

Vivekanand College, Kolhapur (Autonomous)

Department of Botany

B.Sc. II Plant Protection

Topic: Weeds

Dr. B. T. Dangat

M.Sc., Ph.D.

WEEDS

✓ Gross morphology

✓ Reproduction

✓ Ecology

✓ Dispersal

✓ Management

A plant out of place

1. *Argemone mexicana*

2. *Portulaca oleracea*

3. *Parthenium hysterophorus*

4. *Eupatorium species*

5. *Alternanthera sessilis*

6. *Amaranthus spinosus*

7. *Cassia tora*

8. *Cyperus rotundus*

9. *Cynodon dactylon*



Argemone maxicana L.

argemos means white spot, eye cataract, which the plant was believed to cure.

mexicana - from Mexico.

Long slightly branched tap root.



Argemone mexicana

- an erect spiny annual or biennial herb,
- up to 1 m tall, with a slightly branched taproot.
- Its stem is branched and very prickly;
- it exudes a yellow juice when cut.

➤ **The leaves are thistle-like and alternate**

without leaf stalks, toothed and with spiny margins.

➤ **The grey-white veins stand out against the bluish-green upper leaf surface.**





- ❖ Leaves are simple, alternate, sessile, blue-green, thick and leathery.
- ❖ Blade is lobed, pinnate shape obovate, base slightly clasping, 6 to 20 cm long and 3 to 8 cm wide.
- ❖ Lobes oblong, convoluted, teeth ending in spines.
- ❖ Pinnate veins, whitish spines on smaller and less frequent, especially on the underside.
- ❖ Both leaf surfaces are hairless.



- **Stem is cylindrical to oblong, smooth and pale greenish.**
- **The entire stem is covered with very short hairs and few long yellowish spines.**



Inflorescences is solitary Cyme
sessile, in terminal or axillary,



- ❖ **Showy solitary flowers of 2.5–5 cm diameter appear at the tips of the branches**
- ❖ **their six rounded petals are bright yellow.**



- The fruit is a prickly oblong or egg shaped capsule that releases numerous small black seeds.
- Fruits are ovoid capsules, 5cm long and 2cm in diameter.
- It is covered by stout, yellowish spines.
- When ripe it opens from the apex.
- It is divided into five chambers, contain numerous seeds.

- **Reproduction occurs by seed.**
- **It is estimated that a single plant can produce up to 30 000 seeds per year (60 to 90 capsules per plant, 300 to 400 seeds per capsule).**
- **Seeds of Mexican Poppy usually fall close to the parent plant.**
- **Seeds are readily dispersed by moving water, especially where plants grow in riparian habitats and on terrain where erosion and runoff occurs.**
- **Contaminated soil, fodder, vehicles and the fur and hooves of livestock are also vectors for transport of Mexican Poppy seed.**
- **The seeds can also be dispersed by birds.**

***Parthenium hysterophorus* L.**

Common names:

- **Carrot weed,**
- **white top,**
- **Congress grass,**
- **Star weed.**
- **Family: Asteraceae**



Parthenium hysterophorus L.

Family : Compositeae (Asteraceae)

Common name : Congress Weed

Morphology : Broad leaved weed.

Habit : Annual herb, up to 1.5 m to 2.0 m

Stem : Slender , branched and covered with trichomes

Leaf : Leaves alternate, sessile, bipinnatifid, up to 20 x 10 cm, pubescent, lobes entire, acute, Leaves are pale green, lobed, hairy, initially forming a basal rosette of strongly dissected leaves that are upto 30 cm in length, close to the soil, alternate, sessile, irregularly dissected and bipinnate, having small hairs on both the sides, resembling the leaves of carrot. The number of leaves per plant ranges from 6 to 55.



