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# INVASIVE ALIEN PLANTS OF KISHTWAR DISTRICT (NORT-WEST) HIMALAYAS, JAMMU AND KAHMIR, INDIA

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**Abstract**

Invasive alien species (IAS) pose a significant threat to the biodiversity. The present study was undertaken to record the diversity of Invasive Alien Plants of District Kishtwar of Jammu and Kashmir State, India. A total of 30 species were collected, preserved and identified. Out of 30 plant species 17 have been listed here. The invasives comprised of 11 families, the largest being Asteraceae. Most of the species originated from Europe. The ecological diversity of invasive plants suggest wide ranging impacts which needs to be assessed. Further studies with regard to the diagnostic features of the species, native range and introduced range are also incorporated in this communication. *Parthenium* has been reported for the first time from this area, as new distributional records.

Key words: Invasive alien species, Diversity.

## INTRODUCTION

Biological diversity faces many threats throughout the world. One of the major threats to the native biological diversity is now acknowledged by scientists and Governments to be Biological Invasions caused by the invasive alien species. Those alien species that become established in a new environment, then proliferate and spread in ways that are destructive to human interests are considered "Invasive Alien Species" (IAS). These are the non-native species that are introduced intentionally or unintentionally in areas outside their natural range where they grow, survive, reproduce and produce self sustaining populations of themselves that are destructive to human interests. The integrity of natural ecological systems worldwide is increasingly being jeopardized due to large – scale introductions of alien plants, animals and micro-organisms. This process is rapidly breaching the biogeographic barriers that are responsible for global biodiversity maintenanace leading to the 'McDonaldisation' (Lovei, 1997), or increasing homogenisation (Lodge,1993; Werren et al., 2002). 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 et al., 1996, 1997; Mack et al., 2000). Once unappreciated as "sleeper environmental issue", invasions are now considered as one of our most serious environmental and economic problems worldwide. These species are causing enormous damage to biodiversity and the valuable natural agricultural systems upon which we depend. Direct and indirect health effects are increasingly serious and the damage to nature is often irreversible. The effects are exacerbated by global climate change and chemical and physical disturbance to species and ecosystems. Change in climate may also produce more conducive conditions for the establishment and spread of invasive species as well as change the suitability of local climate for native species and nature of interactions among native species (Sutherst, 2000).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).They are thus a serious impediment to conservation and sustainable use of global, regional and local biodiversity with significant undesirable impacts on the goods and service provided by ecosystems; and it has already had devastating consequences for the planet and challenges for the conservation managers. They are major problem for national development and economic planning and pose an enormous and accelerating cost to economies, societies and

ecosystems around the world. Direct financial costs alone mount into billions of US dollars per country, per year. The size and seriousness of this threat has only started to dawn on the global community in the past decade, and we remain woefully ill - equipped to deal with it. In particular, developing countries, in many ways vulnerable to invasive alien species, are often least equipped to prevent, eradicate and control them. Taking note of the importance of studies on the alien invasive species, present study was aimed at compiling the first ever inventorisation of the alien fauna and flora of Kishtwar district, along with supplementation of each species with information on origin, spread, habit, mode of introduction and the invasion status. The world is now on a path to building a future of living in harmony with nature and Nations agreed to halting and eventually reversing the loss of biodiversity of the planet. To build support and momentum for this urgent task, the United Nations General Assembly at its 65th session declared the period 2011-2020 to be "the United Nations Decade on Biodiversity, with a view to contributing to the implementation of the Strategic Plan for Biodiversity. Throughout the United Nations Decade on Biodiversity, governments are encouraged to document status survey of biodiversity for its overall conservation at Regional, National and International level. The present study in part will support the implementation of the Strategic Plan for the Conservation of the Biodiversity.

*The main objectives of the present studies are :*

**1.** Documentation and inventorisation of the alien fauna and flora of Kishtwar district.
**2.** To record their origin, spread, introduction pathway and invasion status.
**3.** To spread public awareness on the impact of invasive alien species on environment and economy.

Such baseline information would act as the foundation stone for the advanced studies in the invasion ecology and biology and would serve a benchmark for future assessment of extent of invasion not only in this biodiversity rich region of J&K state but also the rest of the country.

