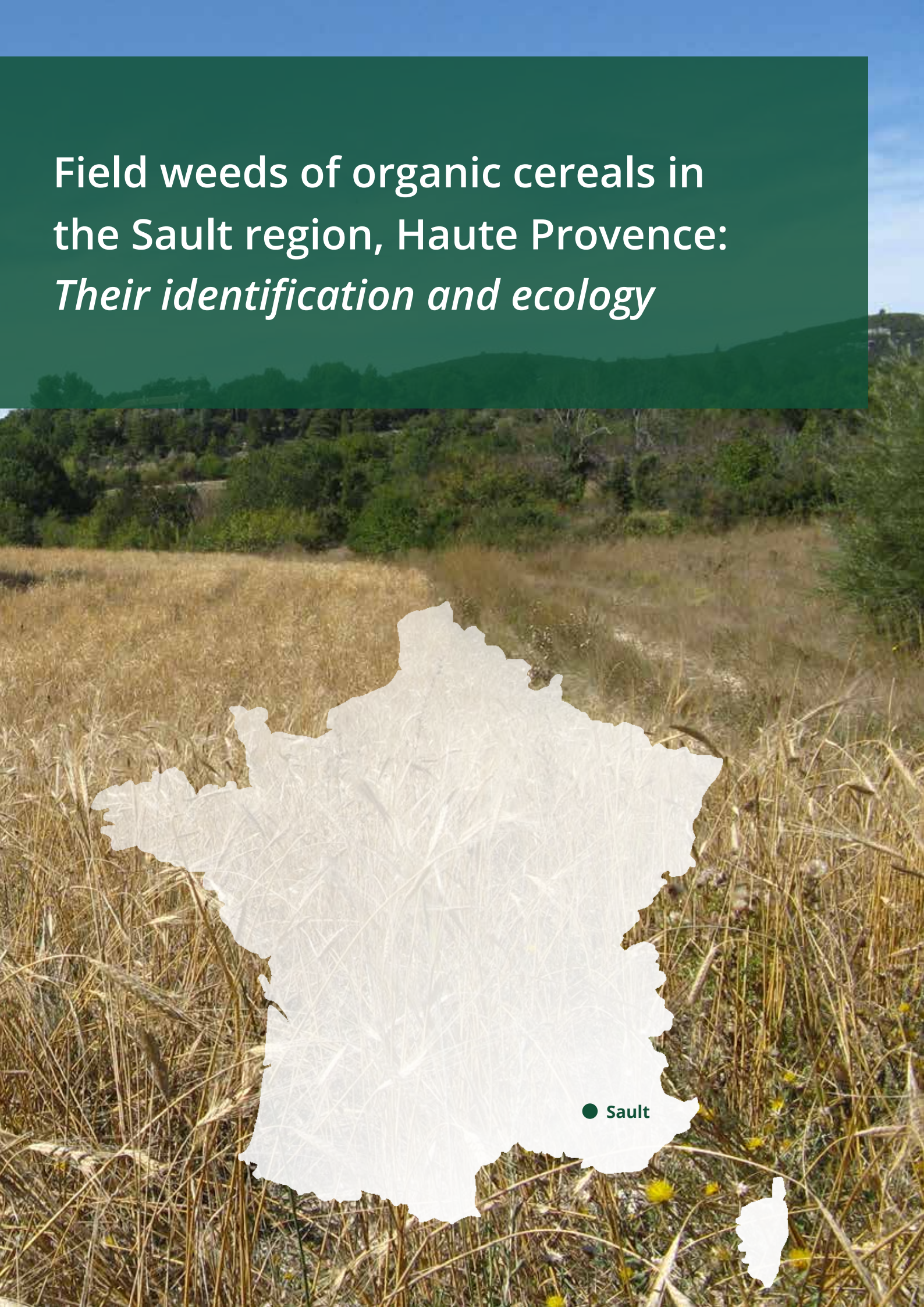
Field weeds of organic cereals in the Sault region, Haute Provence: *Their identification and ecology*



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Field weeds of organic cereals in the Sault region, Haute Provence: Their identification and ecology

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Produced in collaboration with:

Introduction

Arable weeds are perhaps the ecological grouping most vulnerable to changing land use in Europe (Storkey *et al*., 2012). These endangered communities are not only valued by ecologists, conservationists and archaeologists (who study present-day agrosystems to build models for comparison with the past), but are also an inherent part of working life for organic farmers. This booklet is the product of collaboration among organic cereal producers based in and around Sault, Haute Provence, the Chambre d'agriculture in Sault (and more recently the Chambre d'agriculture du Vaucluse), the Conservatoire d'espaces naturels Provence-Alpes-Côte d'Azur (CEN-PACA), the Conservatoire Botanique National Alpin (CBNA), the Centre d'Ecologie Fonctionnelle et Evolutive (CEFE) and the School of Archaeology, University of Oxford.

This booklet describes 45 representative weeds of the organic cereal fields of Haute Provence ranging from the most agriculturally troublesome to the most threatened in the present-day flora. It utilizes three main data sources: French databases on species distribution, ecology and conservation status (e.g. SILENE and HYpermedia for Plant Protection — Weeds databases; *Plan national d'actions en faveur des plantes messicoles* 2012-2017), a 2013 survey of organic fields in Provence (Bogaard *et al.*, 2016) and in-house measurements of weed functional attributes. Accounts are presented for:

Economically important weeds of no conservation concern (15 species).

Weeds that are still common and economically important but for which there is some evidence of decline. Also included here are weeds that are more representative of non-arable habitats (10 species).

Weeds still frequent in the organic fields studied but of conservation concern (11 species).

Weeds now rare or extinct in organic fields and of conservation concern (9 species).

Species additionally classified as 'messicole' are further distinguished by an 'M' in the title of the accounts with their conservation status, M 'abundant', M 'monitored' or M 'precarious', also identified from the PNA 2012-2017. An historically important grouping, 'messicoles' are traditional, primarily autumn-germinating, annual cereal weeds considered to have arrived in France from the Near East with early agriculture thousands of years ago.

Each weed is the subject of a standardised two-page species account. This consists of a brief description of the plant with an overview of ethnobotanical uses (top of page 1) and an ecological summary (lower portion of page 1 and all of page 2).

The ecological section is less self-explanatory than the descriptive section and the following brief notes are therefore provided:

Ecology: type of weed: Six classes are tentatively recognised:

'Cereal mimic' — 'messicoles' and other relatively tall annual arable weeds with similar seasonal growth to that of the cereal crop and a similarly short period of seed-set. Potentially competitive with the crop through a majority of the period of crop growth and seeds potentially contaminate the harvest (e.g. Corncockle, *Agrostemma githago*).

'Early competitor' — smaller annual weeds whose often prolonged period of flowering and seed-set commences before that of the cereal crop. May provide important early competition with crops but in summer is less competitive than the taller cereal plant. After the harvest 'early competitors' may again increase to become an important component of 'stubble' (e.g. Scarlet and Blue Pimpernels, *Anagallis arvensis*).

'Late competitor' — relatively robust annual arable weeds with typically a later commencement of growth and seed-set than the cereal crop. Likely to be most competitive as the cereal plant approaches maturity. Many 'late competitors' achieve maximum abundance and vigour in late-harvested crops such as maize (e.g. Common Amaranth, *Amaranthus retroflexus*) or during periods in the organic crop cycle when species, such as lavender, rather than cereals, are grown (e.g. Yellow Star-thistle, *Centaurea solstitialis*). In contrast, when growing in cereal fields, such species are generally small and produce little seed.

'Open field' species — low-, mainly slow-growing annuals (e.g. Ground-pine, *Ajuga chamaepitys*), in open areas. Most typical of the less productive arable fields. Competition with the crop is generally predicted to be slight. However, European Bur-grass, *Tragus racemosus*, aggressively carpets, lavender fields during summer after they have been cleared of weeds in early summer. (*Tragus* behaves similarly in olive groves following weeding.)

'Vernal transient' — exclusively winter-annual (i.e. species that germinate in the autumn, overwinter and flower and set seed in the spring or early summer). Vernal transients' are small and most typical of droughted infertile habitats (e.g. Annual Androsace, *Androsace maxima*). On arable land they are indicative of unproductive areas not conducive to high cereal yields.

'Vegetative-fragmenter' — perennial species able to reproduce from fragments of underground stem or roots (e.g. Field Bindweed, *Convolvulus arvensis*). Potentially important fast-growing and competitive particularly with the mature cereal. Often an impediment at harvest time and may continue growth after the harvest.

Impact on agricultural production: Subjectively assessed firstly in relation to abundance since rare and declining weeds cannot be considered to have a major impact upon agricultural production irrespective of their potential competitive ability. Secondly, for common species, competitive ability was additionally factored in. Predicted rankings for species of greatest, least and uncertain agricultural concern are coloured **red**, **green** and **brown** respectively.

Conservation status: Europe: Value identifies the percentage of countries where the species is considered endangered by Storkey *et al*. (2012). **Red** identifies high and **green** low conservation concern. France: The classification follows Jauzein (2011), colour-coded as for Europe.

Main agricultural habitats in France: Abstracted from the HPPA database.

Occurrence in 2013 arable survey: Firstly, we provide data on how many of the fields sampled (60 in total) contained the weed (i.e. was the plant common or rare?). Secondly, we assess how many times it was recorded in each of the field where it occurred (i.e. did it form small or large populations?).

Regeneration: As the crop changes, so too does the favourableness of the habitat for each weed species. To help survive years with an unfavourable crop, many weeds possess a persistent seed bank in the soil. In practice, seeds with a capacity for long-term persistence tend to be small and rounded to facilitate burial while transient seeds are often larger and elongated or flattened (Thompson *et al*., 1993). Accordingly, in the graph to predict seed persistence increasing asymmetry in seed shape (varp) is identified as the horizontal axis and increasing seed size as the vertical axis. All 45 weed species, coloured according to known or predicted persistence, are included on each graph. Areas within the highest probability of persistence (i.e. where the seeds are small and round) are bounded by dotted lines. [Ideally, we would have used another better method for estimating persistence (Saatkamp *et al*., 2009, 2011). However, it is based upon seed germination characteristics which are less generally available.] There follows a statement as to how the plant regenerates (by seed, vegetatively, or both), numerical details of seed size and shape and a prediction of number of seeds produced by a 'well-grown' plant (from Hodgson *et al*., 2020). Since values for seed yield relate to a single plant rather than to m^2, readers are reminded of plant size. Subsequently, how seeds may be dispersed is briefly considered.

Life history strategy: In CSR strategy theory (Grime, 2001) two groups of external environmental factors are considered to vitally affect plant performance. The first, **stress**, includes factors that constrain production, particularly soil fertility. The converse, eutrophication, releases plants from nutrient stress and is very much a feature modern, non-organic farming. The second group of environmental factors, **disturbance**, results in the destruction of already-produced plant biomass. In an arable context, this includes ploughing, weeding and harvesting. In the third extreme scenario, where **stress** and **disturbance** are both low, the distribution of species is determined by **competition**. Importantly, the abandonment or relaxation of land use intensity, dereliction, is associated with increased competition. CSR strategies (corresponding to the dimensions of Competition (C), Stress (S) and Disturbance (R)) have been estimated using the method of Hodgson *et al*. (2020), and the predicted position of the 45 weeds studied and some commonly encountered crops is presented in diagrammatic form. We also follow the spirit of Dutoit (2001) and provide summary comparisons between weed species and wheat on a five-point scale (– – to + +).

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Black-grass Ⓜ

Poaceae

Alopecurus myosuroides Huds.

IDENTIFICATION

Image by Kurt Stüber. Source: Wikimedia Commons. CC BY-SA 3.0

Image by Christophe Noroy. Source: Wikimedia Commons. CC BY-SA 3.0

Similar species

None.

USES

Food: No use reported. **Toxicity:** None reported. **Medicinal:** No use reported. **Fodder:** Has been grown as fodder but rejected by cattle.

ECOLOGY

Type of weed: Intermediate between early competitor and cereal mimic. **Impact on agricultural production:** A serious weed (on fertile soils). **Conservation status - Europe:** 7 % threatened; **France:** Very common. **Main agricultural habitats in France:** Winter and spring cereals, rape and potato, beet and orchards. **Occurrence in 2013 arable survey:** Uncommon (most characteristic of intensively managed systems). In only 13 % of fields but at high population densities where present.

Websites: www.tela-botanica.org, www.wikipedia.org

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Moist clays and loams. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

Plant

Erect, slender, hairless annual grass; up to 1 m in height.

Leaves

Alternate, with membranous projection (ligule) at base of leaf blade; up to 8 mm wide.

Flowers

Greenish or purplish. Aggregated into a terminal cylindrical head up to 12 cm long and 6 mm in diameter. Individual flowers enclosed within oblong flattened, papery structures, each with a single straight bristle about twice as long as the 'flower'.

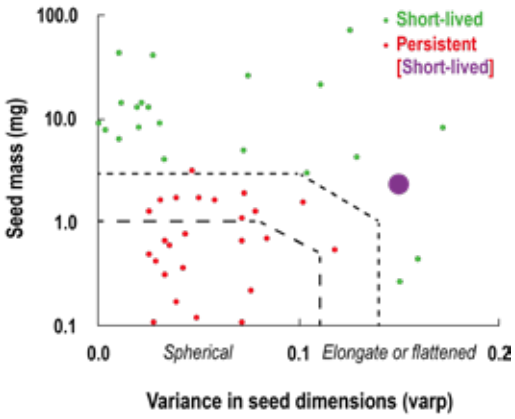
Main flowering time

June–July.

Seeds

Yellow-brown; oval, flattened, 3 x 2 mm; with an attached papery bract about 6 x 3 mm, with a long basal bristle.

REGENERATION



Only by seed.

Seed size: Intermediate, 2.0 mg; **Shape:** Oblong and awned; **Varp:** 0.15. **Predicted number of seeds per plant:** Medium, 753. **Plant diameter:** Medium.

Seed dispersal in time

Despite its intermediate seed size and elongate shape a shortly-persistent soil seed bank has been widely reported.

Seed dispersal in space

With the harvest: Yes, but typically a majority of seed shed before harvest time. **In soil transported by machinery and feet:** Yes. **Other:** Not strongly specialised for wind dispersal and seed tends not to survive animal ingestion (Maréchal *et al*. 2012). However, the seed may adhere to animals and clothing.

SEEDS

Seeds of Black-grass (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An erect, basally-branched, leafy, medium-sized annual arable weed.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set in summer.

Impact on crop establishment and yield: A serious weed. Predicted to have an intermediate competitive ability, although in autumn-sown cereals on fertile soils very high densities can cause a 30 % decline in crop yield. It is also a potential contaminant of crop seed. However, Black-grass was uncommon and restricted to the most highly-productive intensively-managed of the organic arable fields that we studied in Provence.

LIFE HISTORY STRATEGY

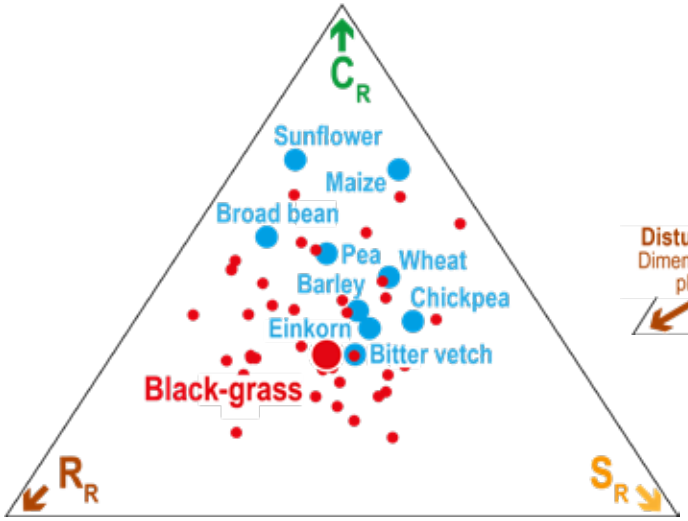
Comparison with wheat

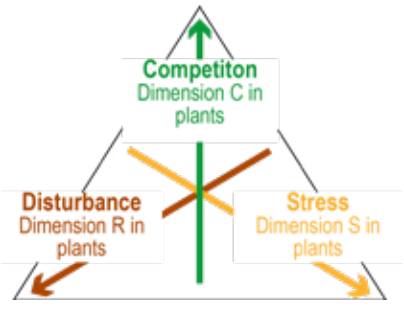
Seed yield: -

Soil fertility: =

Competitiveness: - -

Disturbance: + +





Common Amaranth

Amaranthaceae

Amaranthus retroflexus L.

IDENTIFICATION

Image by Stefan Lefnaer. Source: Wikimedia Commons. CC BY-SA 4.0

Image by Lynk Media. Source: Wikimedia Commons. CC BY-SA 3.0

Similar species

Pigweeds (*Amaranthus*) include many species that are difficult to separate. However, they are nearly all fast-growing summer-annuals of moist, fertile soils.

USES

Food: Consumption of this species has been reported in France, Italy, Greece, Crete, Turkey, Cyprus and Lebanon. The young plant is boiled and served with olive oil and lemon juice, or lightly fried. The level of vitamin C is very high (145–196 mg/100 g). The plant is also rich in amino acids, vitamin A and Ca, P, K and Fe. The seeds are eaten in Lebanon, cooked as a cereal or vegetative shoots added to salads. The Aztecs used seeds of many different species of amaranth as a cereal. A species close to Guernsey Pigweed (*A. blitum* L.) was consumed by the Romans. The leaves are currently commonly used as "spinach" in the tropics, sometimes grown under the name "Malabar brede" (e.g. in Mauritius). **Toxicity:** Species of the genus are not considered toxic at low doses, but the leaves contain oxalic acid and may contain nitrates. The cooking water should be discarded, but can be used as a fertiliser. The maximum recommended dose is 50 g of fresh leaves per day. **Medicinal:** No use reported. **Fodder:** No use reported.

Edible rating: 3 **Medicinal rating: 2**

References consulted: Couplan (2015)

Websites: https://pfaf.org

ECOLOGY

Type of weed: Late competitor. **Impact on agricultural production:** A serious weed (autumn-harvested crops). **Conservation status - Europe:** 0 % threatened; **France:** Very common (naturalised). **Main agricultural habitats in France:** Potato, beet, sunflower, maize, vineyards, orchards and vegetable crops. **Occurrence in 2013 arable survey:** Unrecorded in survey (characteristic of spring-sown, late-harvested crops in intensively managed systems).

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Moist clays and loams. **Soil reaction:** Wide-ranging but most typically neutral. **Soil fertility:** Fertile.

Plant

Robust, erect, bushy, somewhat hairy annual; to 1 m or more in height.

Leaves

Alternate; large, oval; up to 6 cm wide.

Flowers

Greenish, aggregated in dense terminal spikes; minute, 2–3 mm in diameter.

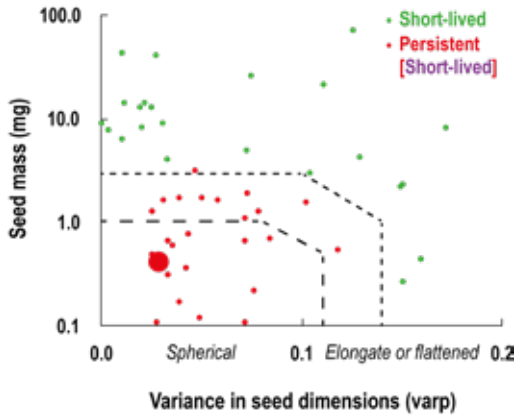
Main flowering time

July–October.

Seeds

Black, shining, flattened, disk-like; 1.5 mm in diameter; enclosed within the senescent flower.

REGENERATION



Only by seed.

Seed size: Small, 0.4 mg; **Shape:** Rounded; **Varp:** 0.03. **Predicted number of seeds per plant:** Very many, 12 981. **Plant diameter:** Large.

Seed dispersal in time

A long-persistent seed bank is both predicted on the basis of seed size and shape and has been reported from the field (Costea *et al*., 2004).

Seed dispersal in space

With the harvest: A proportion of seeds are long-persistent on the plant and can be dispersed by combine harvester (Costea *et al*., 2004). **In soil transported by machinery and feet:** Yes. **Other:** Not strongly specialised for wind dispersal and not readily adhering to animals and clothing but survives mammalian ingestion (Costea *et al*., 2004).

SEEDS

Seeds of Common Amaranth (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An erect, leafy, branched, often bushy, medium to large annual of arable and wasteland.

Seasons of growth

Seed germination: Spring–summer.

Plant growth: Vegetative growth 'warm–season' (late spring–autumn) with flowering and seed-set from summer onwards.

Impact on crop establishment and yield: A serious weed. Predicted to be more competitive than wheat, and in maize and soya,very high densities can cause up to a 90 % decline in crop yield. Even a density of 0.5 plants per m^2 can reduce yield by 5 %. It is also a potential contaminant of crop seed. However, Common Amaranth is primarily a weed of spring-sown crops on very fertile soils and was not recorded in our survey of the organic arable fields of Provence.

LIFE HISTORY STRATEGY

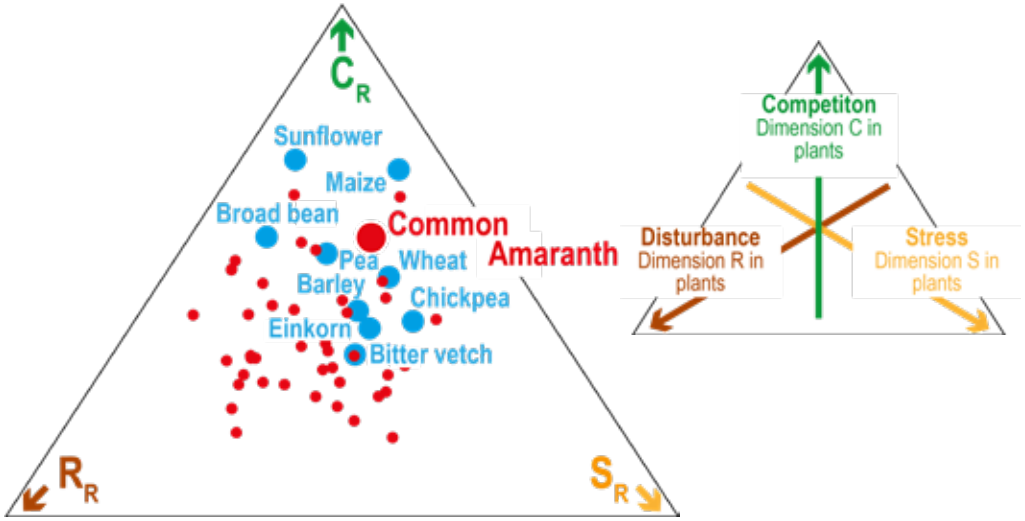
Comparison with wheat

Seed yield: -

Soil fertility: =

Competitiveness: +

Disturbance: =



Barren Brome

Poaceae

Anisantha sterilis (L.) Nevski, Syn: *Bromus sterilis L.*

IDENTIFICATION

Image by Hermann Schachner. Source: Wikimedia Commons. CC0 1.0

Image by Hermann Schachner. Source: Wikimedia Commons. CC0 1.0

Similar species

Great Brome (*A. diandra* (Roth) Tutin ex Tzvelev) is slightly larger with longer seed bracts (20–35 mm) and a longer bristle (25–60 mm) and Compact Brome (*A. madritensis* (L.) Nevski) is smaller with bracts (10–14 mm) and bristles (10–25 mm). Other similar small species also occur in non-arable habitats.

USES

Food: No use reported. **Toxicity:** None reported. **Medicinal:** No use reported. **Fodder:** No use reported.

References consulted: Lintell Smith *et al*. (1999)

Websites: www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: Intermediate between early competitor and vernal transient. **Impact on agricultural production:** A potentially serious weed (especially cereals and shallow ploughing). **Conservation status - Europe:** 3 % threatened; **France:** Common. **Main agricultural habitats in France:** Winter cereals, vineyards and orchards. **Occurrence in 2013 arable survey:** Frequent but even more characteristic of field boundaries and other linear habitats. In 40 % of fields often at low population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Dry sandy loams to clays. **Soil reaction:** Wide-ranging. **Soil fertility:** Relatively fertile.

Plant

Erect or spreading, hairy, annual grass; up to 1 m in height.

Leaves

Alternate, with small membranous projection (ligule) at base of leaf blade; up to 8 mm wide.

Flowers

Aggregated into drooping spikelets up to 6 cm or more in length (including bristles). Spikelets on long stalks, in a very loose terminal inflorescence. Each spikelet consists of 4–10 flowers.

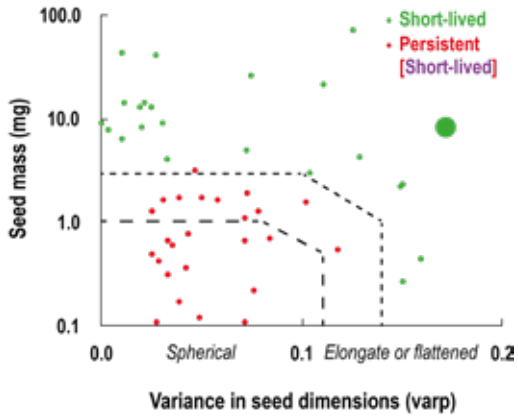
Main flowering time

April–May.

Seeds

Dark brown; elongate, 10 x 2 mm; mostly enclosed by a bract 10–20 mm long with an apical bristle 15–30 mm long.

REGENERATION



Only by seed.

Seed size: Large, 7.7 mg; **Shape:** Elongate with a long awn; **Varp:** 0.17. **Predicted number of seeds per plant:** Few, 282. **Plant diameter:** Medium.

Seed dispersal in time

The large elongate seeds of Barren Brome are short-lived in the soil (Grime *et al*., 2007).

Seed dispersal in space

With the harvest: Yes for early-harvested crops but typically a majority of seed shed before harvest time. **In soil transported by machinery and feet:** Limited dispersal. **Other:** Not strongly specialised for wind dispersal and seed tends not to survive animal ingestion (CABI). The sharply elongate seed with a long attached bristle readily adheres to animals and clothing.

SEEDS

Seeds of Barren Brome (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An erect, basally-branched, leafy, medium-sized annual of disturbed habitats.

Seasons of growth

Seed germination: Autumn.

Plant growth: Vegetative growth 'cool-season' (autumn–late spring) with flowering and seed-set in late spring to early summer. Most seed shed, and plant generally dead, before the crop harvest.

Impact on crop establishment and yield: A potentially serious weed. Predicted to have only an intermediate competitive ability, although in autumn-sown cereals on fertile soils very high densities can cause a 50 % decline in crop yield. It is also a potential contaminant in the seed of shorter early-maturing crops. Frequent at low densities in the organic arable fields of Provence but more characteristic of field boundaries. However, it is favoured by the replacement of deep ploughing by minimum tillage regimes and continuous winter cereal cultivation.

LIFE HISTORY STRATEGY

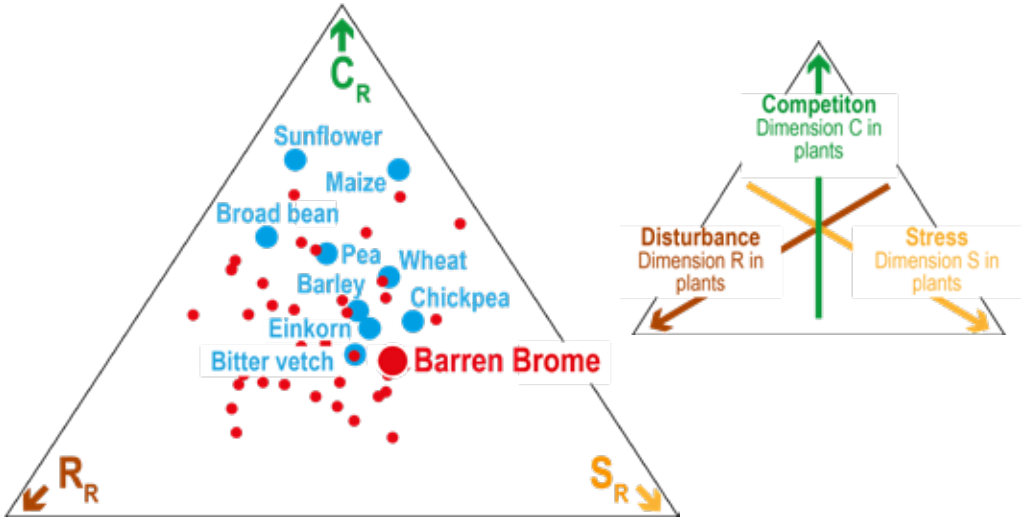
Comparison with wheat

Seed yield: -

Soil fertility: =

Competitiveness: - -

Disturbance: +



Animated Oat/Winter Wild-oat

Poaceae

Avena sterilis L.

IDENTIFICATION

Image by Javier Martin. Source: Wikimedia Commons

Image by Sten Porse. Source: Wikimedia Commons. CC BY-SA 3.0

Similar species

Slender Oat (*A. barbata* Pott ex Link) and Wild-oat (*A. fatua* L.) both tend to be less robust than Animated Oat and in both individual seeds are shed separately. Additionally, the two apical points on the papery bract enclosing the seed is 3–9 mm in Slender Oat but 0.5–2 mm in the other two species.

USES

Food: Ancient use as porridge or boiled seeds has been reported for southern Europe. **Toxicity:** None reported. **Medicinal:** No use reported for this species of oat. **Fodder:** As with other species of oat, seeds and leaves may be fed to animals.

Edible rating: 3 **Medicinal rating: 0**

References consulted: Couplan (2015)

Websites: https://pfaf.org

ECOLOGY

Type of weed: Cereal mimic. **Impact on agricultural production:** A potentially serious weed. **Conservation status - Europe:** 0 % threatened; **France:** Common. **Main agricultural habitats in France:** Winter cereals, rape and vineyards. **Occurrence in 2013 arable survey:** In 67 % of fields but often at low population densities.

HABITAT

Climatic distribution: Weakly Mediterranean. **Soil type:** Dry clays and loams. **Soil reaction:** Wide-ranging. **Soil fertility:** Intermediate.

Plant

Erect, slender, slightly hairy annual grass; up to 1.8 m in height.

Leaves

Alternate, with membranous projection (ligule) at base of leaf blade; typically less than 16 mm wide.

Flowers

Greenish; spikelets long-stalked in a loose terminal head. Each spikelets consists of 2–3 flowers and is up to 3 cm or more in length and with two long bristles bent near their midpoint.

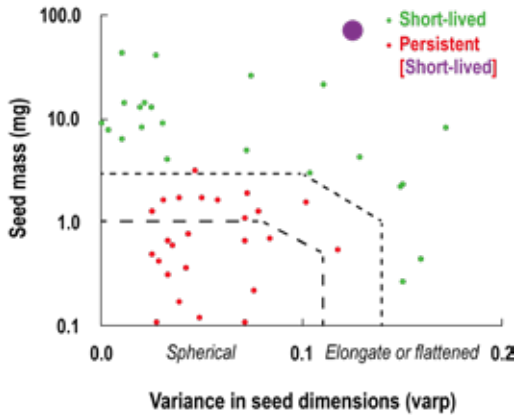
Main flowering time

June–July.

Seeds

Dark brown; elongate and tapered at the tips; 6 x 2 mm; partially enclosed by papery bract about 14 mm, with an apical notch and a long basal bristle to 4 cm. Seeds from spikelet shed together because the axis fragments only below the lowermost seed.

REGENERATION



Only by seed.

Seed size: Large, 18.2 mg; **Shape:** Elongate with a long awn; **Varp:** 0.13. **Predicted number of seeds per plant:** Medium, 541. **Plant diameter:** Large.

Seed dispersal in time

Despite its large seed size and elongate shape a shortly-persistent soil seed bank has been reported.

Seed dispersal in space

With the harvest: Yes, with seed difficult to separate from cereals. **In soil transported by machinery and feet:** Limited dispersal. **Other:** Not strongly specialised for wind dispersal but the elongate seed with a long attached bristle adheres to animals and clothing.

SEEDS

Seeds of Animated Oat (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An erect, basally-branched, leafy, large annual arable weed.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set in summer.

Impact on crop establishment and yield: A potentially serious weed. Predicted to have a competitive ability similar to that of wheat. Up to 15 %, 40 % and 50 % loss in wheat yield have been recorded for 3, 10 and 30 plants of oat per m^2. It is also a potential contaminant of crop seed. Animated Oat is a frequent, perhaps increasing, weed in the organic arable fields of Provence.

