i> Willd.	AMS	A	Ui	Cs	1900–2700	Kaul (1986)
<i>Bellis perennis</i> L.	EU	P	O	Nt	1600–2100	Kaul (1986)
<i>Bidens cernua</i> L.	EU; AMN	P	Ui	Nt	1600–3000	Stewart (1972)
<i>Bidens chinensis</i> Willd.	AMN	P	Ui	Cs	2000–2500	Stewart (1972)
<i>Bidens tripartita</i> L.	AF; EU	A	Ui	Cn	1600–1800	Kaul (1986)
<i>Calendula officinalis</i> L.	EU	A	O	Cs	1600–2200	Stewart (1972)
<i>Carduus edelbergii</i> Rech. f.	EU	B	Ui	In	1700–3000	Kaul (1986)
<i>Carpesium abrotanoides</i> L.	AS; EU	A	Ui	Nt	1700–2300	Kaul (1986)
<i>Centaurea iberica</i> Trev. ex Spreng.	AS; EU	B	Ui	In	1700–2600	Kaul (1986)
<i>Chrysanthemum cinerariifolium</i> Vis.	EU	P	O	Nt	1600–1800	Stewart (1972)
<i>Chrysanthemum coronarium</i> L.	AF; EU	P	Md	Cn	1600–1800	Stewart (1972)
<i>Chrysanthemum parthenium</i> Bernh.	EU	P	Md	Cn	1600–2100	Kaul (1986)
<i>Cichorium intybus</i> L.	EU	P	Ui	In	1600–2500	Kaul (1986)
<i>Cirsium arvense</i> Scop.	AS	P	Ui	In	1600–2700	Stewart (1972)
<i>Cirsium wallichii</i> DC.	AS	B	Ui	Nt	1600–1900	Reshi (1984)
<i>Conyza bonariensis</i> Cronquist	AMS	A	Ui	Cs	1900–2300	Kaul (1986)
<i>Conyza canadensis</i> Cronquist	AMN	B	Ui	In	1600–2500	Kaul (1986)
<i>Crepis sancta</i> Babc.	AS	A	Ui	In	1600–2300	Kaul (1986)
<i>Erigeron annuus</i> Pers.	AMN	A	Ui	Cn	1800–2200	Kaul (1986)
<i>Erigeron pulchellus</i> Michx.	AMN	P	Ui	Cs	1600–1800	Stewart (1972)
<i>Filago arvensis</i> L.	AF; EU	A	Ui	Nt	1700–2200	Stewart (1972)
<i>Filago pyramidata</i> L.	AS; EU	A	Ui	Nt	2300–2900	Kaul (1986)
<i>Gaillardia aristata</i> Pursh	AMN	P	O	Nt	1600–2000	Stewart (1972)
<i>Galinsoga parviflora</i> Cav.	AMS	A	Ui	In	1600–2200	Kaul (1986)
<i>Gnaphalium affine</i> D. Don	AF; EU	B	Ui	Nt	1700–2500	Stewart (1972)
<i>Gnaphalium spicatum</i> Lamn.	AMS	B	Ui	Cn	1900–2300	Stewart (1972)
<i>Helianthus annuus</i> L.	AMN	A	O	Cs	1600–2300	Stewart (1972)

**Table 2** continued

Family/Name of plant species	Origin	Growth form	Mode/purpose of introduction	Invasion status	Altitudinal range (meters above sea level)	Primary published source
<i>Helianthus tuberosus</i> L.	AMN	P	Fd	Cs	1600–1700	Kaul (1986)
<i>Hieracium crocatum</i> Fries	EU	P	Ui	Nt	1800–2400	Stewart (1972)
<i>Lactuca dissecta</i> D. Don	EU	A	Ui	Nt	1700–2800	Kaul (1986)
<i>Onopordum acanthium</i> L.	EU	P	Ui	Nt	1800–2300	Kaul (1986)
<i>Parthenium hysterophorus</i> L.	AMS	A	Ui	Cs	1600–1700	Yaqoob et al. (1988)
<i>Rudbeckia laciniata</i> L.	AMN	A	O	Cs	1600–1900	Stewart (1972)
<i>Senecio vulgaris</i> L.	EU	A	Ui	Nt	1600–2000	Kaul (1972)
<i>Siegesbeckia orientalis</i> L.	AF	A	Ui	In	1600–1900	Kaul (1986)
<i>Silybum marianum</i> Gaertn.	AF; EU	A	Ui	Cs	1600–1800	Stewart (1972)
<i>Sonchus arvensis</i> L.	AS; EU	A	Ui	In	1600–2600	Kaul (1986)
<i>Tagetes erecta</i> L.	AMS	A	O	Cs	1600–1900	Stewart (1972)
<i>Tagetes minuta</i> L.	AMS	P	Ui	Nt	2000–2800	Singh and Kachroo (1994)
<i>Tagetes patula</i> L.	AMS	A	O	Cs	1600–1700	Stewart (1972)
<i>Taraxacum officinale</i> Weber	EU	P	Ui	In	1600–3100	Kaul (1986)
<i>Xanthium spinosum</i> L.	AMS	A	Ui	In	1600–2200	Dar et al. (1990)
<i>Xanthium strumarium</i> L.	AF	A	Ui	In	1600–2100	Kaul (1986)
<i>Zinia elegans</i> Jacq.	AMS	A	O	Cs	1600–1800	Stewart (1972)
<b>Balsaminaceae</b>						
<i>Impatiens balsamina</i> L.	AS	A	O	Cs	1600–1800	Stewart (1972)
<b>Begoniaceae</b>						
<i>Campsis grandiflora</i> K. Schum.	AS	L	O	Cl	1600–1700	Ara et al. (1995)
<i>Campsis radicans</i> Seem.	AMN	L	O	Cl	1600–1700	Ara et al. (1995)
<i>Catalpa bignonioides</i> Walt.	AMN	T	Ld	Cl	1600–1700	Ara et al. (1995)
<i>Catalpa speciosa</i> Ward. ex Engelm	AMN	T	Ld	Cl	1600–1700	Ara et al. (1995)
<b>Boraginaceae</b>						
<i>Anchusa italica</i> Retz.	EU	P	Ui	Cn	1800–2500	Stewart (1972)
<i>Cynoglossum lanceolatum</i> Forssk.	AS; AF	B	Ui	Cn	1700–2200	Kaul (1986)
<i>Lantana camara</i> L.	AMS	S	O	Cs	1600–1800	Stewart (1972)
<i>Lithospermum arvense</i> L.	AS; EU	A	Ui	In	1600–2800	Kaul (1986)
<i>Myosotis caespitosa</i> Schultz	AMN	A	Ui	Nt	1600–2000	Kaul (1986)
<i>Phyla nodiflora</i> Greene	AMS	P	Ui	Cn	1600–1800	Stewart (1972)
<b>Brassicaceae</b>						
<i>Arabis thaliana</i> Heynh.	AF; EU	A	Ui	Nt	1600–2600	Naqshi and Javeid (1985)
<i>Barbarea intermedia</i> Boreau.	AS; EU	B	Fd	Nt	2200–2900	Kaul (1986)
<i>Brassica campestris</i> L.	EU	A	Fd	Cs	1600–2300	Naqshi and Javeid (1987)
<i>Brassica napus</i> L.	EU	A	Fd	Cs	1600–2400	Naqshi and Javeid (1987)
<i>Brassica nigra</i> Koch	EU	A	Fd	Cs	1700–2500	Naqshi and Javeid (1987)
<i>Brassica oleracea</i> L. var. <i>capitata</i> L.	EU	B	Fd	Cl	1600–2200	Dar et al. (2002)
<i>Brassica oleracea</i> L. var. <i>gongyloides</i> L.	EU	B	Fd	Cl	1600–2200	Dar et al. (2002)
<i>Brassica oleracea</i> L. var. <i>botrytis</i> L.	EU	B	Fd	Cl	1600–2200	Dar et al. (2002)
<i>Brassica tournefortii</i> Gouan.	AF; EU	A	Ui	Cn	1800–2000	Naqshi and Javeid (1987)
<i>Capsella bursa-pastoris</i> Medic.	EU	A	Ui	In	1600–3000	Kaul (1986)
<i>Cardamine flexuosa</i> With.	EU	A	Ui	Nt	1600–2300	Reshi (1984)
<i>Cardamine hirsuta</i> L.	EU	A	Ui	Nt	1600–2600	Kaul (1986)
<i>Cheiranthus cheiri</i> L.	EU	P	Ui	Cn	1900–2700	Stewart (1972)
<i>Coronopus didymus</i> Sm.	AMS	A	Fd	Nt	1700–2200	Kaul (1986)
<i>Descurainia sophia</i> Webb.	AF	A	Ui	Nt	1700–2900	Kaul (1986)
<i>Diplotaxis muralis</i> DC.	EU	A	Fd	Nt	2200–2900	Naqshi and Javeid (1987)
<i>Erophila verna</i> Besser	AF	A	Fr	Nt	1600–2300	Kaul (1986)
<i>Eruca sativa</i> Miller	EU	A	Fd	Nt	1700–2000	Kaul (1986)