## MATERIALS AND METHODS

### Study Area

Kishtwar district is situated in the north – east corner of Jammu region in the outer Himalayan range in J&K State. It is positioned at an altitude of 5374 feet above the sea level. It is situated on a central plateau set amidst sylvan surroundings. This part of Jammu region encompasses extraordinary biotic communities which is attracting people from different regions and is being promoted as a tourist destination. This fragile Himalayan ecosystem has witnessed intentional or unintentional introduction of varying faunal and floral elements from different regions over the time. Such anthropogenic influences along with wanton axing of forests, unregulated grazing, pollution, climate change etc, have promoted invasion by non-native species.

The influence of the monsoon is weak. Mean annual rainfall is 827 mm, precipitation is maximal and in excess of 100 mm per month in March and April and again in July and August. Snowfall occurs in December and January when the whole area becomes snowbound. Mean maximun and minimum temperatures recorded are 13º C and -7 ºC in January and 35 ºC and 11 ºC in July respectively.

### Method

The survey and data collection on the invasive species of Kishtwar district was carried out from 2011 to 2012. The study followed a random sampling method so that no bias is introduced. The survey areas were selected at different tehsils of Kishtwar district. During the work the selected study sites were visited, samples were collected and systematically pressed, stored for identification. Existing literature and information from web based data, online identification system and ISSG database were used to identify and determine the alien origin of the species. Each of the sites was divided into different land use types, the following were recognised: roadsides, disturbed areas, agricultural fields, along the banks of water bodies and forest areas. The survey revealed 30 species. About 80% of these alien species were introduced from Europe, followed by North America. Of 30 plants, 17 have been identified and are listed below in Table-1. Maximum number of species was from the family Asteraceae, followed by Solanaceae, Ranunculaceae and others (%age shown in the **pie-1** below). Studies on various aspects like origin, impacts and invasiveness were done and have been discussed.

## RESULTS AND DISCUSSION

**1. *Anthemis cotula* L.** **(Fig: 1)**

**Common Name:** Stinking chamomile, dog- daisy, chigger weed, mayweed.
**Native Range:** Europe and North Africa.
**Brief Description:** *Anthemis cotula*, is a flowering annual bushy plant with a noticeable and strong odour. The plant has branching upright stems reaching a height of 12 inches to 24 inches. The leaves of the plant sometimes have very fine and soft hairs on the upper surface, although the plant is mostly hairless. There is no leaf stalk; leaves grow immediately from the stems. The leaves are pinnate in shape, with many extremely thin lobes, and can be around 1 or 2 inches long. Each stem is topped by a single flower head which is usually around 1 inch in diameter. The flower head is encompassed by about 10- 18 white ray florets.
**Occurs In:** Cereal crops, waste areas, farmyards, overgrazed pastures and roadsides (Hultén, 1968; Kay, 1971; Roberts and Neilson, 1981; Whitson et al., 2000).

**2. *Centaurea calcitrapa* L.** **(Fig: 2)**

**Common Name:** Purple star thistle.
**Native Range:** Europe.
**Brief Description:** This is an annual plant growing erect to a maximum height of one to 1.3 metres and is known across the globe as an introduced noxious species. The species name calcitrapa comes from the word caltrop, a type of weapon covered in sharp spikes. The stems are hairless and grooved. The leaves are dotted with resin glands. The lowermost may reach a length of 20 cms and are deeply cut into lobes. The inflorescence contains a few flower heads. The phyllaries are green or straw- coloured and tipped in tough, sharp yellow spines.The head contains many bright purple flowers.
**Occurs In:** Disturbed grounds, along roadsides and fields.

**3. *Conyza canadensis* (L.) Cronquist** **(Fig: 3)**

**Common Name:** Horseweed, Canadian horseweed, mares tail and butterweed.
**Native Range:** North and Central America.
**Brief Description:** It is an annual plant growing up to 1.5 m tall, with sparsely hairy stems. The leaves are slender, 2- 10 cm long and up to 1 cm broad, with a coarsely toothed margin. The flowers are produced in dense inflorescences 1 cm in diameter, with a ring of white or pale purple ray florets and a centre of yellow disc florets.
**Occurs In:** Horseweed is commonly considered a weed and can be found in disturbed sites, fields, meadows, gardens, sidewalk crevices and by roadsides.