Flower : Heads many, peduncled in panicles, florets white, outer florets 5, female, supported by two hyaline wings at base; inner few male florets; corolla in female an obovate, entire ligule; in male tubular, 5 lobed; anthers obtuse below

Fruit : Fruit an achene, dorsally compressed, narrowed below; pappus of lateral reflexed awns

Propagation :By seed

Habitat: Cultivated fields and road side

- Flower heads are creamy white, about 4 mm across, arising from the leaf forks.
- Flowering occurs about a month after germination.
- The fruit is cypsella.
- Each flower contains five seeds, which are wedge-shaped, black, 2 mm long with thin white scales.
- A large single plant produces up to 100,000 seeds in its lifecycle.
- More than 340 million seeds per ha can be present in the surface soil.
- Seeds do not have a dormancy period and are capable of germinating anytime when moisture is available.
- The highest germination rates are at temperatures ranging from 12 o t o 27 oC. The root system has one main branched taproot and many finer roots.

Parthenium (Parthenium hysterophorus L.)

also known as star weed, carrot weed, white cap, white top, etc. has been found growing naturally since centuries in Mexico, North and South America, Australia, China, Pacific islands, East and South Africa and Canada. Till 1977, the weed did not find any place in the list of world's worst weeds. But, within the last decade, it has become one of the seven most dreaded weeds of the world.

Parthenium can germinate, flower and set seeds within four weeks. Once established, it can survive even severe drought and frost conditions



Ecology of Parthenium

In India, it is noticed only from mid-fifties and is presumed to have been accidentally introduced by the import of wheat in Maharashtra during 1956. However, its spread throughout the country has been very rapid with abnormal density. Further, factors such as (i) the absence of natural agents that restrict the spread of this plant, (ii) high fecundity, (iii) efficient seed dispersal mechanisms, (iv) Allelopathy impact on other plant species, (v) unsuitability for grazing because of the presence of anti-feedants in the plant system and (vi) wide adaptability to varying soil and agro climatic conditions have enabled this plant to invade a variety of growing environments particularly in situations associated with human activities.

Control of Parthenium

An integrated approach now termed "Integrated Parthenium Weed Management (IPWM)" involving the various methods could be effective in controlling Parthenium. If a concerted effort is made to adopt IPWM, the results will be visible in the second year and by the third year the Parthenium will come down to a negligible level. The newly suggested IPWM envisages five steps viz.,

- **Maintenance of natural biodiversity without disturbing the existing flora to the extent possible under non crop/ public utility areas.**
- **Sowing of Cassia sericea, Cassia tora, Abutilon indicum, Gynandropsis pentaphylla, and Tagetes sp at the start of rainy season. The growth of such plants can insulate opened up soils against invasion by Parthenium.**
- **In already infested areas, planting of botanical agents may be taken up at the start of rainy season and there will be no need to plant botanical agents again as it will perpetuate on its own.**

- **To watch for the commencement of rains and build up of Mexican beetles (*Zygogramma*) and when the beetles become available in large numbers, they have to be collected and released in *Parthenium*-invaded areas.**
- **In case of gardens, flowers beds, lawns intensively cultivated agricultural fields; manual removal has to be taken up. In the manual method, it should be noted that the persons chosen for uprooting the weed should not be allergic to *Parthenium*.**
- **In vast stretches of already *Parthenium* invaded areas and where immediate relief is needed, herbicides such as Atrazine (pre emergence), 2,4-D, Glyphosate and Metribuzin can be used.**

Chemical control of Parthenium

Herbicide	Dose	Time of spraying
	<i>Pre-emergence</i>	
Atrazine	2.5 kg ha-1	Before seed germination
	<i>Post-emergence</i>	
Common salt +Teepol	200 g/l + 2 ml per litre of water	Before flowering of Parthenium
2,4-D Na Salt + NH₄SO₄ + soap solution	10 g + 20 g + 2 ml per litre of water	Before flowering of Parthenium
Glyphosate + NH₄SO₄ + soap solution	15 g +20 g + 2 ml per litre of water	Before flowering of Parthenium
Metribuzin + soap solution	4 g + 2 ml per litre of water	Before flowering of Parthenium

Vermicomposting of Parthenium

Before flowering Parthenium plants are collected and the materials are to be chopped into 5-10 cm length and spread into 10 cm height above the surface with the circle radius of 1.0 m diameter.

Above this weed materials layer, 10 % of cow dung slurry at semisolid condition (10 % of weed materials weight) is sprinkled evenly and the sequential process is repeated for 5 layers.