**Table 2** continued

Family/Name of plant species	Origin	Growth form	Mode/purpose of introduction	Invasion status	Altitudinal range (meters above sea level)	Primary published source
<i>Hesperis matronalis</i> L.	EU	B	Fd	Cn	1900–2700	Reshi (1984)
<i>Iberis amara</i> L.	EU	A	O	Cs	1600–2200	Stewart (1972)
<i>Lepidium sativum</i> L.	AS	A	Fd	Nt	1700–2600	Stewart (1972)
<i>Lepidium virginicum</i> L.	AMN	A	Fd	Cn	1800–2300	Naqshi and Javeid (1975)
<i>Lobularia maritima</i> Desv.	AF; EU	A	Fd	Cn	2000–2600	Stewart (1972)
<i>Matthiola incana</i> R. Br.	EU	P	O	Cn	1600–1900	Stewart (1972)
<i>Nasturtium officinale</i> R. Br.	EU	P	Ui	Nt	1600–2100	Kaul (1986)
<i>Raphanus sativus</i> L.	AF; EU	B	Fd	Cs	1600–2200	Reshi (1984)
<i>Rorippa islandica</i> Borbas	AS; EU	Aq	Ui	Nt	1600–1800	Naqshi and Javeid (1976)
<i>Sinapis alba</i> L.	AF; EU	A	Ui	Cn	2200–2900	Stewart (1972)
<i>Sisymbrium loesellii</i> L.	AF; EU	A	Ui	In	1600–2800	Kaul (1986)
<i>Turritis glabra</i> L.	EU	A	Ui	Nt	1700–2500	Kaul (1986)
<b>Buddlejaceae</b>						
<i>Buddleja alternifolia</i> Maxim.	AS	T	Ld	Cl	1600–1800	Ara et al. (1995)
<i>Buddleja davidii</i> Franch.	AS	T	Ld	Cl	1600–1700	Ara et al. (1995)
<i>Buddleja lindleyana</i> Fortune	AS	S	Ld	Nt	1700–1900	Stewart (1972)
<b>Butomaceae</b>						
<i>Butomus umbellatus</i> L.	AS; EU	P	Ui	In	1600–2000	Kaul (1986)
<b>Buxaceae</b>						
<i>Buxus sempervirens</i> L.	AS; AF; EU	S	Ld	Nt	1600–1700	Ara et al. (1995)
<b>Caesalpinaceae</b>						
<i>Cercis siliquastrum</i> L.	AS; EU	S	Ld	Cl	1600–1700	Singh and Misri (1974)
<i>Parkinsonia aculeata</i> L.	AMS	T	Ld	Cl	1600–1700	Stewart (1972)
<b>Calycanthaceae</b>						
<i>Chimonanthus praecox</i> Link.	AS	S	Ld	Cl	1600–1700	Stewart (1972)
<b>Campanulaceae</b>						
<i>Codonopsis clematidea</i> Clarke	AS	P	Ui	Cn	1600–2200	Stewart (1972)
<b>Cannabiaceae</b>						
<i>Cannabis sativa</i> L.	AS	A	Ui	In	1600–2400	Kaul (1986)
<b>Capparidaceae</b>						
<i>Humulus lupulus</i> L.	AMN	P	O	Cs	1600–2500	Dar et al. (2002)
<i>Cleome lutea</i> Hook.	AMN	A	O	Cl	1600–1800	Stewart (1972)
<b>Caprifoliaceae</b>						
<i>Lonicera japonica</i> Thunb.	AS	L	O	Cl	1600–1800	Ara et al. (1995)
<i>Lonicera quinquelocularis</i> Hardw.	AS	S	Pl	Nt	1800–2400	Stewart (1972)
<i>Sambucus wightiana</i> Wall. ex Wt. and Arn.	AS; AF	Ss	Ui	In	2200–3000	Stewart (1972)
<i>Sambucus nigra</i> L.	EU	S	O	Cl	1600–1800	Ara et al. (1995)
<i>Viburnum opulus</i> L.	AF; EU	S	O	Cl	1600–1900	Ara et al. (1995)
<i>Weigela florida</i> A. DC.	AS	S	O	Cl	1600–1700	Ara et al. (1995)
<b>Caryophyllaceae</b>						
<i>Arenaria serpyllifolia</i> L.	AS; EU	A	Ui	In	1600–2400	Kaul (1986)
<i>Cerastium glomeratum</i> Thuill.	EU	A	Ui	Nt	1600–2600	Kaul (1986)
<i>Dianthus barbatus</i> L.	AS	A	O	Nt	1600–2100	Stewart (1972)
<i>Dianthus caryophyllus</i> L.	EU	A	O	Cs	1600–1800	Stewart (1972)
<i>Gypsophila muralis</i> L.	EU	A	Ui	Nt	1800–2800	Stewart (1972)
<i>Holosteum umbellatum</i> L.	AF	A	Ui	Cn	1600–2300	Kaul (1986)
<i>Lychnis coronaria</i> Desr.	EU	P	Ui	In	1600–2700	Reshi (1984)
<i>Myosoton aquaticum</i> Moench.	AS; EU	Aq	Ui	Nt	1600–2500	Kaul (1986)
<i>Sagina procumbens</i> L.	EU; AMN	P	Ui	Cn	1900–2900	Stewart (1972)

**Table 2** continued

Family/Name of plant species	Origin	Growth form	Mode/purpose of introduction	Invasion status	Altitudinal range (meters above sea level)	Primary published source
<i>Sagina saginoides</i> Karst.	EU	P	Ui	In	2100–3000	Kaul (1986)
<i>Silene conoidea</i> L.	AS	A	Ui	Nt	1800–3100	Kaul (1986)
<i>Silene schafta</i> G. Gmel.	EU	P	Ui	Cs	1700–2200	Stewart (1972)
<i>Stellaria media</i> Cyr.	EU	A	Ui	In	1600–2900	Kaul (1986)
<b>Celastraceae</b>						
<i>Euonymus japonicus</i> L.	AS	S	O	Cl	1600–1800	Ara et al. (1995)
<b>Ceratophyllaceae</b>						
<i>Ceratophyllum demersum</i> L.	AMN	Aq	Ui	In	1600–2100	Kak (1990)
<b>Chenopodiaceae</b>						
<i>Atriplex hortensis</i> L.	EU	A	Fd	Cs	1600–2200	Stewart (1972)
<i>Chenopodium album</i> L.	EU	A	Fd	In	1600–2900	Kaul (1986)
<i>Chenopodium ambrosioides</i> L.	AMS	P	Ui	Nt	1700–2100	Kaul (1986)
<i>Chenopodium botrys</i> L.	AF; EU	A	Ui	Nt	1600–3700	Kaul (1986)
<i>Chenopodium foliosum</i> Aschers.	AS; EU	P	Ui	In	1600–2800	Kaul (1986)
<i>Chenopodium hybridum</i> L.	AS; EU	A	Fd	In	1700–3000	Reshi (1984)
<i>Chenopodium murale</i> L.	AF; EU	P	Ui	Nt	1700–2000	Stewart (1972)
<i>Chenopodium opulifolium</i> Schd. ex DC.	EU	P	Ui	Cs	2100–2600	Stewart (1972)
<i>Kochia scoparia</i> Schrad.	AS; EU	A	Fr	Cs	1600–2000	Stewart (1972)
<i>Spinacia oleracea</i> L.	AS	A	Fd	Cl	1600–1900	Dar et al. (2002)
<b>Convolvulaceae</b>						
<i>Convolvulus arvensis</i> L.	EU	P	Ui	In	1600–3100	Kaul (1986)
<i>Ipomoea eriocarpa</i> R. Br.	AS; AU	C	O	Cn	1600–1900	Kaul (1986)
<i>Ipomoea hederacea</i> Jacq.	AMS	C	O	Cs	1700–2100	Stewart (1972)
<i>Ipomoea hispida</i> Roem and Schult.	AS; AF	C	Ui	Cs	1600–2000	Stewart (1972)
<i>Ipomoea purpurea</i> Roth.	AMS	C	O	Nt	1700–2100	Reshi (1984)
<i>Ipomoea quamoclit</i> L.	AMS	C	Ui	Cn	1900–2300	Ara and Naqshi (1991)
<b>Crassulaceae</b>						
<i>Sedum ewersii</i> Ledeb.	AS	P	O	Cn	2700–3700	Stewart (1972)
<b>Cucurbitaceae</b>						
<i>Citrullus vulgaris</i> Schrad.	AF	A	Fd	Cl	1600–1800	Stewart (1972)
<i>Cucumis melo</i> L.	AS	A	Fd	Cl	1600–1700	Stewart (1972)
<i>Cucurbita maxima</i> Duch. ex. Lam.	AMS	A	Fd	Cl	1600–1700	Dar et al. (2002)
<i>Cucurbita pepo</i> L.	AF; AMN	A	Fd	Cl	1600–1700	Stewart (1972)
<b>Cupressaceae</b>						
<i>Cupressus arizonica</i> Greene	AMN	T	Ld	Cl	1600–1900	Ara et al. (1995)
<i>Cupressus sempervirens</i> L.	EU	T	Pl	Cl	1600–2600	Ara et al. (1995)
<i>Thuja orientalis</i> L.	AS	S	Pl	Cl	1600–2500	Ara et al. (1995)
<b>Cuscutaceae</b>						
<i>Cuscuta chinensis</i> Lam.	AS; AU	Ps	Ui	Cn	1600–2600	Reshi (1984)
<i>Cuscuta planiflora</i> Tenore	AS; EU	Ps	Ui	Cs	1800–2400	Stewart (1972)
<b>Cyperaceae</b>						
<i>Carex diluta</i> M. Bieb.	AU	P	Ui	Nt	1600–2500	Stewart (1972)
<i>Carex notha</i> Kunth.	AS	B	Ui	In	1600–3000	Kaul (1986)
<i>Cyperus difformis</i> L.	AF; EU	A	Ui	In	1600–3100	Reshi (1984)
<i>Cyperus flabelliformis</i> Rottb.	AF	Aq	Ui	Cn	2600–3200	Stewart (1972)
<i>Cyperus globosus</i> All.	AF; EU	A	Ui	In	1700–2500	Reshi (1984)
<i>Cyperus iria</i> L.	AS; AF	Aq	Ui	Nt	1800–2100	Kaul (1986)
<i>Cyperus rotundus</i> L.	EU	P	Ui	In	1600–2400	Kaul (1986)
<i>Cyperus sanguinolentus</i> L.	AMN; AMS	Aq	Ui	Cn	1700–1900	Kaul (1986)
<i>Eleocharis acicularis</i> Roem et Schult.	AMN; AMS	P	Ui	Cn	2100–2900	Kak and Javeid (1976)