LIFE HISTORY STRATEGY

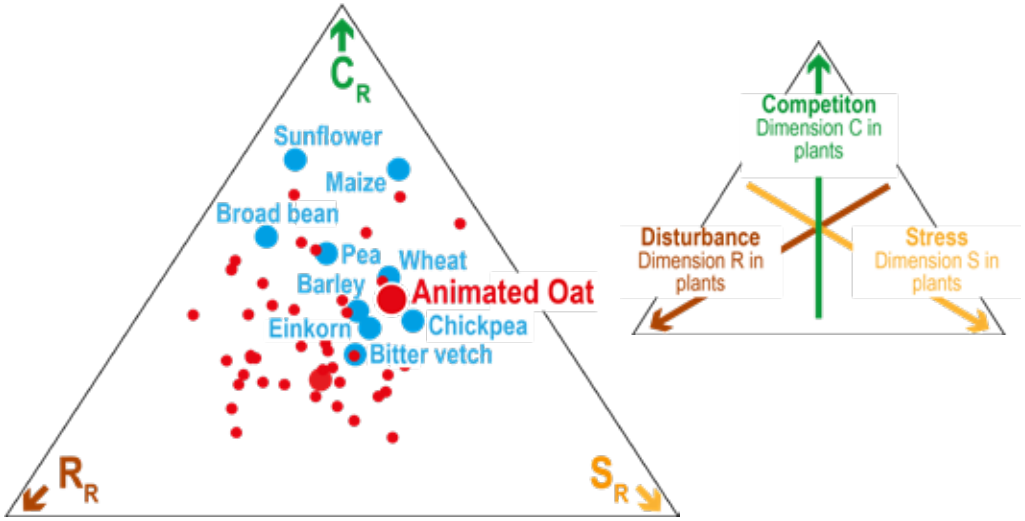
Comparison with wheat

Seed yield: =

Soil fertility: =

Competitiveness: =

Disturbance: =



Yellow Star-thistle

Asteraceae

Centaurea solstitialis L.

IDENTIFICATION

Similar species

None.

USES

Food: In Sicily, young leaves are boiled and consumed with olive oil and lemon. Also eaten in Turkey. **Toxicity:** None reported. **Medicinal:** In Turkey, traditionally used to treat ulcers. Recent pharmacological studies in the laboratory appear to corroborate an effect on ulcers. **Fodder:** Eaten by livestock with other weeds.

Edible rating: 1 **Medicinal rating: 1**

References consulted: Yesilada *et al*. (2004); Couplan (2015)

Websites: https://pfaf.org, http://uses.plantnet-project.org/fr/Bleuet_(Cazin_1868)

ECOLOGY

Type of weed: Late competitor. **Impact on agricultural production:** A potentially serious weed (on soils of intermediate fertility and with less intensive management regimes). **Conservation status - Europe:** 3 % threatened; **France:** Quite common. **Main agricultural habitats in France:** Vineyards, winter cereals and vegetable crops. **Occurrence in 2013 arable survey:** Common but populations probably maintained by larger more floriferous biennial plants in linear habitats and fallow fields. In 45 % of fields and often at moderate to high population densities.

HABITAT

Climatic distribution: Mediterranean. **Soil type:** Dry clays and loams. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

Plant

Erect robust, bushy annual or biennial covered in woolly hairs; typically less than 1 m in both height and width.

Leaves

Alternate; the basal ones large, oblong, lobed, up to 4 cm wide and withering before flowering; stem leaves smaller, entire, less than 2 cm wide and extending down the stem as a narrow wing.

Flowers

Bright yellow; numerous, small, flowers overtopping a cone of greenish scales, some bearing spreading spines up to 2 cm in length; together forming a long-stalked, terminal 'thistle-flower' 2.5–5 cm in diameter.

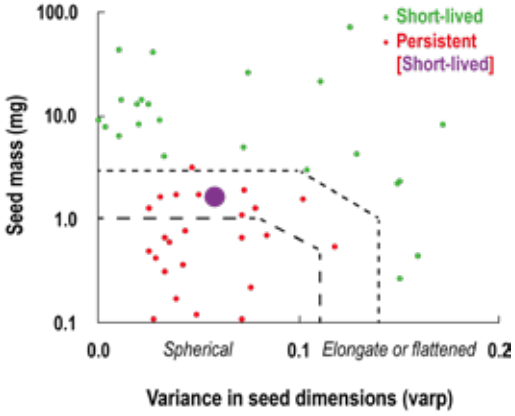
Main flowering time

June–July.

Seeds

Mostly pale with a plume of stiff hairs but some darker without hairs; 3 x 1.5 mm; loosely attached to the base of each senescent 'flower'.

REGENERATION



Only by seed.

Seed size: Intermediate, 1.6 mg; **Shape:** Broadly elongate and mostly plumed; **Varp:** 0.06. **Predicted number of seeds per plant:** Medium, 4518 [Measured: 711, Saatkamp *et al*. 2011]. **Plant diameter:** Large.

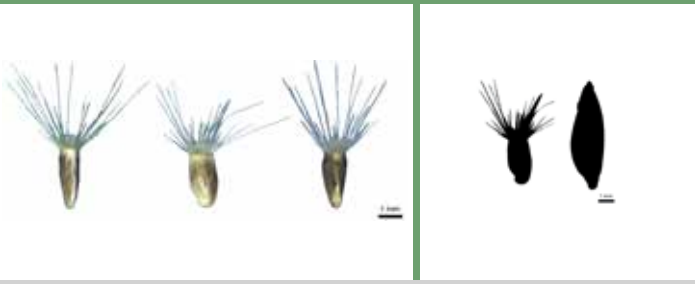
Seed dispersal in time

Despite its intermediate seed size and elongate shape a shortly-persistent soil seed bank has been widely reported.

Seed dispersal in space

With the harvest: Potentially yes, with later-harvested crops, particularly Lucerne (*Medicago Sativa* L). **In soil transported by machinery and feet:** Limited dispersal. **Other:** Has a limited capacity for dispersal by wind and by adhering to animals and clothing.

SEEDS



Seeds of Yellow Star-thistle (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A large, erect, leafy, often much-branched and bushy annual to biennial of waste and arable land.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Initially, vegetative growth is 'cool-season' (autumn–early summer). However,Yellow Star-thistle has a deep tap-root facilitating access to subsoil moisture and is slow to reach maturity. Flowering and seed-set is delayed until mid-summer onwards. We suspect that some large relatively early-flowering plants are in their second year.

Impact on crop establishment and yield: A potentially serious weed. Despite the robust bushy habit of mature plants, it overwinters as a low-growing leaf rosette and, on fertile soils, is predicted to have only an intermediate competitive ability. A common weed in the organic arable fields of Provence, optimally producing many widely-dispersed seeds. However, Yellow Star-thistle is late-maturing and often produces little seed before harvest-time in arable habitats. It is probably more economically important, and typically larger, in dry pasture.

LIFE HISTORY STRATEGY

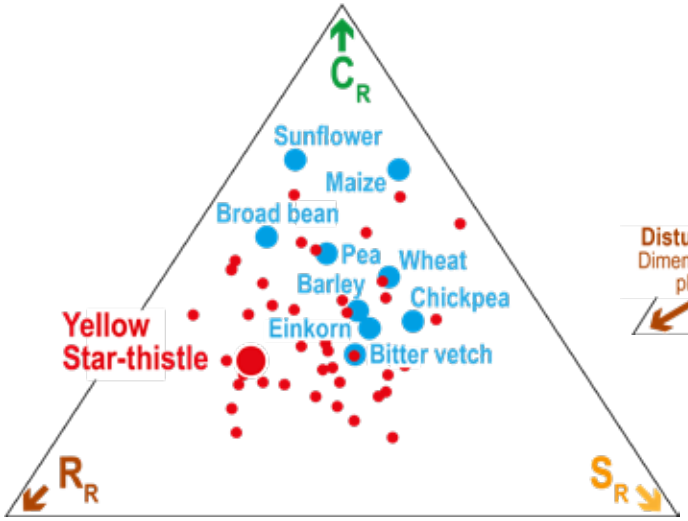
Comparison with wheat

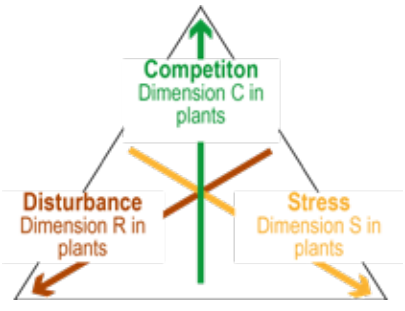
Seed yield: -

Soil fertility: +

Competitiveness: - -

Disturbance: + +





Fat-hen

Amaranthaceae

Chenopodium album L.

IDENTIFICATION

Image by Harry Rose. Source: Wikimedia Commons. CC BY-SA 2.0

Image by Matt Lavin. Source: Wikimedia Commons. CC BY-SA 2.0

Similar species

Goosefeet (*Chenopodium*) include many species that are difficult to separate. However, they are nearly all fast-growing summer-annuals of moist, fertile soils.

USES

Food: The plant has been eaten as a vegetable since ancient times (e.g. by the Incas [Boisvert 2003]). Young leaves were included in salads (but see 'Toxicity' below). Older but still tender leaves are cooked like spinach. The seeds are edible once cooked (to remove saponins). Young stems are eaten like asparagus. Flowers are used in desserts (mousses, fruit salads or cakes). In the Cevennes, the young leaves are cooked in boudin (blood sausage) with herbs and in "bourbouillade". **Toxicity:** Toxic if eaten in large quantities because of the presence of saponins and oxalic acids. Consumption of raw foliage is discouraged because of saponins, nitrates and oxalic acid. Like spinach excessive consumption should be avoided particularly for renal, hepatic and arthritic patients. Cooking removes saponins but not oxalates. **Medicinal:** Not used in herbal medicine but appears to possess some mild beneficial properties (PFAF). Crushed fresh roots can be used as a mild soap substitute. **Fodder:** May be fed to animals.

Edible rating: 3 **Medicinal rating: 2**

References consulted: Boisvert (2003); Rénaux (2011)

Websites: https://pfaf.org, http://www.plantes-comestibles.fr/especes/chenopodium-album

ECOLOGY

Type of weed: Late competitor. **Impact on agricultural production:** A serious weed (particularly autumn-harvested crops). **Conservation status - Europe:** 0 % threatened; **France:** Very common. **Main agricultural habitats in France:** Very strongly or strongly associated with all cultivation regimes except rice. **Occurrence in 2013 arable survey:** More characteristic of spring-sown crops in more intensively managed systems and as a result only uncommon here. In 18 % of fields but often at moderate to high population densities.

Plant

Erect, robust, hairless often bushy annual; to 1.5 m or more in height. Young parts of the plant often with a sparse whitish, granular covering.

Leaves

Alternate; diamond-shaped to narrowly oval; up to 5 cm wide.

Flowers

Greenish, aggregated in dense terminal clusters; minute, about 2 mm in diameter.

Main flowering time

July–October.

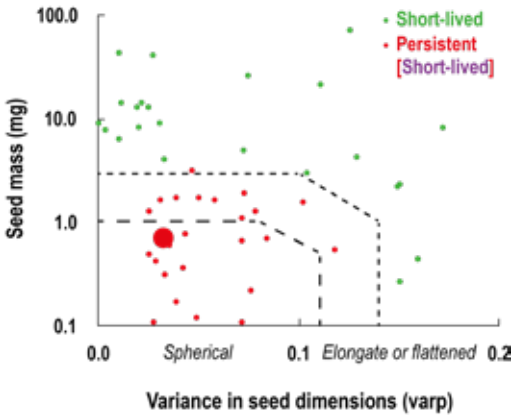
Seeds

Two types. (1) Black glossy; spherical, flattened; 1.2 mm in diameter and (2) brown; 1.5 mm; enclosed in a papery case.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Most types of soil. **Soil reaction:** Neutral. **Soil fertility:** Relatively fertile

REGENERATION



Only by seed.

Seed size: Small, 0.7 mg; **Shape:** Rounded; **Varp:** 0.03. **Predicted number of seeds per plant:** Very many, 14 633. **Plant diameter:** Large.

Seed dispersal in time

A long-persistent seed bank is both predicted on the basis of seed size and shape and has been recorded in the field (Grime *et al*. 2007).

Seed dispersal in space

With the harvest: Yes, but only for later-harvested crops. **In soil transported by machinery and feet:** Yes. **Other:** Not strongly specialised for wind dispersal nor readily adhering to animals and clothing but may survive ingestion.

SEEDS

Seeds of Fat-hen (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A large, erect, leafy, often much-branched and bushy annual of arable and waste land.

Seasons of growth

Seed germination: Spring–summer.

Plant growth: Vegetative growth primarily 'warm–season' (late spring–autumn) with flowering and seed-set in summer through to autumn.

Impact on crop establishment and yield: A potentially serious weed. Predicted to have a competitive ability similar to or greater than that of wheat and, for example, high densities may cause a 50+ % reduction in yield in maize. It is also a potential contaminant of crop seed and considered to be one of the 'world's worst weeds', but essentially a weed of spring-sown crops on fertile soils. It is less problematic in less fertile arable habitats and relatively uncommon in our survey of the organic arable fields of Provence.

LIFE HISTORY STRATEGY

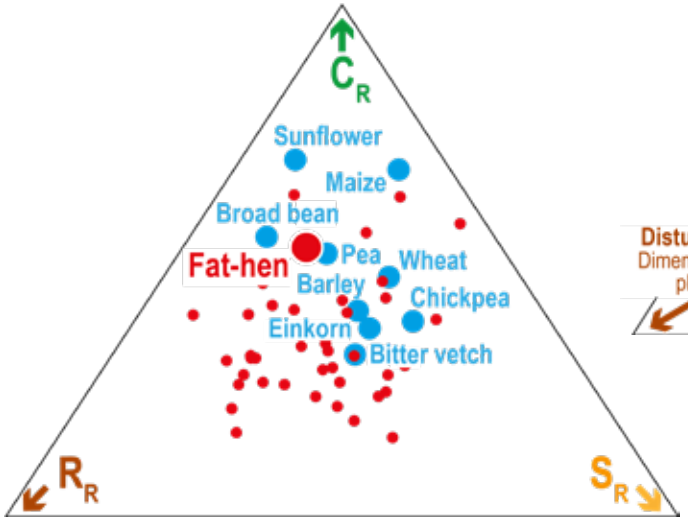
Comparison with wheat

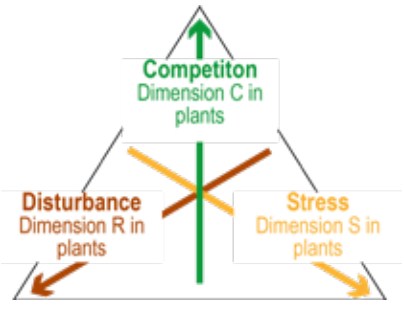
Seed yield: -

Soil fertility: +

Competitiveness: =

Disturbance: =





Creeping Thistle

Asteraceae

Cirsium arvense (L.) Scop.

IDENTIFICATION

Image by Matt Lavin. Source: Wikimedia Commons. CC BY-SA 2.0

Image by Isidre Blanc. Source: Wikimedia Commons. CC BY-SA 4.0

Similar species

When only vegetative, can be confused with Globe Thistle (*Echinops ritro* L.), a plant of less fertile soils with a blue spherical inflorescence about 4 cm in diameter.

USES

Food: The very young stems are good raw and have a sweet, salty taste (Couplan 2015). **Toxicity:** Seeds are potentially toxic. **Medicinal:** The root has been used for a variety of purposes including as a diuretic (PFAF). **Fodder:** No use reported but, as with many thistles, young shoots can be eaten by animals.

Edible rating: 2 **Medicinal rating: 2**

References consulted: Couplan (2015)

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: Vegetative-fragmenter. **Impact on agricultural production:** A serious weed. **Conservation status - Europe:** 0 % threatened; **France:** Very common. **Main agricultural habitats in France:** Very strongly associated with all cultivation regimes except rice. **Occurrence in 2013 arable survey:** Very common. In 60 % of fields and often at moderate to high population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Moist clays and loams. **Soil reaction:** Wide-ranging. **Soil fertility:** Relatively fertile.

Plant

Erect perennial up to 1 m or more in height, forming open patches.

Leaves

Alternate; elongate with undulating spiny edges, glossy green above and sometimes with cottony hairs below; up to 3 cm wide.

Flowers

Pale purple; numerous small flowers overtopping a cone of greenish scales; together forming a long-stalked, terminal 'thistle-flower', about 1.5–2.5 cm in diameter.

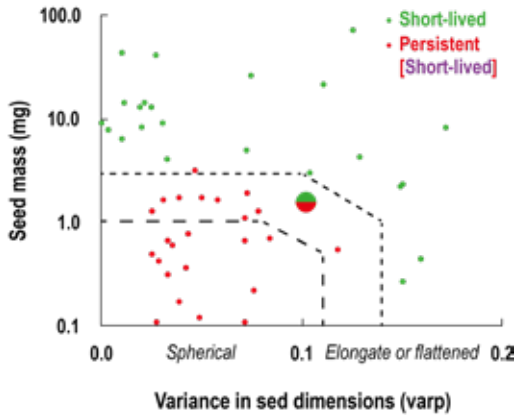
Main flowering time

June–September.

Seeds

Dark brown; elongate, smooth, with a fragile, feathery 'parachute'; 4 x 1.6 mm; loosely attached to the base of each senescent 'flower'.

REGENERATION



Vegetatively (and by seed).

Seed size: Intermediate, 1.5 mg; **Shape:** Broadly elongate and plumed; **Varp:** 0.10. **Predicted number of seeds per plant:** Few seeds produced in arable habitats. **Plant diameter:** Variable.

Seed dispersal in time

Seed size and shape are towards the predicted limit for a persistent seedbank. Typically seeds germinate within a year but in non-arable habitats a persistent seed bank has been recorded (Tiley, 2010).

Seed dispersal in space

With the harvest: Potentially dispersed with later-harvested crops. **In soil transported by machinery and feet:** Yes (but regeneration from transported root fragments more important). **Other:** specialised for wind dispersal but plume of hairs easily detached. No strong specialisations apparent for animal dispersal.

SEEDS

Seeds of Creeping Thistle (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A large, erect, leafy perennial herb, forming large clonal patches by means of far-creeping roots. Characteristic of waste, pasture and arable habitats.

Seasons of growth

Seed germination: Spring.

Plant growth: Buds from intact/detached roots and stem bases generate new shoots/plants. All vegetative growth 'warm-season' (spring–autumn). Flowering and seed-set commence mid- to late-summer and shoots die back in late autumn.

Impact on crop establishment and yield: A potentially serious weed. Predicted to have a competitive ability greater than that of wheat and, for example, may cause a 50+ % reduction in yield in wheat. Creeping Thistle is one of the 'world's worst weeds'. It is favoured by reduced tillage farming systems and is probably increasing in the organic arable fields of Provence (perhaps along with, on less fertile soils, the morphologically similar Globe-thistle).

LIFE HISTORY STRATEGY

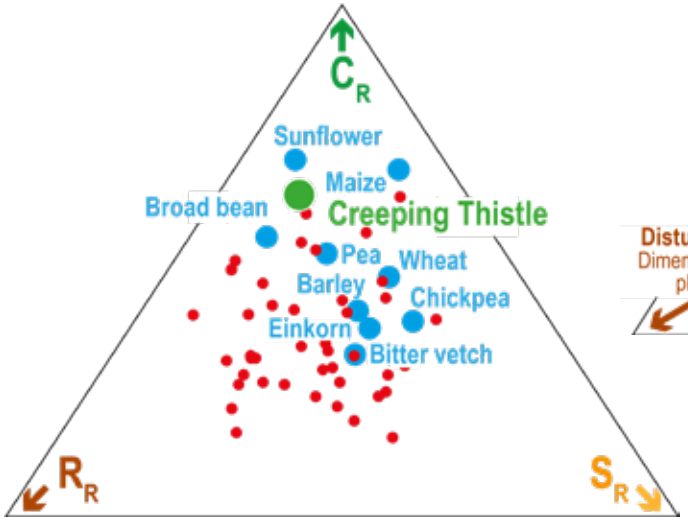
Comparison with wheat

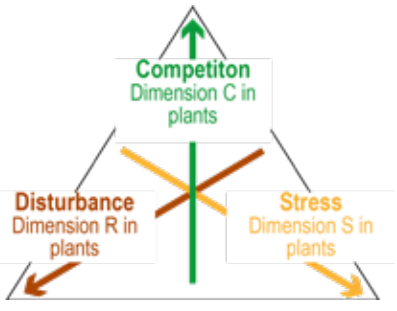
Seed yield: - -

Soil fertility: +

Competitiveness: + +

Disturbance: + +





Field Bindweed

Convolvulaceae

***Convolvulus arvensis* L.**

IDENTIFICATION

Image by Olivier Pichard. Source: Wikimedia Commons, CC BY-SA 3.0

Image by Isidre Blanc. Source: Wikimedia Commons, CC BY-SA 4.0

Similar species

None.

USES

Food: Has been used as a condiment (PFAF). **Toxicity:** None reported. **Medicinal:** In herbalism, a syrup made from its roots is used as a laxative. An infusion of its leaves has similar laxative properties. **Fodder:** No use reported.

Edible rating: 1 **Medicinal rating: 2**

References consulted: Fleury de la Roche (1937)

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org, http://www.luontoportti.com/suomi/fr/kukkakasvit/pied-dalouette-royal

ECOLOGY

Type of weed: Vegetative-fragmenter. **Impact on agricultural production:** A serious weed. **Conservation status - Europe:** 0 % threatened; **France:** Very common. **Main agricultural habitats in France:** Very strongly associated with all cultivation regimes except rice. **Occurrence in 2013 arable survey:** Very common. In 77 % of fields and often at moderate to high population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Most types of dry soils. **Soil reaction:** Wide-ranging. **Soil fertility:** Intermediate to fertile.

Plant

Perennial with stems up to 1 m or more in length, prostrate on open ground or twisting around the stems of other species and supported by them.

Leaves

Alternate; stalked, arrow-shaped, hairy when young; up to 3 cm wide.

Flowers

Pinkish; solitary on long stalks in the leaf axils; up to 3 cm in diameter. Petals 5 fused, broadening into a flat, plate-like flower. Sepals 5, small, greenish and inconspicuous.

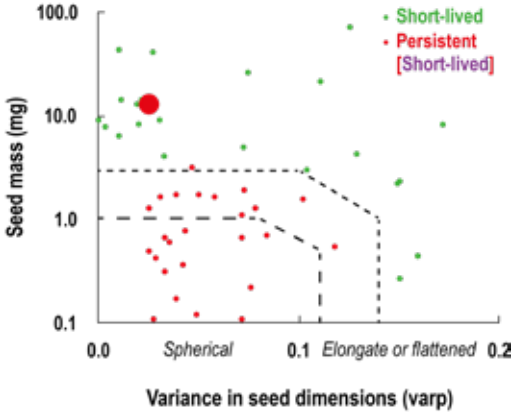
Main flowering time

June–October.

Seeds

Dark brown; flattened on two surfaces with a rounded back; 3 x 1.5 mm; in longitudinally-splitting capsule, 8 x 6 mm.

REGENERATION



Vegetatively (and by seed).

Seed size: Large, 12.1 mg; **Shape:** Roundish; **Varp:** 0.04. **Predicted number of seeds per plant:** Often few seeds produced in arable habitats (up to 300 - Weaver, 1982). **Plant diameter:** Variable.

Seed dispersal in time

Field Bindweed has hard (water-impermeable) seeds that tend to escape detection by smell by predators. Therefore, despite its large seed size a long-persistent seed bank is predicted and has been recorded (Grime *et al*., 2007).

Seed dispersal in space

With the harvest: Yes. **In soil transported by machinery and feet:** Yes (but regeneration from transported rhizome fragments more important). **Other:** No strong specialisations apparent for either wind or animal dispersal.

SEEDS

Seeds of Field Bindweed (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A large, leafy perennial herb; tall if twining around and supported by the stems of other plants; where unsupported, prostrate. Forms large clonal patches by means of far-creeping roots. Characteristic of waste and arable land.

Seasons of growth

Seed germination: Seed germinates over much of the growing season; particularly spring.

Plant growth: Buds from intact/detached roots generate new shoots/plants. Vegetative growth: essentially 'warm-season' (spring–autumn). Flowering and seed-set commence in summer. Shoots die back in late autumn.

Impact on crop establishment and yield: A serious weed. Predicted to have a competitive ability greater than that of wheat and a major weed of most crops. Field Bindweed is favoured by reduced tillage farming systems. It is already very common in the organic arable fields of Provence and seems destined to become even more so.

LIFE HISTORY STRATEGY

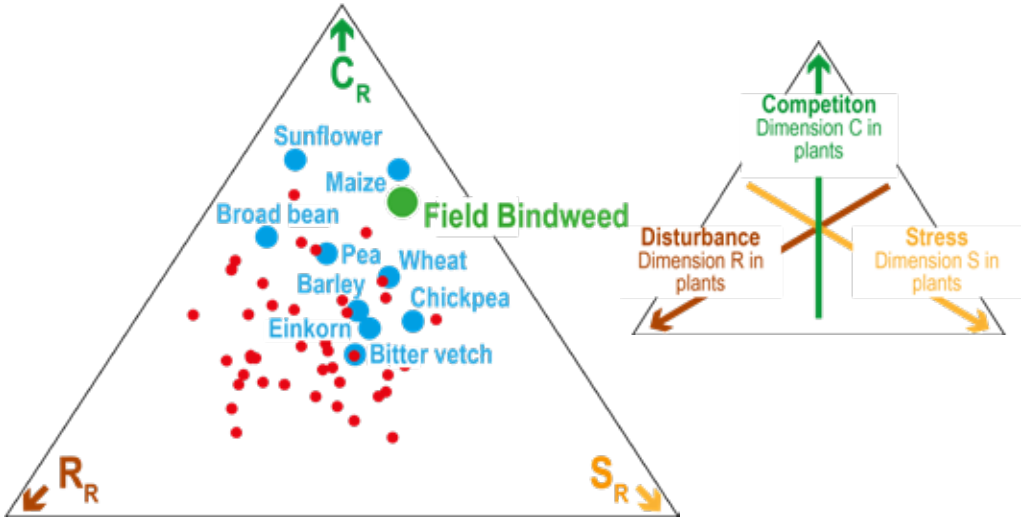
Comparison with wheat

Seed yield: - - -

Soil fertility: =

Competitiveness: + +

Disturbance: + +



Black-bindweed

Polygonaceae

***Fallopia convolvulus* (L.) Á.Löve**

IDENTIFICATION

Image by Olivier Pichard. Source: Wikimedia Commons, CC BY-SA 3.0

Image by Rasbak. Source: Wikimedia Commons, CC BY-SA 3.0

Similar species

Copse-bindweed (*F. dumetorum* (L.) Holub) has smaller, shiny seeds (2.5–3 mm long) on longer stalks (5–8 mm, compared with 2–3 mm).

USES

Food: Seed may be eaten after being ground (PFAF). **Toxicity:** None reported. **Medicinal:** No use reported. **Fodder:** Seed may be fed to animals.

Edible rating: 1 **Medicinal rating: 0**

Websites: https://pfaf.org, http://www.agroatlas.ru/en/content/weeds/Fallopia_convolvulus/

ECOLOGY

Type of weed: Late competitor and crop mimic. **Impact on agricultural production:** A serious weed (particularly autumn-harvested crops). **Conservation status - Europe:** 0 % threatened; **France:** Very common. **Main agricultural habitats in France:** Very strongly associated with all cultivation regimes except rice. **Occurrence in 2013 arable survey:** Most characteristic of spring-sown crops in more intensively managed systems but very common. In 88 % of fields usually at high population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Most types of moist soils. **Soil reaction:** Wide-ranging. **Soil fertility:** Intermediate to fertile.

Plant

A branched, hairless annual with weak stems up to about 1.5 m in length, either prostrate or, scrambling over or twining round the stems of other plants.

Leaves

Alternate with a brownish papery sheath encircling the stem; long-stalked and broadly arrow shaped; up to 5 cm wide.

Flowers

Whitish-green; in loose elongate spikes in the axils of the leaf; 2–3 mm in diameter.

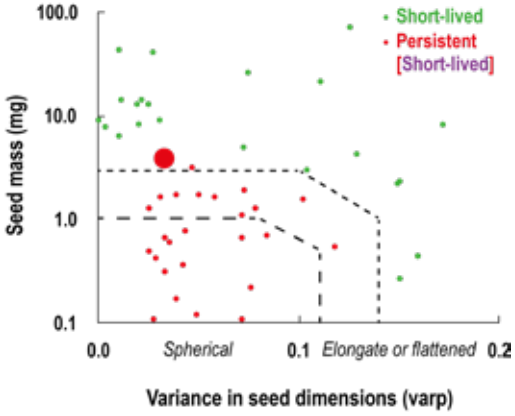
Main flowering time

July–October.

Seeds

Dull black; oval, triangular in cross-section, minutely pitted; 4 x 2.4 mm; enclosed by papery floral remains.

REGENERATION



Only by seed.

Seed size: Large, 3.7 mg; **Shape:** Broadly triangular; **Varp:** 0.03. **Predicted number of seeds per plant:** Many, 2223. **Plant diameter:** Large.

Seed dispersal in time

Despite the relatively large seeds, the soil seed bank is generally long-persistent (Grime *et al*. 2007).

Seed dispersal in space

With the harvest: Yes. **In soil transported by machinery and feet:** Yes. **Other:** Not strongly specialised for wind dispersal nor readily adhering to animals and clothing but survives ingestion by birds (Grime *et al*. 2007).

SEEDS

Seeds of Black-bindweed (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An often large leafy annual arable weed; tall if twining around and supported by the stems of other plants, otherwise prostrate.

Seasons of growth

Seed germination: Spring–summer.

Plant growth: Vegetative growth primarily 'warm–season' (late spring–autumn) with flowering and seed-set in summer onwards.

Impact on crop establishment and yield: A serious weed. Predicted to have a competitive ability similar to that of wheat and in dense stands it can cause a reduction of 25 % in yield. Black-bindweed is also a potential contaminant of crop seed and its long stems may become enmeshed in harvesting equipment. It is a common weed in the organic arable fields of Provence probably making its biggest economic impact on fertile soils in spring-sown crops and fallow.

LIFE HISTORY STRATEGY

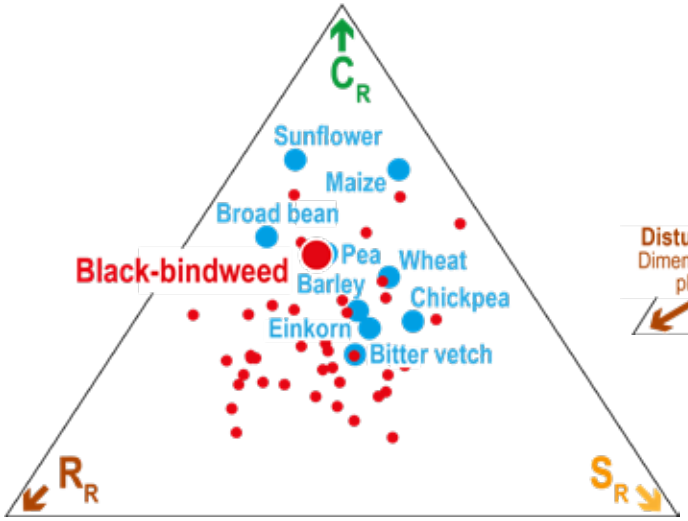
Comparison with wheat

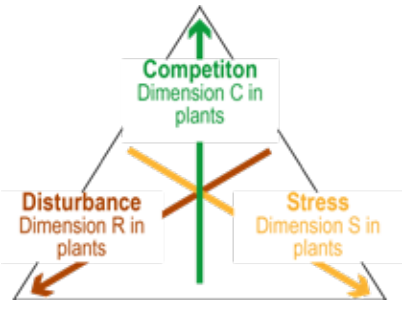
Seed yield: =

Soil fertility: +

Competitiveness: =

Disturbance: =





Prickly Lettuce

Asteraceae

Lactuca serriola L.

IDENTIFICATION

Image by AnRo0002. Source: Wikimedia Commons, CC0 1.0

Image by AnRo0002. Source: Wikimedia Commons, CC0 1.0

Similar species

Great Lettuce (*L. virosa* L.) has larger dark red or blackish seeds (4-5 mm, excluding slender apical stalk) and stem and leaf midrib strongly tinged with dark red. Least Lettuce (*L. saligna* L.) is shorter, usually less than 1 m; upper leaves narrow (often about 1 cm) with a spear-shaped base.

USES

Food: Very young leaves and shoots are eaten raw in salads, boiled, or lightly fried. Widely used in the Mediterranean. Peeled young stems are eaten like asparagus in Crete. In the Languedoc, a constituent of boudin and sausage with herbs. **Toxicity:** The mature plant is slightly toxic (PFAF). **Medicinal:** Has calming, laxative and detoxifying properties. The milk can be used as a substitute for opium in the treatment of drug addiction or drunk in herbal tea. **Fodder:** No use reported.