These weed materials are to be kept as such for 10 days for decaying purpose.

After 5 days earth worm at 250-300 numbers are to be introduced into this decayed material.

The compositing process to be continued up to 45 to 60 days for complete decomposition of Parthenium

Seed dispersal:

The seeds are mainly dispersed through water currents, animals and the movement of vehicles, machinery, livestock, grain, stock feed and other produce, and to a lesser extent by the wind.

Most of the long distance spread is through vehicles, farm machinery and flooding.

Germination of parthenium seeds can occur between 8 °C to 30° C the optimum temperature for germination being 22 °C to 25° C.

Persistence tests demonstrated that more than 70% of parthenium seeds buried at 5 cm below the soil surface survived for at least 2 years, whereas seeds on the soil surface did not survive for longer than 6 months. Seed viability for 20 years has also been reported.

Mechanical Control

- Uprooting the weed after seed setting will increase the area of infestation.
- Pulling a plant in flower will aid in the dispersal of pollen grains, resulting in allergic reactions.
- Ploughing the weed in before the plants reach the flowering stage and establishing pastures or other plants may be effective.



Utilization:

The large-scale utilization of Parthenium may be one of the effective methods. Parthenium has been well documented for its insecticidal, nematocidal and herbicidal properties. It is also used for mulching and for producing biogas, paper and compost.

Chemical control:

A large number of chemicals have been tried. The use of Glyphosate, Atrazine, and Metribuzin has been promising. The timing of chemical control is critical. The plants should be treated before flowering and seed setting and when other plants, especially grass, are actively growing and can recolonize the infested area. In open wasteland, noncropped areas and along railway tracks and roadsides, the spraying of a solution of common salt (Sodium chloride) at 15- 20% concentration has been found effective.

Biological Control: Several insects and pathogens have been tried from time to time. The leaf-feeding beetle *Zygogramma bicolorata* and the stem-galling moth *Epiblema strenuana* are widely used in several countries to manage Parthenium. *Z. bicolorata* is now widely used in India to control Parthenium.

In Australia, both the insects have been tried successfully. The moth significantly reduces flower and seed production of the weed, especially at a young age. It has a relatively high reproduction in a short period of time and its effectiveness has been validated in the central highlands of Queensland.



Other major biocontrol agents used are *Listronotus setosipennis* (stem-boring weevil), *Semicronyx lutulentus* (seed-feeding weevil), *Bucculatrix parthenica* (leaf-mining moth), *Platphalonidia mystica* (stem-boring moth), *Conotrachelus albocinereus* (stem-galling weevil) and *Carmenta ithacae* (rootboring moth).

Another on-going development in the biological control of Parthenium is the use of a rust fungus, *Puccinia abrupta var. partheniicola*.

Uredospore suspensions from 3-week old pustules of the rust have been applied to the foliage of Parthenium and a consistent control effect has been achieved.

This fungus is now being evaluated for development as a mycoherbicide.

Pathogens like *Fusarium pallidoroseum*, *Puccinia melampodii* and *Oidium parthenii* also show good potential as biocontrol agents.

Purslane



Portulaca oleracea

➤ *Portulaca oleracea* belongs to the family Portulacaceae,

➤ Purslane plants are succulent, annual herbaceous, and erect or decumbent up to 30 cm high.

➤ *Habitat.* It grows well in orchards, vineyards, crop fields, landscaped areas, gardens, roadsides, and other disturbed sites.



- Stems are cylindrical,
- up to 30 cm long,
- 2-3 mm in diameter,
- green or red,
- swollen at the nodes,
- smooth, glabrous
- diffusely branched.



- Leaves alternate or subopposite,
- sessile or indistinctly petiolate,
- flat, fleshy, having variable shapes,
- obovate, 1–5 cm long, 0.5–2 cm across,
- obtuse or slightly notched at the apex,
- tapering at base,
- glabrous, smooth, and waxy on the upper surface,
- with entire margin, small stipules,



- Flowering initiates during May to September.
- Flowers originate as single or clusters of two to five at the tips of stems.
- The flowers are minute or small having orange yellow, purple, or white pink color
- with five petals and typically open only on hot and sunny days.