**Table 2** continued

Family/Name of plant species	Origin	Growth form	Mode/purpose of introduction	Invasion status	Altitudinal range (meters above sea level)	Primary published source
<i>Eleocharis atropurpurea</i> Presl.	AMS	Aq	Ui	Nt	1600–1800	Reshi (1984)
<i>Eleocharis palustris</i> R. Br.	AS; AF	Aq	Ui	Nt	1700–1900	Stewart (1972)
<i>Eleocharis parishii</i> Britton	AMN	Aq	Ui	Cn	1700–2300	Kak (1990)
<i>Fimbristylis dichotoma</i> Vahl.	AS; AF	Aq	Ui	Nt	1600–2100	Reshi (1984)
<i>Scirpus juncooides</i> Roxb.	AMN	Aq	Ui	Cn	1600–1800	Kaul (1986)
<i>Scirpus triqueter</i> L.	AF	Aq	Ui	Nt	2400–3000	Stewart (1972)
<b>Dioscoreaceae</b>						
<i>Dioscorea bulbifera</i> L.	AS	Ss	Md	Nt	1600–1800	Stewart (1972)
<b>Ebenaceae</b>						
<i>Diospyros kaki</i> L.	AS	T	Fd	Nt	1800–2500	Ara et al. (1995)
<b>Elaeagnaceae</b>						
<i>Elaeagnus angustifolia</i> L.	AS; EU	S	O	Cl	1600–1900	Ara et al. (1995)
<i>Elaeagnus umbellata</i> Thunb.	AS	S	Pl	Nt	1700–2200	Singh and Kachroo (1976)
<b>Euphorbiaceae</b>						
<i>Euphorbia helioscopia</i> L.	AS; EU	A	Ui	In	1600–2500	Kaul (1986)
<i>Euphorbia hispida</i> Boiss.	AS	A	Ui	Nt	1800–2000	Reshi (1984)
<i>Ricinus communis</i> L.	AF	Ss	Fd	Cs	1600–1800	Stewart (1972)
<b>Fabaceae</b>						
<i>Amorpha fruticosa</i> L.	AMN	S	O	Cl	1600–1800	Ara et al. (1995)
<i>Arachis hypogaea</i> L.	AMS	A	Fd	Cl	1600–1900	Dar et al. (2002)
<i>Caragana versicolor</i> Benth.	AS	S	Pl	Nt	2500–2800	Stewart (1972)
<i>Glycine max</i> Merr.	AS	A	Fd	Cl	1600–2300	Dar et al. (2002)
<i>Laburnum anagyroides</i> Medic.	EU	T	O	Cl	1600–1700	Ara et al. (1995)
<i>Lathyrus aphaca</i> L.	AF; EU	A	Fr	Nt	1600–1900	Kaul (1986)
<i>Lathyrus odoratus</i> L.	EU	C	Fd	Cs	1600–1800	Dar et al. (2002)
<i>Lespedeza juncea</i> Pers.	AS; AU	B	Ui	Cn	1700–1900	Kaul (1986)
<i>Lotus corniculatus</i> L.	AS; EU	P	Fr	Nt	1600–2500	Kaul (1986)
<i>Lupinus polyphyllus</i> Lindl.	AMN	P	O	Cl	1600–1800	Stewart (1972)
<i>Medicago lupulina</i> L.	AF; EU	P	Fr	Nt	1600–2300	Kaul (1986)
<i>Medicago polymorpha</i> L.	AF; EU	A	Fr	In	1600–2500	Kaul (1986)
<i>Medicago sativa</i> L.	AF; EU	B	Fr	Nt	1600–1900	Dar et al. (2002)
<i>Ononis arvensis</i> L.	EU	Ss	Fr	Cn	1600–2300	Stewart (1972)
<i>Phaseolus vulgaris</i> L.	AMS	A	Fd	Cl	1600–2400	Dar et al. (2002)
<i>Robinia pseudoacacia</i> L.	AMN	T	Pl	In	1600–2200	Stewart (1972)
<i>Sophora japonica</i> L.	AS	T	O	Cl	1600–1800	Stewart (1972)
<i>Spartium junceum</i> L.	EU	S	O	Cl	1800–2000	Ara et al. (1995)
<i>Trifolium alexandrianum</i> L.	AS	A	Fr	Cs	1600–2400	Dar et al. (2002)
<i>Trifolium dubium</i> Sibth.	EU	A	Fr	Cn	1600–1800	Singh (1972)
<i>Trifolium fragiferum</i> L.	EU	P	Fr	Nt	1600–1700	Kaul (1986)
<i>Trifolium pratense</i> L.	EU	P	Fr	In	1600–3000	Kaul (1986)
<i>Trifolium repens</i> L.	EU	P	Fr	In	1600–3400	Kaul (1986)
<i>Trigonella foenum-graecum</i> L.	AS; EU	A	Fd	Cs	1600–1900	Kaul (1986)
<i>Vicia faba</i> L.	AS; AF	A	Fd	Nt	1600–2100	Dar et al. (2002)
<i>Vicia narbonensis</i> L.	EU	A	Fr	Cs	1700–2000	Stewart (1972)
<i>Vicia sativa</i> L.	AS; EU	A	Fr	Cn	1600–1800	Kaul (1986)
<i>Wisteria sinensis</i> Sw.	AS	L	O	Cl	1600–1700	Ara et al. (1995)
<b>Fagaceae</b>						
<i>Castanea sativa</i> Mill.	AF; EU	T	Fd	Cl	1600–1800	Dar et al. (2002)
<i>Quercus baloot</i> Griffith	EU	T	Pl	Nt	1600–1700	Stewart (1972)
<i>Quercus robur</i> L.	AS; AF; EU	T	Pl	Cl	1700–1900	Singh and Kachroo (1976)
<b>Geraniaceae</b>						
<i>Erodium cicutarium</i> L'Herit. ex Ait.	AF; EU	A	Ui	Nt	1700–2200	Kaul (1986)