Edible rating: 2 **Medicinal rating: 3**

References consulted: Rénaux (2011); Couplan (2015)

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: Late competitor. **Impact on agricultural production:** A potentially serious weed (on fertile soils with less intensive management regimes). **Conservation status - Europe:** 0 % threatened; **France:** Quite common. **Main agricultural habitats in France:** Very strongly associated with all cultivation regimes except rice. **Occurrence in 2013 arable survey:** Very common. In 73 % of fields and at moderate population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Dry particularly clays and loams. **Soil reaction:** Basic to neutral. **Soil fertility:** Relatively fertile.

Plant

Tall, erect, narrow annual with whitish stems; to 2 m or more in height. Cut stems and leaves exude white juice.

Leaves

Alternate; oblong, often lobed, hairless but with small prickles particularly on the whitish midrib.

Flowers

Pale yellow; several elongate, flattened flowers overtopping a cone of greenish scales; together forming a 'lettuce-flower' 1.5–2.5 cm in diameter. 'Lettuce-flowers' are numerous, in an open terminal inflorescence.

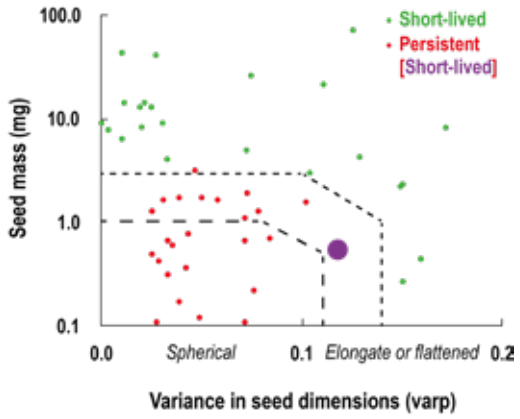
Main flowering time

July–September.

Seeds

Olive grey; cylindrical, ridged, with slender apical stalk bearing a plume of long white hairs; 3–4 x 1 mm; loosely attached to the base of each senescent 'flower'.

REGENERATION



Only by seed.

Seed size: Small, 0.5 mg; **Shape:** Elongate and plumed; **Varp:** 0.12. **Predicted number of seeds per plant:** Very many, 8813. **Plant diameter:** Medium.

Seed dispersal in time

A shortly-persistent soil seed bank is reported for these relatively elongate seed (Weaver and Downs, 2003).

Seed dispersal in space

With the harvest: Potentially yes, but only with later-harvested crops. More typically flower buds and the sticky latex of cut stems contaminate the crop (Weaver and Downs, 2003). **In soil transported by machinery and feet:** Limited dispersal. **Other:** Strongly specialised for wind dispersal and perhaps sometimes adhering to animals and clothing.

SEEDS

Seeds of Prickly Lettuce (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A tall, narrow, leafy annual; primarily a species of wasteland.

Seasons of growth

Seed germination: Autumn.

Plant growth: Early vegetative growth 'cool-season' (autumn–early summer) but much stem extension growth, flowering and seed-set in late summer and autumn.

Impact on crop establishment and yield: A potentially serious weed. Predicted to have a slightly lower competitive ability than wheat and its white, sticky latex may clog machinery and adversely enhance seed moisture in the harvested crop. A late-maturing plant with very effective seed dispersal and often has produced little seed by harvest-time in cereal fields. Therefore, although a common often 'transient' weed in the organic arable fields of Provence, Prickly Lettuce is primarily a wasteland species. However, it is promoted by no-tillage regimes and may in the future become a more economically-important arable weed.

LIFE HISTORY STRATEGY

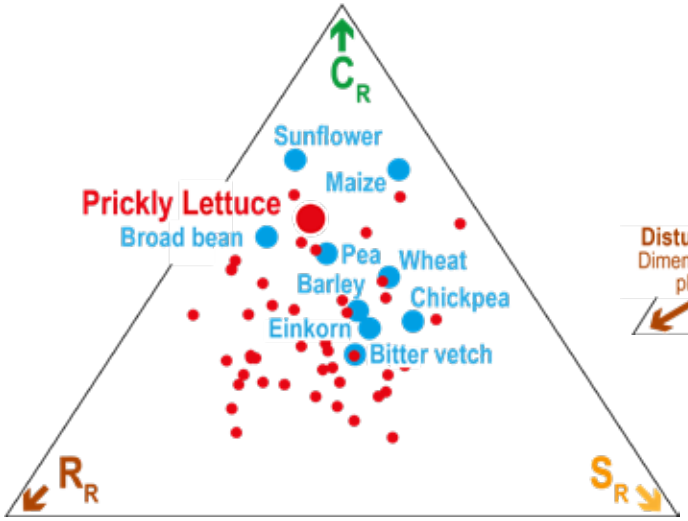
Comparison with wheat

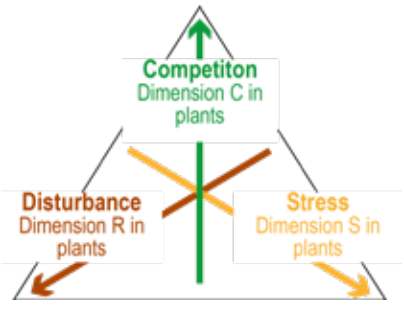
Seed yield: -

Soil fertility: +

Competitiveness: - -

Disturbance: =





Mediterranean Rye-grass

Poaceae

Lolium rigidum Guad.

IDENTIFICATION

Image by Harry Rose. Source: Wikimedia Commons. CC BY 2.0

Image by Gideon Pisanty. Source: Wikimedia Commons. CC BY 3.0

Similar species

Italian Rye-grass (*L. multiflorum* Lam.) usually has spikelets with bristles and more than 11 flowers. Perennial Rye-grass (*L. perenne* L.) is perennial (with vegetative non-flowering shoots at flowering time).

USES

Food: No use reported. **Toxicity:** None reported. **Medicinal:** No use reported. **Fodder:** No use reported.

References consulted: Monaghan (1980); Goggin *et al*. (2012)

Websites: www.wikipedia.org,

ECOLOGY

Type of weed: Intermediate between early competitor and cereal mimic. **Impact on agricultural production:** A potentially serious weed (on soils of intermediate fertility). **Conservation status - Europe:** 3 % threatened; **France:** Common. **Main agricultural habitats in France:** Winter and spring cereals, vineyards, orchards, vegetable crops and rape. **Occurrence in 2013 arable survey:** Very common. In 67 % of fields and generally at moderate to high population densities.

HABITAT

Climatic distribution: Weakly Mediterranean. **Soil type:** Dry clay, loam and sandy soils. **Soil reaction:** Wide-ranging. **Soil fertility:** Intermediate.

Plant

Erect or spreading, hairless annual grass; up to 0.5 m or more in height.

Leaves

Alternate, with membranous projection (ligule) at base of leaf blade; up to 8 mm wide.

Flowers

Greenish; flower spikelets flattened, appressed to the main axis of the spike; each up to 18 x 3 mm, 5–8 flowered, orientated vertically.

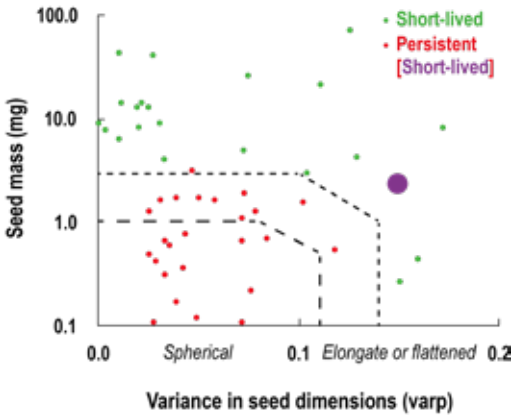
Main flowering time

June–July.

Seeds

Light brown; elongate, flattened; 7 x 2 mm; partially enclosed within oblong flattened, greenish bracts 4–8 mm, usually without a bristle.

REGENERATION



Only by seed.

Seed size: Intermediate, 2.2 mg; **Shape:** Elongate; **Varp:** 0.15. **Predicted number of seeds per plant:** Few, 133. **Plant diameter:** Small.

Seed dispersal in time

Despite its intermediate seed size and elongate shape a shortly-persistent soil seed bank has been widely reported.

Seed dispersal in space

With the harvest: Yes, particularly in shorter-stemmed crops. **In soil transported by machinery and feet:** Limited dispersal. **Other:** No strong specialisations apparent for either wind or animal dispersal.

SEEDS

Seeds of Mediterranean Rye-grass (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An erect, basally-branched, leafy, medium-sized annual arable weed.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set in summer.

Impact on crop establishment and yield: A potentially serious weed. Predicted to have an intermediate competitive ability and is also a potential contaminant of crop seed. Mediterranean Rye-grass is a common weed in the organic arable fields of Provence, it probably impacts competitively primarily on the earlier stages of crop growth.

LIFE HISTORY STRATEGY

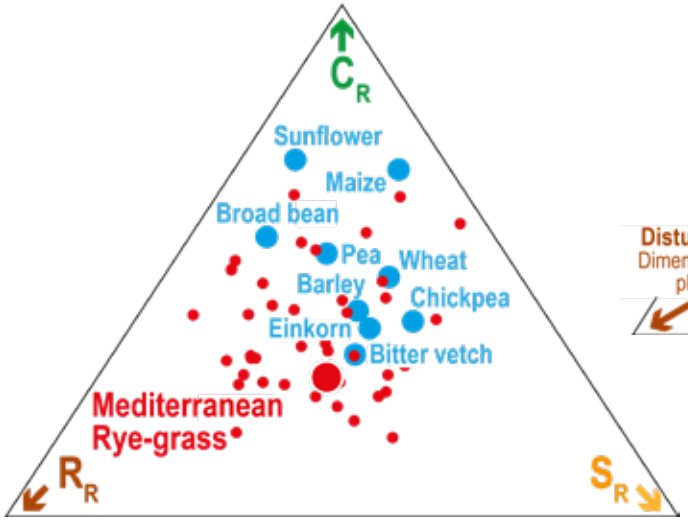
Comparison with wheat

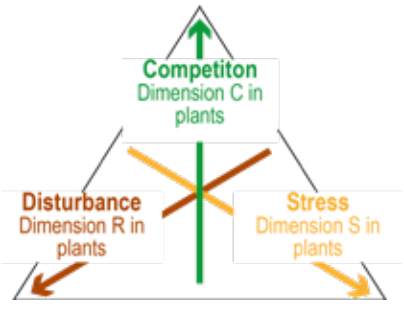
Seed yield: - - -

Soil fertility: =

Competitiveness: - -

Disturbance: + +





Knotgrass

Polygonaceae

***Polygonum aviculare* L. agg.**

IDENTIFICATION

Image by Sten Porse. Source: Wikimedia Commons, CC BY-SA 3.0

Image by Dalgial. Source: Wikimedia Commons, CC BY-SA 3.0

Similar species

The aggregate species can be subdivided, with some difficulty. Knotgrass (*P. aviculare* L., in the strict sense) is robust with branch leaves much smaller than stem leaves and leaves up to 15 mm wide. Its fruit is hidden in the flower. Equal-leaved Knotgrass (*P. arenastrum* Boreau) is small and prostrate with stems usually less than 30 cm. It has branch and stem leaves of similar size, about 5 mm wide, and its fruit hidden in the flower. Cornfield Knotgrass (*P. rurivagum* Jord. ex Boreau) is small, to 30 cm and usually erect with leaves less than 4 mm wide and branch leaves much smaller than stem leaves. The apex of fruit is visible between gaps in the petals. Additionally, *P. bellardii* All. is larger and more erect (over 1 m tall) and the upper flowers are without leaves.

Plant

Prostrate to ascending, hairless annual; to 0.5 m or more in height.

Leaves

Alternate with a basal silvery papery sheath encircling the stem; small, oval, widely spaced.

Flowers

Pinkish white; in tight clusters of 1–6 in the axils of the leaf; small, 2–3 mm in diameter.

Main flowering time

July–October.

Seeds

Reddish-brown to black; oval, triangular in cross-section; 3 x 1.5 mm; partially enclosed within the remains of the flower.

USES

Food: The young shoots and leaves are edible raw or cooked. Older plants have tannins and are inedible. Particularly used as a food source in southern Europe, as well as recently in Bosnia. Also infusions may be drunk as a tea (cf. Couplan 2015). **Toxicity:** None reported. **Medicinal:** Used in folk medicine in France to treat diarrhoea, gout, haemorrhoids and rheumatism. Equally, known as a diuretic, a purgative and a de-wormer. Also applied to stem blood loss. In ancient Greece, Dioscorides used it to treat snakebites. Considered to have homeopathic properties. **Fodder:** No use reported.

Edible rating: 2 **Medicinal rating: 3**

References consulted: Lieuthagui (1996); Couplan (2015)

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org, http://www.xn--homopathie-d7a.com/traitements/polygonum-aviculare.htm

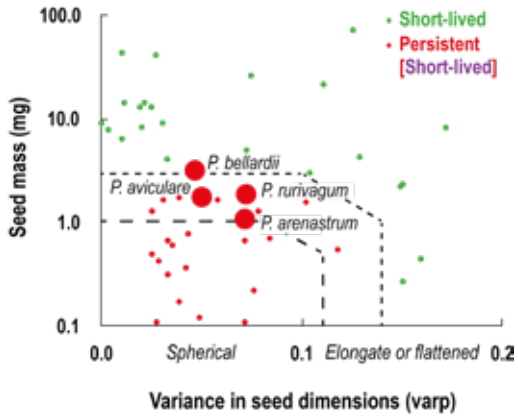
ECOLOGY

Type of weed: Late competitor. **Impact on agricultural production:** A serious weed. **Conservation status - Europe:** 0 % threatened; **France:** Very common. [Two segregates of conservation concern *P. rurivagum* (quite rare) and *P. bellardii* (a crop mimic, rare).] **Main agricultural habitats in France:** Very strongly or strongly associated with all cultivation regimes except rice. **Occurrence in 2013 arable survey:** A spring-germinating species but very common. The aggregate species in 85 % of fields and at moderate to high population densities. Includes *P. rurivagum* (frequent) and *P. bellardii* (rare).

HABITAT

Climatic distribution: Wide-ranging [*P. bellardii*: Weakly Mediterranean]. **Soil type:** Wide-ranging. **Soil reaction:** Wide-ranging. **Soil fertility:** More fertile [*P. bellardii*: Intermediate; *P. rurivagum*: Relatively infertile].

REGENERATION



Only by seed.

Seed size: Intermediate, *P. arenastrum* 1.1 mg, *P. aviculare* 1.7 mg, *P. bellardii* 2.9 mg, *P. rurivagum* 1.8 mg; **Shape:** Triangular-oval; **Varp:** *P. arenastrum* 0.07, *P. aviculare* 0.05, *P. bellardii* 0.05, *P. rurivagum* 0.07; **Predicted number of seeds per plant:** Medium, *P. arenastrum* 911, *P. aviculare* 2135, *P. bellardii* 582, *P. rurivagum* 440. **Plant diameter:** Medium.

Seed dispersal in time

On the basis of seed size and shape a long-persistent seed bank is predicted for all segregates. It has been recorded in the field (Grime *et al.*, 2007).

Seed dispersal in space

With the harvest: Yes (Grime *et al.*, 2007) but least so for the low-growing *P. arenastrum*. **In soil transported by machinery and feet:** Yes, particularly *P. arenastrum*, which is particularly characteristic of trampled habitats. **Other:** Not strongly specialised for wind dispersal nor readily adhering to animals and clothing but survives ingestion by animals (Grime *et al.*, 2007).

SEEDS

Seeds of Knotgrass (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A procumbent to ascending, much-branched medium-sized, leafy annual of wasteland and arable habitats. [*P. bellardii*: large, semi-basal with primary stem erect; *P. arenastrum*: often prostrate.]

Seasons of growth

Seed germination: Spring.

Plant growth: Vegetative growth primarily 'warm–season' (late spring–autumn) with flowering and seed-set from summer onwards.

Impact on crop establishment and yield: A serious weed. Predicted to have an intermediate competitive ability. Also segregates, particularly *P. bellardii*, are potential contaminants of crop seed. Despite being summer annual, *P. aviculare* sensu lato is an important, common and often abundant arable weed in the organic arable fields of Provence.

LIFE HISTORY STRATEGY

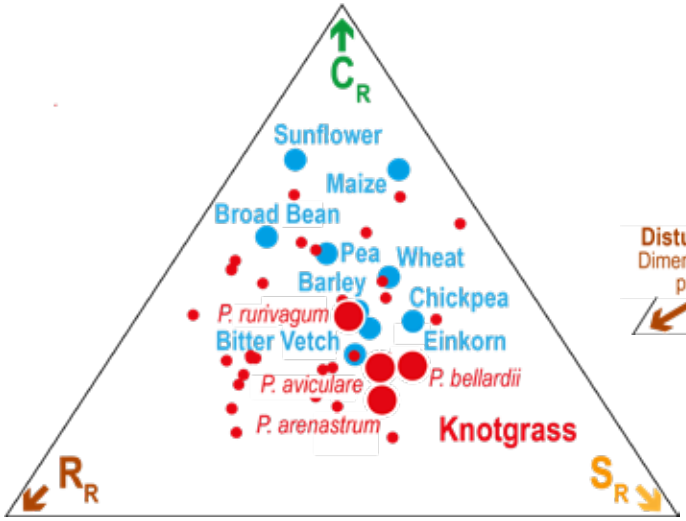
Comparison with wheat

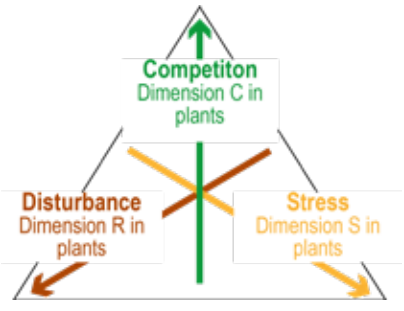
Seed yield: -

Soil fertility: =

Competitiveness: - -

Disturbance: + +





Wild Radish

Brassicaceae

Raphanus raphanistrum subsp. *raphanistrum* L.

IDENTIFICATION

Image by Cwmhiraeth. Source: Wikimedia Commons. CC BY-SA 4.0

Image by PePeEfe. Source: Wikimedia Commons. CC BY-SA 3.0

Similar species

None.

USES

Food: In England, young leaves were eaten raw or cooked. They were also valued for their digestive properties in many regions (France [Brittany], Italy, Spain, Cyprus, Tunisia). The tops of young stems with young inflorescences were also used in Poland and were cooked in Sicily with olive oil, garlic and chilli and eaten with pasta. **Toxicity:** None reported. **Medicinal:** Has been reported as a treatment for rheumatism (PFAF). **Fodder:** No use reported but probably eaten by livestock with other weeds.

Edible rating: 2 **Medicinal rating: 1**

References consulted: Campbell and Snow (2007); Couplan (2015)

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: Intermediate between cereal mimic and Late competitor. **Impact on agricultural production:** A serious weed (particularly on moderately fertile soils). **Conservation status - Europe:** 10 % threatened; **France:** Very common. **Main agricultural habitats in France:** Winter cereals, vineyards and orchards. **Occurrence in 2013 arable survey:** More characteristic of productive habitats (rare). In only 7 % of fields and at low population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Moist sandy and loamy soils. **Soil reaction:** Neutral to acidic. **Soil fertility:** Relatively fertile.

Plant

Erect or branched, coarsely hairy annual with most leaves associated with the basal part of the plant; up to 1 m in height.

Leaves

Alternate; elongate, deeply lobed and up to 3 cm wide; basal rosette withering before flowering.

Flowers

White or yellow with purple veins; in elongate terminal spikes. Petals 4; 15–22 mm in length. Sepals 4, 8–12 mm.

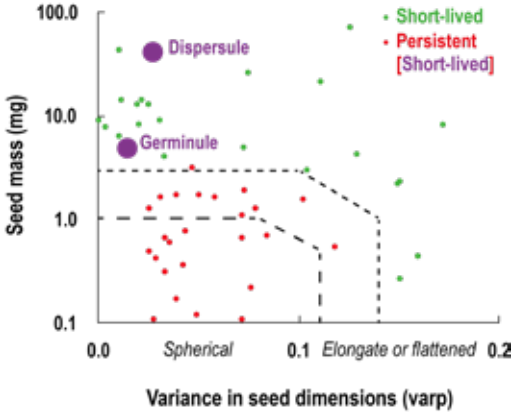
Main flowering time

May–July.

Seeds

Brown; globular or flattened; 3 x 2 mm; embedded within an indehiscent segmented, cylindrical fruit of dimensions to 80 x 5 mm, with constrictions between seeds.

REGENERATION



Only by seed.

Seed size: Dispersule large, 38.3 mg; germinule 4.5 mg; **Shape:** Broadly oblong; **Varp:** Dispersule 0.03; germinule 0.01. **Predicted number of seeds per plant:** Medium, 367. **Plant diameter:** Large.

Seed dispersal in time

On the basis of seed size and shape no persistent soil seed bank is predicted. Nevertheless, in the field seeds do persist in the soil; most are short- but a few longer-lived. Perhaps best classified as with a shortly-persistent seed bank.

Seed dispersal in space

With the harvest: Yes. **In soil transported by machinery and feet:** Limited dispersal. **Other:** No strong specialisations apparent for either wind or animal dispersal but some seed may pass unharmed through the mammalian gut (Warwick and Francis, 2005).

SEEDS

Seeds of Wild Radish (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A robust, ascending, branched semi-basal, annual arable weed.

Seasons of growth

Seed germination: Particularly autumn.

Plant growth: Vegetative growth typically 'cool-season' (autumn–early summer) with flowering and seed-set commencing in summer but under suitable conditions germination and growth may occur in the summer months.

Impact on crop establishment and yield: A serious weed. Predicted to have a competitive ability similar to that of wheat. It is also a potential contaminant of crop seed. Wild Radish can cause reductions of over 50 % in yield on fertile soils but, at present, it is a rare weed in the (less fertile) organic arable fields of Provence.

LIFE HISTORY STRATEGY

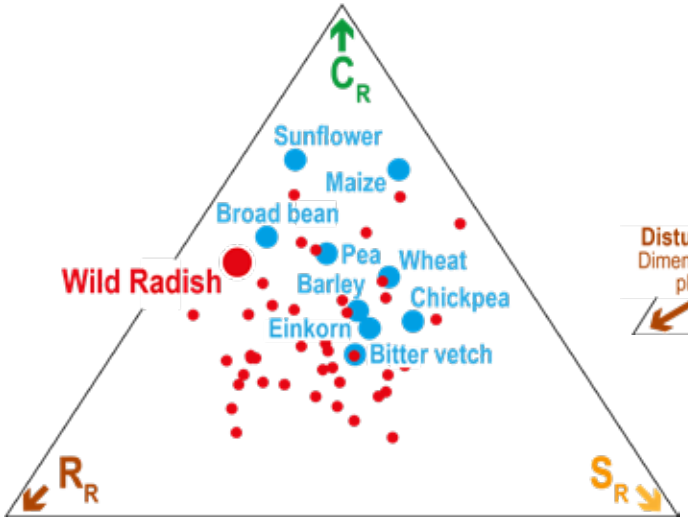
Comparison with wheat

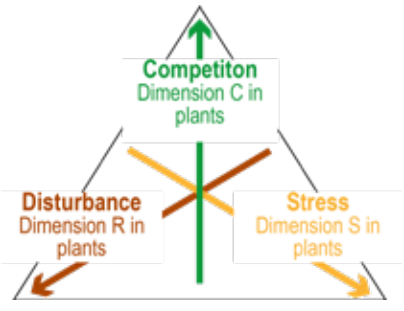
Seed yield: =

Soil fertility: + +

Competitiveness: =

Disturbance: + +





Groundsel

Asteraceae

Senecio vulgaris L.

IDENTIFICATION

Image by EugeneZelenko. Source: Wikimedia Commons. CC BY-SA 4.0

Image by Jean Tosti. Source: Wikimedia Commons. CC BY-SA 3.0

Similar species

None.

USES

Food: Despite their toxicity leaves are eaten both in salad and cooked (PFAF). **Toxicity:** Eating any part of the plant causes progressive liver damage. **Medicinal:** Its inflammatory properties were recorded by Dioscorides in the 1st century A.D and, for example, in Haute-Provence Groundsel was a popular medicine for the treatment of contusions and as a poultice. Now, less favoured because of its toxicity although still used in homeopathy. **Fodder:** No use reported.

Edible rating: 1 **Medicinal rating: 2**

References consulted: Lieutaghi (1996)

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: Early competitor. **Impact on agricultural production:** A serious weed (on fertile soils with horticulture). **Conservation status - Europe:** 0 % threatened; **France:** Very common. **Main agricultural habitats in France:** Vineyards, orchards, vegetable crops, spring cereals, potato and beet. **Occurrence in 2013 arable survey:** Typical of highly disturbed productive habitats and consequently rare. In 3 % of fields and at low population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Moist clayey to sandy soils. **Soil reaction:** Wide-ranging. **Soil fertility:** Relatively fertile.

Plant

Erect, almost hairless annual, to 0.5 m in height.

Leaves

Alternate; coarsely lobed, often with cottony hairs towards base; usually less than 10 mm wide.

Flowers

Yellow; numerous small yellow tubular flowers overtopping a cone of greenish scales; together 4–5 mm in diameter. 'Flowers' are in terminal clusters.

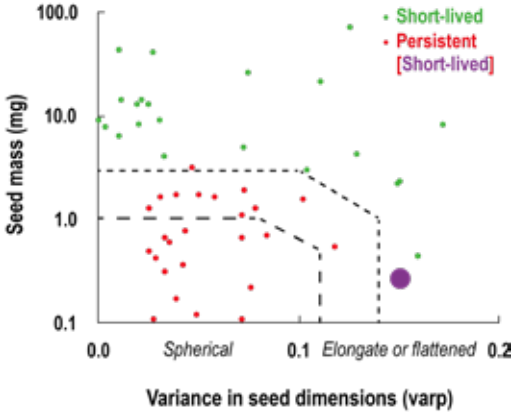
Main flowering time

Throughout the year.

Seeds

Brown; cylindrical, ridged, with a plume of long white hairs; 2 x 0.5 mm; loosely attached to the base of each senescent 'flower'.

REGENERATION



Only by seed.

Seed size: Small, 0.3 mg; **Shape:** Elongate; **Varp:** 0.15. **Predicted number of seeds per plant:** Medium, 1288. **Plant diameter:** Medium.

Seed dispersal in time

Despite its elongate seeds short-lived persistence in the soil has been observed (Grime *et al*. 2007).

Seed dispersal in space

With the harvest: Not regularly dispersed in this way. **In soil transported by machinery and feet:** Limited dispersal. **Other:** The plumed seed is specialised for wind dispersal and may additionally adhere to animals and clothing, as well as surviving ingestion by birds (Grime *et al*. 2007).

SEEDS

Seeds of Groundsel (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A medium-sized, short-lived, erect, branching, leafy annual of disturbed habitats, including horticultural and agricultural land.

Seasons of growth

Seed germination: Most commonly spring.

Plant growth: Most frequently spring to early summer, but potentially germination and vegetative growth may occur throughout the warmer months.

Impact on crop establishment and yield: A serious weed. Predicted to have a slightly lower competitive ability than wheat but because of its short lifespan will impact primarily upon early crop growth. Groundsel, which is rare in the organic arable fields of Provence, is probably more characteristic of horticultural habitats.

LIFE HISTORY STRATEGY

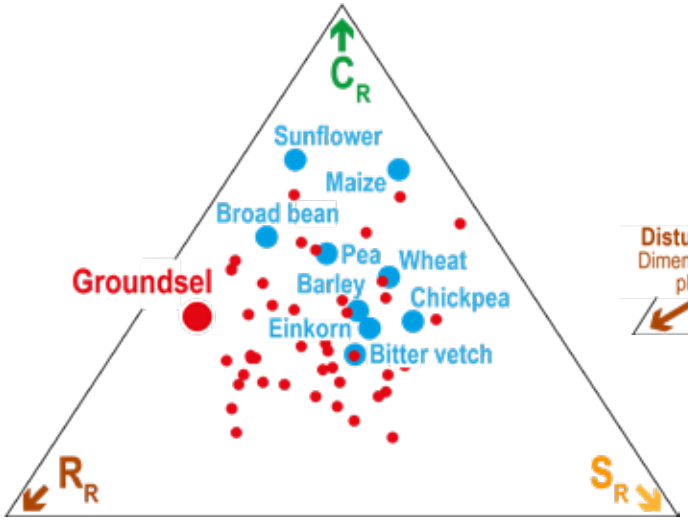
Comparison with wheat

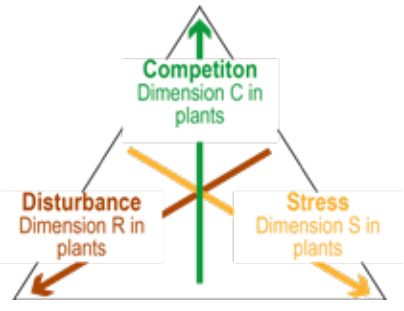
Seed yield: - - -

Soil fertility: + +

Competitiveness: -

Disturbance: + +





European Bur-grass

Poaceae

Tragus racemosus (L.) All.

IDENTIFICATION

Image by Erick Dronnet. Source: UniProt.org. CC BY-SA 4.0

Image by calphotos.berkeley.edu. Source: UniProt.org. CC BY-SA 4.0

Similar species

None.

USES

Food: No use reported. **Toxicity:** None reported. **Medicinal:** No use reported. **Fodder:** No use reported, although may be used as a cover crop to prevent soil erosion.

Websites: www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: An open field species. **Impact on agricultural production:** A serious weed (specialist colonist of sites where winter-annuals ploughed up in spring). **Conservation status - Europe:** 0 % threatened; **France:** Rare. **Main agricultural habitats in France:** Vineyards. **Occurrence in 2013 arable survey:** Associated primarily with sites ploughed or disturbed in spring. Not recorded in survey.

HABITAT

Climatic distribution: Weakly Mediterranean. **Soil type:** Dry loams and sands. **Soil reaction:** Neutral to acidic. **Soil fertility:** Intermediate.

Plant

Creeping, low-growing annual grass, often less than 8 cm in height but forming extensive mats, rooting at the lower nodes.

Leaves

Alternate, with a dense fringe of hairs (ligule) at base of leaf blade; up to 2–3 mm wide.

Flowers

Often purplish; into an open terminal cylindrical head up to 10 cm long and 1 cm in diameter. Flower spikelets each with 2–4 flowers, compressed, about 4 mm in length, in groups of 2–5 on a short common stalk.

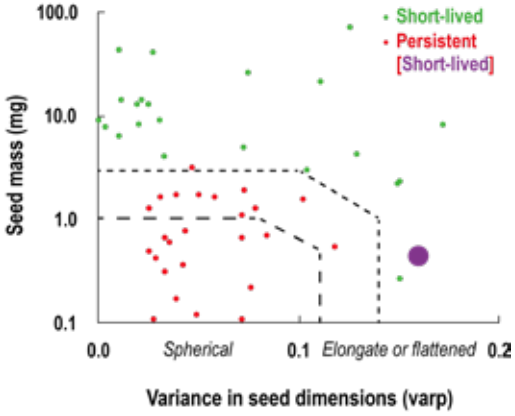
Main flowering time

July–October.

Seeds

Yellow-brown; elongated; 2 x 0.5 mm; enclosed within pale bracts bearing hooked spines. Each group of flower spikelets falls together at maturity to form a small burr that is strongly adhesive to fur and clothing.

REGENERATION



Only by seed.

Seed size: Small, 0.4 mg; **Shape:** Elongate, bristly; **Varp:** 0.16. **Predicted number of seeds per plant:** Medium, 708. **Plant diameter:** Medium.

Seed dispersal in time

Despite its elongate seeds short-lived persistence in the soil has been observed (Johannsmeier, 2009).

Seed dispersal in space

With the harvest: Not really an arable weed; moreover semi-prostrate. **In soil transported by machinery and feet:** Yes. **Other:** Not specialised for wind dispersal but readily adhering to animals and clothing.

SEEDS

Seeds of European Bur-grass (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A much-branched annual with prostrate leafy stems. Characteristic of disturbed ground.

Seasons of growth

Seed germination: Spring–summer.

Plant growth: Exhibits 'warm-season' (late spring–autumn) growth with flowering and seed-set commencing in summer to early autumn.

Impact on crop establishment and yield: A serious weed. Predicted to have low competitive ability and not an important weed in the organic arable fields of Provence. However, European Bur-grass is an effective, and increasing, summer-annual colonist of fallow sites where the existing annual vegetation has been mechanically removed in spring or early summer.