**4. *Parthenium hysterophorus* L.** **(Fig: 4)**

**Common Name:** Congress grass, bitterweed, white top, false ragweed.
**Native Range:** Tropical America
**Brief Description:** It is an annual herb with erect, light green branching stems, which becomes woody with age. Leaves are finely lobed. *Parthenium* weed flower is creamy white in colour. It has small (1-2 mm long) black seeds with white scales. They are not visible to the naked eye.
**Occurs In:** Agricultural areas, disturbed areas, urban areas and along highways.

**5. *Xanthium spinosum* L.** **(Fig: 5)**

**Common Name:** Spiny cocklebur, prickly bur weed.
**Native Range:** South America, possibly from Chile.
**Brief Description:** This is an annual herb producing a slender stem up to a meter tall or slightly taller. It is lined at intervals with very long, sharp, yellowish spines which may exceed three cms in length and may divide into two or three separate spines. The leaves are divided into linear or lance-shaped lobes, the middle much longer than the others, and are arranged alternately all along the stem. Each is up to 10 or 12 cms long and dark green or greyish on top with a white underside. The plant produces male and female flower heads. The spiny burs are easily dispersed to new areas when they become attached to animals, people, and objects, or float on water.
**Occurs In:** Disturbed grounds, pastures, along highways and agricultural fields.

**6. *Jacobaea vulgaris* Gaertn.** **(Fig: 6)**

**Common Name:** Ragwort, stinking nanny, benweed tansy ragwort, ragweed.
**Native range:** Europe.

**Brief Description:** The plant is biennial or perennial. The stems are erect, straight, have no or few hairs, and reach a height of 0.3- 2.0 metres. The leaves are pinnately lobed and the end lobe is blunt. The hermaphrodite flower heads are 1.5- 2.5 cm diameter, and are borne in dense, flat-topped clusters; the florets are bright yellow. It has a long flowering period lasting from June to November.
**Occurs In:** Agricultural fields, road sides, patures and wastelands.

**7. *Cirsium arvense* (L.) Scop.** **(Fig: 7)**

**Common Name:** Canada thistle.
**Native Range:** Europe and eastern Asia.
**Brief Description:** Canada thistle is a tall, erect, spiny, perennial, herbaceous plant that grows to 4 ft. tall. It has an extensive creeping rootstock. The leaves are lance-shaped, irregularly lobed, 2- 6 in. long with prickly margins. The stems are ridged and hairy. The flowers are purple to white and can be up to 0.5 inch in diameter. The small fruit, called achenes, are 1 to 1.5 in long and have a feathery pappus which allows them to be dispersed further by wind.
**Occurs In:** Agricultural areas, pastures, roadsides and open woodlands.

**8. *Adonis aestivalis* L.** **(Fig. 8)**

**Common Name:** Summer pheasant's- eye.
**Native Range:** Europe.
**Brief Description:** *Adonis aestivalis* is an annual herb. Stem is 20- 50 cm long. Leaves are basal, 3- 5 cm and petiolate. The single flowers are carried at the tips of the stems. The stamens and anthers are usually black and they provide a strong contrast against the bright red petals. The plants have an upright habit of growth with branching stems and pale, feathery leaves. Flowering occurs from spring to summer in Kishtwar region.
**Occurs In:** Agricultural fields, wastelands and along roadsides.

**9. *Malva neglecta* Wallr.** **(Fig. 9)**

**Common Name:** Button weed, round leaf mallow, round dock.
**Native Range:** Europe and North Africa.
**Brief Description:** The plant is an annual herb, 60 cm long with round leaves. Leaves are alternate, petiolate, stipulate, ciliated, margined, acute, dentate and pubescent. Flowers are pinkish with darker pink lines, glabrous externally and mostly internally but pubescent near base internally. Anthers are pale yellow to whitish. Calyx is 5 lobed, subtended by 3 linear bracts. Calyx lobes are acute, acrescent, stellate and pubescent. Carpels are pubescent in fruit.
**Occurs In:** Agricultural fields, neglected residential areas, commercial landscapes, vacant lots and roadsides.

**10. *Plantago lanceolata* L.** **(Fig. 10)**

**Common Name:** Ribwort plantain, english plantain, narrow leaf plantain.
**Native Range:** Europe.
**Brief Description:** The plant is a rosette-forming perennial herb, with leafless, silky, hairy flower stems.The basal leaves are lanceolate spreading or erect, scarcely- toothed with 3- 5 strong parallel veins narrowed to short petiole, leaf stalk are deeply furrowed, ending in an oblong inflorescence of many small flowers each with a pointed bract. Onset of flowering/ fruiting must occur early enough during a growing season to allow for successful pollination, fertilization and fruit maturation. Reproduces through seeds.
**Occurs In:** Agricultural fields, gardens, along roadsides and disturbed grounds.