**Table 2** continued

Family/Name of plant species	Origin	Growth form	Mode/purpose of introduction	Invasion status	Altitudinal range (meters above sea level)	Primary published source
<i>Geranium rotundifolium</i> L.	AS; EU	A	Ui	Nt	1600–2100	Kaul (1986)
<i>Pelargonium zonale</i> Ait.	AF	P	O	Cl	1600–1800	Stewart (1972)
<b>Ginkgoaceae</b>						
<i>Ginkgo biloba</i> L.	AS	T	Ld	Cl	1600–1700	Javied (1964)
<b>Grossulariaceae</b>						
<i>Ribes alpestre</i> Dcne	AF; EU	S	Pl	Nt	2300–3400	Stewart (1972)
<b>Hippocastanaceae</b>						
<i>Aesculus indica</i> Hook. f.	NA	T	Pl	Nt	1600–2600	Ara et al. (1995)
<b>Hydrocharitaceae</b>						
<i>Hydrocharis dubia</i> Backer	AS; EU	Aq	Ui	Nt	1600–2600	Kak (1990)
<i>Vallisneria spiralis</i> L.	EU	Aq	Ui	Cn	1600–2300	Kak (1990)
<b>Hypericaceae</b>						
<i>Hypericum perforatum</i> L.	EU	P	Ui	Nt	1600–2900	Kaul (1986)
<b>Iridaceae</b>						
<i>Crocus sativus</i> L.	AS	A	Fd	Cl	1600–1700	Dar et al. (2002)
<i>Iris ensata</i> Thunb.	AS	P	O	In	1600–2200	Reshi (1984)
<i>Iris germanica</i> L.	EU	P	O	Nt	1600–2400	Kaul (1986)
<i>Iris reticulata</i> M. Bieb.	EU	P	O	Nt	1600–1900	Stewart (1972)
<i>Iris spuria</i> L.	AS; EU	P	O	Cn	1600–1900	Kaul (1986)
<i>Ixia maculata</i> L.	AF	P	O	Cn	1700–1900	Stewart (1972)
<i>Freesia refracta</i> Klatt.	AF	P	O	Cl	1600–1700	Stewart (1972)
<b>Juglandaceae</b>						
<i>Juglans nigra</i> L.	AMN	T	Ld	Cl	1600–1700	Ara et al. (1995)
<b>Juncaceae</b>						
<i>Juncus articulatus</i> L.	AS; EU	Aq	Ui	In	1700–2800	Kaul (1986)
<i>Juncus bufonius</i> L.	AS; EU	A	Ui	Nt	1800–2400	Reshi (1984)
<i>Juncus inflexus</i> L.	AF	P	Ui	Cn	1600–2400	Stewart (1972)
<b>Lamiaceae</b>						
<i>Clinopodium umbrosum</i> C. Koch	AS; EU	P	Ui	Nt	1800–3100	Stewart (1972)
<i>Clinopodium vulgare</i> L.	AS; EU	P	Ui	Nt	1700–2900	Stewart (1972)
<i>Dracocephalum nutans</i> L.	AS	P	Fd	Cs	2200–2900	Stewart (1972)
<i>Lavendula officinalis</i> Chaix	EU	Ss	Md	Cl	1600–2200	FR
<i>Leucas mollissima</i> Wall. ex Benth.	AS	A	O	Cn	1600–2000	Stewart (1972)
<i>Lycopus europaeus</i> L.	EU	P	Ui	Nt	2000–2800	Kaul (1986)
<i>Marrubium anisodon</i> C. Koch	AF; EU	P	Ui	Cn	2000–2900	Stewart (1972)
<i>Marrubium vulgare</i> L.	AS; EU	P	Ui	In	1700–2500	Kaul (1986)
<i>Mentha aquatica</i> L.	EU	Aq	Ui	Nt	1900–2400	Stewart (1972)
<i>Mentha arvensis</i> L.	AF; EU	P	Fd	Nt	1600–2600	Reshi (1984)
<i>Mentha longifolia</i> L.	AF; EU	P	Ui	In	1800–3700	Kaul (1986)
<i>Mentha piperita</i> L.	EU	P	Fd	Cl	1600–2800	Reshi (1984)
<i>Mentha spicata</i> L.	EU; AMN	P	Fd	Cs	1600–2300	Stewart (1972)
<i>Nepeta cataria</i> L.	EU	P	Ui	Nt	1700–2800	Kaul (1986)
<i>Origanum vulgare</i> L.	EU	P	Ui	Nt	2000–2800	Kaul (1986)
<i>Prunella vulgaris</i> L.	AF; EU	P	Md	Nt	1600–2900	Kaul (1986)
<i>Rosmarinus officinalis</i> L.	EU	S	Md	Cl	1600–1800	FR
<i>Salvia coccinea</i> Eclinger	AMN; AMS	P	Ui	Cs	1700–2900	Stewart (1972)
<i>Salvia officinalis</i> L.	EU	Ss	O	Cn	1900–2800	Stewart (1972)
<i>Scutellaria teucriifolia</i> Dunn	EU	Ss	Ui	Cs	1900–2500	Stewart (1972)
<i>Teucrium scordium</i> L.	EU	B	Ui	Cn	2300–3100	Kaul (1986)
<i>Thymus linearis</i> Benth.	AS	Ss	Md	Nt	1600–2000	Stewart (1972)
<i>Thymus serpyllum</i> L.	EU	Ss	Fr	In	1600–3400	Kaul (1986)

**Table 2** continued

Family/Name of plant species	Origin	Growth form	Mode/purpose of introduction	Invasion status	Altitudinal range (meters above sea level)	Primary published source
<b>Lauraceae</b>						
<i>Laurus ovata</i> L.	EU	T	Ld	Cl	1600–1700	Ara et al. (1995)
<b>Lemnaceae</b>						
<i>Lemna minor</i> L.	AS; AF	Aq	Ui	In	1600–2500	Kaul (1986)
<i>Lemna turionifera</i> Landolt	AS; AMN	Aq	Ui	Cs	1800–2300	Kak (1990)
<i>Spirodela polyrhiza</i> Schleid.	AS; AF	Aq	Ui	In	1600–2600	Reshi (1984)
<i>Wolffia arrhiza</i> Horkel ex Wimmer	AF; EU	Aq	Ui	Nt	1700–2200	Kak (1990)
<b>Liliaceae</b>						
<i>Aloe barbadensis</i> Mill.	AF; EU	P	O	Cl	1600–1700	Stewart (1972)
<i>Asparagus officinalis</i> L.	AS; EU	Ss	Md	Nt	1800–2600	Kaul (1986)
<i>Hemerocallis fulva</i> L.	EU	P	O	Nt	1600–2200	Stewart (1972)
<i>Hyacinthus orientalis</i> L.	AS; EU	P	O	Cl	1600–1700	Stewart (1972)
<i>Tulipa lanata</i> E. Regel	AS; EU	P	O	Nt	1600–2700	Kaul (1986)
<b>Linaceae</b>						
<i>Linum usitatissimum</i> L.	EU	P	Fd	Cl	1600–2300	Dar et al. (2002)
<b>Lythraceae</b>						
<i>Ammania auriculata</i> Willd.	AS; AU	A	Ui	Nt	1600–2600	Kaul (1986)
<i>Ammania baccifera</i> L.	AS; AU	A	Ui	Nt	1700–2700	Kaul (1986)
<i>Rotala densiflora</i> Koehne	AS; AU	A	Ui	Nt	1600–2200	Kaul (1986)
<b>Magnoliaceae</b>						
<i>Magnolia grandiflora</i> L.	AMN	T	O	Cl	1600–1700	Ara et al. (1995)
<i>Magnolia kobus</i> DC.	AS	T	O	Cl	1600–1700	Ara et al. (1995)
<i>Magnolia liliflora</i> Desr.	AS	T	O	Cl	1600–1800	Ara et al. (1995)
<b>Malvaceae</b>						
<i>Abelmoschus esculentus</i> Moench	AS; AF	A	Fd	Cl	1600–1800	Naqshi et al. (1988)
<i>Abutilon theophrasti</i> Medic.	EU	A	Ui	Cn	1800–2500	Kaul (1986)
<i>Althaea officinalis</i> L.	EU	P	O	Cs	1600–1900	Naqshi et al. (1988)
<i>Althaea rosea</i> Cav.	AS	B	O	Cs	1600–1900	Naqshi et al. (1988)
<i>Hibiscus rosa-sinensis</i> L.	AS	S	Ld	Nt	1600–2600	Naqshi et al. (1988)
<i>Hibiscus syriacus</i> L.	AS	S	O	Cs	1700–2200	Ara et al. (1995)
<i>Hibiscus schizopetalus</i> Hook. f.	AF	A	O	Cs	2000–2500	Naqshi et al. (1988)
<i>Hibiscus trionum</i> L.	AF	A	Ui	Nt	1600–2000	Kaul (1986)
<i>Malva mauritiana</i> L.	EU	A	Fd	Cs	1800–2000	Naqshi et al. (1988)
<i>Malva neglecta</i> Wall.	AS; AF	B	Fd	Nt	1600–2400	Kaul (1986)
<i>Malva verticillata</i> L.	AS	A	Fd	Cn	1600–2100	Naqshi et al. (1988)
<i>Sida cordata</i> Blumea	AMS	A	Ui	Cn	1800–2000	Naqshi et al. (1988)
<b>Marsileaceae</b>						
<i>Marsilea quadrifolia</i> L.	EU	Aq	Ui	In	1600–2200	Reshi (1984)
<b>Meliaceae</b>						
<i>Melia azedarach</i> L.	AS	T	Pl	Cl	1600–1700	Ara et al. (1995)
<b>Menyanthaceae</b>						
<i>Menyanthes trifoliata</i> L.	AS	P	Ui	Cn	1600–2100	Kaul (1986)
<i>Nymphoides peltatum</i> Kuntze	AS; EU	Aq	Fd	In	1600–1800	Kaul (1986)
<b>Mimosoaceae</b>						
<i>Albizia julibrissin</i> Durazz.	AS	T	Ld	Cl	1600–1800	Ara et al. (1995)
<b>Moraceae</b>						
<i>Ficus carica</i> L.	EU	T	Fd	Nt	1600–1900	Dar et al. (2002)
<i>Ficus religiosa</i> L.	EU	T	Pl	Nt	1600–1700	Stewart (1972)
<i>Morus alba</i> L.	AS	T	Ht	Nt	1600–2500	Dar et al. (2002)
<i>Morus nigra</i> L.	AS	T	Ht	Nt	1600–2200	Dar et al. (2002)