LIFE HISTORY STRATEGY

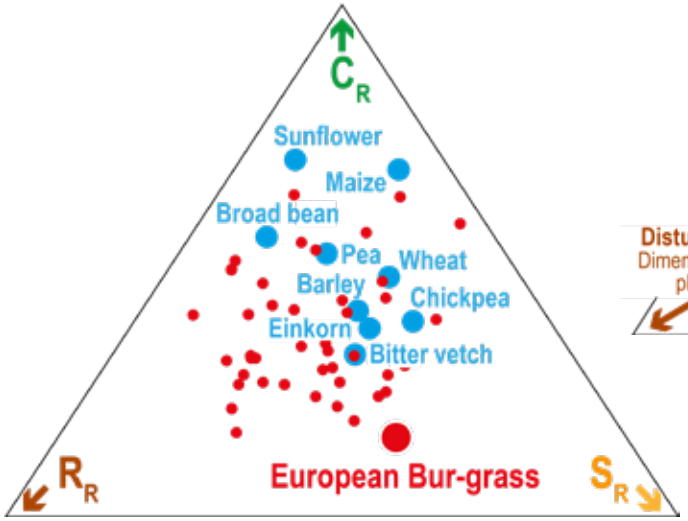
Comparison with wheat

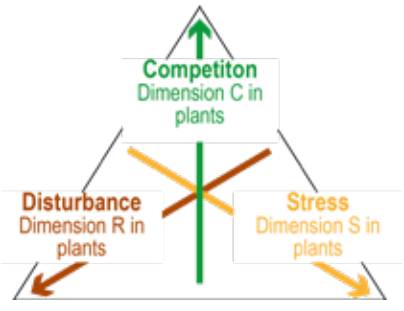
Seed yield: - - -

Soil fertility: -

Competitiveness: - - -

Disturbance: + +





Blue Pimpernel

Primulaceae

Anagallis foemina Mill., Syn: *Lysimachia foemina* (Mill.) U.Manns & Anderb.

IDENTIFICATION

Image by Hans Hillewaert. Source: Wikimedia Commons. CC BY-SA 3.0

Image by Ghislain118. Source: Wikimedia Commons. CC BY-SA 3.0

Similar species

Scarlet Pimpernel (*A. arvensis* L.) typically has red flowers. Blue-flowered forms can be distinguished (with difficulty!) from Blue Pimpernel by the more broadly oval leaves, petals that slightly overlap when the flower is open, a flower stalk that is shorter than the leaf and sepals in bud not completely hiding the petals.

USES

Food: No use reported, but the leaves of Scarlet Pimpernel, though toxic, have been eaten raw in salads or cooked. **Toxicity:** Known to be toxic and should not be ingested. **Medicinal:** Used traditionally in Spain to treat wounds, this species as well as Scarlet Pimpernel has been studied for its pharmacological properties. It has shown to have antimicrobial and anti-inflammatory properties, especially against the fungus, *Candida albicans*. **Fodder:** No use reported.

Edible rating: 2 **Medicinal rating: 2**

References consulted: Lopez *et al*. (2011)

Websites: www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: Early competitor and stubble. **Impact on agricultural production:** A serious weed (especially on soils of intermediate fertility). **Conservation status - Europe:** 24 % threatened (Scarlet Pimpernel 10 %); **France:** Common. **Main agricultural habitats in France:** Very strongly or strongly associated with all cultivation regimes except rice. **Occurrence in 2013 arable survey:** Very common. Together with Scarlet Pimpernel in 82 % of fields and at high population densities.

HABITAT

Climatic distribution: Weakly Mediterranean [Scarlet Pimpernel: Wide-ranging]. **Soil type:** Dry sandy loams to clays. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate [Scarlet Pimpernel: Relatively fertile].

Plant

Low-growing, hairless annual; often little more than 10 cm high but spreading; large plants can reach 0.5 m in diameter.

Leaves

Opposite; narrowly oval, with black spots (glands) on the lower surface; about 8 mm wide.

Flowers

Blue; solitary on long stalks in the leaf axils; 1 cm in diameter. Petals 5 fused, broadening into a flat, lobed plate-like flower. Sepals 5, greenish and inconspicuous, slightly longer than the petals.

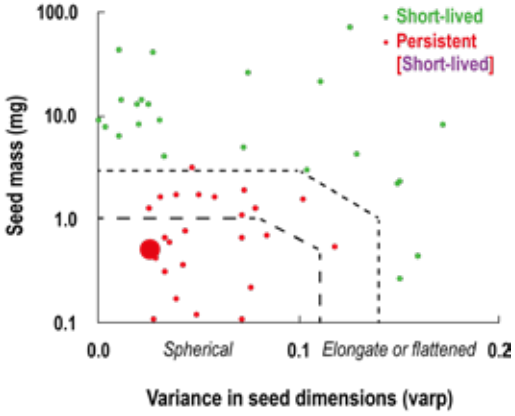
Main flowering time

May–October.

Seeds

Dark brown, oval, sharply angled; 3 x 2 mm; in a spherical, transverse-splitting capsule.

REGENERATION



Only by seed.

Seed size: Small, 0.5 mg; **Shape:** Rounded; **Varp:** 0.03. **Predicted number of seeds per plant:** Medium, 811. **Plant diameter:** Medium.

Seed dispersal in time

A long-persistent seed bank is both predicted on the basis of seed size and shape and has been reported from the field.

Seed dispersal in space

With the harvest: Unlikely in cereals, because the plant is low-growing. More typically in low-growing legume crops. **In soil transported by machinery and feet:** Yes. **Other:** Not strongly specialised for wind dispersal nor readily adhering to animals and clothing but survives ingestion by birds (Grime *et al*. 2007).

SEEDS

Seeds of Blue Pimpernel (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A procumbent to ascending, much-branched, leafy, patch-forming annual arable weed.

Seasons of growth

Seed germination: Mainly spring.

Plant growth: Perhaps mainly 'warm-season' (spring–late summer) with growth potentially continuing late into autumn. Flowering and seed-set commences in early summer.

Impact on crop establishment and yield: A serious weed. Predicted to have an intermediate competitive ability (consistent with Dutoit *et al*. [2001] for Scarlet Pimpernel). Blue Pimpernel is a common weed in the organic arable fields of Provence but this small but early-germinating species probably impacts primarily on the early stages of crop growth.

LIFE HISTORY STRATEGY

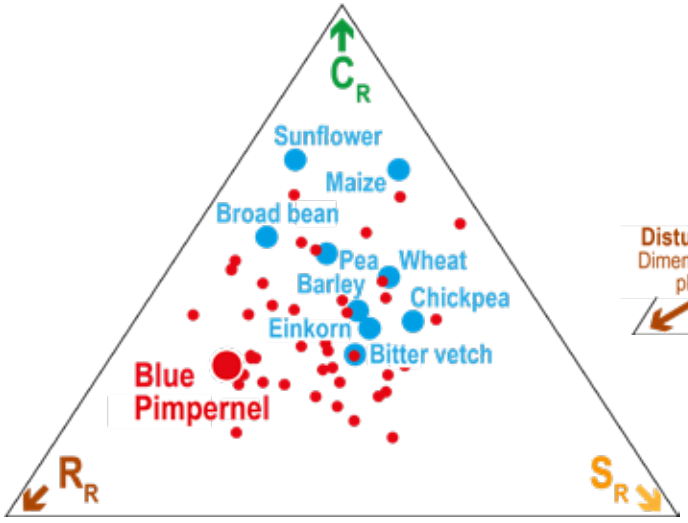
Comparison with wheat

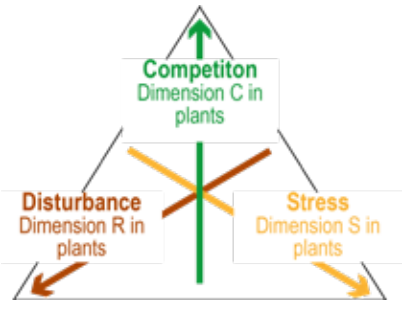
Seed yield: - - -

Soil fertility: +

Competitiveness: - -

Disturbance: + +





Giant Chamomile M

Asteraceae

Anthemis altissima L., Syn: *Cota altissima* (L.) J.Gay ex Guss.

IDENTIFICATION

Image by Arne Saatkamp ©

Image by Arne Saatkamp ©

Similar species

See Corn Chamomile (*A. arvensis*).

USES

Food: No use reported. **Toxicity:** None reported. **Medicinal:** No traditional use reported. However, its essential oil may have useful anti-bacterial properties but this requires confirmation. **Fodder:** No use reported.

Websites: www.tela-botanica.org

ECOLOGY

Type of weed: Intermediate between early competitor and cereal mimic (a traditional arable weed). **Impact on agricultural production:** A potentially serious weed (on soils of intermediate fertility). **Conservation status - Europe:** 3 % threatened; **France:** Quite common. **Main agricultural habitats in France:** Winter and spring cereals, rape and vineyards. **Occurrence in 2013 arable survey:** In 20 % of fields but where it occurs often at moderate to high population densities.

HABITAT

Climatic distribution: Weakly Mediterranean. **Soil type:** Dry loams and clays. **Soil reaction:** Basic to neutral. **Soil fertility:** Relatively fertile.

Plant

Erect or bushy, minutely hairy annual; to 1 m or more in height.

Leaves

Alternate; finely-dissected, with narrow, parallel-sided lobes less than 1 mm wide.

Flowers

Numerous, small, yellow tubular flowers in round central cushion surrounded by an outer ring of larger white elongate and flattened flowers; together forming a long-stalked, terminal 'daisy-flower' 4 cm in diameter.

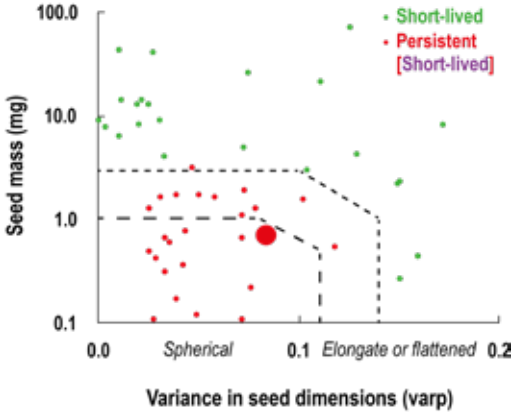
Main flowering time

June–July.

Seeds

Greyish, quadrangular in cross-section, smooth and narrowly winged; 2 x 1 mm; attached, with numerous papery, persistent scales, to the conical base of each senescent 'daisy-flower'.

REGENERATION



Only by seed.

Seed size: Small, 0.7 mg; **Shape:** Oblong; **Varp:** 0.08. **Predicted number of seeds per plant:** Many, 1846. **Plant diameter:** Large.

Seed dispersal in time

A species requiring further study but a long-persistent seed bank is predicted on the basis of seed size and shape.

Seed dispersal in space

With the harvest: Yes. **In soil transported by machinery and feet:** Yes. **Other:** Not strongly specialised for wind dispersal and not readily adhering to animals and clothing but may perhaps, like Corn Chamomile survive mammalian ingestion.

SEEDS

Seeds of Giant Chamomile (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An ascending to erect, leafy, branched, medium-sized annual arable weed.

Seasons of growth

Seed germination: Autumn–spring.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set in summer.

Impact on crop establishment and yield: A potentially serious weed. Predicted to have an intermediate competitive ability and is also a potential contaminant of crop seed. Giant Chamomile is a relatively uncommon but locally abundant weed in the organic arable fields of Provence and perhaps a declining species rather than a locally significant weed.

LIFE HISTORY STRATEGY

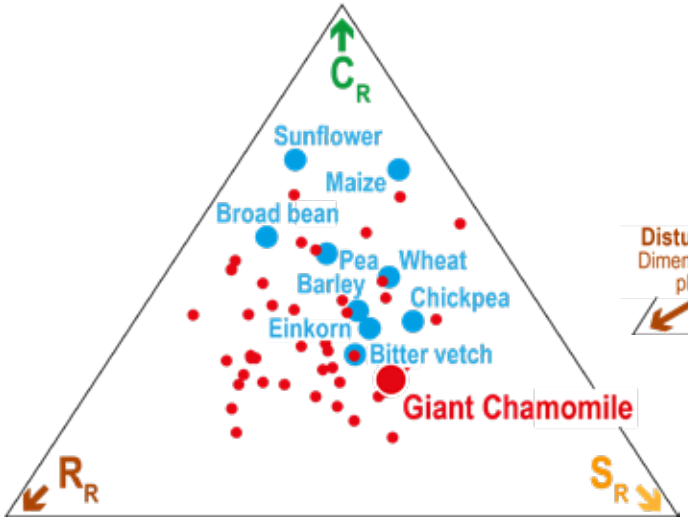
Comparison with wheat

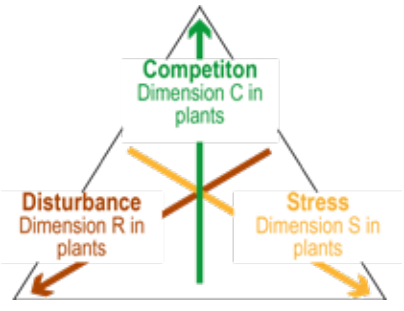
Seed yield: - -

Soil fertility: =

Competitiveness: - -

Disturbance: +





Wall Bedstraw

Rubiaceae

Galium parisiense L.

IDENTIFICATION

Image by allenplantsbelgium. Source: Alien Plants Belgium, CC BY-SA 3.0

Image by allenplantsbelgium. Source: Alien Plants Belgium, CC BY-SA 3.0

Similar species

Much smaller in all its parts than Corn Cleavers (*G. tricornutum*) and Cleavers (*G. aparine* L.).

USES

Food: No use reported. **Toxicity:** None reported but Cleavers can cause severe skin irritation (PFAF). **Medicinal:** No use reported but Cleavers has medicinal use (PFAF). **Fodder:** No use reported.

References consulted: Friščić et al. (2016)

Websites: www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: Vernal transient. **Impact on agricultural production:** Low. (An uncommon weed.) **Conservation status - Europe:** 17 % threatened; **France:** Quite rare. **Main agricultural habitats in France:** Vineyards. **Occurrence in 2013 arable survey:** More characteristic of non-arable habitats but, nevertheless, widespread. In 28 % of fields often at moderate population densities.

HABITAT

Climatic distribution: Weakly Mediterranean. **Soil type:** Dry sandy to clayey loams. **Soil reaction:** Wide-ranging. **Soil fertility:** Relatively infertile.

Plant

A small, often prostrate branched annual with weak, 4-angled, stems with backward-pointing bristles and up to 30 cm in length.

Leaves

In whorls of 5–7; small, elongate, with marginal, forward-pointing bristles; about 2 mm wide.

Flowers

Inconspicuous, greenish-white; in axillary clusters; about 0.5 mm in diameter. Petals 4.

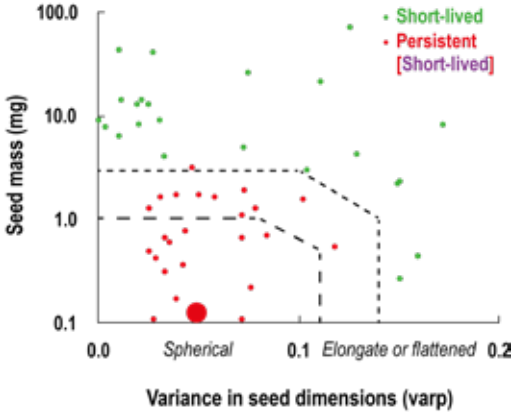
Main flowering time

April–May.

Seeds

Blackish; globular with a dimpled surface; 1 mm in diameter; in pairs on a straight stalk.

REGENERATION



Only by seed.

Seed size: Small, 0.1 mg, often shed as two-seeded units; **Shape:** Roundish with hooked bristles; **Varp:** 0.04. **Predicted number of seeds per plant:** Medium, 1752. **Plant diameter:** Medium.

Seed dispersal in time

A long-persistent seed bank is predicted on the basis of seed size and shape with data from the literature also supportive.

Seed dispersal in space

With the harvest: Not dispersed; plant low-growing and seed set early. **In soil transported by machinery and feet:** Yes. **Other:** Not specialised for wind dispersal but seeds and shoots readily adhere to animals and clothing.

SEEDS

Seeds of Wall Bedstraw (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A small, leafy, procumbent or ascending low-growing annual of bare ground and crop fields.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set in summer.

Impact on crop establishment and yield: Low. Predicted to have low competitive ability and is not an important weed in the organic arable fields of Provence.

LIFE HISTORY STRATEGY

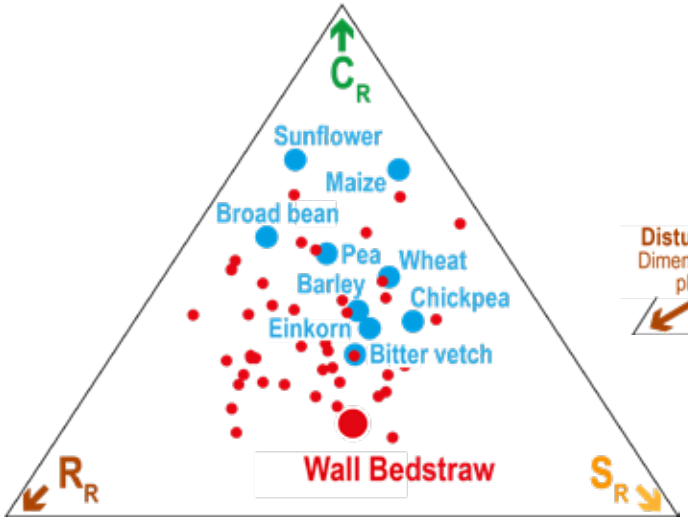
Comparison with wheat

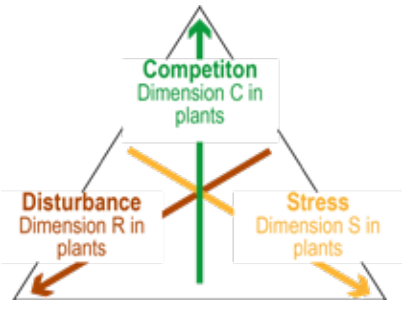
Seed yield: - - -

Soil fertility: =

Competitiveness: - - -

Disturbance: + +





Eastern Gladiolus M

Iridaceae

Gladiolus italicus Mill.

IDENTIFICATION

Image by Krzysztof Ziarnek. Source: Wikimedia Commons. CC BY-SA 4.0

Image by Frank Xover. Source: Wikimedia Commons. CC BY-SA 3.0

Similar species

None.

USES

Food: No use reported. Grown horticulturally. **Toxicity:** None reported. **Medicinal:** No use reported. **Fodder:** No use reported.

References consulted: Contu (2013)

Websites: www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: Vegetative-fragmenter. **Impact on agricultural production:** Low. (A rare weed.) **Conservation status - Europe:** 10 % threatened; **France:** Quite rare. **Main agricultural habitats in France:** Winter cereals and vineyards. **Occurrence in 2013 arable survey:** Very rare. In 5 % of fields and at low population densities.

HABITAT

Climatic distribution: Weakly Mediterranean. **Soil type:** Dry clays and loams. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

Plant

Erect, hairless perennial; to 1 m or more, arising from a short underground, swollen stem that has a fibrous covering.

Leaves

Alternate; grass-like, decreasing in size up the stem; up to 16 mm wide.

Flowers

Purplish-red; in a terminal 6–16-flowered spike; 4–5 cm in diameter.

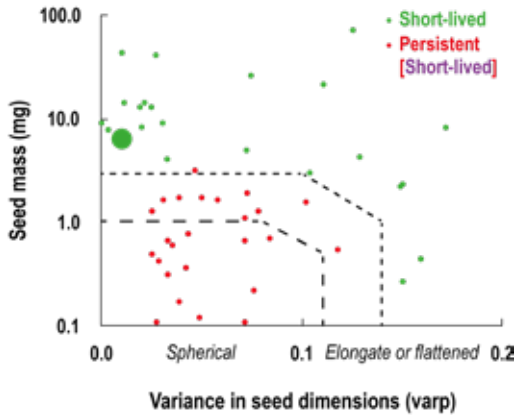
Main flowering time

June–July.

Seeds

Blackish; pear-shaped; 5 x 4 mm; in longitudinally-splitting capsule, 13 x 11 mm.

REGENERATION



Vegetatively (and by seed).

Seed size: Large, 6.1 mg; **Shape:** Roundish; **Varp:** 0.01. **Predicted number of seeds per plant:** Few seeds produced in arable habitats. **Plant diameter:** Variable.

Seed dispersal in time

A species requiring further study. Any seeds produced are predicted to be short-lived in the soil.

Seed dispersal in space

With the harvest: Potentially yes, in later-harvested crops, but often only little seed set. **In soil transported by machinery and feet:** Limited, with regeneration from transported young corms potentially more important. **Other:** No strong specialisations apparent for either wind or animal dispersal (other than by ants).

SEEDS

Seeds of Eastern Gladiolus (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A large, semi-basal, tufted perennial of waste and arable land.

Seasons of growth

Seed germination: Spring.

Plant growth: Vegetative growth mainly 'cool-season' (spring–mid-summer) but leaves may persist until autumn. Flowering and seed-set in summer.

Impact on crop establishment and yield: Low. Predicted to have a competitive ability greater than that of wheat but, because the plant has a large storage organ and determinant growth, it is probably most competitive in less productive habitats. Currently, too rare in the organic arable fields of Provence to be considered an important weed.

LIFE HISTORY STRATEGY

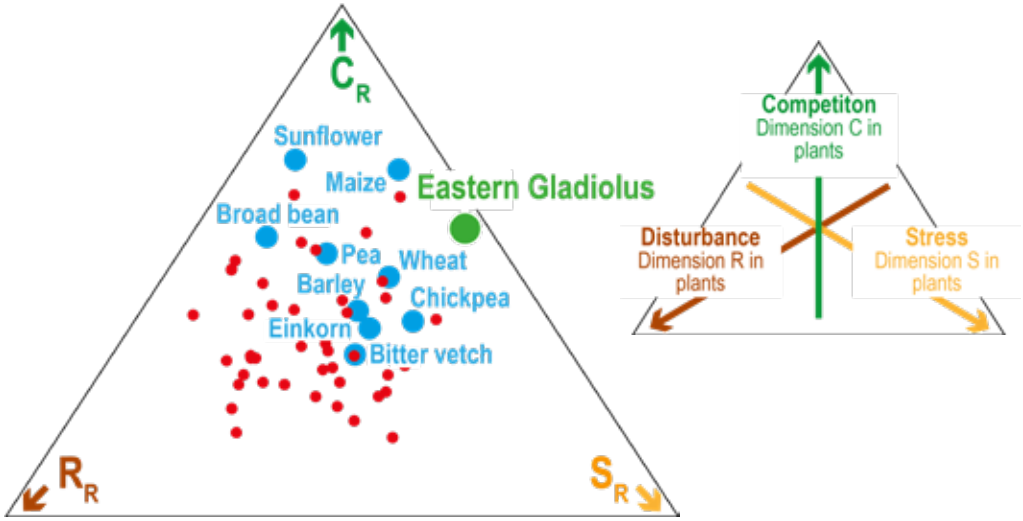
Comparison with wheat

Seed yield: - - -

Soil fertility: =

Competitiveness: + +

Disturbance: + +



Perforate St John's-wort

Hypericaceae

Hypericum perforatum L.

IDENTIFICATION

Similar species

Other species occur on field banks and roadsides but none is of common occurrence on arable land.

USES

Food: Young shoots are used as a condiment in Bosnia and oil from the macerated flowers can be used sparingly in salad (Couplan 2015). **Toxicity:** The sap can cause photosensitivity and inflammation of the skin. **Medicinal:** Contains an essential oil and a dye (hypericin). Its properties have been appreciated since antiquity (Dioscorides and Pliny the Elder). Traditionally, its oil is applied to burns, skin irritations and wounds or insect bites. Commonly used in herbal medicine for the treatment of depression. A syrup is utilised in Switzerland to treat asthma. **Fodder:** No use reported.

Edible rating: 2 **Medicinal rating: 4**

References consulted: Couplan (2015)

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org, http://www.magievegetale.fr/precis/simples-medecines/millepertuis

ECOLOGY

Type of weed: Vegetative-fragmenter. **Impact on agricultural production:** A potentially serious weed (on soils of intermediate fertility and with less intensive management regimes). **Conservation status - Europe:** 0 % threatened; **France:** Quite common. **Main agricultural habitats in France:** Vineyards and orchards. **Occurrence in 2013 arable survey:** Typically a plant of little-managed and linear habitats and currently very rare. Only recorded from one field (2 %) and at very low population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Dry clays and loams. **Soil reaction:** Wide-ranging. **Soil fertility:** Intermediate.

Plant

Erect, hairless, patch-forming perennial, to 1 m or more in height.

Leaves

Opposite; elongate, with a mixture of minute translucent glands (looking like pin-pricks through the leaf) and minute black glands; less than 1.5 cm wide.

Flowers

Bright yellow; in a branched, terminal head; 2 cm in diameter. Petals 5 surrounding 5 bundles of numerous stamens. Sepals 5, small.

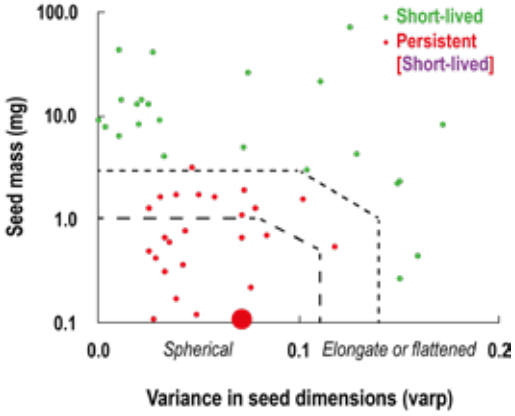
Main flowering time

June–September.

Seeds

Brown; cylindrical; 1 x 0.5 mm; in longitudinally-splitting capsule, 9 x 5 mm.

REGENERATION



Vegetatively (and by seed).

Seed size: Small, 0.1 mg; **Shape:** Elongate; **Varp:** 0.07. **Predicted number of seeds per plant:** Few seeds produced in arable habitats. **Plant diameter:** Variable.

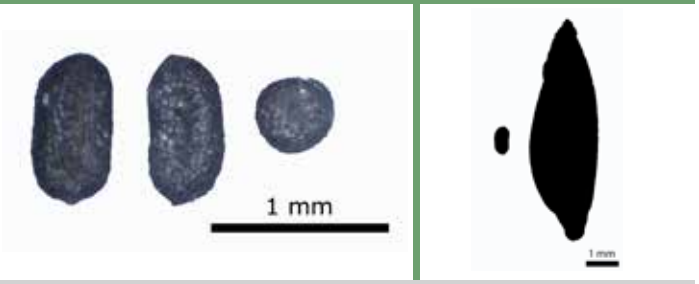
Seed dispersal in time

A long-persistent seed bank is both predicted on the basis of seed size and shape and has been recorded in the field (Grime *et al*. 2007).

Seed dispersal in space

With the harvest: Unlikely to occur in regularly ploughed habitats. **In soil transported by machinery and feet:** Yes (but regeneration from transported rhizome fragments perhaps equally important). **Other:** The small seeds have perhaps a limited capacity for wind dispersal but are not specialised for animal dispersal.

SEEDS



Seeds of Perforate St John's-wort (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: Perennial with medium-sized, leafy, much-branched stems. Forms clonal patches by means of far-creeping rhizomes. Primarily a species of wasteland.

Seasons of growth

Seed germination: Spring.

Plant growth: Buds from intact/detached roots and from stem bases generate new shoots. Vegetative growth mainly 'warm-season' (spring–autumn) with flowering and seed-set in mid- to late-summer. Shoots die back in late autumn.

Impact on crop establishment and yield: A potentially serious weed. Predicted to have a slightly lower competitive ability than wheat. Currently, this relationship has no practical relevance as it is an important weed of grazed (rather than arable) habitats, and in our survey of the organic arable fields of Provence only non-persistent seedlings were recorded. However, in less productive minimum tillage systems, perennial non-arable species with effective vegetative spread (e.g. Dewberry [*Rubus caesius* L.]) have become established on arable land and Perforate St. John's-wort is one of a number of potential additional colonists.

LIFE HISTORY STRATEGY

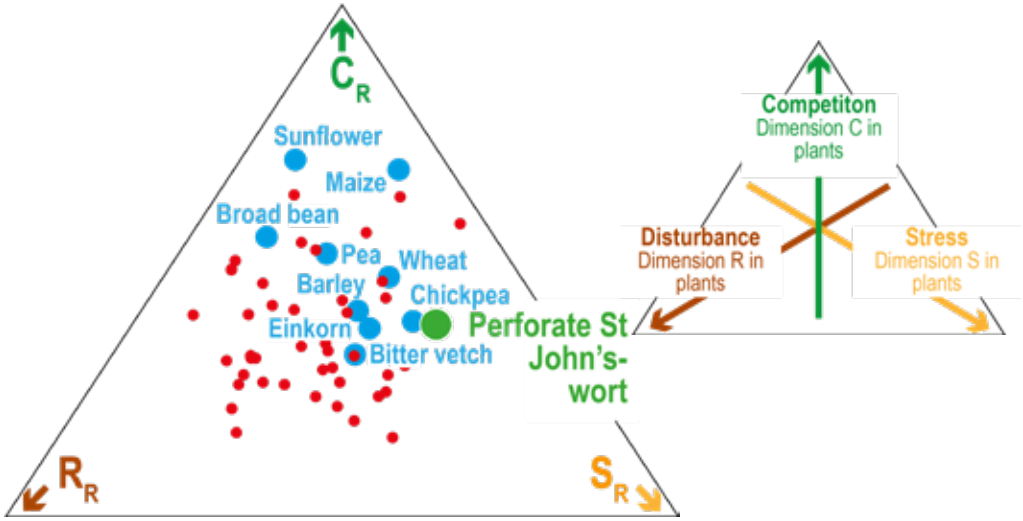
Comparison with wheat

Seed yield: - -

Soil fertility: -

Competitiveness: -

Disturbance: + +



Annual Scabious

Caprifoliaceae

Knautia integrifolia (L.) Bertol.

IDENTIFICATION

Image by Daniel Pavon ©

Image by Donald Hobern. Source: Wikimedia Commons. CC BY 2.0

Similar species

Other similar species are perennial, usually more robust and much more securely anchored to the ground.

USES

Food: Young shoots and flower buds are cooked and eaten in Crete and sold in local markets. **Toxicity:** None reported. **Medicinal:** No use reported but Field Scabious (*K. arvensis* (L.) Coult.) has medicinal properties (PFAF). **Fodder:** No use reported.

References consulted: Couplan (2015)

Websites: https://pfaf.org, www.tela-botanica.org

ECOLOGY

Type of weed: Perhaps an open field species. **Impact on agricultural production:** A potentially serious weed (on soils of intermediate fertility and with less intensive management regimes). **Conservation status - Europe:** No information; **France:** Quite common. **Main agricultural habitats in France:** Vineyards, orchards and winter cereals. **Occurrence in 2013 arable survey:** Still common. In 43 % of fields and often at moderate to high population densities.

HABITAT

Climatic distribution: Mediterranean. **Soil type:** Dry sandy to clayey loams. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

Plant

Erect, often much branched, hairy annual; to 1 m with most leaves towards the base.

Leaves

Opposite; the basal coarsely lobed and up to 6 cm wide; the upper more deeply lobed.

Flowers

Bluish lilac; aggregated into a long-stalked, tight flat-topped head up 3 cm in diameter. Petals 4, up to 12 mm long, fused, unequal. Sepals fused ending in a ring of 12–24 wire-like teeth.

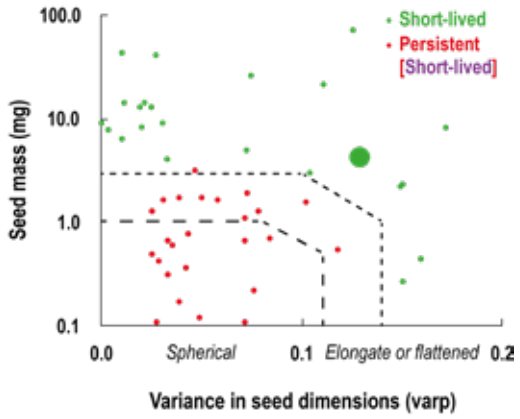
Main flowering time

June–August.

Seeds

Light brown; cylindrical hairy, with a small basal, whitish body facilitating dispersal by ants; 5 x 2 mm; clustered in a loose head.

REGENERATION



Only by seed.

Seed size: Large, 4.0 mg; **Shape:** Elongate; **Varp:** 0.13. **Predicted number of seeds per plant:** Medium, 3061. **Plant diameter:** Large. (Few seeds per plant but plant small and many plants per m^2.)