- Fruit consists of almost round to egg-shaped capsules,
- usually about 4–8 mm long that open around the middle to release the seeds.
- Seeds are tiny, less than 1 mm in diameter, circular to egg shaped, flattened,
- and brown to black with a white point of attachment.
- Numerous seeds are produced.



- ❖ Purslane primarily reproduces through the formation of large amounts of seeds,
- ❖ which are dispersed primarily by wind and water.
- ❖ It can reproduce vegetatively from stem cuttings by forming adventitious roots from the cut end of the stem

ECOLOGY

- ❖ It grows in a wide range of temperate and tropical habitats and on various types of grounds,
- ❖ but prefers an open one and a rich moist soil.
- ❖ It is drought-resistant, able to grow well under poor, low-fertility soil conditions.
- ❖ In the tropics the plants may flower all year round.

Dispersal

- ❑ Human cultural practices:
- ❑ Seed dispersal by humans—Humans are a large source of seed dispersal among the purslane.
- ❑ Seed dispersal by animals—Animals are another large source of dispersion of purslane seeds
- ❑ Autochory - self dispersal,
- ❑ Anemochory - wind dispersal,
- ❑ Zoochory - dispersal by birds or animals,
- ❑ Anthropochory - dispersal by humans.

MANAGEMENT

- ✓ The primary method of management for common purslane is prevention.
- ✓ Common purslane is such a prolific seeder that once it has become established it is difficult to control.
- ✓ Avoid bringing common purslane into uninfested areas.
- ✓ Use weed-free planting stock and seed.
- ✓ Clean mowers, planters, and cultivation equipment that have been used in infested areas before allowing them to enter clean areas.
- ✓ Monitor uninfested sites for common purslane seedlings and destroy them before they set new seed.
- ✓ In home landscapes and gardens, this weed is generally managed by cultural means such as hand-weeding and mulching.

➤ **Biological Control**

- Purslane sawfly is an insect that feeds and reproduces on common purslane.
- It eats the leaves of common purslane, leaving the plants low in vigor and with little photosynthetic area.
- Unfortunately, by the time it develops sufficient numbers to have an impact on the common purslane population, seed development and much of the damage from purslane competition in the garden or crop have already occurred.



*Cassia
tora*

Habit : A fetid, annual herb or undershrub.

Stem : 0.3-1 m tall with glabrous branches.

Leaves : 6-12.5 cm long; leaflets in 2-4 opposite pairs with a conical gland between each of the two lowest pairs of leaflets; blades 1.5-5 cm long and 1.5-2.5 cm wide, membranous, ovateoblong, apex acute to subacute, often mucronate, base acute to asymmetrically rounded.

Flowers : Usually in pairs, on very short axillary peduncle; pale yellow, upper petal 2-lobed and the others entire.

Fruits : Pods stout, 4-angled, 15-25 cm long, containing 25-30 seeds.

Seeds : 4-5 mm long, rhomboidal, yellowish brown to tan red, shiny.

- ❖ Spread is by seed in water and by animals.
- ❖ The seeds survive passage through the guts of cattle, horses and goats that eat the fruit.
- ❖ Seeds are also spread in mud attached to animals, footwear, machinery or vehicles, or as a contaminant of fodder and pasture seeds.

Physical & Mechanical

Cultivation. Repeated discing can be used; it promotes germination and reduces the number of seeds in the soil, but is liable to spread the weed.

Mulch. Grass (e.g., rye) has been used in soybeans and sunflower.

Hand pulling. Possible, but has to be done early as the plant has a long tap roots which can regrow from the crown if it is not removed completely.

Slashing. It is a methods that can be used in pastures to weaken the weeds and, with fertilizer and limited grazing, promote the development of grasses.

It should be done before seed set.

Exclusion

Restrict cattle and other livestock to areas as yet uninfested by the weeds. If stock is introduced from areas where mature seed are present, confine them to a small paddock for a week to ensure all seeds have been passed.

Hygiene

Treat vehicles and farm machinery. If moving from areas where the weed occurs to those weed-free, wash to remove soil. This is equally important if the machinery is being imported into a country or moved within a country. Also, ensure seeds are not carried on clothes between infested and 'clean' areas.