**11. *Oxalis stricta* L.** **(Fig. 11)**

**Common Name:** Common yellow wood sorrel, common yellow oxalis, upright yellow- sorrel, lemon clover or pickle plant.
**Native Range:** North America, China, Japan
**Brief Description:** *Oxalis stricta* is a herbaceous plant which may grow either as an annual or as a perennial. This delicate seeming plant forms colonies which arise from slender but tough underground stems (rhizomes). The smooth, palmately compound leaves are divided into three heart-shaped leaflets, each leaflet having a centre crease, from which the leaflets fold upward in half. The leaves are most often green, but may also be purplish or brownish red. The mature plant may reach 6 - 15" in height. Yellow sorrel starts blooming in mid-spring and continues to produce flowers through mid-fall.

**Occurs In:** Woodlands, grasslands and on disturbed sites, parks and gardens, agricultural fields, crevices and along roadsides.

**12. *Capsella bursa- pastoris* (L.) Medik** **(Fig. 12)**

**Common Name:** Shepherd's purse.

**Native Range:** Eastern Europe

**Brief Description:** *Capsella bursa- pastoris*, known by its common name shepherd's purse because of its triangular, purse-like pods, is a small annual and ruderal species, and a member of mustard family. The plant grows from a rosette of lobed leaves at the base. Stem is about 0.2 to 0.5 meters tall and bears a few pointed leaves which partly grasp the stem. The flowers are white and small, and produce seed pods which are heart-shaped.

**Occurs In:** Cultivated crops, gardens, disturbed grounds, along roadsides and rock crevices.

**13. *Euphorbia helioscopia* L.** **(Fig. 13)**

**Common Name:** Sun spurge, wart spurge, umbrella milkweed.

**Native Range:** Europe, northern Africa and eastward through most of Asia

**Brief Description:** It is an annual plant growing in arable land and disturbed ground. It grows up to 10- 50 cm tall, with a single, erect, hairless stem, branching towards the top. The leaves are oval, broadest near the tip, 1.5- 3 cm long, with a finely toothed margin. The flowers are small, yellow-green, with two to five basal bracts similar to the leaves but yellower; flowering lasts from mid spring to late summer. It is highly poisonous.

**Occurs In:** Agricultural fields, waste lands and along roadsides.

**14. *Galium aparine* L.** **(Fig. 14)**

**Common Name:** Catchweed, cleavers, goosegrass, stickyweed, sticky leaf catchweed.

**Native Range:** North America and Europe.

**Brief Description:** *Galium aparine* is an annual plant growing to 1.2 m. It is in flower from June to August. The flowers are small, white with four petals and bisexual. The leaves are simple and borne in whorls of six to eight. Both leaves and stem have fine hairs tipped with tiny hooks, making them cling to clothes and fur.

**Occurs In:** Agricultural fields, orchards, pastures, wastelands and gardens.

**15. *Medicago lupulina* L.** **(Fig. 15)**

**Common Name:** Black medic, black hay, blackweed.

**Native Range:** Europe.

**Brief Description:** *Medicago lupulina* is an annual or bi-annual plant, sometimes long- lived thanks to adventitious buds on the roots. The plant measures from 15- 60 cm in height, with fine stems often lying flat at the beginning of growth and later erecting. The nodes bear three leaves, carried by a long petiole and have oval leaflets, partially toothed towards the tip. This species has very small yellow flowers grouped in tight bunches. Fruit is a pod, a little arched and bearing a single seed.

**Occurs In:** Agricultural fields, along roadsides and gardens.

**16. *Rumex crispus* L.** **(Fig. 16)**

**Common Name:** Curly dock, yellow dock, sour dock, narrow dock, narrow-leaved dock, curled dock.

**Native Range:** Europe and Western Asia.

**Brief Description:** Curly dock is a perennial, herbaceous plant; stems die back each fall and roots re-sprout each spring. The mature plant is reddish brown in colour and produces a stalk that grows to about 1 m high. It has smooth leaves shooting off from a large basal rosette, with distinctive waved or curled edges. On the stalk flowers and seeds are produced in clusters on branched stems, with the largest cluster being found at the apex. Flowers are crowded in whorls which are usually distinct except towards the ends of the branches.