**Table 2** continued

Family/Name of plant species	Origin	Growth form	Mode/purpose of introduction	Invasion status	Altitudinal range (meters above sea level)	Primary published source
<b>Najadaceae</b>						
<i>Najas gramineum</i> Del.	AMN; AMS	Aq	Ui	Cn	1600–1900	Kak (1990)
<b>Nyctaginaceae</b>						
<i>Bougainvillea glabra</i> Choisy	AMS	L	O	Cn	1600–1900	Stewart (1972)
<i>Bougainvillea spectabilis</i> Willd	AMS	L	O	Cn	1600–1700	Stewart (1972)
<i>Mirabilis jalapa</i> L.	AMS	P	O	Cs	1600–1800	Stewart (1972)
<b>Nymphaeaceae</b>						
<i>Nymphaea alba</i> L.	AF; EU	Aq	Ui	Nt	1600–2500	Koul and Naqshi (1988)
<i>Nymphaea lotus</i> L.	AF	Aq	Ui	Cn	1700–2200	Koul and Naqshi (1988)
<i>Nymphaea mexicana</i> Zucc.	AMN	Aq	O	Nt	1600–1900	Kak (1990)
<i>Nymphaea tetragona</i> Georgi	AS; AMN	Aq	Ui	Nt	1600–2400	Koul and Naqshi (1988)
<i>Nymphaea tuberosa</i> Paine.	AMN	Aq	Ui	Cn	1600–1700	Koul and Naqshi (1988)
<b>Oleaceae</b>						
<i>Forsythia viridissima</i> Lindl.	AS	S	O	Cl	1600–1900	Ara et al. (1995)
<i>Fraxinus excelsior</i> L.	AS; EU	T	Ld	Cl	2200–2400	Stewart (1972)
<i>Jasminum humile</i> L.	AS	S	O	Nt	1800–2300	Ara et al. (1995)
<i>Ligustrum lucidum</i> Ait.	AS	S	O	Cl	1600–2000	Ara et al. (1995)
<i>Ligustrum ovalifolium</i> Haussk.	AS	S	O	Cl	1600–1700	Ara et al. (1995)
<i>Ligustrum vulgare</i> L.	AS; AF; EU	S	O	Cl	1600–1700	Ara et al. (1995)
<i>Olea europaea</i> L.	EU	T	Fd	Nt	1600–1800	Stewart (1972)
<i>Syringa emodi</i> Don.	AS	S	O	Nt	2100–2900	Stewart (1972)
<i>Syringa laciniata</i> Miller	AS	S	O	Cl	1600–1800	Ara et al. (1995)
<i>Syringa persica</i> L.	AS	S	O	Cl	1600–1700	Ara et al. (1995)
<b>Onagraceae</b>						
<i>Epilobium cylindricum</i> D. Don	AS	P	Ui	Nt	1700–1800	Reshi (1984)
<i>Epilobium hirsutum</i> L.	AF; EU	P	Ui	In	1600–2600	Kaul (1986)
<i>Epilobium parviflorum</i> Schreb.	AF; EU	P	Ui	Nt	1700–2500	Reshi (1984)
<i>Epilobium tetragonum</i> L.	AF; EU	B	Ui	Cn	1800–2400	Dar and Naqshi (1985)
<i>Godetia amoena</i> Den.	AMN; AMS	A	O	Cl	1600–1700	FR
<i>Oenothera biennis</i> L.	AMN	B	O	Nt	1600–2400	Khuroo et al. (2004)
<i>Oenothera glazioviana</i> Micheli	AMN	B	O	Nt	1600–2300	Dar and Naqshi (1984)
<i>Oenothera hookeri</i> Torr. and Gray	AMN	B	Ui	Cs	1700–2000	Stewart (1972)
<i>Oenothera rosea</i> Ait.	AMS	A	Ui	In	1600–2900	Kaul (1986)
<b>Oxalidaceae</b>						
<i>Oxalis corniculata</i> L.	AS; EU	P	Ui	Nt	1600–2500	Kaul (1986)
<b>Paeoniaceae</b>						
<i>Paeonia suffruticosa</i> Andr.	AS	S	O	Cl	1600–1700	Ara et al. (1995)
<b>Papaveraceae</b>						
<i>Eschscholzia californica</i> Cham.	AMN	A	O	Cs	1600–1900	Stewart (1972)
<i>Papaver dubium</i> L.	AF; EU	A	Ui	Cn	1600–2200	Kaul (1986)
<i>Papaver hybridum</i> L.	AS; EU	A	Ui	Nt	1600–1800	Stewart (1972)
<i>Papaver macrostomum</i> Boiss.	AS	A	Ui	Cn	1800–2200	Kaul (1986)
<i>Papaver rhoeas</i> L.	AF; EU	A	O	Cs	1700–2300	Kaul (1986)
<i>Papaver somniferum</i> L.	EU	A	Md	Cs	1600–1800	Stewart (1972)
<b>Passifloraceae</b>						
<i>Passiflora edulis</i> Sims	AMS	L	O	Cl	1600–1700	Stewart (1972)

**Table 2** continued

Family/Name of plant species	Origin	Growth form	Mode/purpose of introduction	Invasion status	Altitudinal range (meters above sea level)	Primary published source
<b>Philadelphaceae</b>						
<i>Philadelphus incanus</i> Koehne	AS	S	O	Cl	1600–1700	Ara et al. (1995)
<i>Philadelphus pubescens</i> Lois.	AMN	S	O	Cl	1600–1800	Ara et al. (1995)
<b>Pinaceae</b>						
<i>Pinus canariensis</i> Smith	EU	T	Pl	Cl	1800–2000	Ara et al. (1995)
<i>Pinus halepensis</i> Mill	AF; EU	T	Pl	Cl	1700–1800	Ara et al. (1995)
<i>Pinus radiata</i> D. Don	AMN	T	Pl	Cl	1700–1900	Ara et al. (1995)
<b>Plantaginaceae</b>						
<i>Plantago lanceolata</i> L.	AF; EU	P	Ui	In	1600–3000	Kaul (1986)
<i>Plantago major</i> L.	EU	P	Ui	In	1600–2800	Kaul (1986)
<b>Plantanaceae</b>						
<i>Plantanus occidentalis</i> L.	AMN	T	Ld	Cl	1600–1700	Ara et al. (1995)
<i>Plantanus orientalis</i> L.	AS; EU	T	Pl	Nt	1600–2200	Stewart (1972)
<b>Poaceae</b>						
<i>Aegilops tauschii</i> Cosson	AF	A	Fr	In	1700–2500	Stewart (1972)
<i>Agrostis canina</i> L.	EU	P	Ui	Nt	2500–3000	Stewart (1972)
<i>Agrostis palustris</i> Huds.	EU	P	Ui	Nt	1700–2100	Stewart (1972)
<i>Agrostis stolonifera</i> L.	AMN	P	Fr	In	1700–2800	Kaul (1986)
<i>Agrostis tenuis</i> Sibth.	EU	P	Ui	Nt	1900–2500	Stewart (1972)
<i>Alopecurus aequalis</i> Sobol.	AMN	B	Ui	Nt	1700–2000	Reshi (1984)
<i>Alopecurus arundinaceus</i> Poir.	EU	P	Fr	Nt	1800–2600	Kaul (1986)
<i>Arthraxon lancifolius</i> Hochst.	AF	P	Ui	Cn	1700–1900	Reshi (1984)
<i>Arundo donax</i> L.	AF; EU	Ss	Ui	Cs	1800–2000	Stewart (1972)
<i>Avena barbata</i> Pott. ex Link.	EU	A	Fr	Cl	1600–1900	Stewart (1972)
<i>Avena fatua</i> L.	EU	P	Fr	Nt	1600–2000	Reshi (1984)
<i>Bothriochloa ischaemum</i> Keng	AF	P	Ui	In	1600–3000	Reshi (1984)
<i>Bothriochloa pertusa</i> A. Camus	AS; AF	P	Ui	Nt	1800–2000	Reshi (1984)
<i>Briza media</i> L.	EU	P	Fr	Cn	2500–4000	Stewart (1972)
<i>Bromus inermis</i> Leyss.	EU	P	Fr	In	1600–2800	Kaul (1986)
<i>Bromus japonicus</i> Thunb.	EU	A	Fr	Nt	1600–2600	Reshi (1984)
<i>Bromus unioloides</i> Kunth.	AMS	A	Fr	Cn	1700–2100	Stewart (1972)
<i>Capillipedium parviflorum</i> Stapf	AS; AU	P	Ui	Nt	1700–1900	Stewart (1972)
<i>Chloris gayana</i> Kunth.	AF	P	Fr	Cs	1700–1900	Stewart (1972)
<i>Dactylis glomerata</i> L.	AS; EU	P	Fr	In	1600–3200	Kaul (1986)
<i>Digitaria adscendens</i> Hern.	AS; AF	A	Ui	Cs	1600–1800	Stewart (1972)
<i>Digitaria longiflora</i> Pers.	AF	A	Ui	Nt	1900–3100	Kaul (1986)
<i>Digitaria sanguinalis</i> Scop.	EU	A	Ui	Cn	1600–1800	Kaul (1986)
<i>Echinochloa colonum</i> Link.	EU	Aq	Ui	Nt	1700–1900	Stewart (1972)
<i>Echinochloa crus-galli</i> Beauv.	AS	Aq	Ui	Nt	1600–2400	Kaul (1986)
<i>Eragrostis pilosa</i> P. Beauv.	AF	A	Ui	In	1600–2600	Kaul (1986)
<i>Eragrostis poaeoides</i> P. Beauv.	AS; AF	A	Ui	Nt	1700–2000	Reshi (1984)
<i>Erianthus ravennae</i> Beauv.	EU	P	Fr	Cs	2400–2800	Stewart (1972)
<i>Helictotrichon pratense</i> Pilger	EU	P	Ui	Nt	2400–3200	Stewart (1972)
<i>Hordeum vulgare</i> L.	EU; AMN	A	Fr	Cs	1600–1900	Dar et al. (2002)
<i>Imperata cylindrica</i> P. Beauv.	AS; EU	P	Ui	Nt	1800–2000	Kaul (1986)
<i>Koeleria macrantha</i> Schult.	AS; EU	P	Fr	Nt	2400–2900	Stewart (1972)
<i>Lagurus ovatus</i> L.	EU	A	Fr	Cs	1800–2300	Stewart (1972)
<i>Lolium perenne</i> L.	AS; EU	P	Fr	Nt	1600–2300	Reshi (1984)
<i>Lolium temulentum</i> L.	EU	A	Fr	In	1600–2700	Kaul (1986)
<i>Lygeum spartum</i> Loeft. ex L.	EU	P	Fr	Cs	2100–2500	Stewart (1972)
<i>Oryza sativa</i> L.	AS	A	Fd	Cl	1600–2200	Stewart (1972)
<i>Panicum miliaceum</i> L.	AS	A	Fr	Cn	1800–2400	Kaul (1986)
<i>Paspalum paspaloides</i> Scribner	AMN	A	Fr	Nt	1600–1800	Stewart (1972)
<i>Pennisetum orientale</i> Rich.	AS; AF	P	Fr	Nt	1800–2500	Kaul (1986)