Seed dispersal in time

A species requiring further study. The large elongate seeds are predicted to be short-lived in the soil.

Seed dispersal in space

With the harvest: Yes. **In soil transported by machinery and feet:** Limited dispersal. **Other:** Not strongly specialised for wind dispersal but potentially adhering to animals and clothing.

SEEDS

Seeds of Annual Scabious (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An erect, semi-rosette, basally-branched, medium-sized annual arable weed.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set commencing in summer.

Impact on crop establishment and yield: A potentially serious weed. Predicted to have an intermediate competitive ability and still common in the organic arable fields of Provence. However, most leaves are held close to the soil and Annual Scabious is perhaps more characteristic of bare ground than of arable fields.

LIFE HISTORY STRATEGY

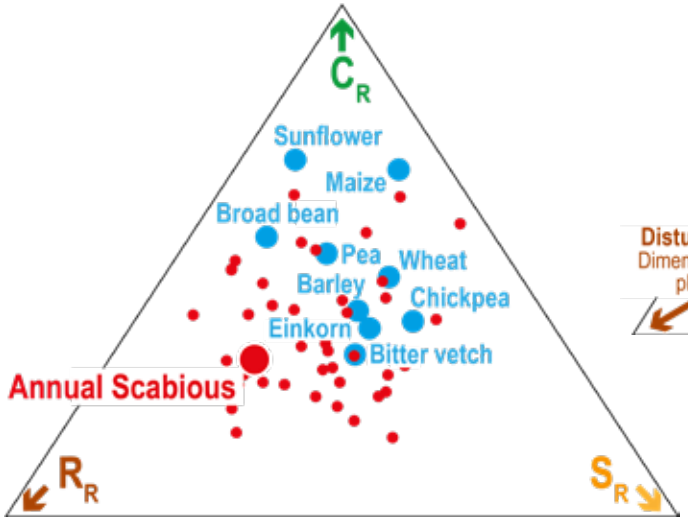
Comparison with wheat

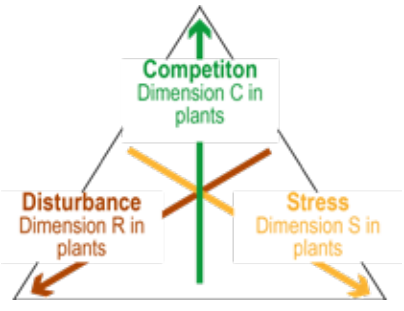
Seed yield: - -

Soil fertility: +

Competitiveness: - -

Disturbance: + +





Black Medick

Fabaceae

Medicago lupulina L.

IDENTIFICATION

Image by Rosbak. Source: Wikimedia Commons. CC BY-SA 3.0

Image by Björn S. Source: Wikimedia Commons. CC BY-SA 2.0

Similar species

Other common species of medick have fewer (1–5) flowers and produce a larger several-seeded coiled pod, mostly with spiny margins. In trefoils (*Trifolium* species) there are more flowers in each head with the fruit almost enclosed within the sepals, and often the dead flower. Also, unlike Black Medick, the apex of leaflets lack a projecting point.

USES

Food: Leaves and seeds eaten cooked (PFAF). **Toxicity:** None reported. **Medicinal:** Has antibacterial and laxative properties (PFAF). **Fodder:** Although relatively unproductive, a very good fodder plant.

Edible rating: 2 **Medicinal rating: 1**

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: An open field species. **Impact on agricultural production:** A potentially serious weed (on soils of intermediate fertility and with less intensive management regimes). **Conservation status - Europe:** 0 % threatened; **France:** Quite common. **Main agricultural habitats in France:** Vineyards and orchards. **Occurrence in 2013 arable survey:** Very common. In 67 % of fields and often at moderate population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Relatively moist clay, loam and sandy soils. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

Plant

A spreading, low-growing, hairy annual (on arable land) or short-lived perennial, with stems to 50 mm or more but plant typically not more than 10 cm in height.

Leaves

Alternate; trifoliate, the 3 oval leaflets typically lighter-coloured below; about 8 mm wide.

Flowers

Bright yellow; 10–50 together in a globular long-stalked cluster from the leaf axil; each flower 2–3 mm. Has the typical pea-flower construction, an erect upper petal, the 'standard', two petals forming the lower 'keel' and two lateral 'wing' petals.

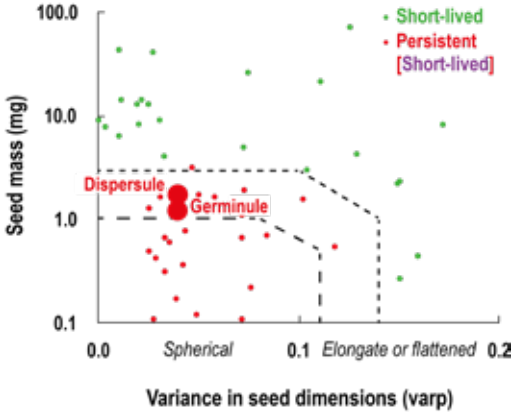
Main flowering time

June–October.

Seeds

Pale brown; oval; 1.6 x 1.3 mm within an indehiscent black, coiled 1-seeded pod, 2.4 x 2 mm, without marginal spines.

REGENERATION



Only by seed.

Seed size: Dispersule intermediate, 1.7 mg; Germinule 1.2 mg; **Shape:** Roundish and flattened; **Varp:** 0.04. **Predicted number of seeds per plant:** Medium, 793. **Plant diameter:** Large.

Seed dispersal in time

Has hard (water-impermeable) seeds that tend to escape detection by smell by predators. A long-persistent seed bank is predicted and recorded (Grime *et al*., 2007).

Seed dispersal in space

With the harvest: Potentially yes in legume crops (Turkington, 1979), less so in cereals. **In soil transported by machinery and feet:** Yes. **Other:** Not specialised for wind dispersal but has some capacity to adhere to animals and clothing (Turkington, 1979).

SEEDS

Seeds of Black Medick (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A procumbent, much branched annual or short-lived perennial; primarily a species of wasteland.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set in summer.

Impact on crop establishment and yield: A potentially serious weed. Predicted to have an intermediate competitive ability. However, it also has a limited nitrogen-fixing capacity, which may be of agricultural benefit. Black Medick is common in the organic arable fields of Provence and is most abundant in less productive fields where the crop canopy is open.

LIFE HISTORY STRATEGY

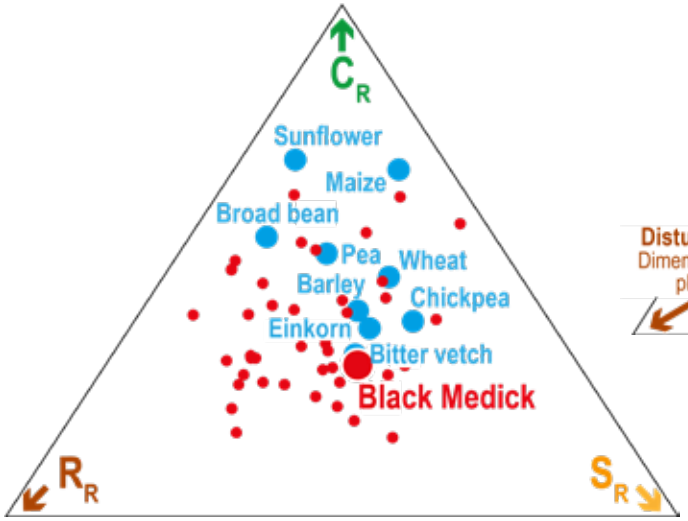
Comparison with wheat

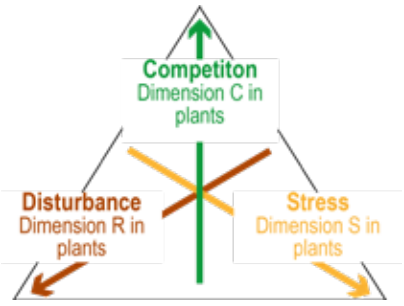
Seed yield: - - -

Soil fertility: =

Competitiveness: - -

Disturbance: + +





Common Poppy M

Papaveraceae

Papaver rhoeas L.

IDENTIFICATION

Image by Björn S. Source: Wikimedia Commons, CC BY-SA 2.0

Image by Drow_male. Source: Wikimedia Commons, CC BY-SA 4.0

Similar species

Long-headed Poppy (*P. dubium* L.) has more orange-red flowers and a longer seed capsule (more than twice as long as wide). Subspecies *dubium* has white or cream latex and wider leaf segments (usually greater than 2 mm). Yellow-juiced Poppy (subspecies *lecoqii* (Lamotte) Syme) has yellow juice and more finely divided leaves. See also Prickly Poppy, a smaller species whose long seed capsule has ascending, bristly hairs.

USES

Food: Young leaves are eaten raw in salad or cooked. In Languedoc, leaves are mixed with other herbs to produce the bourbouillade and in the Cevennes they are added to boudin. In Southern Italy, the leaves are fried in olive oil and garlic. Also eaten in Cyprus, Kabilie (Algeria) and Crete. Oil was formerly extracted from the seeds. Seeds may be used in breads, pasta, or mixed with honey. Poppy syrup and candies may also be produced. **Toxicity:** The plant, but not the seed, has a low toxicity to mammals (PFAF). **Medicinal:** A wide range of uses including as a light sedative and to treat coughs. The petals are taken as an infusion to treat insomnia. **Fodder:** No use reported.

Edible rating: 2 **Medicinal rating: 3**

References consulted: Boisvert (2003); Rénaux (2011); Couplan (2015)

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: Cereal mimic (a traditional arable weed). **Impact on agricultural production:** A serious but declining weed (particularly on soils of intermediate fertility). **Conservation status - Europe:** 7 % threatened; **France:** Very common. **Main agricultural habitats in France:** Winter cereals and vineyards. **Occurrence in 2013 arable survey:** Very common. In 77 % of fields and at moderate to high population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Relatively moist clay, loam and sandy soils. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

Plant

Erect, branched, coarsely-hairy annual; typically less than 1 m with most leaves towards the base. Cut stems and leaves exude a white juice.

Leaves

Alternate; deeply divided with terminal lobes less than 8 mm wide.

Flowers

Scarlet, often black at the base; solitary, long-stalked; up to 8 cm in diameter. Petals 4, broader than long, up to 6 cm. Sepals shed before flowering.

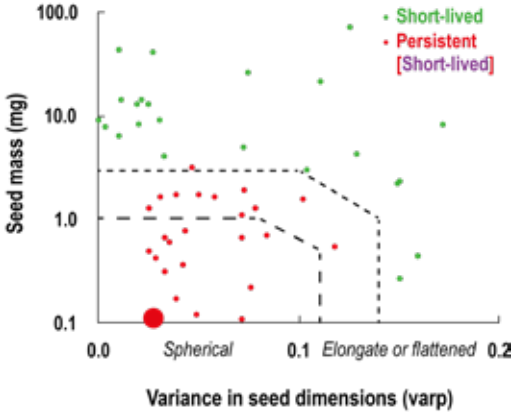
Main flowering time

May–July.

Seeds

Brown; kidney-shaped; 0.9 x 0.7 mm; shed from apical pores of a hairless capsule, 12 x 10 cm.

REGENERATION



Only by seed.

Seed size: Small, 0.1 mg; **Shape:** Kidney-shaped; **Varp:** 0.03. **Predicted number of seeds per plant:** Very many, 6599 [Measured: 1763, Saatkamp *et al*. 2011]. **Plant diameter:** Medium.

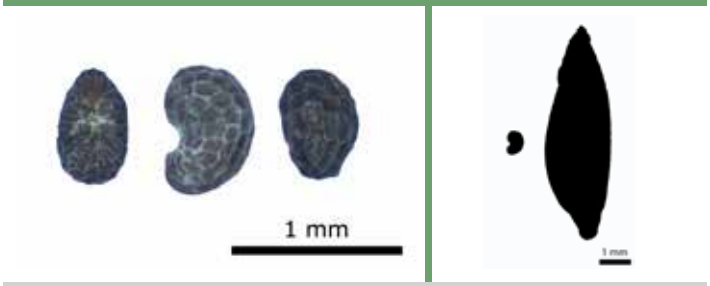
Seed dispersal in time

A long-persistent seed bank is both predicted on the basis of seed size and shape and has been recorded in the field (Grime *et al*. 2007).

Seed dispersal in space

With the harvest: Yes. **In soil transported by machinery and feet:** Yes. **Other:** Shed in the wind from a capsule by a censer mechanism. Not strongly specialised for animal dispersal.

SEEDS



Seeds of Common Poppy (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An erect, semi-rosette, much-branched, medium-sized annual arable weed.

Seasons of growth

Seed germination: Autumn/spring.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set commencing in early summer.

Impact on crop establishment and yield: A serious but declining weed. Predicted to be slightly less competitive than wheat but there are few records of it causing significant reductions in crop yields. Common Poppy is also a potential contaminant of crop seed and, although probably not an economically important arable weed, it remains very common in the organic arable fields of Provence.

LIFE HISTORY STRATEGY

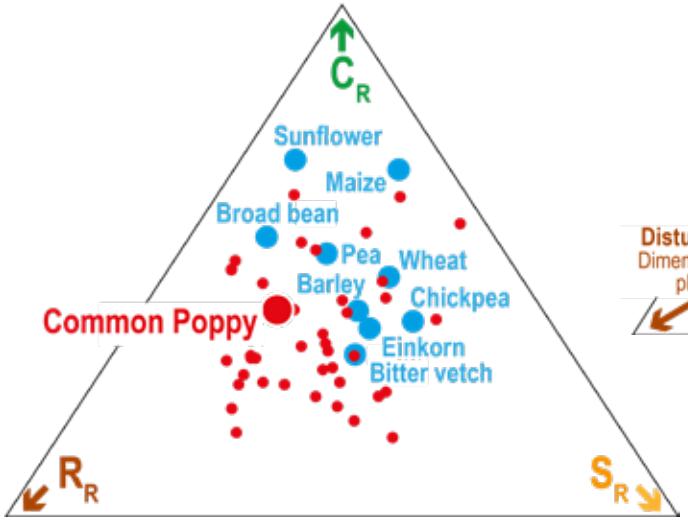
Comparison with wheat

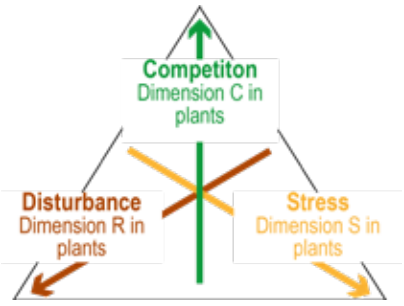
Seed yield: - - -

Soil fertility: +

Competitiveness: -

Disturbance: + +





Corn Mignonette

Resedaceae

Reseda phyteuma L.

IDENTIFICATION

Image by Adrian198cm. Source: Wikimedia Commons

Image by Adrian198cm. Source: Wikimedia Commons

Similar species

None.

USES

Food: Young leaves can be eaten in salads. **Toxicity:** None reported. **Medicinal:** The root is very bitter and used in Turkey to treat stomach problems. **Fodder:** No use reported.

Edible rating: 1 **Medicinal rating: 0**

References consulted: Couplan (2015)

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: An open field species. **Impact on agricultural production:** A serious but declining weed (particularly on soils of intermediate fertility). **Conservation status - Europe:** 7 % threatened; **France:** Quite common. **Main agricultural habitats in France:** Vineyards, orchards, vegetable crops, maize and sunflower. **Occurrence in 2013 arable survey:** Uncommon but more widespread in non-arable habitats. In 20% of fields and at low population densities.

HABITAT

Climatic distribution: Weakly Mediterranean. **Soil type:** Dry clayey to sandy soils. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

Plant

Much branched, finely hairy annual or biennial; typically less than 30 cm in height with most leaves below 15 cm.

Leaves

Alternate; oblong, sometimes lobed; up to 16 mm wide.

Flowers

White; in a loose terminal spike. Petals 6, 3–4 mm, dissected; partially hidden by the prominent stamens. Sepals 6.

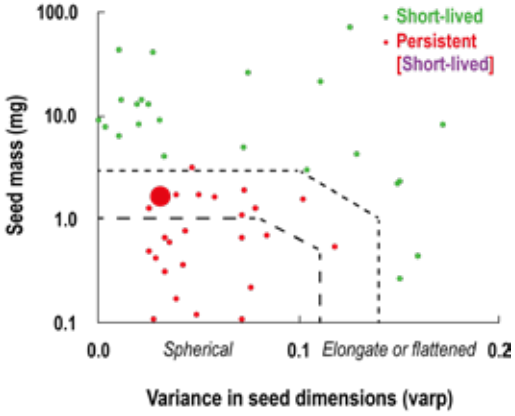
Main flowering time

April–August.

Seeds

Brown or black; kidney-shaped; 2 x 1 mm; shed apically from a ridged, inflated, pendulous, many-seeded capsule.

REGENERATION



Only by seed.

Seed size: Intermediate, 1.6 mg; **Shape:** Kidney-shaped; **Varp:** 0.03. **Predicted number of seeds per plant:** Few, 234. **Plant diameter:** Medium.

Seed dispersal in time

A long-persistent seed bank is both predicted on the basis of seed size and shape and data from the literature is supportive.

Seed dispersal in space

With the harvest: Perhaps to a very limited extent: the plant is low-growing. **In soil transported by machinery and feet:** Limited dispersal. **Other:** No strong specialisations apparent for either wind or animal dispersal.

SEEDS

Seeds of Corn Mignonette (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A much-branched, spreading, low-growing, semi-basal annual to short-lived perennial of waste and arable land.

Seasons of growth

Seed germination: Probably mainly autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn–early summer) with the long flowering period commencing in late spring.

Impact on crop establishment and yield: A serious but declining weed. Predicted to have an intermediate competitive ability. Corn Mignonette, which is uncommon in the organic arable fields of Provence and in ecological terms is probably more characteristic of bare ground than of arable land, is not a significant weed.

LIFE HISTORY STRATEGY

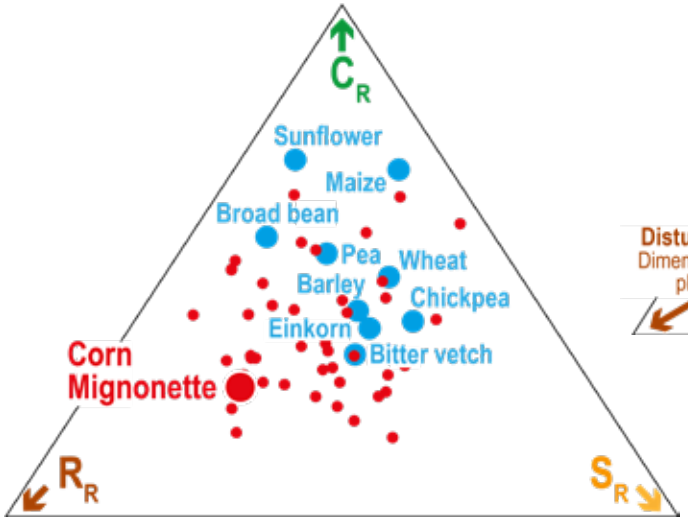
Comparison with wheat

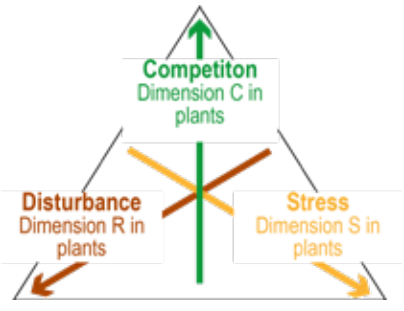
Seed yield: - - -

Soil fertility: + +

Competitiveness: - -

Disturbance: + +





Hungarian Vetch M

Fabaceae

Vicia pannonica Crantz

IDENTIFICATION

Image by Stefan Lefnaer. Source: Wikimedia Commons, CC BY-SA 3.0

Image by Fornax. Source: Wikimedia Commons, CC BY-SA 3.0

Similar species

Yellow-vetch (*V. lutea* L.) has solitary yellowish flowers and the 'standard' petal lacks hairs. The Common Vetch (*V. sativa*) group including cultivated vetch, subspecies sativa with bright purple flowers in groups of 1–2, and *V. peregrina* L. with extremely narrow leaves (no more than 2 mm).

USES

Food: No use reported. **Toxicity:** None reported. **Medicinal:** No use reported. **Fodder:** A fodder crop.

Websites: www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: Intermediate between early competitor and cereal mimic. **Impact on agricultural production:** Uncertain. (A competitive but nitrogen-fixing weed.) **Conservation status - Europe:** 3 % threatened; **France:** Quite rare. **Main agricultural habitats in France:** Winter cereals, vineyards and orchards. **Occurrence in 2013 arable survey:** Common. In 48 % of fields and at moderate to high population densities.

HABITAT

Climatic distribution: Weakly Mediterranean. **Soil type:** Dry clayey to sandy soils. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

Plant

A robust, ascending, hairy, climbing annual; to 0.5 m or more in height.

Leaves

Alternate; each leaf stalk with up to 10 pairs of oval leaflets up to 8 mm wide and terminating in a branched structure (tendril). By twining around other plants, this tendril helps to support the plant.

Flowers

Brownish-purple; 2–4 together (rarely solitary) in the leaf axil; each flower 14–22 mm. Has the typical pea-flower construction, an erect upper petal, the 'standard', two petals forming the lower 'keel' and two lateral 'wing' petals. The 'standard' petal has hairs on the back.

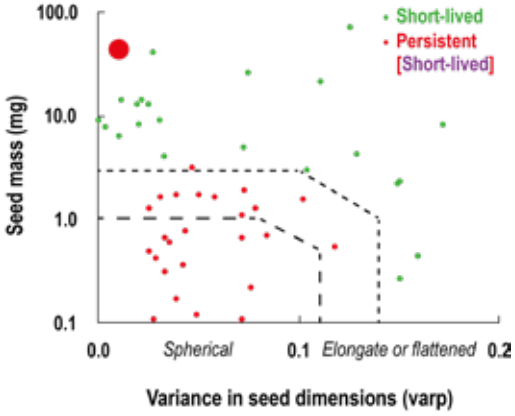
Main flowering time

May–June.

Seeds

Brownish; spherical; 3 mm in diameter, shed from a cylindrical 2–8-seeded pod, 25 x 9 mm.

REGENERATION



Only by seed.

Seed size: Large, 40.0 mg; **Shape:** Spherical; **Varp:** 0.01. **Predicted number of seeds per plant:** Very few, 31. **Plant diameter:** Medium.

Seed dispersal in time

Has hard (water-impermeable) seeds that tend to escape detection by smell by predators. Therefore, despite its large seed size a long-persistent seed bank is predicted (Grime *et al*. 2007).

Seed dispersal in space

With the harvest: Potentially yes, but typically a majority of seed shed before harvest time. **In soil transported by machinery and feet:** Limited dispersal. **Other:** No strong specialisations apparent for either wind or animal dispersal.

SEEDS

Seeds of Hungarian Vetch (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An erect, leafy, basally-branched, medium-sized annual, often scrambling over and supported by the associated vegetation. Characteristic of waste and arable land.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth 'cool-season' (autumn–early summer) with flowering and seed-set in summer.

Impact on crop establishment and yield: Uncertain. Predicted to have an intermediate competitive ability and is also a potential contaminant of crop seed. However, Hungarian Vetch, which is common and sometimes abundant in the organic arable fields of Provence, is sometimes cultivated as a fodder crop. It also has a limited nitrogen-fixing capacity, which may be of agricultural benefit.

LIFE HISTORY STRATEGY

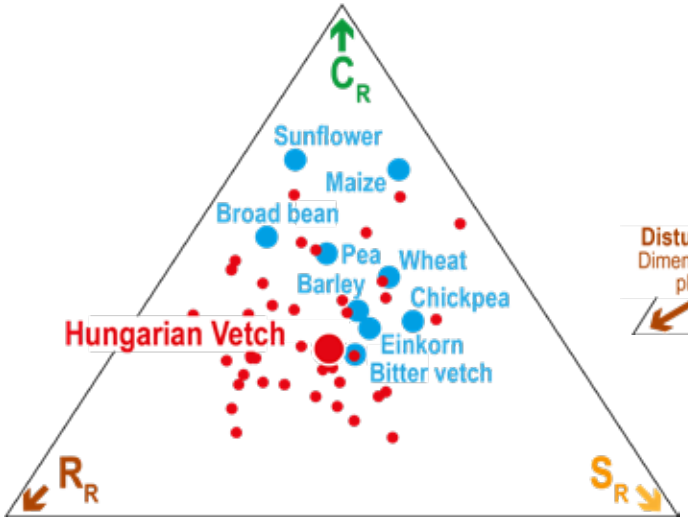
Comparison with wheat

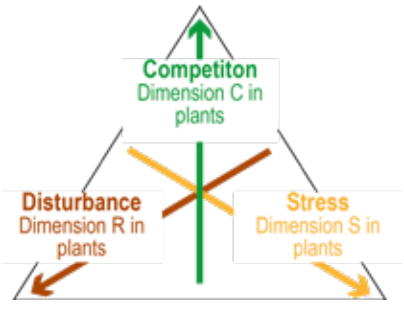
Seed yield: -

Soil fertility: =

Competitiveness: - -

Disturbance: +





Corncockle

Caryophyllaceae

Agrostemma githago L.

IDENTIFICATION

Image by Stefan Lefnaer. Source: Wikimedia Commons. CC BY-SA 4.0

Image by BerndH. Source: Wikimedia Commons. CC BY-SA 2.5

Similar species

None.

Plant

Erect annual; often >1 m.

Leaves

In pairs; long, narrow, with white hairs.

Flowers

Bright pink with dark streaks, 3 cm or more in diameter. Petals 5. Sepals 5, fused into a tube below, much longer than petals.

Main flowering time

June–July.

Seeds

About 3 mm, black and warty in a large, many-seeded capsule.

USES

Food: No use reported other than some ancient reports of the young leaves being cooked and eaten with vinegar and bacon in Western Europe. **Toxicity:** Considered toxic since Dioscorides. Long known to have poisonous seeds and, as a contaminant of flour, turning bread bitter and giving it a bluish colour. It is now appreciated that the plant and especially the seeds contain high levels of triterpene saponosides, which cause serious food poisoning if mixed with wheat flour. A potential problem in Europe, the Caucasus (and perhaps Central Asia). **Medicinal:** Rarely used therapeutically. **Fodder:** No use reported. Poisonous.

Edible rating: 1 **Medicinal rating: 1**

References consulted: Couplan (2015)

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org, http://www.toxiplante.fr/monographies/nielle.html

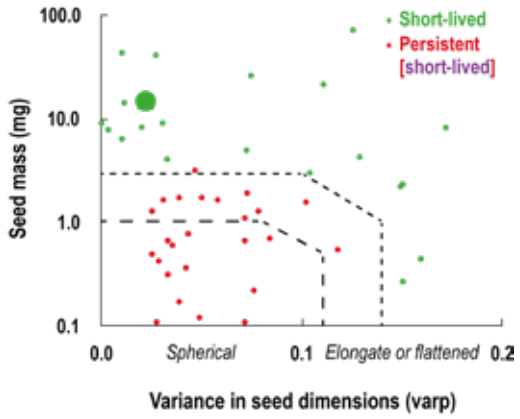
ECOLOGY

Type of weed: Cereal mimic (a traditional arable weed). **Impact on agricultural production:** Low. (A rare weed.) **Conservation status - Europe:** 86 % threatened; **France:** Rare and of conservation concern. **Main agricultural habitats in France:** Winter and spring cereals. **Occurrence in 2013 arable survey:** Still widespread. In 28 % of fields but at low population densities.

HABITAT

Climatic distribution: Weakly Mediterranean. **Soil type:** Dry clays and loams. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

REGENERATION



Only by seed.

Seed size: Large, 13.5 mg; **Shape:** Rounded; **Varp:** 0.02. **Predicted number of seeds per plant:** Few, 128 [Measured: 338, Saatkamp *et al*. 2011]. **Plant diameter:** Medium.

Seed dispersal in time

Lacks a persistent seed bank. This is consistent with both predictions based upon seed size and shape and field observations.

Seed dispersal in space

With the harvest: Yes. **In soil transported by machinery and feet:** Limited dispersal. **Other:** No strong specialisations apparent for either wind or animal dispersal.

SEEDS

Seeds of Corncockle (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An erect, leafy, typically branched, medium-sized annual arable weed.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set in summer.

Impact on crop establishment and yield: Low. Consistent with Dutoit *et al*. (2001), predicted to have a similar competitive ability to that of wheat. It is also a potential contaminant of crop seed and the plant and seed are considered toxic. Nevertheless, in the organic arable fields of Provence, Corncockle is only recorded at low densities.

LIFE HISTORY STRATEGY

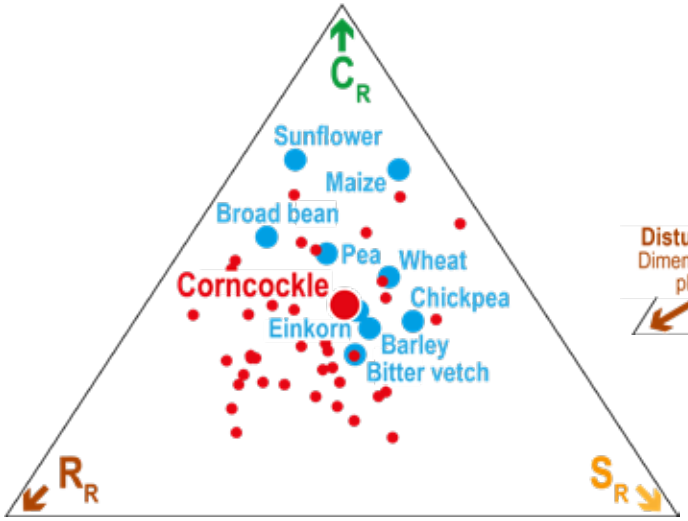
Comparison with wheat

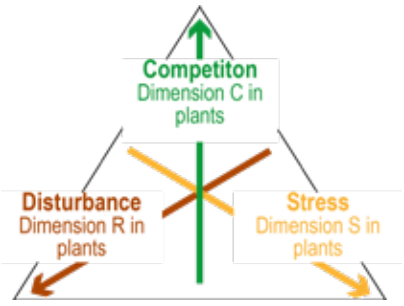
Seed yield: - -

Soil fertility: =

Competitiveness: - -

Disturbance: =





Ground-pine Ⓜ

Lamiaceae

Ajuga chamaepitys subsp. *chamaepitys* (L.) Schreb.

IDENTIFICATION

Image by Stefan Lefnaer. Source: Wikimedia Commons. CC BY-SA 3.0

Image by Stefan Lefnaer. Source: Wikimedia Commons. CC BY-SA 4.0

Similar species

None.

USES

Food: The leaves are bitter but can be adanagallisded to salads. The plant is sometimes eaten in Anatolia but it is not currently considered as an edible species in France. However, some perennial species are eaten as a cooked vegetable in Bosnia. **Toxicity:** None reported. **Medicinal:** Formerly, the leaves were included in theriac, a complex concoction of plant and animal extracts used by the Greeks as an antidote to poisoning and also as a panacea to cure many diseases. In France, the plant was a constituent of the theriac made by apothecaries in Montpellier according to the French Codex of 1758. Used throughout Europe. **Fodder:** No use reported.

Edible rating: 0 **Medicinal rating: 2**

References consulted: Couplan (2015)

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: An open field species. **Impact on agricultural production:** Low. (A rare weed.) **Conservation status - Europe:** 57 % threatened; **France:** Quite rare. **Main agricultural habitats in France:** Vineyards and spring cereals, potato, beet and sunflower. **Occurrence in 2013 arable survey:** Widespread. In 27 % of fields but at low population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Dry clays and loams. **Soil reaction:** Basic to neutral. **Soil fertility:** Relatively infertile.

Plant

Annual or more rarely (in unploughed habitats) longer-lived; erect or spreading, typically less than 5 cm in height.

Leaves

In pairs; hairy, divided into linear lobes; smelling of pine when crushed.

Flowers

Yellow with red spots; shorter than, and often partially hidden by, the leaves and situated towards shoot apex. Corolla 5-lobed, hooded above and larger and flattened below. Calyx bell-shaped.

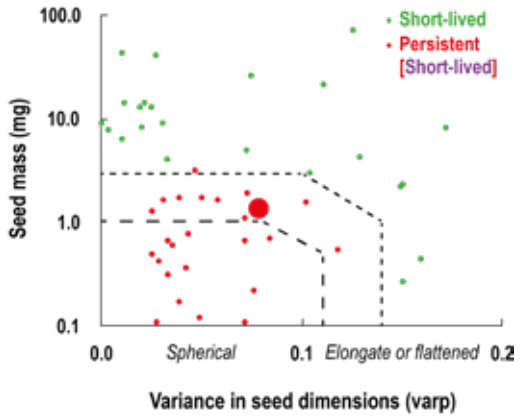
Main flowering time

April onwards.