**Occurs In:** Agricultural fields, wastelands and along roadsides.

**17. *Chenopodium album* L.** **(Fig. 17)**

**Common Name:** White goose foot, Lamb's quarter.

**Native Range:** Europe, eastern Asia.

**Brief Description:** *Chenopodium* is a fast growing weedy annual herb reaching a height of 10- 150 cm. Leaves are alternate and varied in appearance. The first leaves near the base of the plant are toothed and roughly diamond shaped while the leaves on the upper part are entire and lanceolate. Flowers are small and radially symmetrical.

**Occurs In:** Agricultural fields and along roadsides.

The place of origin, introduced range and the introduction in the study area are shown in the plates below.

## CONCLUSION AND RECOMMENDATIONS

The severity of the invasion problem has grown tremendously as the global economy has reached into virtually all corners of our planet. As significant global problem with negative impact on all countries, the problem of invasive alien species is deserving of a significant global response. No country can afford to ignore this threat. The seriousness of the problem varies from country to country, but many countries can still tackle the problem before it becomes unmanageable. Countries with major problems have realised too late, that a small investment of time and money on prevention, early detection and control would have saved a huge amount spend on failed attempts at eradication and the repair of badly disrupted ecological services. In the present context, the species which are listed to be immediate cause of concern in the Kishtwar district of J&K state (India) includes - *Parthenium hysterophorus, Xanthium spinosum, Cirsium arvense, Anthemis cotula*. However *Parthenium* has been recorded for the first time in some parts of the Kishtwar district it is spreading at a very fast rate and needs close monitoring considering the invasive status this species has acquired in many parts of the world. All these species threaten agriculture, forestry, horticulture and fisheries, which threatens food security, which in turn threatens human livelihoods.

Global management of invasive alien species needs serious colloborative efforts of many people. Some elements are recommended in response to the growing challenge of invasive alien species: **a)** Build management capacity; **b)** Promote sharing of information; **c)** Build public awareness and engagement; prepare national strategies and plans; **d)** Build invasive alien species issue into global change initiatives and **e)** Promote international cooperation.

Controlling or eradicating invasive alien species is not a management goal in itself, but only one means to achieve higher goals, such as the conservation of biological diversity, protection of human health and prevention of economic loss.