**Table 2** continued

Family/Name of plant species	Origin	Growth form	Mode/purpose of introduction	Invasion status	Altitudinal range (meters above sea level)	Primary published source
<i>Phacelurus speciosus</i> Hubb.	AS	P	Fr	Cn	1700–2300	Stewart (1972)
<i>Phalaris arundinacea</i> L.	EU; AMN	P	Fr	Nt	1800–2200	Stewart (1972)
<i>Phleum pratense</i> L.	EU	P	Fr	Nt	2400–3000	Stewart (1972)
<i>Phragmites australis</i> Trin.	AMS	P	Fr	In	1600–2600	Kaul (1986)
<i>Poa angustifolia</i> L.	EU	P	Ui	Nt	1600–2200	Kaul (1986)
<i>Poa annua</i> L.	EU	A	Ui	In	1600–3200	Kaul (1986)
<i>Poa palustris</i> L.	AMN; AMS	P	Ui	Nt	1900–2400	Stewart (1972)
<i>Poa pratensis</i> L.	EU; AMN	P	Ui	Nt	1800–2200	Reshi (1984)
<i>Poa trivialis</i> L.	EU	P	Ui	Cs	1900–2300	Stewart (1972)
<i>Polypogon fugax</i> Nees ex Steud.	AS	A	Fr	Nt	1700–2400	Reshi (1984)
<i>Polypogon monspeliensis</i> Desf.	EU	A	Fr	Cn	3200–3400	Kaul (1986)
<i>Setaria pumila</i> Roem. and Schult.	AS; AF	A	Fr	Cn	1900–2100	Stewart (1972)
<i>Setaria viridis</i> P. Beauv.	AS; AF	A	Fr	In	1600–2900	Kaul (1986)
<i>Sorghum halepense</i> Pers.	EU	P	Fr	In	1600–2700	Kaul (1986)
<i>Sorghum nitidum</i> Pers.	AS; AU	P	Fr	Nt	1700–1900	Kaul (1986)
<i>Sorghum vulgare</i> Pers.	AF	A	Fr	Nt	1600–2500	Stewart (1972)
<i>Themeda anathera</i> Hack.	AS	P	Fr	In	1800–2900	Stewart (1972)
<i>Triticum aestivum</i> L.	na	A	Fd	Cl	1600–1800	Stewart (1972)
<i>Vulpia myuros</i> Gmel.	EU	A	Fr	In	1800–3200	Kaul (1986)
<i>Zea mays</i> L.	AMS	A	Fd	Cl	1600–2800	Stewart (1972)
<b>Polemoniaceae</b>						
<i>Phlox drummondii</i> Hook.	AMN	A	O	Cs	1600–1900	Stewart (1972)
<i>Polemonium coeruleum</i> L.	EU	P	Ui	Nt	2400–2900	Stewart (1972)
<b>Polygonaceae</b>						
<i>Fagopyrum esculentum</i> Moench	AS	A	Fd	Cs	1900–3200	Munshi and Javied (1986)
<i>Polygonum amphibium</i> L.	AMN	Aq	Ui	Nt	1600–1800	Kak (1990)
<i>Polygonum aviculare</i> L.	EU	A	Ui	In	1600–2500	Reshi (1984)
<i>Polygonum hydropiper</i> L.	EU	A	Fd	In	1600–3000	Kaul (1986)
<i>Polygonum maritimum</i> L.	AF; EU	P	Ui	Cs	1700–2300	Munshi and Javied (1986)
<i>Polygonum orientale</i> L.	AS; AU	A	Fd	Cs	1800–2000	Kaul (1986)
<i>Polygonum pacificum</i> V. Petrov ex Komarov	AS	P	Ui	Cs	1900–2200	Munshi and Javied (1976)
<i>Polygonum rotboelliioides</i> Jaub.	AS	A	Ui	Cn	1800–2700	Reshi (1984)
<i>Rumex alveolatus</i> Losinsk	AS	P	Ui	Cn	1800–2400	Munshi and Javied (1986)
<i>Rumex conglomerates</i> Murr.	AS; EU	P	Ui	Cn	2100–2500	Munshi (1975)
<i>Rumex crispus</i> L.	AS; EU	P	Ui	Nt	1700–2000	Munshi and Javied (1986)
<i>Rumex dentatus</i> L.	AF; EU	A	Md	Nt	1800–2200	Kaul (1986)
<i>Rumex hastatus</i> D. Don	AS	P	Md	In	1700–2600	Reshi (1984)
<i>Rumex nepalensis</i> Spreng.	AF; EU	P	Fd	Nt	1800–2600	Munshi and Javied (1986)
<i>Rumex palustris</i> Smith	EU	B	Ui	Nt	2200–2800	Munshi and Javied (1976)
<b>Portulacaceae</b>						
<i>Portulaca oleracea</i> L.	AF; AMS	A	Fd	Nt	1600–1900	Kaul (1986)