Seeds

2.5–3 x 1.1–1.4 mm, brown, up to 4 per flower.

REGENERATION



Only by seed.

Seed size: Intermediate, 1.3 mg; **Shape:** Broadly oblong; **Varp:** 0.03. **Predicted number of seeds per plant:** Few, 220. **Plant diameter:** Small–medium.

Seed dispersal in time

On the basis of seed size and shape a long-persistent soil seed bank is predicted. This is supported by data from the literature.

Seed dispersal in space

With the harvest: Unlikely to be dispersed; plant too low-growing. **In soil transported by machinery and feet:** Yes. **Other:** No strong specialisations apparent for either wind or animal dispersal.

SEEDS

Seeds of Ground-pine (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A procumbent to ascending, often much-branched, leafy, patch-forming arable annual (rarely overwintering) of bare ground and crop fields.

Seasons of growth

Seed germination: Autumn–spring.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) but, in the absence of drought, may continue until autumn. Flowering and seed-set commence in early summer.

Impact on crop establishment and yield: Low. Predicted to have low competitive ability and in the organic arable fields of Provence, Ground-pine is too rare to be an important weed.

LIFE HISTORY STRATEGY

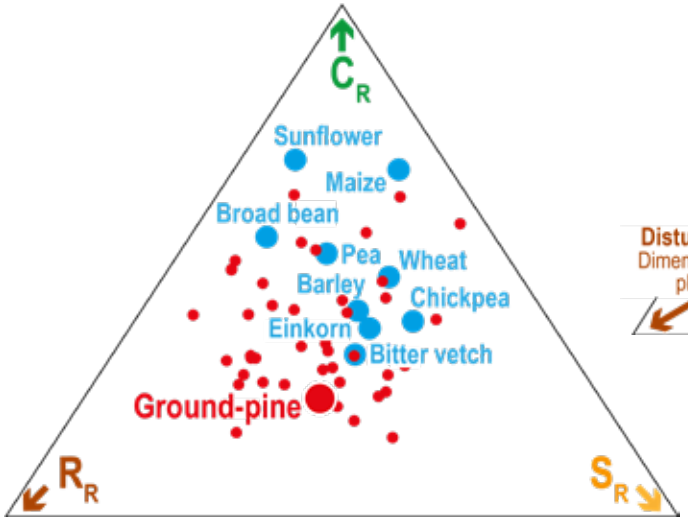
Comparison with wheat

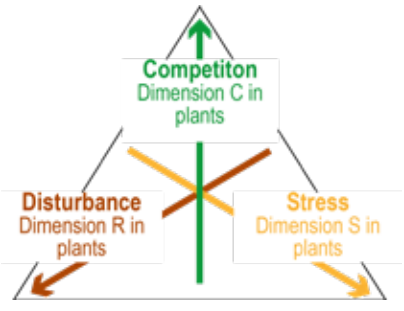
Seed yield: - - -

Soil fertility: =

Competitiveness: - - -

Disturbance: + +





Corn Chamomile

Asteraceae

Anthemis arvensis L.

IDENTIFICATION

Image by Jean-Pierre Dalmas, CBNA ©

Image by Daniel Pavon ©

Similar species

Giant Chamomile (*A. altissima*) is more robust with (a) larger flowers (to 4 cm), (b) seeds that are quadrangular in cross-section (not rounded) and with a smooth (not furrowed) surface and (c) scales on the flower head that are persistent and difficult to dislodge.

USES

Food: No use reported. **Toxicity:** None reported. **Medicinal:** Odourless and not drunk as a herbal tea. There are reports of its use to de-worm animals and as a gargle to reduce fever. However, it lacks the medical importance of true Chamomile (*Chamaemelum nobile* (L.) All.). **Fodder:** Mixed with other weeds this species can be used for fodder.

Edible rating: 0 **Medicinal rating: 2**

References consulted: Vandermaelen (1832)

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org, http://quelleestcetteplante.fr/especes.php?genre=Anthemis&variete=arvensis

ECOLOGY

Type of weed: Intermediate between early competitor and cereal mimic (a traditional arable weed). **Impact on agricultural production:** A potentially serious but declining weed (on soils of intermediate fertility). **Conservation status - Europe:** 31 % threatened; **France:** Quite common. **Main agricultural habitats in France:** Winter and spring cereals, rape and vineyards. **Occurrence in 2013 arable survey:** In 28 % of fields but where it occurs often at moderate to high population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Dry sands and loams. **Soil reaction:** Wide-ranging. **Soil fertility:** Intermediate.

Plant

Erect to bushy, minutely hairy, aromatic annual, or in some in unfarmed habitats a short-lived perennial; to 0.5 m or more in height.

Leaves

Alternate; finely-dissected, with narrow, parallel-sided lobes less than 1 mm wide.

Flowers

Numerous, small, yellow tubular flowers in round central cushion surrounded by an outer ring of larger white elongate and flattened flowers; together forming a long-stalked, terminal 'daisy-flower' 2–3 cm in diameter.

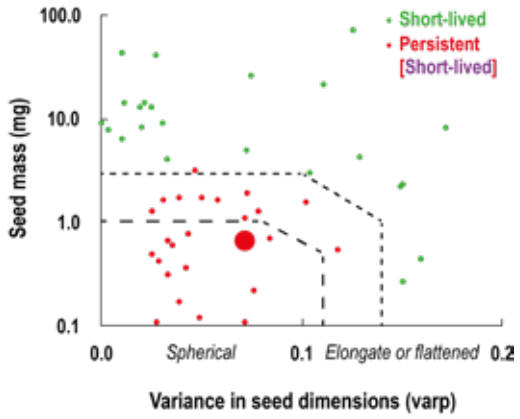
Main flowering time

May–June.

Seeds

Pale brown; cylindrical, furrowed, narrowed to the base; 2 x 1 mm; attached, with numerous papery, easily-dislodged scales, to the conical base of each senescent 'daisy-flower'.

REGENERATION



Only by seed.

Seed size: Small, 0.6 mg; **Shape:** Oblong; **Varp:** 0.07. **Predicted number of seeds per plant:** Medium, 532. **Plant diameter:** Medium.

Seed dispersal in time

A long-persistent seed bank is predicted on the basis of seed size and shape and its existence is also broadly supported by field studies.

Seed dispersal in space

With the harvest: Yes (Kay, 1971). **In soil transported by machinery and feet:** Yes. **Other:** Not strongly specialised for wind dispersal and not readily adhering to animals and clothing but may perhaps survive mammalian ingestion (Kay, 1971).

SEEDS

Seeds of Corn Chamomile (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An ascending to erect, leafy, branched, small- to medium-sized annual arable weed. Rarely a short-lived perennial.

Seasons of growth

Seed germination: Autumn–spring.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set in summer.

Impact on crop establishment and yield: A potentially serious but declining weed. Predicted to have an intermediate competitive ability and is also a potential contaminant of crop seed. Corn Chamomile is a relatively frequent weed in the organic arable fields of Provence. It tends not to occur beneath tall crop canopies and probably impacts competitively primarily on the early stages of crop growth.

LIFE HISTORY STRATEGY

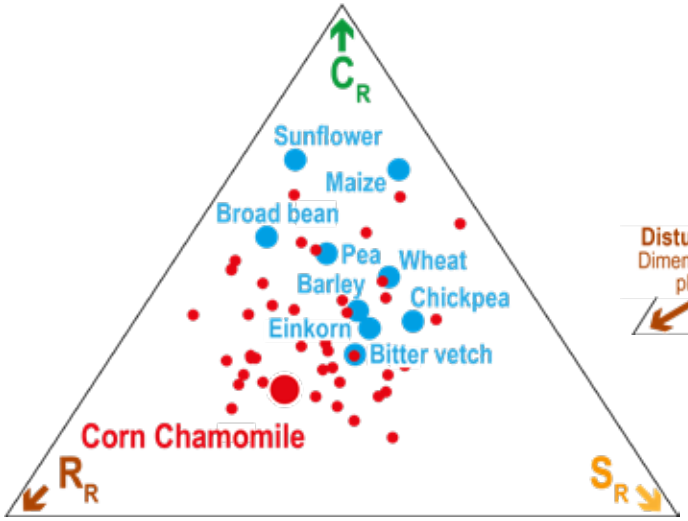
Comparison with wheat

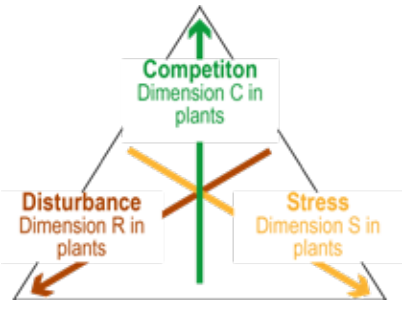
Seed yield: - - -

Soil fertility: +

Competitiveness: - -

Disturbance: + +





Rayed Bifora M

Apiaceae

Bifora radians M. Bieb.

IDENTIFICATION

Image by Arne Saatkamp ©

Image by Arne Saatkamp ©

Similar species

In Bifora *(B. testiculata* (L.) Roth) the number of 'spokes' in the flower head is 1–3 and all petals are nearly equal.

USES

Food: Used as a condiment in Turkey, especially in Anatolia where the aerial parts are used to flavour soup. **Toxicity:** None reported. **Medicinal:** Traditionally used in Turkey to relieve flatulence and stomach problems. Recent pharmacological studies show that this species, like other Apiaceae, has good antioxidant properties and its essential oils contain volatile compounds of aldehyde type that may interest the perfume and biopesticide industries. **Fodder:** No use reported.

References consulted: Gökçe *et al*. (2011)

Websites: www.tela-botanica.org

ECOLOGY

Type of weed: Cereal mimic (a traditional arable weed). **Impact on agricultural production:** Low. (A rare weed.) **Conservation status - Europe:** 53 % threatened; **France:** Quite rare. **Main agricultural habitats in France:** Winter and spring cereals and rape. **Occurrence in 2013 arable survey:** In 37 % of fields but at low population densities.

HABITAT

Climatic distribution: Weakly Mediterranean. **Soil type:** Dry clays and loams. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

Plant

Erect, hairless annual; up to 0.5 m or more in height with most leaves associated with the basal part of the plant.

Leaves

Alternate; finely-dissected, with narrow, parallel-sided lobes less than 1 mm wide, except for the short-lived basal leaves that are wider (about 2 mm).

Flowers

White; in a loose circular head up to 5 cm in diameter. Heads consist of 4–8 unequal radiating stalks (like bicycle spokes); each terminating in clusters of 7–9 flowers. Petals 5; mostly 1–1.5 mm long but in marginal flowers outer twice as long as inner.

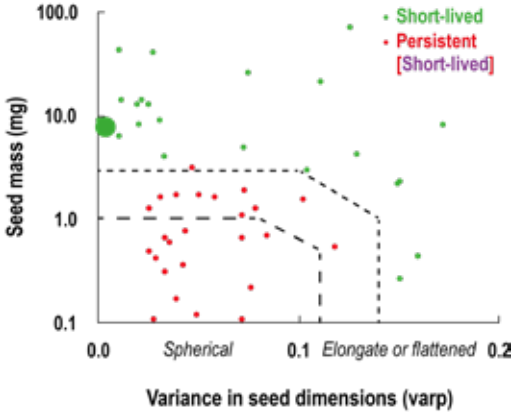
Main flowering time

May–June.

Seeds

Yellowish; globular, with longitudinal ridges; 2.5 x 2 mm; in terminal pairs.

REGENERATION



Only by seed.

Seed size: Large, 8.5 mg; **Shape:** Round; **Varp:** 0.00. **Predicted number of seeds per plant:** Very few, 15 [Measured: 47, Saatkamp *et al*. 2011]. **Plant diameter:** Small.

Seed dispersal in time

Seeds are large and germinate in the dark (Saatkamp *et al*., 2011). Therefore, although persistence has been experimentally demonstrated (Saatkamp *et al*., 2009) the soil seed bank is probably, at best, shortly-persistent.

Seed dispersal in space

With the harvest: Yes [and inseparable from Coriander (*Coriandrum* L.) seeds]. **In soil transported by machinery and feet:** Limited dispersal. **Other:** No strong specialisations apparent for either wind or animal dispersal.

SEEDS

Seeds of Rayed Bifora (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An erect, leafy, sparingly branched, medium-sized annual arable weed.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set in summer.

Impact on crop establishment and yield: Low. Predicted to have low competitive ability but may be a potential contaminant of crop seed. However, although still frequent in the organic arable fields of Provence, Rayed Bifora is declining and only ever present at low densities. Too rare to be an agriculturally-significant weed.

LIFE HISTORY STRATEGY

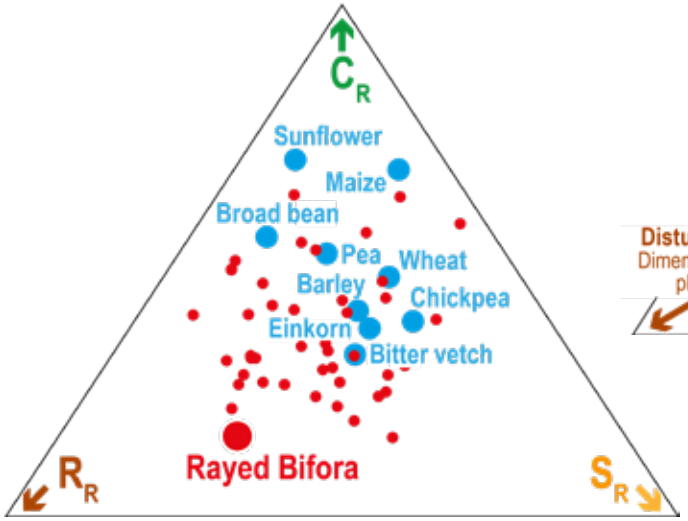
Comparison with wheat

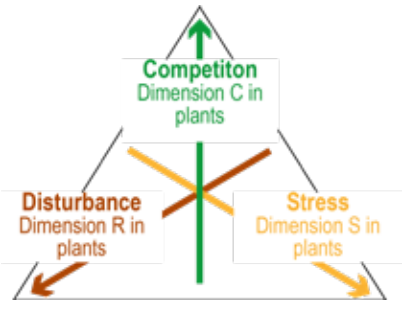
Seed yield: - - -

Soil fertility: +

Competitiveness: - - -

Disturbance: + + +





Thorow-wax M

Apiaceae

Bupleurum rotundifolium L.

IDENTIFICATION

Image by Stefan Lefnaer. Source: Wikimedia Commons. CC BY-SA 4.0

Image by Krzysztof Ziarnek. Source: Wikimedia Commons. CC BY-SA 4.0

Similar species

None.

USES

Food: Leaves used in salads and as a pot-herb or spice (PFAF). **Toxicity:** Uncertain. **Medicinal:** The leaves are bitter when chewed and the seeds even more so. Has been considered excellent to heal wounds and effective as a versatile astringent, even preventing or curing hernias. Schulze reports that leaves cooked in vinegar and applied hot to ganglia 'dissipate them as if by magic' (Cazin 1868). Not studied pharmacologically but other species in the same genus are used in Chinese and Japanese medicine and there is an abundant literature on their pharmaceutical properties. **Fodder:** No use reported.

Edible rating: 1 **Medicinal rating: 0**

Websites: https://pfaf.org, www.tela-botanica.org, http://uses.plantnet-project.org/fr/Bupl%C3%A8vre_(Cazin_1868)

ECOLOGY

Type of weed: Cereal mimic (a traditional arable weed). **Impact on agricultural production:** Low. (A rare weed.) **Conservation status - Europe:** 65 % threatened; **France:** Rare and of conservation concern. **Main agricultural habitats in France:** Winter cereals. **Occurrence in 2013 arable survey:** Still widespread. In 23 % of fields but at low population densities.

HABITAT

Climatic distribution: Weakly Mediterranean. **Soil type:** Dry clays and loams. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

Plant

Erect, narrow, slightly greyish-green, hairless annual; up to 1 m in height.

Leaves

Alternate; oval, clasping the stem and up to 5 cm wide.

Flowers

Yellow; in a loose circular head up to 3 cm in diameter. Heads consist sof 4–8 radiating stalks (like bicycle spokes); each terminating in clusters of 7–9, small flowers, overtopped by small modified leaves 5–12 mm in length.

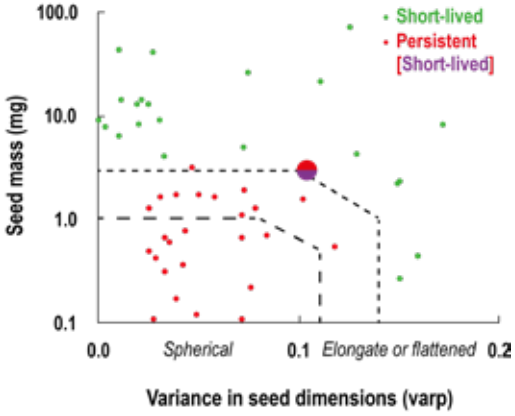
Main flowering time

June–July.

Seeds

Blackish; elongate, with longitudinal ridges; 3 x 1 mm; in terminal pairs.

REGENERATION



Only by seed.

Seed size: Intermediate, 2.8 mg; **Shape:** Elongate; **Varp:** 0.10. **Predicted number of seeds per plant:** Medium, 1384 [Measured: 430, Saatkamp *et al*. 2011]. **Plant diameter:** Medium.

Seed dispersal in time

The plant is generally present only at low densities. Nevertheless, on the basis of Saatkamp *et al*. (2009, 2011) and of seed size and shape a persistent seed bank is predicted.

Seed dispersal in space

With the harvest: Yes. **In soil transported by machinery and feet:** Limited dispersal. **Other:** No strong specialisations apparent for either wind or animal dispersal.

SEEDS

Seeds of Thorow-wax (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An erect, leafy, sparingly branched, medium-sized annual arable weed.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set in summer.

Impact on crop establishment and yield: Low. Predicted to have a competitive ability similar to that of wheat (a comparable relationship experimentally described by Dutoit *et al*. [2001]). It is also a potential contaminant of crop seed. Despite having some attributes that theoretically could make it a serious weed, Thorow-wax is a rare and declining plant, whose ecological characteristics have been little studied. The fact that Thorow-wax was still widespread, albeit at low densities, during our survey of the organic arable fields of Provence is perhaps best regarded as an asset to conservation rather than of agricultural concern.

LIFE HISTORY STRATEGY

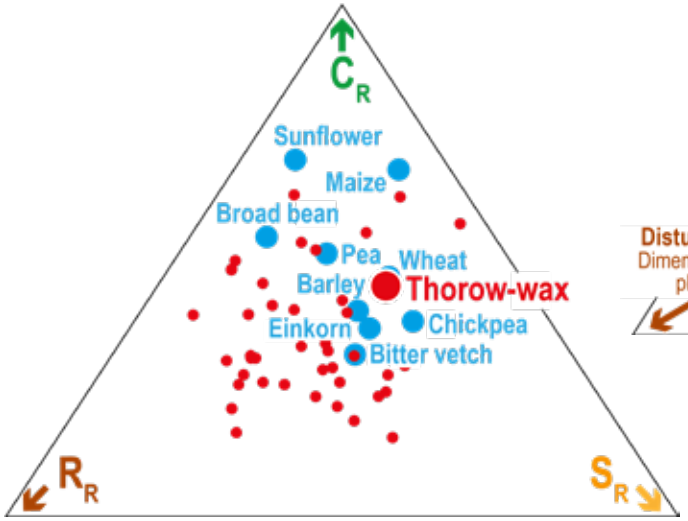
Comparison with wheat

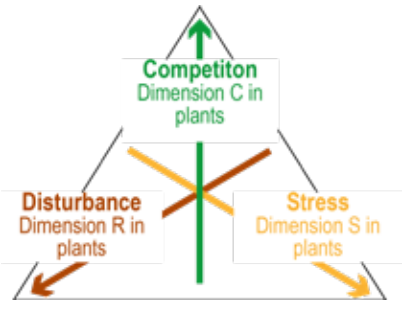
Seed yield: -

Soil fertility: =

Competitiveness: =

Disturbance: =





Cornflower Ⓜ

Asteraceae

Centaurea cyanus L., Syn: *Cyanus segetum* Hill.

IDENTIFICATION

Image by H. Zell. Source: Wikimedia Commons. CC BY-SA 3.0

Image by Albert H. Source: Wikimedia Commons. CC BY-SA 3.0

Similar species

None.

Plant

Erect, slender, slightly cottony annual; to 1 m.

Leaves

Alternate; lower ones divided; upper smaller, narrow, undivided and less than 2 mm wide.

Flowers

Numerous; outer, bright blue and larger; central ones are red-purple and smaller; overtopping a cone of greenish scales; together forming a long-stalked, terminal 'thistle-flower' about 3 cm in diameter.

Main flowering time

May–June.

Seeds

Greyish, cylindrical, with an apical tuft of short dark hairs; 5 x 2.5 mm; loosely attached to the base of each senescent 'flower'.

USES

Food: Young shoots, particularly the flowers are edible as a salad or vegetable (PFAF). Flowers are used in mousses, fruit salads and cakes and the leaves are reputed to have been boiled in beer to make an 'aperitif' drink. Today it is used in herbal teas or tea such as "Lady Grey". **Toxicity:** None reported. **Medicinal:** Formerly used to treat many ailments, particularly dropsy. It was recognised as a diuretic. Nowadays, little used, although sometimes employed as a light astringent in eye drops. Was distilled in water (Cazin 1868) to treat eye irritation conjunctivitis, and more generally inflammation of the skin or soft membranes. Infusions of petals thought to relieve rheumatism, inflammation of the joints or kidneys. Cornflower lotion is recommended against oral inflammation (Boisvert 2003). **Fodder:** Eaten by livestock with other weeds.

Edible rating: 2 **Medicinal rating: 2**

References consulted: Boisvert (2003)

Websites: https://pfaf.org, www.wikipedia.org, http://uses.plantnet-project.org/fr/Bleuet_(Cazin_1868)

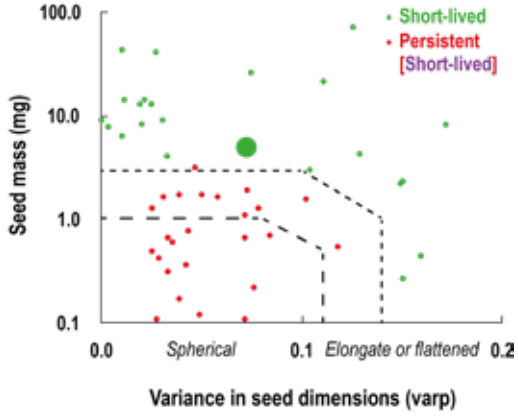
ECOLOGY

Type of weed: Cereal mimic (a traditional arable weed). **Impact on agricultural production:** A potentially serious but declining weed (on soils of intermediate fertility). **Conservation status - Europe:** 48 % threatened; **France:** Quite common. **Main agricultural habitats in France:** Winter cereals, rape and spring cereals. **Occurrence in 2013 arable survey:** Still widespread. In 28 % of fields but where it occurs often at moderate to high population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Dry sandy loams to clays. **Soil reaction:** Wide-ranging. **Soil fertility:** Intermediate.

REGENERATION



Only by seed.

Seed size: Large, 4.6 mg; **Shape:** Broadly elongate and shortly-plumed; **Varp:** 0.07. **Predicted number of seeds per plant:** Few, 234 [Measured: 629, Saatkamp *et al*. 2011]. **Plant diameter:** Medium.

Seed dispersal in time

The absence of a persistent seed bank is predicted on the basis of seed size and shape and field observations, a result also broadly supported by field studies and Saatkamp *et al*. (2009, 2011).

Seed dispersal in space

With the harvest: Yes. **In soil transported by machinery and feet:** Limited dispersal. **Other:** Not specialised for wind dispersal but the seed with its tuft of short hairs may perhaps be dispersal by animals and, to a lesser extent, on clothing.

SEEDS

Seeds of Cornflower (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An erect, leafy, sparingly branched, medium-sized annual arable weed.

Seasons of growth

Seed germination: Autumn/spring.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set in summer.

Impact on crop establishment and yield: A potentially serious but declining weed. Consistent with Dutoit *et al*. (2001), predicted to have an intermediate competitive ability and, although infrequently studied in this context, known to cause a reduction in crop growth. It is also a potential contaminant of crop seed. Declining but remains relatively frequent in the organic arable fields of Provence.

LIFE HISTORY STRATEGY

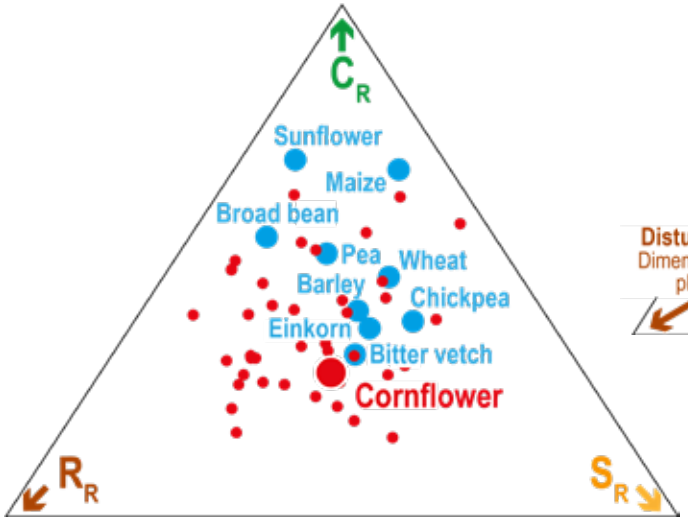
Comparison with wheat

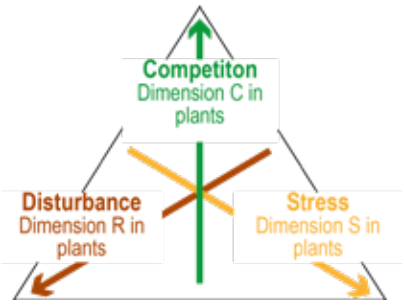
Seed yield: -

Soil fertility: =

Competitiveness: - -

Disturbance: + +





Sickle Spurge Ⓜ

Euphorbiaceae

Euphorbia falcata L.

IDENTIFICATION

Image by Daniel Pavon ©

Image by Gilles Pache, CBNA ©

Similar species

Other species lack the sharp apical point. Petty Spurge (*E. peplus* L.) is the most similar but is usually more robust and erect and Sun Spurge (*E. helioscopia* L.) has a whorl of large, oval, yellow-green leaves below the 'spokes' of the flower and larger brown seeds (2 mm long). Also Dwarf Spurge (*E. exigua* L.) is usually smaller with very narrow leaves (about 2 mm wide).

USES

Food: No use reported other than some ancient reports of the young leaves being cooked and eaten with vinegar and bacon in Western Europe. **Toxicity:** Like many spurges (*Euphorbia*), its milky latex has some toxicity. **Medicinal:** Used in Morocco for the treatment of urinary infections, colds etc. (Bouharb *et al*., 2014). **Fodder:** No use reported.

References consulted: Bouharb *et al*. (2014)

Websites: www.tela-botanica.org

ECOLOGY

Type of weed: Early competitor. **Impact on agricultural production:** Probably low. (A small and relatively sparsely-distributed weed.) **Conservation status - Europe:** 24 % threatened; **France:** Quite rare. **Main agricultural habitats in France:** Vineyards. **Occurrence in 2013 arable survey:** Still common. In 47 % of fields and not infrequently at moderate population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Dry clays and loams. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

Plant

Hairless annual; typically branched from the base and prostrate or erect to 30 cm. Cut stems and leaves exude a white juice.

Leaves

Alternate; oval with a sharp apical point; 3–5 mm wide.

Flowers

Green (lacking petals); in a loose circular head up to 3 cm in diameter. Heads consist of 8 unequal radiating stalks; each terminating in clusters of flowers overtopped by small modified leaves.

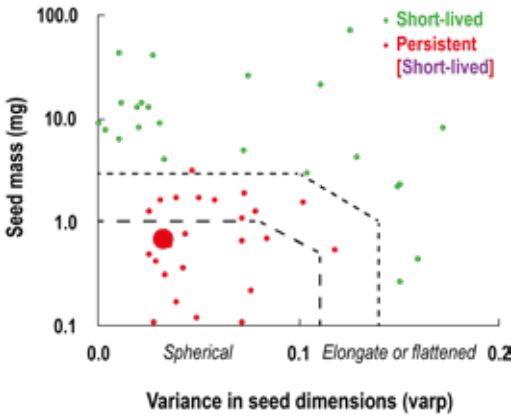
Main flowering time

April–July.

Seeds

Grey, ovoid, compressed with small parallel, horizontal lines and a small whitish apical body facilitating dispersal by ants; 1.2 x 0.7 mm; in a ridged, almost spherical longitudinal-splitting capsule 2 mm in length.

REGENERATION



Only by seed.

Seed size: Small, 0.5 mg; **Shape:** Broadly oblong; **Varp:** 0.03. **Predicted number of seeds per plant:** Medium, 1122. **Plant diameter:** Medium.

Seed dispersal in time

A long-persistent seed bank is predicted on the basis of seed size and shape but confirmatory field studies of seed bank longevity are required.

Seed dispersal in space

With the harvest: Classified in USA as a contaminant of crops (AOSA, 2014) but this low-growing weed may rarely contaminate cereal grain. **In soil transported by machinery and feet:** Yes. **Other:** No strong specialisations apparent for either wind or animal dispersal (other than by ants).

SEEDS

Seeds of Sickle Spurge (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A small, ascending, often basally branched, leafy annual arable weed.

Seasons of growth

Seed germination: Autumn or spring (uncertain which is the more important).

Plant growth: Vegetative growth mainly 'cool-season' with flowering and seed-set in summer.

Impact on crop establishment and yield: Low. Predicted to have too low a competitive ability to be an important weed, although still frequent in the organic arable fields of Provence.

LIFE HISTORY STRATEGY

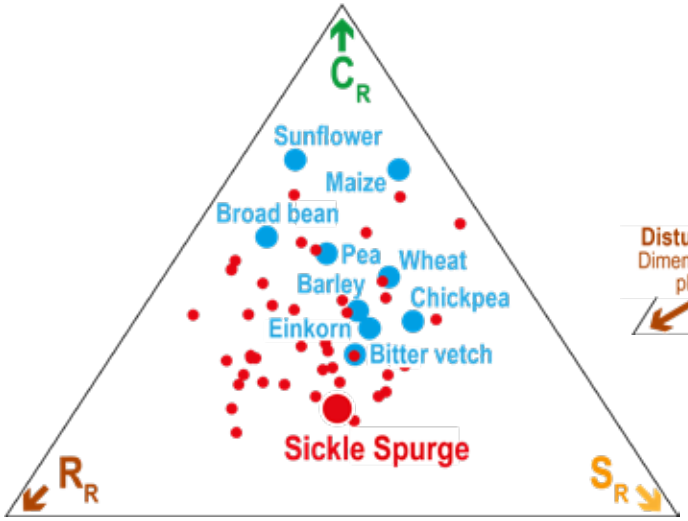
Comparison with wheat

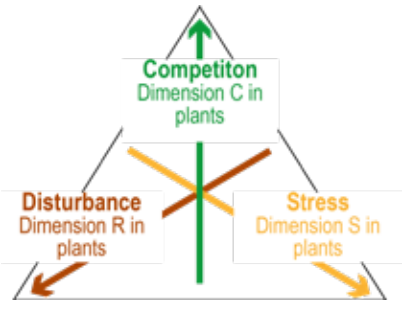
Seed yield: - - -

Soil fertility: =

Competitiveness: - - -

Disturbance: + +





Corn Cleavers Ⓜ

Rubiaceae

Galium tricornutum Dandy

IDENTIFICATION

Image by Stefan Lefnaer. Source: Wikimedia Commons. CC BY-SA 4.0

Image by Stefan Lefnaer. Source: Wikimedia Commons. CC BY-SA 4.0

Similar species

Cleavers (*G. aparine* L.) is even more robust, to 1.5 m or more, and its seeds both have hooked bristles and straight stalks. See also Wall bedstraw.

USES

Food: No use reported but the young shoots of the closely related Cleavers are eaten both raw and cooked (PFAF). **Toxicity:** None reported but Cleavers can cause severe skin irritation (PFAF). **Medicinal:** No use reported but Cleavers has medicinal use (PFAF). **Fodder:** No use reported.