CHEMICAL CONTROL

2,4-D (amine); 2,4-D + picloram; dichlorprop-p; triclopyr + picloram; dicamba, are registered for use against sicklepod.

Note, herbicides are only effective on seedlings and new growth; this is because the outside layer of mature plants is thick and provides protection from herbicide action.

Glyphosate.



***Alternanthera sessilis* (L.) R. Br. ex DC.**

Sessile joyweed or dwarf copperleaf is native to tropical and subtropical regions of the world.

- Terrestrial, prostrate spreading herb,
 - Upto 30cm.
 - Annual or perennial
 - Rooting at nodes
 - Taproot white or brown
 - Flowering and fruiting: Throughout the year.
- ✓ **Gross**
- Morphology**

✓ Habitat and Ecology

- It is found along the edges of ponds and watersides.
- This weed is found in wet disturbed areas and is a weed of rice and sugarcane fields in tropical and subtropical regions.
- Abundant in moist places, along sides of water courses and marshy areas.

Stem: prostrate, rarely ascending, often rooting at the nodes, Stem rounded, solid, hairy, Stipules absent.

Leaves: simple, opposite, stalked or sessile, obovate to broadly elliptic, margin entire, apex acute, pinnately veined, occasionally linear-lanceolate, 1-15 cm long, 0.3-3 cm wide.



Flowers:

In sessile spikes,
bract and bracteoles shiny white,
0.7-1.5 mm long, glabrous;
stamens 5,
2 sterile,
bisexual,
grouped together in
few-flowered glomerules,
sessile, white.



Fruit nut-like, utricle
Dispersed
by myrmecochorously.

A dry, indehiscent, one-seeded
fruit that has developed from
one flower having a single
ovary, and the ovary wall
becomes more or less bladdery
or inflated at maturity.



✓ **Reproduction**

- Reproduced by seeds and by vegetative means.
- Many branched and stolons from the node creep on the ground.



✓ Dispersal

Flowering During August-October,

- *Alternanthera sessilis* produces many utricles that spread with wind and water.
- *Alternanthera sessilis* transfers seeds by wind, water, and also rooting at the stem nodes.

Hand Weeding

A. sessilis is removed by hand weeding in various crop fields as other cultural practices are ineffective against this perennial weed.

✓ **Chemical Control**

- It can be controlled using amitrole, and repetitive applications of 2,4-D
- Amitrole (3-amino-1,2,4-triazole) is very effective.

2,4-Dichlorophenoxyacetic acid (2,4-D)

It is a common systemic herbicide used in the control of broadleaf weeds

- An alternative method of controlling *A. sessilis* is through the utilization of the weed by farmers.
- Young shoots and leaves of the weed are harvested as vegetables in Malaysia, Sri Lanka, Indonesia, the Philippines and Indo-China.
- It also serves as good ground cover and fodder.

Amaranthus spinosus L.



Family - Amaranthaceae



Common Names:

- Spiny amaranth,
- Spiny pigweed,
- Hogweed

Origins:

Native to

tropical America

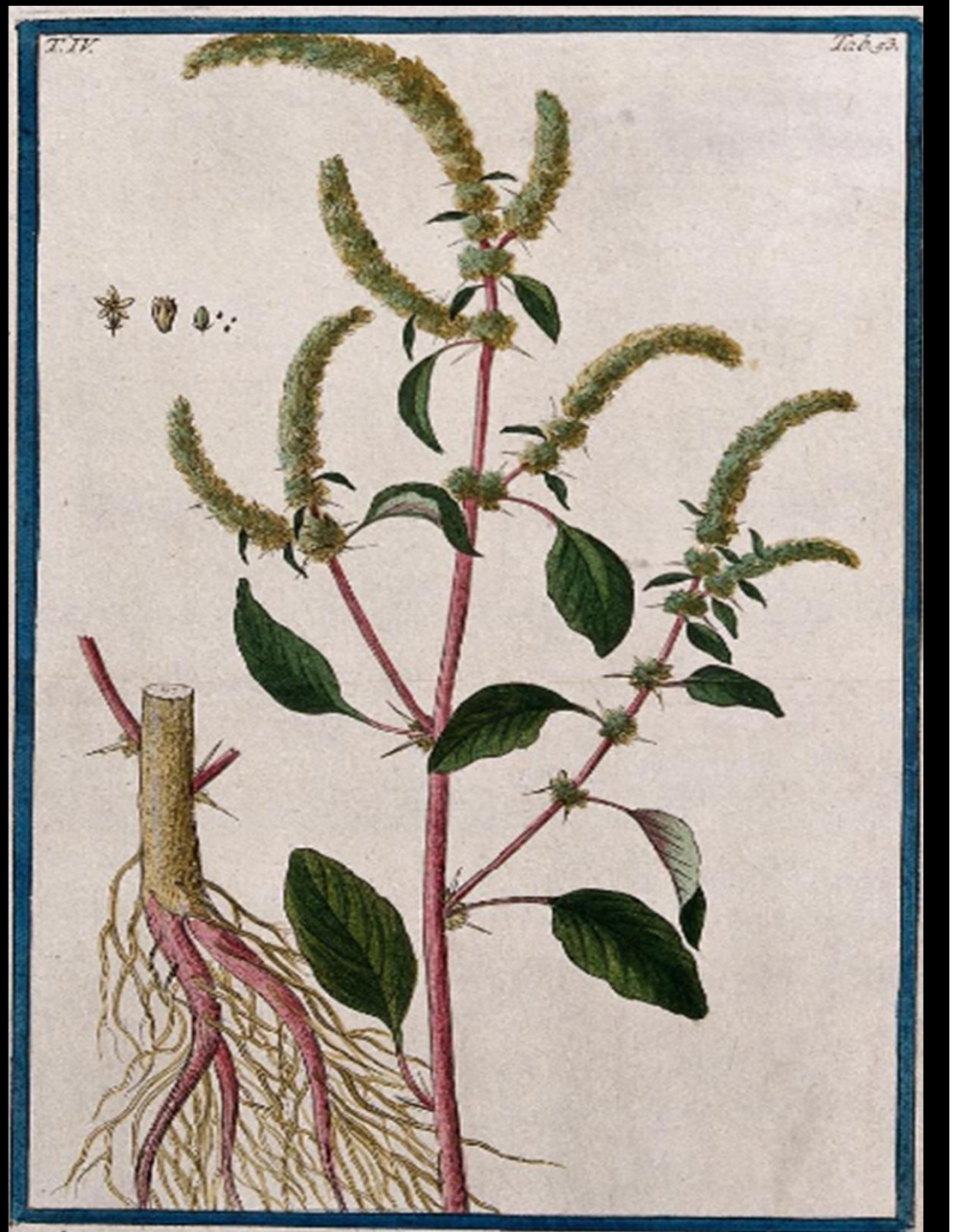
Distribution:

Cosmopolitan in warm temperate and tropical regions but increasingly found in temperate areas.

Description

- ❖ An annual herb reproducing by seed only.
- ❖ Distinguished by flowers and pairs of spiny bracts that occur in the leaf axils.
- ❖ Mature plants are erect, branched and may grow to 1.2 m tall.
- ❖ Stems are angled in cross section, reddish, fleshy and bear many spines.

Leaves are alternate,
ovate-rhombic to
lanceolate
sometimes with
sparse hairs on the
lower surface and
most with a pair of
long, straight spines
at the base.



Flower heads are either a long terminal spike or clumped at the leaf axils in the lower part of the plant.

Male and female flowers are small, greenish and occur on the same plant.

Fruit is ovoid and contains compressed, shiny, tiny, dark red to black seeds.

Ecology

- ❖ It occurs as a weed of varying significance in a variety of crops and horticultural enterprises
- ❖ It is not associated with particular soil types but grows best in well drained but moist situations.
- ❖ It is found on acid, basic and neutral soils.
- ❖ It prefers sunny sites and will not grow well in shaded situations.
- ❖ *A. spinosus* occurs on disturbed ground, along roadsides, railway lines, neglected land, tip sites and poorly maintained grazing land.