**Table 2** continued

Family/Name of plant species	Origin	Growth form	Mode/purpose of introduction	Invasion status	Altitudinal range (meters above sea level)	Primary published source
<b>Potamogetonaceae</b>						
<i>Potamogeton crispus</i>	EU; AMS	Pq	Ui	In	1600–2400	Naqshi and Javeid (1973)
L. var. <i>serrulatus</i> Reichb.						
<i>Potamogeton filiformis</i> Pers.	EU; AMN	Aq	Ui	Nt	1800–2100	Kak and Javeid (1982)
<i>Potamogeton lucens</i>	AF; EU	Aq	Ui	Cn	1600–2000	Naqshi and Javeid (1973)
L. var. <i>acuminatus</i> Fries						
<i>Potamogeton natans</i> L.	AS; EU	Aq	Ui	Nt	1600–2500	Kak (1984b)
<i>Potamogeton nodosus</i> Poir.	AMN	Aq	Ui	Nt	1600–2200	Kak (1984b)
<b>Primulaceae</b>						
<i>Anagalis arvensis</i> L.	EU	A	Ui	In	1600–2800	Kaul (1986)
<b>Ranunculaceae</b>						
<i>Aconitum laeve</i> Royle	EU	P	Md	Cn	2500–3000	Stewart (1972)
<i>Adonis aestivalis</i> L.	EU	A	Ui	Nt	1900–2400	Kaul (1986)
<i>Anemone biflora</i> DC.	AF; EU	P	O	Nt	1900–2700	Kaul (1986)
<i>Ceratocephalus falcatus</i> Pers.	EU	A	Ui	Nt	1800–2200	Kaul (1986)
<i>Consolida ambigua</i>	EU	A	O	Cs	1600–2600	Stewart (1972)
Ball and Heywood						
<i>Delphinium ajacis</i> L.	EU	A	O	Cs	1600–2800	Stewart (1972)
<i>Nigella damascena</i> L.	AF; EU	A	O	Cs	1600–2200	Stewart (1972)
<i>Nigella sativa</i> L.	EU	A	O	Cs	1600–2400	FR
<i>Ranunculus arvensis</i> L.	AF; EU	A	Ui	In	1600–3200	Kaul (1986)
<i>Ranunculus asiaticus</i> L.	AS; EU	P	O	Cl	1600–1700	FR
<i>Ranunculus laetus</i>	EU	P	Ui	In	1600–2800	Kaul (1986)
Wall. ex Hk. f. and T.						
<i>Ranunculus lingua</i> L.	EU	Aq	Ui	Nt	1700–2300	Kaul (1986)
<i>Ranunculus muricatus</i> L.	AF; EU	A	Ui	In	1600–2700	Kaul (1986)
<i>Ranunculus sceleratus</i> L.	EU	A	Ui	Nt	1600–2300	Kaul (1986)
<i>Thalictrum minus</i> L.	EU	P	Ui	Nt	1700–2400	Stewart (1972)
<b>Rosaceae</b>						
<i>Chaenomeles lagenaria</i> Koidz.	AS	S	O	Cl	1600–1700	Ara et al. (1995)
<i>Crataegus songarica</i> C. Koch	AF; EU	T	Ld	Cl	1700–1900	Stewart (1972)
<i>Cydonia oblonga</i> Mill	AS	T	Ht	Cl	1600–1800	Dar et al. (2002)
<i>Eriobotrya japonica</i> Lindl.	AS	T	O	Cl	1600–1700	Dar et al. (2002)
<i>Fragaria nubicola</i>	EU	P	Fd	Nt	1600–3100	Reshi (1984)
Lindel. ex. Lacaita						
<i>Kerria japonica</i> DC.	AS	S	O	Cl	1700–1800	Ara et al. (1995)
<i>Malus baccata</i> Borkh.	AS	T	Ht	Cl	1600–1800	Stewart (1972)
<i>Potentilla reptans</i> L.	AS; EU	P	Ui	Nt	1700–2600	Kaul (1986)
<i>Potentilla supina</i> L.	AF; EU	A	Ui	Nt	1800–3000	Kaul (1986)
<i>Prunus amygdalus</i> Batsch	EU	T	Ht	Cl	1600–1800	Dar et al. (2002)
<i>Prunus armeniaca</i> L.	AS	T	Ht	Cl	1600–2200	Dar et al. (2002)
<i>Prunus avium</i> L.	AS; EU	T	Ht	Cl	1600–1900	Dar et al. (2002)
<i>Prunus cerasifera</i> Ehrh.	AS	T	Ht	Cl	1600–2100	Stewart (1972)
<i>Prunus cerasus</i> L.	AS; EU	T	Ht	Cs	1700–2000	Dar et al. (2002)
<i>Prunus domestica</i> L.	AS	T	Ht	Cl	1600–1900	Dar et al. (2002)
<i>Prunus persica</i> Batsch	AS	T	Ht	Cl	1600–2300	Dar et al. (2002)
<i>Prunus tomentosa</i> Thumb	AS	S	Ht	Nt	1800–2500	Stewart (1972)
<i>Pyrus communis</i> L.	AS; EU	T	Ht	Cl	1600–2000	Dar et al. (2002)
<i>Pyrus lindleyi</i> Rehder	AS	T	Pl	Cl	1700–1800	Stewart (1972)
<i>Pyrus pyrifolia</i> Nakai	AS	T	Ht	Cl	1800–1900	Ara et al. (1995)
<i>Rosa banksiae</i> R. Br.	AS	L	O	Cs	1600–1700	Ara et al. (1995)
<i>Rosa brunonii</i> Lindl.	AF; EU	S	O	Nt	1700–2400	Stewart (1972)
<i>Rosa chinensis</i> Jacq.	AS	L	O	Cl	1600–1800	Ara et al. (1995)

**Table 2** continued

Family/Name of plant species	Origin	Growth form	Mode/purpose of introduction	Invasion status	Altitudinal range (meters above sea level)	Primary published source
<i>Rosa multiflora</i> Thunb.	AS	S	O	Cn	1600–1900	Stewart (1972)
<i>Rubus ulmifolius</i> Schott.	EU	S	Ld	In	1600–2800	Ara et al. (1995)
<i>Sorbaria aitchisonii</i> Hemsl.	AS	S	O	Cn	1800–2400	Stewart (1972)
<i>Sorbus domestica</i> L.	AF; EU	T	O	Cs	2000–2700	Ara et al. (1995)
<i>Spiraea cantoniensis</i> Lour.	AS	S	O	Cl	1600–2500	Ara et al. (1995)
<i>Spiraea hypericifolia</i> L.	AS; EU	S	O	Cl	1600–2000	Stewart (1972)
<i>Spiraea prunifolia</i> Sieb. and Zucc.	AS	S	O	Cl	1600–1800	Ara et al. (1995)
<b>Rubiaceae</b>						
<i>Galium aparine</i> L.	AF; EU	A	Ui	Cn	1600–3200	Kaul (1986)
<i>Galium asperifolium</i> Wall.	EU	P	Ui	Nt	1600–3000	Stewart (1972)
<i>Galium boreale</i> L.	AMN	P	Ui	Cn	2000–2500	Stewart (1972)
<i>Galium elegans</i> Wall.	AF; EU	A	Ui	Nt	1800–2700	Stewart (1972)
<i>Galium palustre</i> L.	AF; EU	P	Ui	Nt	1700–2600	Kak and Javeid (1976)
<i>Galium tenuissimum</i> Bieb.	AS	A	Ui	Nt	1900–2700	Stewart (1972)
<i>Galium verum</i> L.	EU	P	Ui	Cn	1700–3100	Kaul (1986)
<i>Rubia cordifolia</i> L.	AS; AF	C	Ui	Nt	1800–2600	Kaul (1986)
<b>Rutaceae</b>						
<i>Citrus reticulata</i> Blanco	AS	T	Ht	Cl	1600–1700	Stewart (1972)
<i>Citrus sinensis</i> Osbeck	AS	T	Ht	Cl	1600–1700	Stewart (1972)
<b>Salicaceae</b>						
<i>Populus alba</i> L.	EU	T	Pl	Nt	1600–2100	Javeid (1972)
<i>Populus canadensis</i> Moench	EU; AMN	T	Pl	Cl	1700–1900	Ara et al. (1995)
<i>Populus caspica</i> Bornm.	EU	T	Pl	Nt	1800–2600	Javeid (1972)
<i>Populus deltoides</i> Marsh.	AMN	T	Pl	Cl	1800–2300	Ara et al. (1995)
<i>Populus nigra</i> L. var. <i>italica</i> Du Roi	EU	T	Pl	Cl	2000–2500	Ara et al. (1995)
<i>Salix alba</i> L.	AS; AF; EU	T	Pl	Nt	1700–3200	Javeid (1972)
<i>Salix babylonica</i> L.	AS	T	Pl	Nt	1600–2300	Javeid (1972)
<i>Salix purpurea</i> L.	AS; AF; EU	S	Pl	Cl	2000–2500	Ara et al. (1995)
<i>Salix viminalis</i> L.	AS; EU	T	Pl	Cl	2200–2800	Ara et al. (1995)
<b>Salviniaceae</b>						
<i>Salvinia natans</i> All.	AF; EU	Aq	Ui	In	1600–2900	Zutshi and Wanganeo (1979)
<b>Sapindaceae</b>						
<i>Koelreuteria paniculata</i> Laxm.	AS	T	O	Cl	1600–1700	Singh and Misri (1974)
<b>Scrophulariaceae</b>						
<i>Antirrhinum majus</i> L.	EU	A	O	Cs	1600–1800	Stewart (1972)
<i>Digitalis grandiflora</i> Mill	AS; EU	P	Md	Cn	2200–2900	FR
<i>Digitalis lanata</i> Ehrh.	EU	P	Md	Nt	1900–2300	Stewart (1972)
<i>Digitalis purpurea</i> L.	EU	B	Md	Nt	2000–2500	Stewart (1972)
<i>Linaria dalmatica</i> Miller	EU	P	O	Cn	1600–1900	Stewart (1972)
<i>Mazus japonicus</i> Kuntze	AS	A	Ui	Nt	1600–3000	Reshi (1984)
<i>Verbascum thapsus</i> L.	EU	B	Ui	In	1600–3500	Kaul (1986)
<i>Veronica anagallis-aquatica</i> L.	AS	A	Ui	Nt	1600–2200	Kaul (1986)
<i>Veronica beccabunga</i> L.	AS; EU	Aq	Ui	Nt	1700–2300	Kaul (1986)
<i>Veronica biloba</i> L.	AS	A	Ui	Nt	1900–3100	Kaul (1986)
<i>Veronica persica</i> Poir.	AS	A	Ui	In	1600–3100	Kaul (1986)
<b>Simaroubaceae</b>						
<i>Ailanthus altissima</i> Sw.	AS	T	Pl	In	1600–3000	Ara et al. (1995)