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## STUDY AREA

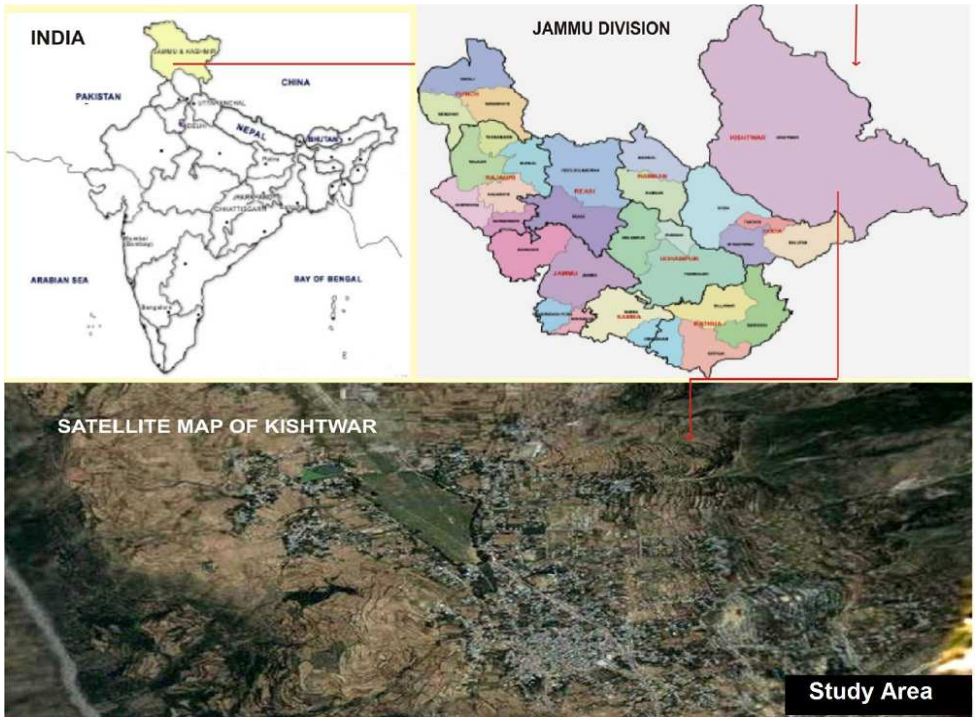

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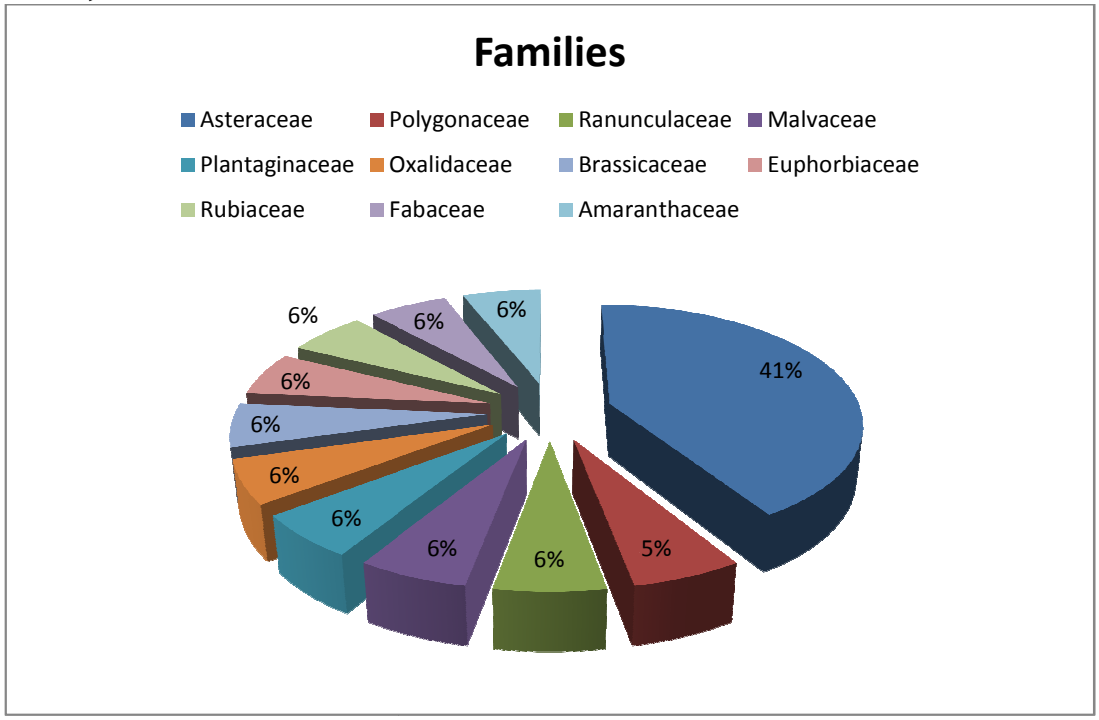
**TABLE 1; SHOWING THE LIST OF SPECIES**

| S. No | SPECIES | FAMILY |
|---|---|---|
| **1.** | *Anthemis cotula* | Asteraceae |
| **2.** | Centaurea calcitrapa | Asteraceae |
| **3.** | Conyza Canadensis | Asteraceae |
| **4.** | Parthenium hysterophorus | Asteraceae |
| **5.** | Xanthium spinosum | Asteraceae |
| **6.** | *Jacobaea vulgaris* | Asteraceae |
| **7.** | Cirsium arvense | Asteraceae |
| **8.** | *Adonis aestivalis* | Ranunculaceae |
| **9.** | *Malva neglecta* | Malvaceae |
| **10.** | *Plantago lanceolata* | Plataginaceae |
| **11.** | *Oxalis stricta* | Oxalidaceae |
| **12.** | *Capsella bursa pastoris* | Brassicaceae |
| **13.** | *Euphorbia helioscopia* | Euphorbiaceae |
| **14.** | *Galium aparine* | Rubiaceae |
| **15.** | *Medicago lupuilina* | Fabaceae |
| **16.** | *Rumex crispus* | Polygonaceae |
| **17.** | *Chenopodium album* | Amaranthaceae |

**PIE 1; SHOWING THE PERCENTAGE OF FAMILIES**



FIGURES 1- 17: Plates showing the native range and the introduced range of the plant species in the world, in India, in J&K and in Kishtwar district(study area). Yellow area shows the place of origin and the green area shows the introduced areas.