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: Cereal mimic (a traditional arable weed). **Impact on agricultural production:** A potentially serious but declining weed (on soils of intermediate fertility). **Conservation status - Europe:** 57 % threatened; **France:** Quite rare. **Main agricultural habitats in France:** Winter and spring cereals and vineyards. **Occurrence in 2013 arable survey:** Still very common. In 73 % of fields and often at moderate to high population densities.

HABITAT

Climatic distribution: Weakly Mediterranean. **Soil type:** Dry clays and loams. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

Plant

A branched annual with weak, 4-angled, stems up to 1 m in length, either prostrate or ascending, supported by the crop. Plant covered in backward-pointing bristles.

Leaves

In whorls of 6–9; small, elongate; about 4 mm wide.

Flowers

Greenish-white; in axillary clusters; 1.5–2 mm in diameter. Petals 4.

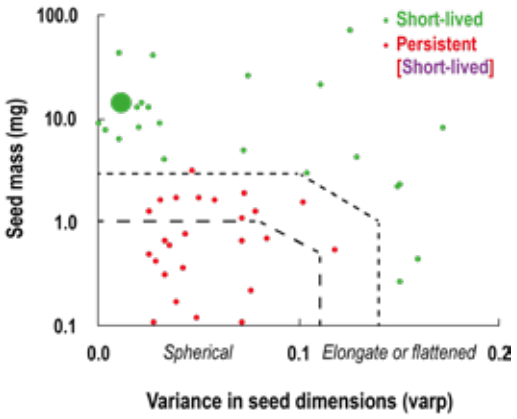
Main flowering time

June–September.

Seeds

Brown; globular with a dimpled surface; 3–4 mm in diameter; in pairs on a hooked stalk.

REGENERATION



Only by seed.

Seed size: Large, 13.3 mg, often shed as two-seeded units; **Shape:** Roundish and warty; **Varp:** 0.01. **Predicted number of seeds per plant:** Few, 197 [Measured: 109, Saatkamp *et al*. 2011]. **Plant diameter:** Large.

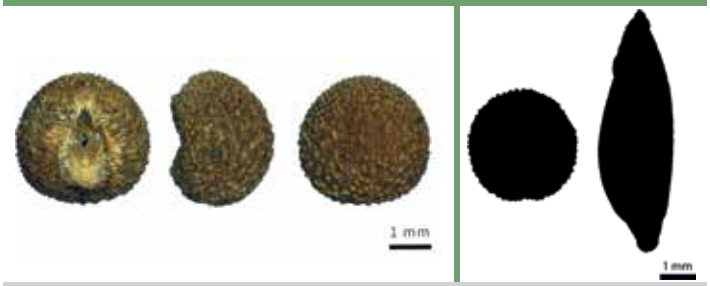
Seed dispersal in time

Seeds are large and germinate in the dark (Chauhan *et al*., 2006). Therefore, although persistence has been experimentally demonstrated (Saatkamp *et al*., 2009) the soil seed bank is probably, at best, shortly-persistent.

Seed dispersal in space

With the harvest: Yes. **In soil transported by machinery and feet:** Limited dispersal. **Other:** Not specialised for wind dispersal but seed-bearing shoots readily adhere to animals and clothing.

SEEDS



Seeds of Corn Cleavers (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A large, leafy, annual arable weed typically scrambling over and supported by the associated vegetation; otherwise prostrate.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set from summer onwards.

Impact on crop establishment and yield: A potentially serious but declining weed. Predicted to have a slightly lower competitive ability than wheat but can significantly reduce crop yields and is a potential contaminant of crop seed. Corn Cleavers is still common in the organic arable fields of Provence but is more abundant in less productive fields where the crop canopy is open. The seriousness of its economic impact here is uncertain.

LIFE HISTORY STRATEGY

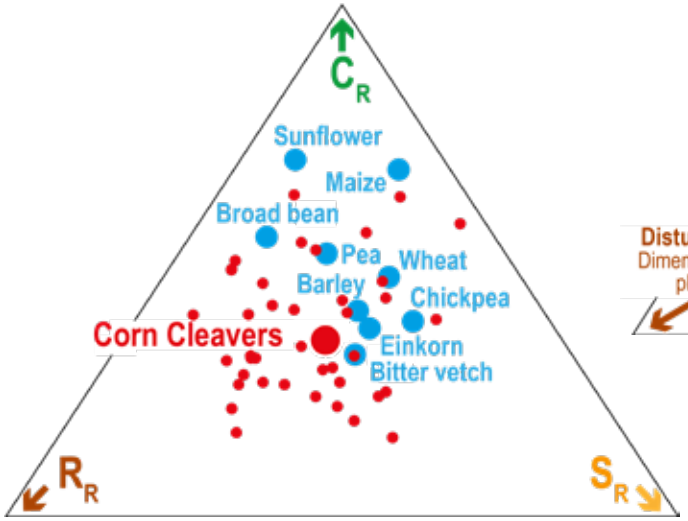
Comparison with wheat

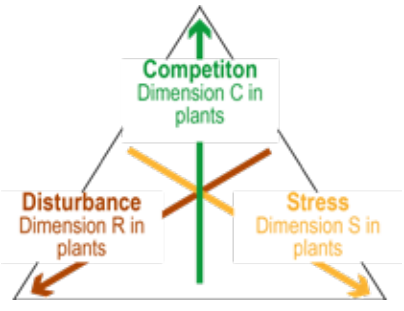
Seed yield: - - -

Soil fertility: =

Competitiveness: -

Disturbance: +





Round-leaved Fluellen

Plantaginaceae

***Kickxia spuria* (L.) Dumort.**

IDENTIFICATION

Image by Stefan Lefnaer. Source: Wikimedia Commons. CC BY-SA 4.0

Image by Olivier Pichard. Source: Wikimedia Commons. CC BY-SA 3.0

Similar species

Sharp-leaved Fluellen (*K. elatine* (L.) Dumort.) is less robust and less hairy and its middle and upper leaves are spear shaped. In subspecies elatine the flower stalks are hairless and in the less common subspecies *crinita* (Mabille) Greuter they are hairy.

USES

Food: No use reported. **Toxicity:** None reported. **Medicinal:** No use reported but Sharp-leaved Fluellen (*K. elatine* (L.) Dumort.) may have medicinal properties (PFAF). **Fodder:** No use reported.

Websites: www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: Early competitor and stubble (a traditional arable weed). **Impact on agricultural production:** A potentially serious but declining weed (on soils of intermediate fertility). **Conservation status - Europe:** 31 % threatened; **France:** Common. **Main agricultural habitats in France:** Spring cereals, potato, beet and vegetable crops. **Occurrence in 2013 arable survey:** Still frequent. In 40 % of fields and often at moderate to high population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Moist clays and loams. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

Plant

Much-branched, hairy annual to about 0.5 m; either completely prostrate or with one robust ascending and several longer less robust prostrate stems.

Leaves

Alternate; oval, declining in size up the stem; up to 3 cm wide.

Flowers

Yellow and purple; solitary, on long hairy stalks from leaf axils; 1 cm in diameter, with a backward-pointing spur of about 1 cm. Petals fused, strongly two lipped the lower yellow, the upper purple. Sepals 5, greenish, about half as long as the petals.

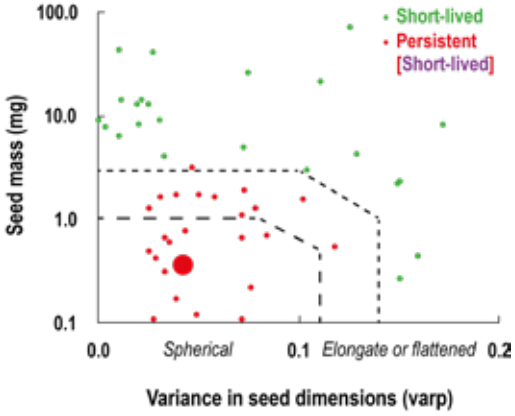
Main flowering time

June–October.

Seeds

Brown; oval, flattened with a dimpled surface; 1 x 0.5 mm; in a spherical capsule 4 x 4 mm, with an apical pore.

REGENERATION



Only by seed.

Seed size: Small, 0.3 mg; **Shape:** Broadly oblong and warty; **Varp:** 0.04. **Predicted number of seeds per plant:** Many, 4900. **Plant diameter:** Large.

Seed dispersal in time

A long-persistent seed bank is predicted on the basis of seed size and shape with data from the literature also supportive.

Seed dispersal in space

With the harvest: Yes, to a very limited extent but the plant is low-growing. **In soil transported by machinery and feet:** Yes. **Other:** No strong specialisations apparent for either wind or animal dispersal.

SEEDS

Seeds of Round-leaved Fluellen (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A small- to medium-sized, prostrate to ascending, much-branched, leafy annual arable weed.

Seasons of growth

Seed germination: Mainly spring.

Plant growth: Perhaps mainly 'warm-season' (spring–late summer) with growth potentially continuing late into autumn. Flowering and seed-set commences in early summer.

Impact on crop establishment and yield: A potentially serious but declining weed. Consistent with Dutoit *et al*. (2001), predicted to have a somewhat lower competitive ability than wheat. Still frequent in the organic arable fields of Provence but most abundant in less productive fields where the crop canopy is open. The seriousness of the economic impact of Round-leaved Fluellen here is uncertain.

LIFE HISTORY STRATEGY

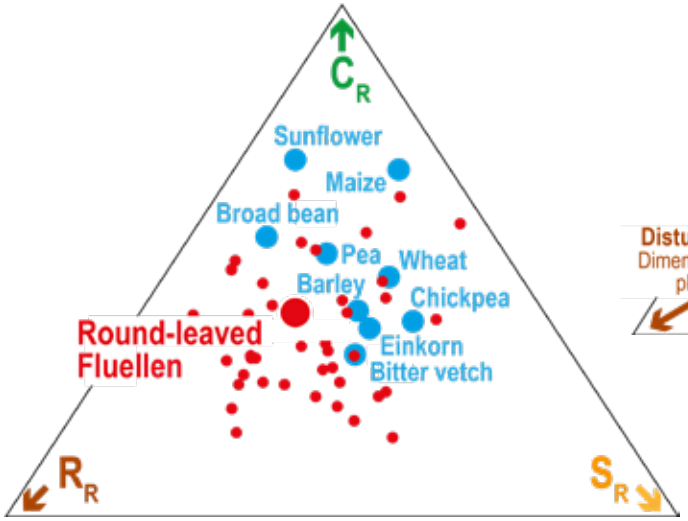
Comparison with wheat

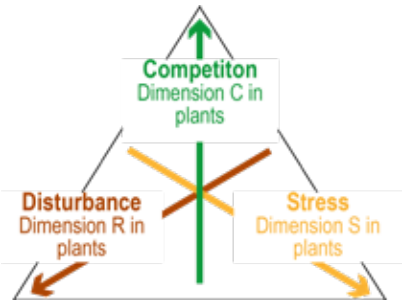
Seed yield: - -

Soil fertility: +

Competitiveness: -

Disturbance: +





Large Venus's-looking-glass Ⓜ

Campanulaceae

Legousia speculum-veneris (L.) Chaix

IDENTIFICATION

Image by Stefan Lefnaer. Source: Wikimedia Commons, CC BY-SA 4.0

Image by Mureil Bendel. Source: Wikimedia Commons, CC BY-SA 4.0

Similar species

Venus's-looking-glass (*L. hybrida* (L.) Delarbre) is smaller (to 30 cm), more hairy and with smaller flowers (to 10 mm across), petals, half as long as the sepals, and a larger, more robust capsule, to 30 mm.

USES

Food: Formerly consumed in salads. **Toxicity:** None reported. **Medicinal:** Has astringent properties. **Fodder:** No use reported.

Edible rating: 2 **Medicinal rating: 0**

References consulted: Couplan (2015)

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: Early competitor (a traditional arable weed). **Impact on agricultural production:** A potentially serious weed (on soils of intermediate fertility). **Conservation status - Europe:** 65 % threatened; **France:** Quite common. **Main agricultural habitats in France:** Winter and spring cereals and rape. **Occurrence in 2013 arable survey:** In 60 % of fields and often at moderate to high population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Dry clays and loams. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

Plant

Erect, slender, much branched, somewhat hairy annual; to about 0.5 m in height.

Leaves

Alternate; oval, with wavy edges; up to 15 mm wide.

Flowers

Purple; in loose terminal clusters; up to 2.5 cm in diameter when fully open. Petals 5 fused, broadening into a flat, lobed plate-like flower. Sepals 5, green, narrow, about equalling the petals.

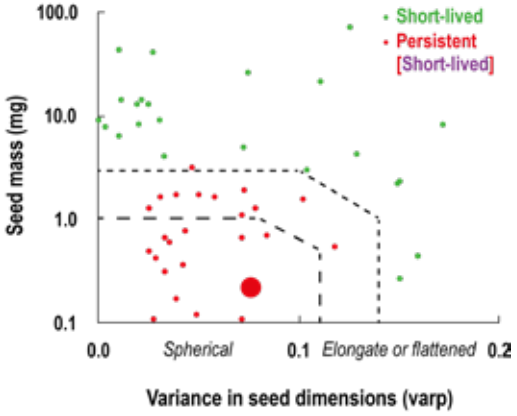
Main flowering time

May–June.

Seeds

Brown; oval; 1 x 0.7 mm; shed apically from a thin, ridged, cylindrical capsule up to 15 mm long.

REGENERATION



Only by seed.

Seed size: Small, 0.2 mg; **Shape:** Elongate; **Varp:** 0.08. **Predicted number of seeds per plant:** Medium, 698 [Measured: 806, Saatkamp *et al*. 2011]. **Plant diameter:** Small.

Seed dispersal in time

A long-persistent seed bank is predicted on the basis of seed size and shape with data from the literature also supportive.

Seed dispersal in space

With the harvest: Limited dispersal. **In soil transported by machinery and feet:** Yes. **Other:** Seed small and light perhaps with a limited capacity for wind dispersal but not strongly specialised for animal dispersal.

SEEDS

Seeds of Large Venus's-looking-glass (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A relatively short, erect, branched, leafy arable annual.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth 'cool-season' (autumn–early summer) with flowering and seed-set commencing in early summer.

Impact on crop establishment and yield: A potentially serious weed. Predicted to have an intermediate competitive ability. Remains a common weed in the organic arable fields of Provence, it probably impacts competitively primarily on the earlier stages of crop growth.

LIFE HISTORY STRATEGY

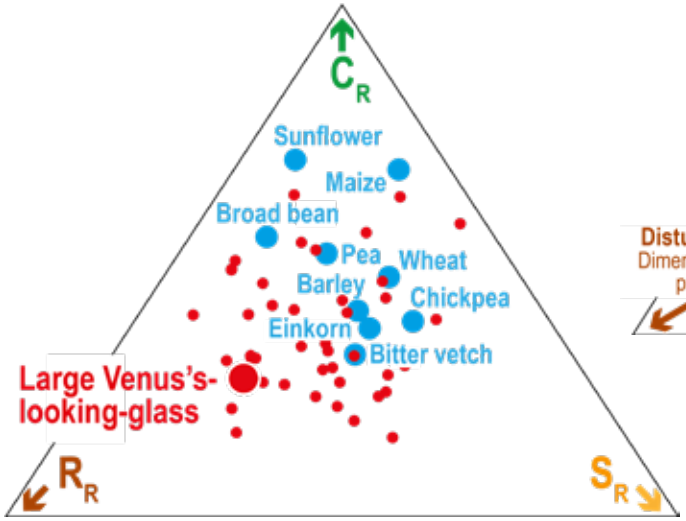
Comparison with wheat

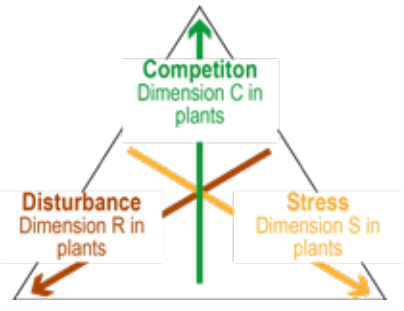
Seed yield: - - -

Soil fertility: +

Competitiveness: - -

Disturbance: + +





Corn Buttercup Ⓜ

Ranunculaceae

Ranunculus arvensis L.

IDENTIFICATION

Image by Arne Saatkamp ©

Image by Arne Saatkamp ©

Similar species

None.

USES

Food: No use reported. **Toxicity:** Contains anemonin and all parts are poisonous. Contact may cause skin blisters. **Medicinal:** Of potential use in the treatment of fevers, gout and asthma (PFAF). **Fodder:** No use reported but toxins are destroyed by drying.

Edible rating: 0 **Medicinal rating: 1**

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: Cereal mimic (a traditional arable weed). **Impact on agricultural production:** A serious but declining weed (particularly on soils of intermediate fertility). **Conservation status - Europe:** 43 % threatened; **France:** Quite common. **Main agricultural habitats in France:** Winter and spring cereals, rape, vineyards and orchards. **Occurrence in 2013 arable survey:** Still very common. In 67 % of fields generally at moderate population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Moist clayey to sandy soils. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

Plant

Erect, often much branched, hairless annual; to 0.5 m or more in height.

Leaves

Alternate; the lowest oblong with lobes up to 8 mm wide; the upper more deeply divided.

Flowers

Lemon yellow, glossy, cup-shaped; 5–12 mm in diameter. Petals 5; longer than the sepals.

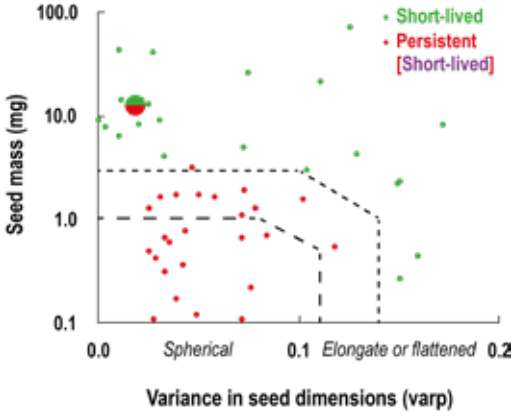
Main flowering time

June–July.

Seeds

Brown, oval, flattened, covered in spines up to 2 mm in length; 8 x 4 mm; in a conical head.

REGENERATION



Only by seed.

Seed size: Large, 12.1 mg; **Shape:** Oval, flattened and spiny; **Varp:** 0.02. **Predicted number of seeds per plant:** Few, 104 [Measured: 151, Saatkamp *et al*. 2011]. **Plant diameter:** Medium.

Seed dispersal in time

Few seeds produced per plant and on the basis of only seed size and shape no persistent soil seed bank is predicted. Nevertheless, there are a few records of a persistent soil seed bank (see also Saatkamp *et al*. 2009, 2011). Overall, evidence points to a small and possibly long-persistent seed bank.

Seed dispersal in space

With the harvest: Yes. **In soil transported by machinery and feet:** Limited dispersal. **Other:** Not specialised for wind dispersal but readily adhering to animals and clothing.

SEEDS

Seeds of Corn Buttercup (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A medium-sized, erect, semi-rosette, branched annual arable weed.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn–early summer) with flowering and seed-set in summer.

Impact on crop establishment and yield: A serious but declining weed. Consistent with Dutoit *et al*. (2001), predicted to have an intermediate competitive ability and is also a potential contaminant of crop seed. Since there are few reports of it causing reductions in crop yields Corn Buttercup is perhaps not an important arable weed. Nevertheless, it remains a common if decreasing weed in the organic arable fields of Provence.

LIFE HISTORY STRATEGY

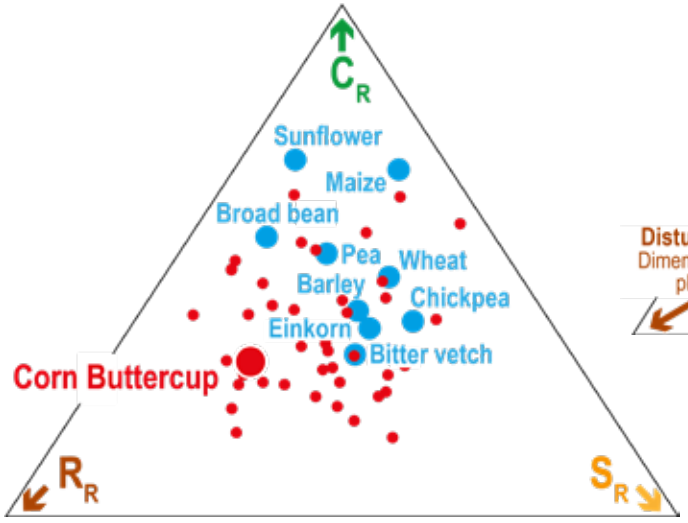
Comparison with wheat

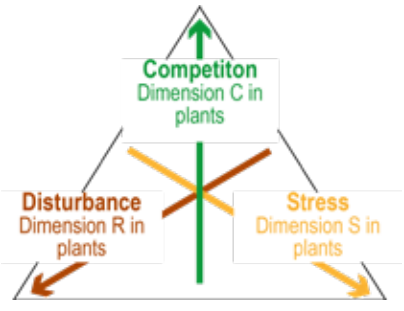
Seed yield: - -

Soil fertility: =

Competitiveness: - -

Disturbance: + +





Pheasant's-eye Ⓜ

Ranunculaceae

Adonis annua L.

IDENTIFICATION

Image by Daniel Pavon ©

Image by Daniel Pavon ©

Similar species

All species of Adonis are uncommon and decreasing. Most similar to Summer Pheasant's-eye (*Adonis aestivalis* L.), with slightly larger, differently-shaped seeds. See also the next species (Large Pheasant's-eye [*A. flammea* Jacq.]).

USES

Food: No use reported. **Toxicity:** Poisonous with glycosides ('adonidine') present throughout the plant. These may cause digestive, cardiac and renal disorders and may lead to death through paralysis of the respiratory system. **Medicinal:** Despite its toxicity, the plant can be used in pharmaceutical preparations to treat heart and diuretic problems. However, the use of this potentially dangerous medicine by non-experts is not permitted. **Fodder:** No use reported. Poisonous.

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: Cereal mimic (a traditional arable weed). **Impact on agricultural production:** Low. (A rare weed.) **Conservation status - Europe:** 60 % threatened; **France:** Rare and of conservation concern. **Main agricultural habitats in France:** [Winter cereals.] **Occurrence in 2013 arable survey:** Unrecorded in survey.

HABITAT

Climatic distribution: Weakly Mediterranean. **Soil type:** Dry clays and loams. **Soil reaction:** Basic to neutral. **Soil fertility:** Relatively infertile.

Plant

Erect, usually hairless annual; to 0.5 m or more in height.

Leaves

Alternate; finely-dissected, with narrow, parallel-sided lobes less than 1 mm wide.

Flowers

Scarlet, black at base, cup-shaped; 1.5–2.5 cm in diameter. Petals 5 to 8; sepals inconspicuous, without hairs.

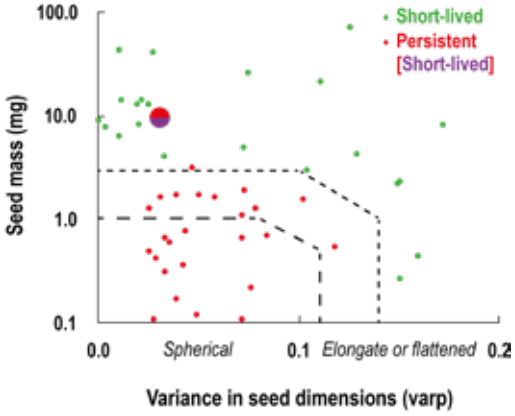
Main flowering time

May.

Seeds

Greenish throughout, claw-shaped, 5 x 4 mm; in a conical head.

REGENERATION



Only by seed.

Seed size: Large, 8.6 mg; **Shape:** Rounded and angled; **Varp:** 0.03. **Predicted number of seeds per plant:** Very few, 40 [Measured: 161, Saatkamp *et al*. 2011]. **Plant diameter:** Medium.

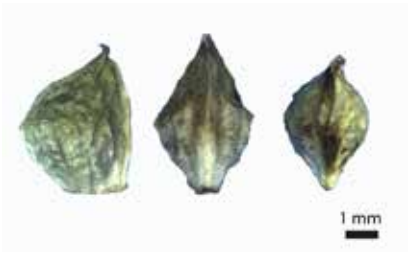
Seed dispersal in time

Few seeds produced per plant and on the basis of only seed size and shape no persistent soil seed bank is predicted. Nevertheless, there are a few records of a persistent soil seed bank (see also Saatkamp *et al*. 2009, 2011). Overall, evidence points to a small and possibly long-persistent seed bank.

Seed dispersal in space

With the harvest: Yes. **In soil transported by machinery and feet:** Limited dispersal. **Other:** No strong specialisations apparent for either wind or animal dispersal.

SEEDS



Seeds of Pheasant's-eye (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An erect, leafy, typically branched, medium-sized annual arable weed.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set in summer.

Impact on crop establishment and yield: Low. Although, consistent with Dutoit *et al*. (2001), predicted to have an intermediate competitive ability and is also a potential contaminant of crop seed, Pheasant's-eye is too rare to be an important weed in the organic arable fields of Provence.

LIFE HISTORY STRATEGY

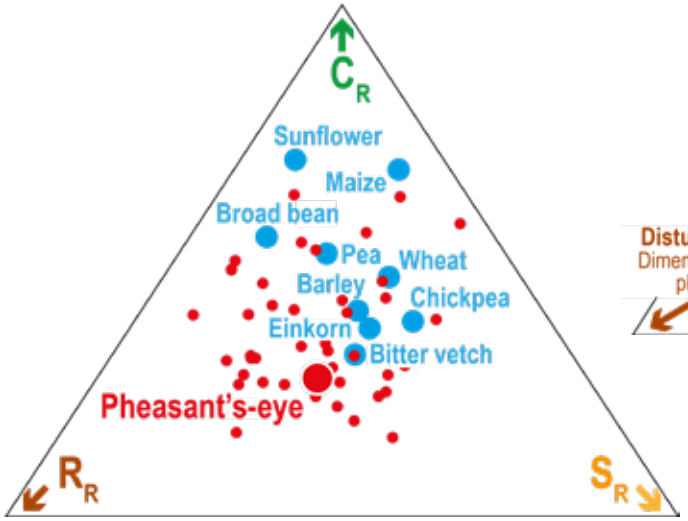
Comparison with wheat

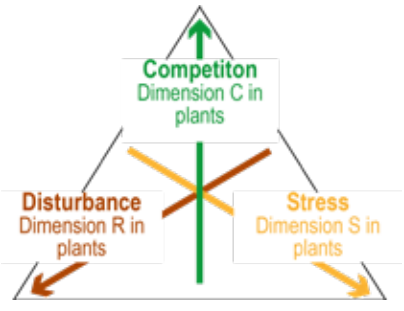
Seed yield: - -

Soil fertility: =

Competitiveness: - -

Disturbance: + +





Large Pheasant's-eye Ⓜ

Ranunculaceae

Adonis flammea Jacq.

IDENTIFICATION

Image by J.C. Villaret, CBNA ©

Image by Arne Saatkamp ©

Image by Arne Saatkamp ©

Similar species

The least rare species, distinguished by its hairy sepals and black-tipped seeds.

USES

Food: No use reported. **Toxicity:** Little information but chemical properties, and toxicity, similar to those of Pheasant's-eye (*A. annua* L.). **Medicinal:** No use reported, but see Pheasant's-eye. **Fodder:** No use reported. Poisonous.

Websites: www.tela-botanica.org, https://inpn.mnhn.fr/espece/cd_nom/80224

ECOLOGY

Type of weed: Cereal mimic (a traditional arable weed). **Impact on agricultural production:** Low. (A rare weed.) **Conservation status - Europe:** 89 % threatened; **France:** Rare and of conservation concern. **Main agricultural habitats in France:** [Winter cereals.] **Occurrence in 2013 arable survey:** Rare. In 10 % of fields and at very low population densities.

HABITAT

Climatic distribution: Weakly Mediterranean. **Soil type:** Dry clays and loams. **Soil reaction:** Basic to neutral. **Soil fertility:** Relatively infertile.

Plant

Erect, mostly hairless annual; to 0.5 m or more in height.

Leaves

Alternate; finely-dissected, with narrow, parallel-sided lobes less than 1 mm wide.

Flowers

Scarlet, black at base, cup-shaped, solitary; 1.5–2.5 cm in diameter. Petals 5 to 8; sepals inconspicuous, with long hairs.

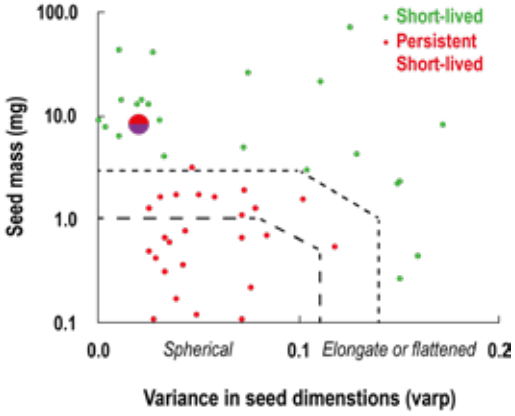
Main flowering time

May.

Seeds

Greenish with a black tip, claw-shaped, 5 x 4 mm; in a conical head.

REGENERATION



Only by seed.

Seed size: Large, 7.8 mg; **Shape:** Rounded and angled; **Varp:** 0.02. **Predicted number of seeds per plant:** Very few, 44 [Measured: 672, Saatkamp *et al*. 2011]. **Plant diameter:** Medium.

Seed dispersal in time

Few seeds produced per plant and on the basis of only seed size and shape no persistent soil seed bank is predicted. Nevertheless, there are a few records of a persistent soil seed bank (see also Saatkamp *et al*. 2009, 2011). Overall, evidence points to a small and possibly long-persistent seed bank.

Seed dispersal in space

With the harvest: Yes. **In soil transported by machinery and feet:** Limited dispersal. **Other:** No strong specialisations apparent for either wind or animal dispersal.

SEEDS

Seeds of Large Pheasant's-eye (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An erect, leafy, typically branched, medium-sized annual arable weed.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set in summer.

Impact on crop establishment and yield: Low. Although predicted to have an intermediate competitive ability and is also a potential contaminant of crop seed, Large Pheasant's-eye is too rare to be an important weed in the organic arable fields of Provence.

LIFE HISTORY STRATEGY

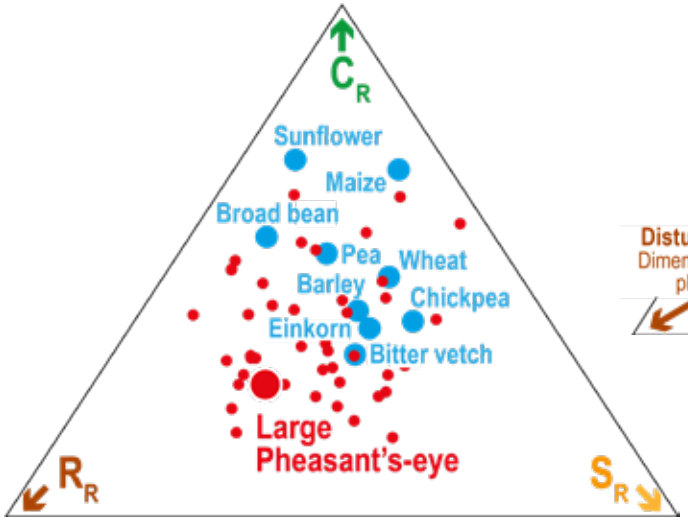
Comparison with wheat

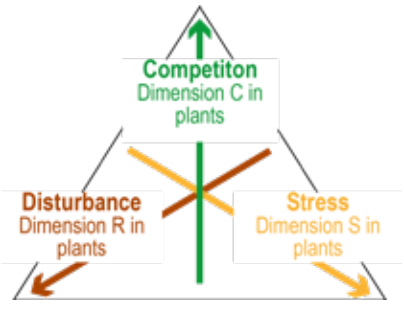
Seed yield: - -

Soil fertility: +

Competitiveness: - -

Disturbance: + +





Annual Androsace Ⓜ

Primulaceae

Androsace maxima L.

IDENTIFICATION

Image by Arne Saatkamp ©

Image by Arne Saatkamp ©

Similar species

None.

USES

Food: No use reported. **Toxicity:** Because of its toxicity, the plant should not be taken internally. **Medicinal:** Has diuretic properties. **Fodder:** No use reported.

Websites: www.tela-botanica.org

ECOLOGY

Type of weed: Vernal transient. **Impact on agricultural production:** Low. (A rare weed.) **Conservation status - Europe:** 47 % threatened; **France:** Rare. **Main agricultural habitats in France:** [Vineyards and spring cereals.] **Occurrence in 2013 arable survey:** In 17 % of fields and at very low population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Dry loams and clays. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

Plant

Diminutive, sparsely hairy annual with erect or spreading flowering stems; typically less than 6 cm high.