**Table 2** continued

Family/Name of plant species	Origin	Growth form	Mode/purpose of introduction	Invasion status	Altitudinal range (meters above sea level)	Primary published source
<b>Solanaceae</b>						
<i>Datura innoxia</i> Mill.	AMN; AMS	A	Ui	Cn	1700–1900	Stewart (1972)
<i>Datura meteloides</i> Dunal	AMS	P	Ui	Cn	1700–1900	Stewart (1972)
<i>Datura stramonium</i> L.	AMN	A	In	In	1600–2700	Kaul (1986)
<i>Hyoscyamus niger</i> L.	AF; EU	B	Ui	Nt	1800–2900	Kaul (1986)
<i>Lycopersicon esculantum</i> Mill.	AMS	A	Fd	Cs	1600–2200	Stewart (1972)
<i>Nicandra physaloides</i> Gaertn.	AMS	A	O	Cs	1600–1700	Stewart (1972)
<i>Nicotiana rustica</i> L.	AMS	A	Fd	Cn	1600–1800	Stewart (1972)
<i>Petunia hybrida</i> Vilm	NA	A	O	Cs	1600–1800	FR
<i>Solanum pseudo-capsicum</i> L.	AS; AF	Ss	Ui	In	1600–2400	Ara et al. (1995)
<i>Solanum tuberosum</i> L.	AMS	A	Fd	Cs	1600–3000	Stewart (1972)
<b>Sparganiaceae</b>						
<i>Sparganium ramosum</i> Huds.	EU	Aq	Ui	In	1600–2600	Kaul (1986)
<b>Taxaceae</b>						
<i>Taxus baccata</i> L.	AF; EU	T	Pl	Cl	2100–2600	Dar (2004)
<b>Taxodiaceae</b>						
<i>Cryptomeria japonica</i> D. Don	AS	T	Pl	Cl	1600–2500	Dar et al. (2002)
<i>Sequoiadendron giganteum</i> Buch.	AMN	T	Pl	Cl	1700–2200	Dhar (1975)
<i>Taxodium distichum</i> Rich.	AMN	T	Pl	Cl	1800–2100	Dar and Dar (2005)
<b>Tiliaceae</b>						
<i>Tilia platyphyllos</i> Scop.	EU	T	Ld	Cl	1700–1900	Ara et al. (1995)
<b>Trapaceae</b>						
<i>Trapa natans</i> L.	EU	Aq	Fd	In	1600–2500	Kak (1990)
<b>Typhaceae</b>						
<i>Typha angustifolia</i> L.	EU; AMN	Aq	Ui	In	1600–2600	Kak (1990)
<b>Urticaceae</b>						
<i>Urtica dioica</i> L.	AF; EU	P	Ui	In	1600–3000	Kaul (1986)
<b>Valerianaceae</b>						
<i>Valeriana officinalis</i> L.	AS; EU	P	Md	Nt	1800–2500	Stewart (1972)
<b>Violaceae</b>						
<i>Viola sylvestris</i> Lam	EU	P	O	Nt	1900–2700	Stewart (1972)
<i>Viola tricolor</i> L.	EU	A	O	Cs	1600–1800	Stewart (1972)
<b>Vitaceae</b>						
<i>Parthenocissus quinquefolia</i> Planch	AMN	L	O	Cl	1600–1700	Ara et al. (1995)
<i>Parthenocissus tricuspidata</i> Planch	AS	L	O	Cl	1600–1700	Ara et al. (1995)
<i>Vitis vinifera</i> L.	AS; EU	L	Ht	Nt	1600–1900	Stewart (1972)
<b>Zannichelliaceae</b>						
<i>Zannichellia palustris</i> L.	AMN; AMS	P	O	Cn	1600–1800	Stewart (1972)
<b>Zygophyllaceae</b>						
<i>Tribulus terrestris</i> L.	AS; AF	A	Fd	Nt	1900–3000	Kaul (1986)

## Abbreviations

NA = Where ever information was not available

Origin: AMN = North America; AMS = South America; EU = Europe; AF = Africa; AU = Australia; AS = Asia (excluding the Indian sub-continent)

Growth form: A = Annual herb; B = Biennial herb; P = Perennial herb; Ss = Subshrub; S = Shrub; T = Tree; Aq = Aquatics; C = Climber; L = Liana; Ps = Parasitic herb

Mode of introduction: Fd = Food; Fr = Fodder; Ht = Horticultural; Ld = Landscaping; Md = Medicinal; O = Ornamental; Pl = Plantation; Ui = Unintentional

Invasion status: Cl = Cultivated un-escaped aliens; Cs = Casual aliens; Cn = Casual or naturalized aliens; Nt = Naturalized aliens; In = Invasive aliens

Source: FR = First report of the plant species from Kashmir Himalaya

mostly invade the terrestrial habitats; whereas *Butomus umbellatus* (Butomaceae), *Ceratophyllum demersum* (Ceratophyllaceae), *Marsilea quadrifolia* (Marsileaceae), *Salvinia natans* (Salviniaceae), *Sparganium ramosum* (Sparganiaceae), *Trapa natans* (Trapaceae) and *Typha angustifolia* (Typhaceae) preferably invade aquatic habitats.

Some earlier studies conducted by Maheshwari (1960) and Nayar (1977) estimate that aliens constitute nearly 40 and 18% of the Indian flora, respectively. Recently, few more studies have compiled the ‘exotic’ flora of different regions of India (Sharma and Pandey 1984; Pandey and Parmer 1994; Nagar et al. 2004). However, the main purpose of such studies has been to provide just a list of the ‘exotics’ growing in their respective regions of their study without any perspective on plant invasion in mind. On comparison with such studies (Table 3), present study shows relatively higher number of alien plant species. The Allahabad region has significantly higher percentage (38%), and the Rajasthan and Barda hills have lower percentages of 11 and 15% of alien species, respectively, than the present study (29%).

Highest number (288) and percentage (38%) of alien species of the region have come from Europe (Table 4). In comparison the American elements contribute 55% to the alien flora of the whole of India while as the European elements are represented by only 15% (Nayar 1977). Two probable reasons for such higher proportion of European species in the alien flora of Kashmir Himalaya could be: (a) successful introduction due to more or less similar climate, and (b) European colonial past that could have facilitated the transport of plant propagules from Europe to this region with men and machinery. Chatterjee (1947) also stated that introduction

and naturalization of foreign plants dates back to the early Aryans who invaded India from countries in the north-west Eurasia.

Plant species with herbaceous habit dominate the alien flora as the percentage of annual and perennial herbs is 32% and 27%, respectively. Though present study lists a sizeable number of plant species (45) that mostly invade aquatic and marshy habitats but perusal of alien floras reveals less emphasis laid on aquatic habitats and species they sustain (Corlett 1992; Weber 1997; Mack 2003; Mosyakin and Yavorska 2002; Villasenor and Espinosa-Garcia 2004). Thus, aquatics should be given equal priority while compiling the alien floras. About 42% of the aliens have been unintentionally introduced without any known purpose and unintentional introduction of plants in non-native range has also been emphasized by Myers and Bazely (2003). Present study also shows that a relatively high percentage (21%) of the aliens was introduced in the region as ornamentals. Similar observations have been made by Silva and Smith (2004) and Wu et al. (2004a, b).

Unlike other studies (Pysek et al. 2002; Silva and Smith 2004; Wu et al. 2004a, b), the present catalogue of the alien flora of Kashmir Himalaya also includes 121 plant species which are under cultivation and have not as yet escaped cultivation. Our premise for their inclusion is because they represent the hidden source of intentionally introduced alien species. Even if this category of 121 unescaped cultivated species is excluded, the aliens belonging to remaining categories are 450 constituting 22.5% of the total flora of the Kashmir Himalaya. Such a relatively intermediate percentage of alien plant species in the floras have been reported from other regions with temperate and Mediterranean type of climate (Vitousek et al. 1997).

**Table 3** Comparison of alien flora of present study with other regions of the Indian subcontinent

Study Area	No. of Family	No. of Genera	No. of species	Percentage of alien species
Allahabad	100	325	458	38%
Rajasthan	80	165	206	11%
Barda Hills (Gujarat)	54	136	154	15%
Present study	104	352	571	29%

**Table 4** Percentage of alien plant species belonging to different categories

Category	Sub-category	Percentage of species
Origin	North America (AMN)	10
	South America (AMS)	8
	Europe (EU)	38
	Africa (AF)	15
	Australia (AU)	2
Habit	Asia (AS)	27
	Annual herb (A)	32
	Biennial herb (B)	6
	Perennial herb (P)	27
	Sub-shrub (Ss)	3
	Shrub (S)	7
	Tree (T)	12
	Aquatics (Aq)	8
	Climber (C)	2
	Liana (L)	2
	Parasitic herb (Ps)	1
	Mode/purpose of introduction	Food (Fd)
Fodder (Fr)		9
Horticultural (Ht)		3
Landscaping (Ld)		4
Medicinal (Md)		3
Ornamental (O)		21
Plantation (Pl)		5
Unintentional (Ui)		42
Invasion status	Cultivated un-escaped aliens (CI)	21
	Casual aliens (Cs)	16
	Casual or naturalized aliens (Cn)	14
	Naturalized aliens (Nt)	32
	Invasive aliens (In)	17

Having benefited from the recent methodological insights regarding the concepts, definitions and terminology of plant invasion, the plant species included in the present catalogue have been supplemented with vital information, especially the invasion status as has been emphasized by Richardson et al. (2000) and Pysek et al. (2004). Such carefully compiled and constantly updated regional data sets, when pooled together, are likely to provide vital clues for elucidation of the probable causes and consequences of the phenomenon of invasion, and can strengthen the policy efforts for effective predictive systems, monitoring tools and management practices. Present work, hopefully, will ‘introduce’ the alien flora of this part of the World to the ‘fast-invading’ body of scientific literature on the plant invasion and trigger compilation of alien floras of other regions of the Indian sub-continent as well.

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