Leaves

In a basal rosette; oval; up to 1 cm wide; almost or completely withering by the time that seed set. Additionally, a whorl of persistent, slightly smaller leaves subtends the flower.

Flowers

White or pink, in loose terminal clusters; 3–4 mm in diameter. Petals 5, fused together; about 5 mm long. Sepals green, narrowly oval, leaf-like, twice as long and much more conspicuous than the petals.

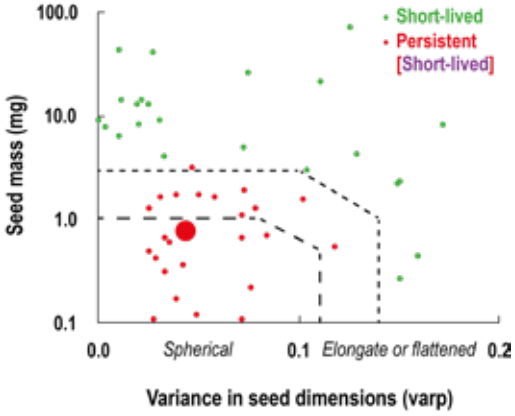
Main flowering time

April–May.

Seeds

Brown, minute; in a spherical capsule splitting almost to the base.

REGENERATION



Only by seed.

Seed size: Small, 0.8 mg; **Shape:** Broadly oblong; **Varp:** 0.04. **Predicted number of seeds per plant:** Few, 145 [Measured: 42, Saatkamp *et al*. 2011]. **Plant diameter:** Small.

Seed dispersal in time

A long-persistent seed bank is both predicted on the basis of seed size and shape and has been reported from the field.

Seed dispersal in space

With the harvest: Not dispersed; plant low-growing and seed set very early. **In soil transported by machinery and feet:** Yes. **Other:** Seed small and light but no strong specialisations apparent for either wind or animal dispersal.

SEEDS

Seeds of Annual Androsace (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A small, erect, rosette-forming annual of bare ground and crop fields.

Seasons of growth

Seed germination: Autumn.

Plant growth: Vegetative growth 'cool-season' (autumn–spring) with flowering and seed-set in spring. Plant already dead by early summer.

Impact on crop establishment and yield: Low. Predicted to have a very low competitive ability and too rare in the organic arable fields of Provence to be an important weed.

LIFE HISTORY STRATEGY

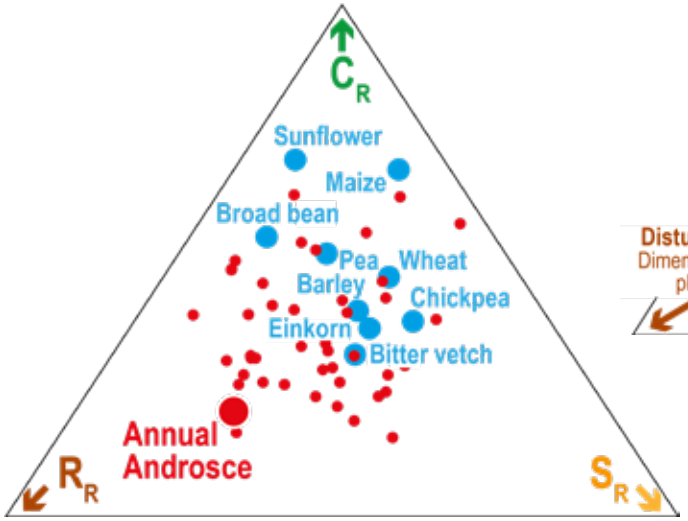
Comparison with wheat

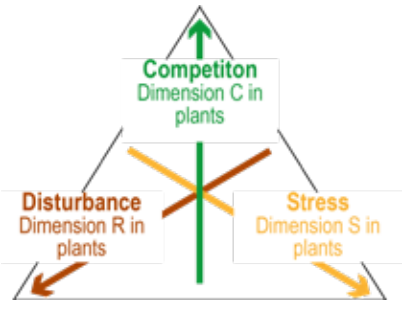
Seed yield: - - -

Soil fertility: +

Competitiveness: - - -

Disturbance: + + +





Lesser Gold-of-pleasure Ⓜ

Brassicaceae

Camelina microcarpa Andrz. ex DC.

IDENTIFICATION

Image by Matt Lavin. Source: Wikimedia Commons. CC BY-SA 2.0

Image by Matt Lavin. Source: Wikimedia Commons. CC BY-SA 2.0

Similar species

C. rumelica Velen. has a persistent basal leaf rosette, longer hairs (about 3.5 mm) at the base of the stem and petals about 7 mm.

USES

Food: Formerly grown in Russia for its seed oil, which was used both for human consumption and as a fuel for lamps. Now, its potential as a source of edible oil and biofuel is being explored. **Toxicity:** The 'oil cake' after extraction may be slightly toxic. **Medicinal:** No use reported. **Fodder:** The 'oil cake' may be fed to livestock but see 'Toxicity' above.

Websites: http://www.luontoportti.com/suomi/fr/kukkakasvit/cameline-a-petits-fruits

ECOLOGY

Type of weed: Cereal mimic (a traditional arable weed). **Impact on agricultural production:** Low. (A rare weed.) **Conservation status - Europe:** 34 % threatened; **France:** Rare and of conservation concern. **Main agricultural habitats in France:** Winter cereals. **Occurrence in 2013 arable survey:** Uncommon. In 12 % of fields and at low population densities.

HABITAT

Climatic distribution: Weakly Mediterranean. **Soil type:** Dry sandy loams to clays. **Soil reaction:** Wide-ranging. **Soil fertility:** Intermediate.

Plant

Erect annual; up to about 1 m; hairy below (hairs about 2 mm long).

Leaves

Alternate, elongate, up to 3 cm wide. Basal rosette withering before flowering. Stem leaves clasping the stem.

Flowers

Pale yellow; in elongate terminal spikes. Petals 4; up to 5 mm in length. Sepals inconspicuous.

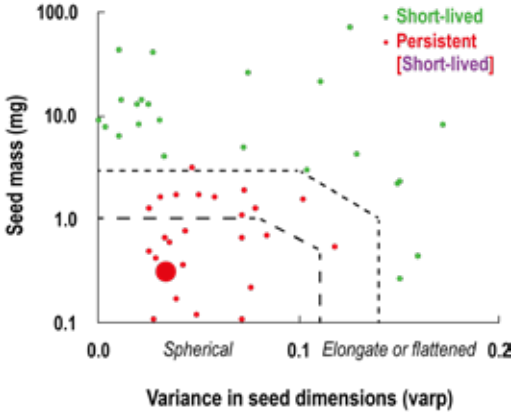
Main flowering time

May–June.

Seeds

Pale brown; oval, flattened; 1.4 x 0.7 mm; in a globular, longitudinally-splitting capsule.

REGENERATION



Only by seed.

Seed size: Small, 0.3 mg; **Shape:** Broadly oblong; **Varp:** 0.03. **Predicted number of seeds per plant:** Very many, 7187. **Plant diameter:** Medium.

Seed dispersal in time

A long-persistent seed bank is predicted on the basis of seed size and shape, a result consistent with the findings of Saatkamp *et al*. (2009, 2011).

Seed dispersal in space

With the harvest: Potentially yes, but only likely to be dispersed with early-harvested crops. **In soil transported by machinery and feet:** Yes. **Other:** When dry, the small seeds of this relatively tall species may perhaps have a limited capacity for wind dispersal. The imbibed seeds are mucilaginous and may adhere to animals and clothing.

SEEDS

Seeds of Lesser Gold-of-pleasure (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An erect, leafy, sparingly branched, medium-sized annual arable weed.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set in summer.

Impact on crop establishment and yield: Low. Predicted to have a competitive ability similar to that of wheat but matures and therefore sets seed earlier and probably competes more effectively during early parts of the growing period. It is also a potential contaminant in the seed of shorter early-maturing crops. Lesser Gold-of-pleasure was only recorded in our survey of the organic arable fields of Provence at low densities and appears to be declining.

LIFE HISTORY STRATEGY

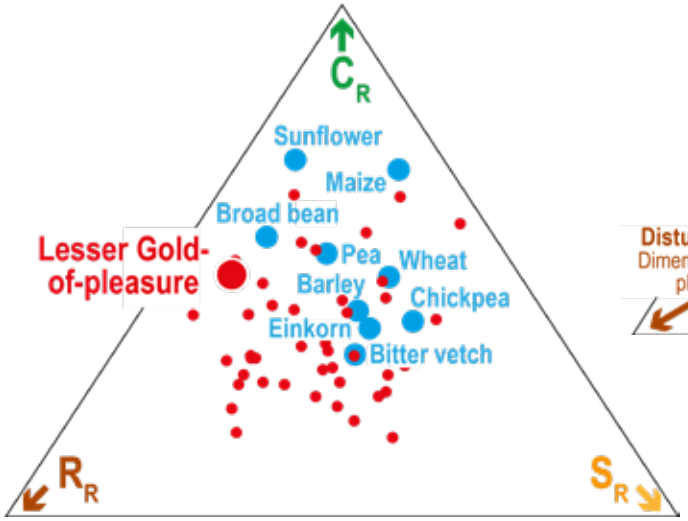
Comparison with wheat

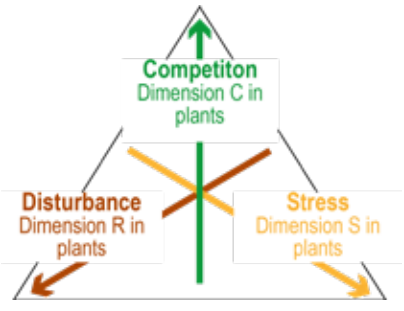
Seed yield: - - -

Soil fertility: + +

Competitiveness: =

Disturbance: +





Small Bur-parsley Ⓜ

Apiaceae

Caucalis platycarpos L.

IDENTIFICATION

Image by Stefan Lefnaer. Source: Wikimedia Commons. CC BY-SA 4.0

Image by Arne Saatkamp ©

Similar species

In *Orlaya* the spines on the fruit are straight and, unlike *Caucalis*, there are well-developed leaf-like structures at the base of the spokes. Flat-fruited *Orlaya* (*Orlaya kochii* Heywood) 2–4 spokes and the rarer Large-flowered *Orlaya* (*O. grandiflora* (L.) Hoffm.) has 5–12. Also Spreading Hedge-parsley (*Torilis arvensis* (Huds.) Link) has small fruits (4–6 mm long) covered in slender, forwardly directed spines.

USES

Food: Despite having a bitter, pungent and unpleasant taste this species was grown as a vegetable by the ancient Greeks and Romans. According to Couplan (2015), the plant was still used in recent times around Montpellier and also in Anatolia. **Toxicity:** None reported. **Medicinal:** No use reported. **Fodder:** No use reported.

Edible rating: 2 **Medicinal rating: 0**

References consulted: Couplan (2015)

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: Intermediate between early competitor and cereal mimic (a traditional arable weed). **Impact on agricultural production:** Low. (A rare weed.) **Conservation status - Europe:** 60 % threatened; **France:** Quite rare. **Main agricultural habitats in France:** Winter and spring cereals and rape. **Occurrence in 2013 arable survey:** Very rare. In only 3 % of fields and at extremely low population densities.

HABITAT

Climatic distribution: Weakly Mediterranean. **Soil type:** Dry clays and loams. **Soil reaction:** Basic to neutral. **Soil fertility:** Relatively infertile.

Plant

Erect, spreading, slightly hairy annual; about 30 cm in height.

Leaves

Alternate; finely-dissected, with narrow, parallel-sided lobes less than 2 mm wide.

Flowers

White; in a loose circular head up to 3 cm in diameter. Heads consist of 2–5 unequal radiating stalks (like bicycle spokes); each terminating in clusters of 6–12 flowers, each about 2 mm in diameter.

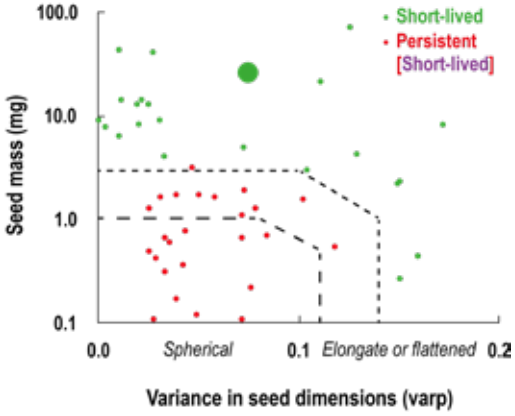
Main flowering time

June–July.

Seeds

Brown; elongate, with scattered coarse spines curved at the tip; 13 x 5 mm; in terminal pairs.

REGENERATION



Only by seed.

Seed size: Large, 24.2 mg; **Shape:** Elongate and spiny; **Varp:** 0.08. **Predicted number of seeds per plant:** Very few, 49 [Measured: 8, Saatkamp *et al*. 2011]. **Plant diameter:** Medium.

Seed dispersal in time

The absence of a persistent seed bank is predicted on the basis of seed size and shape, a result consistent with the findings of Saatkamp *et al*. (2009, 2011).

Seed dispersal in space

With the harvest: Yes. **In soil transported by machinery and feet:** Limited dispersal. **Other:** Not specialised for wind dispersal but readily adhering to animals and clothing.

SEEDS

Seeds of Small Bur-parsley (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An erect, leafy, branched, small- to medium-sized annual arable weed.

Seasons of growth

Seed germination: Autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn–early summer) with flowering and seed-set in late spring to summer.

Impact on crop establishment and yield: Low. Although predicted to have an intermediate competitive ability, the declining Small Bur-parsley was too rare in our survey of the organic arable fields of Provence to be considered a significant weed. However, we may be underestimating its potential impact. Dutoit *et al*. (2001) consider it more competitive than is suggested by our measurements.

LIFE HISTORY STRATEGY

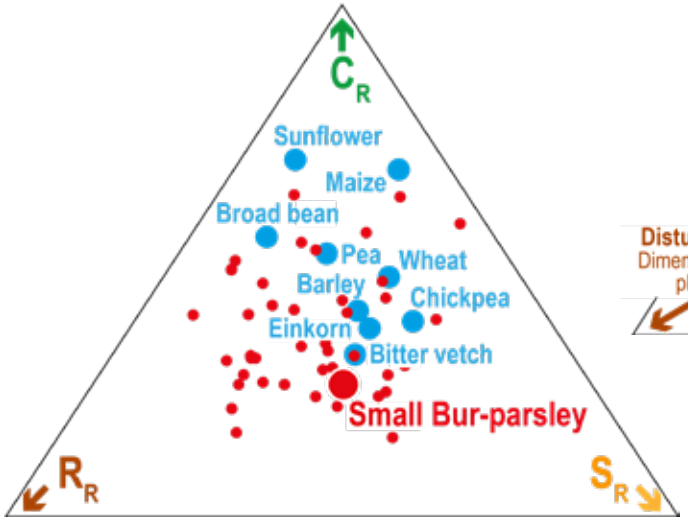
Comparison with wheat

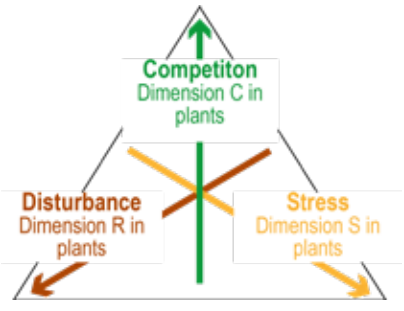
Seed yield: -

Soil fertility: =

Competitiveness: - -

Disturbance: + +





Forking Larkspur (M)

Ranunculaceae

Consolida regalis Gray, Syn: *Delphinium consolida* L.

IDENTIFICATION

Image by H. Zell. Source: Wikimedia Commons, CC BY-SA 3.0

Image by H. Zell. Source: Wikimedia Commons, CC BY-SA 3.0

Similar species

In related species the leaves below the lower flowers are divided. *C. pubescens* (DC.) Soó is also densely hairy, with pale blue or pink flowers and Larkspur (*C. ajacis* (L.) Schur) has deep blue flowers.

USES

Food: Not eaten because of its toxicity although, prepared with alum, the natural colour of its petals was used by confectioners and dyers. **Toxicity:** The plant, and particularly the seeds, contain toxic alkaloids and seed harvested with the cereal crop contaminates flour. The toxicity is similar to that of Monk's-hood (*Aconitum*), but less severe. **Medicinal:** According to Cazin (1868), due to its similarity to Monk's-hood, the plant must be treated with circumspection with respect to internal usage. Has been regarded as a diuretic and used to treat kidney stones, chronic problems in the urinary tract and as a treatment for worms. A few drops of an alcoholic tincture has been added to herbal tea in England to treat breathing problems. However, the efficacy of these uses requires further study. **Fodder:** Toxic and "goats and sheep are the only animals that eat this plant without repugnance, the family to which it belongs making it suspicious" (Cazin 1868).

Edible rating: 0 **Medicinal rating: 3**

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org, http://uses.plantnet-project.org/fr/Pied_c%27alouette_(Cazin_1868)

http://www.luontoportti.com/suomi/fr/kukkakasvit/pied-dalouette-royal

ECOLOGY

Type of weed: Cereal mimic (a traditional arable weed). **Impact on agricultural production:** Low. (A rare weed.) **Conservation status - Europe:** 34 % threatened; **France:** Quite rare. **Main agricultural habitats in France:** Winter cereals and rape. **Occurrence in 2013 arable survey:** Uncommon. In 12 % of fields and at low population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Dry clays and loams. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

Plant

Erect, slender annual; to 0.5 m or more, with short backward-pointing hairs.

Leaves

Alternate; finely-dissected, with parallel-sided lobes less than 2 mm wide; those immediately below the flowers, smaller and undivided.

Flowers

Blue-violet; in terminal spikes; up to 3.5 cm in diameter. Sepals petal-like 5, the upper with a backward-projecting spur of 1.5–2.5 cm; petals 2, fused, much smaller.

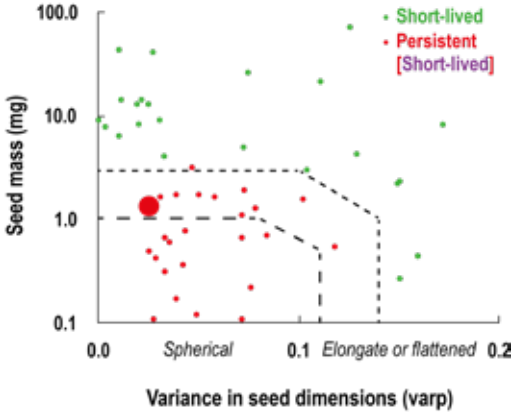
Main flowering time

June–August.

Seeds

Black; triangular, covered in scale-like projections; 2.5 x 2.5 mm; shed from the top of a hairless, cylindrical capsule (up to 15 x 5 mm).

REGENERATION



Only by seed.

Seed size: Intermediate, 1.3 mg; **Shape:** Broadly oblong; **Varp:** 0.03. **Predicted number of seeds per plant:** Medium, 450 [Measured: 227, Saatkamp *et al*. 2011]. **Plant diameter:** Medium.

Seed dispersal in time

A long-persistent seed bank is both predicted on the basis of seed size and shape and has been reported from the field.

Seed dispersal in space

With the harvest: Yes. **In soil transported by machinery and feet:** Yes. **Other:** Not specialised for wind dispersal but the scaly seed surface may perhaps adhere to animals and clothing.

SEEDS

Seeds of Forking Larkspur (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An erect, leafy, sparingly branched, medium-sized annual arable weed.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set in summer.

Impact on crop establishment and yield: Low. Predicted to have a low competitive ability and is also a potential contaminant of crop seed. Nevertheless, Forking Larkspur is too rare in the organic arable fields of Provence to be an important weed.

LIFE HISTORY STRATEGY

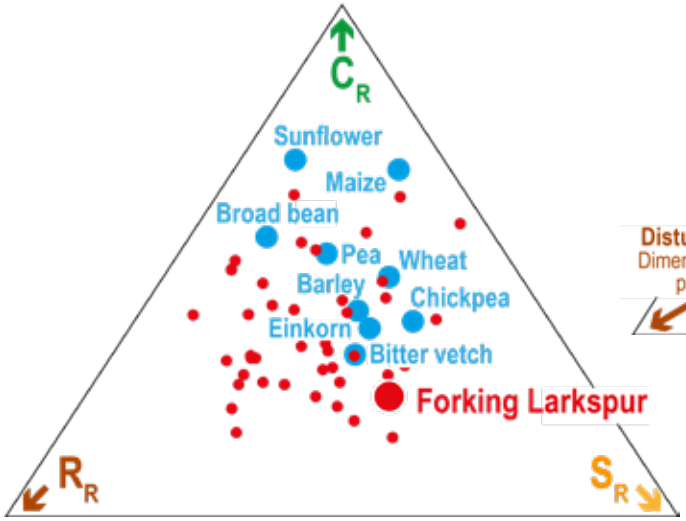
Comparison with wheat

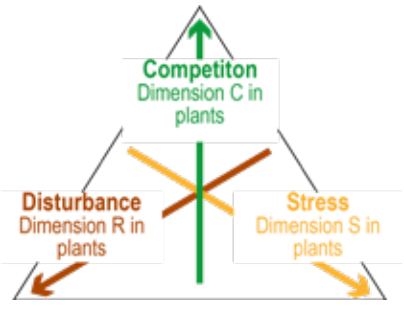
Seed yield: - -

Soil fertility: =

Competitiveness: - - -

Disturbance: + +





Mitre Cress Ⓜ

Brassicaceae

Myagrum perfoliatum L.

IDENTIFICATION

Image by Yildiz Aumeeruddy-Thomas, CEFE ©

Image by Yildiz Aumeeruddy-Thomas, CEFE ©

Similar species

None.

USES

Food: No use reported. **Toxicity:** None reported. **Medicinal:** No use reported. **Fodder:** No use reported.

Websites: http://www.florealpes.com/fiche_myagrumperfoliatum.php

ECOLOGY

Type of weed: Cereal mimic (a traditional arable weed). **Impact on agricultural production:** Low. (A rare weed.) **Conservation status - Europe:** 21 % threatened; **France:** Rare. **Main agricultural habitats in France:** Winter cereals and rape. **Occurrence in 2013 arable survey:** Uncommon. In 13 % of fields but often at moderate population densities.

HABITAT

Climatic distribution: Weakly Mediterranean. **Soil type:** Moist clays and loams. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

Plant

Erect, hairless, greyish, annual; up to about 1 m.

Leaves

Alternate, elongate, up to 3 cm wide. Basal rosette withering before flowering. Stem leaves clasping the stem.

Flowers

Yellow; in elongate terminal spikes. Petals 4, up to 5 mm in length. Sepals inconspicuous.

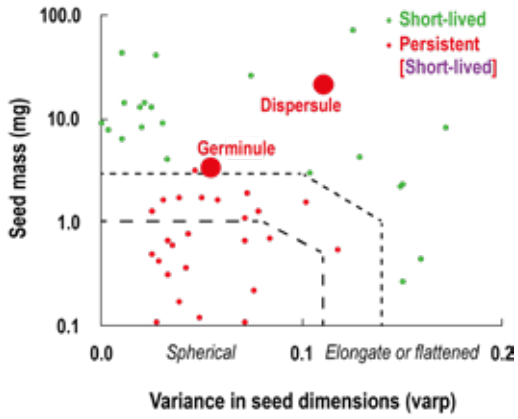
Main flowering time

May–June.

Seeds

Brown; oval; 2 x 0.8 mm; 1 in each, erect, indehiscent club-shaped fruit, 7 x 4 mm.

REGENERATION



Only by seed.

Seed size: Dispersule large, 20.3 mg; Germinule 3.3 mg; **Shape:** Broadly oblong; **Varp:** 0.11. **Predicted number of seeds per plant:** Medium, 696. **Plant diameter:** Medium.

Seed dispersal in time

On the basis of seed (dispersule) size and shape no persistent soil seed bank is expected. However, the germinule is much smaller and a long-persistent seed bank has been recorded (Victoria Resources Online).

Seed dispersal in space

With the harvest: Yes. **In soil transported by machinery and feet:** Limited dispersal. **Other:** Not strongly specialised for wind dispersal but detached plants may function as a 'tumble-weed'. Not readily adhering to animals and clothing but has been recorded as a contaminant of wool.

SEEDS

Seeds of Mitre Cress (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A medium-sized, branched, leafy arable annual.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn–early summer) with flowering and seed-set commencing in early summer.

Impact on crop establishment and yield: Low. Predicted to be nearly as competitive as wheat and there are old records (in Australia) of it causing 50 % reductions in crop yields. It is also a potential contaminant of crop seed. However, Mitre Cress is now uncommon in the organic arable fields of Provence and therefore perhaps not of agricultural concern.

LIFE HISTORY STRATEGY

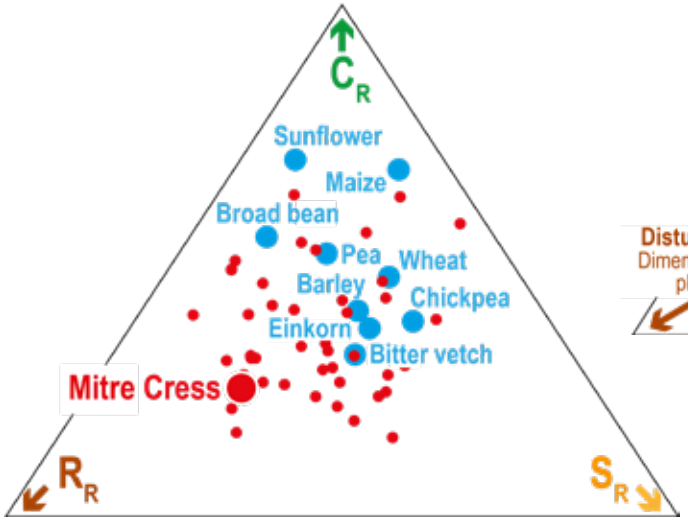
Comparison with wheat

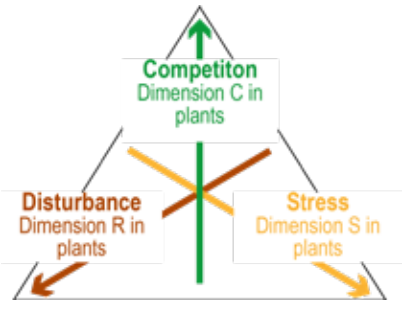
Seed yield: - -

Soil fertility: +

Competitiveness: -

Disturbance: + +





Prickly Poppy M

Papaveraceae

Papaver argemone L.

IDENTIFICATION

Photo par Stefan Lefnaer, Wikimedia Commons, CC BY-SA 4.0

Photo par Daniel Pavon ©

Photo par Gilles Pache, CBNA ©

Similar species

See Common Poppy (*P. rhoeas*).

USES

Food: No use reported. **Toxicity:** The plant, but not the seed, has a low toxicity to mammals (PFAF). **Medicinal:** Used to induce sweating (PFAF). **Fodder:** No use reported.

Edible rating: 0 **Medicinal rating: 1**

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org

ECOLOGY

Type of weed: Cereal mimic (a traditional arable weed). **Impact on agricultural production:** A potentially serious but declining weed (on soils of intermediate fertility). **Conservation status - Europe:** 48 % threatened; **France:** Quite common. **Main agricultural habitats in France:** Winter cereals and vineyards. **Occurrence in 2013 arable survey:** Rare. In 10 % of fields and only at low population densities.

HABITAT

Climatic distribution: Wide-ranging. **Soil type:** Dry clay, loam and sandy soils. **Soil reaction:** Wide-ranging. **Soil fertility:** Intermediate.

Plant

Erect, branched, coarsely-hairy annual; typically less than 0.5 m with most leaves towards the base. Cut stems and leaves exude a white juice.

Leaves

Alternate; deeply divided with terminal lobes less than 4 mm wide.

Flowers

Scarlet, often black at the base; solitary, long-stalked; up to 7 cm in diameter. Petals 4, longer than broad, up to 3 cm. Sepals shed before flowering.

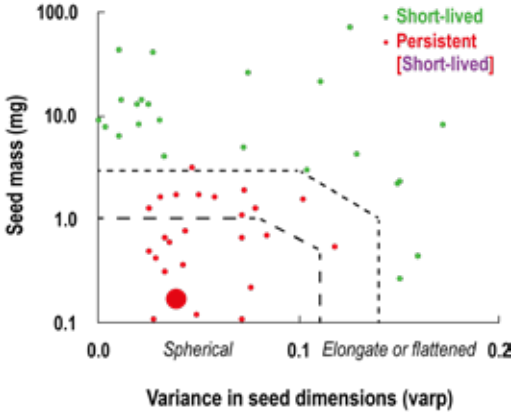
Main flowering time

May–July.

Seeds

Brown; kidney-shaped; 1.2 x 0.9 mm; shed from apical pores of a capsule, 15 x 4–5 cm, with ascending, bristly hairs.

REGENERATION



Only by seed.

Seed size: Small, 0.2 mg; **Shape:** Kidney-shaped; **Varp:** 0.04. **Predicted number of seeds per plant:** Many, 2577 [Measured: 3488, Saatkamp *et al*. 2011]. **Plant diameter:** Medium.

Seed dispersal in time

A long-persistent seed bank is both predicted on the basis of seed size and shape and has been recorded in the field (Grime *et al*. 2007).

Seed dispersal in space

With the harvest: Yes. **In soil transported by machinery and feet:** Yes. **Other:** Shed in the wind from a capsule by a censer mechanism. Not strongly specialised for animal dispersal.

SEEDS

Seeds of Prickly Poppy (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: An erect, semi-rosette, much-branched, small- to medium-sized annual arable weed.

Seasons of growth

Seed germination: Mainly autumn.

Plant growth: Vegetative growth mainly 'cool-season' (autumn/spring–early summer) with flowering and seed-set in early summer.

Impact on crop establishment and yield: Low. Although, consistent with Dutoit *et al*. (2001), predicted to have an intermediate competitive ability and is also a potential contaminant of crop seed. Prickly Poppy is too rare to be an important weed in the organic arable fields of Provence.

LIFE HISTORY STRATEGY

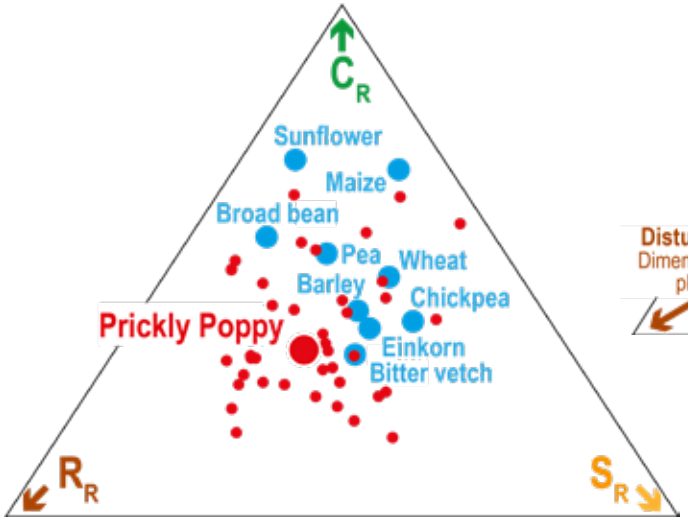
Comparison with wheat

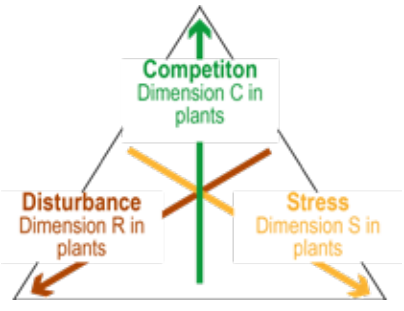
Seed yield: - - -

Soil fertility: =

Competitiveness: - -

Disturbance: + +





Cowherb Ⓜ

Caryophyllaceae

Vaccaria hispanica (Mill.) Rauschert

IDENTIFICATION

Image by L. Garraud, CBNA ©

Image by Daniel Pavon ©

Similar species

None.

Plant

Erect, branched, hairless annual; to 0.5 m or more in height.

Leaves

Opposite; oval, greyish and hairless, declining in size up the stem; up to 3 cm wide.

Flowers

Pink; in a much branched terminal head; large, about 1.5 cm in diameter. Petals, 5 with their lower parts enclosed within 5 fused sepals in the form of a pale green inflated, 5-angled tube 12–17 mm long.

Main flowering time

June–July.

Seeds

Black; oval, pitted; 2 x 1.5 mm; shed apically from a capsule, 10 x 6 cm.

USES

Food: Although there are problems of toxicity, leaves may be utilised as a condiment and the starchy seed may be ground into a flour (PFAF). **Toxicity:** The plant contains saponins, which are toxic. **Medicinal:** The plant has been used in the treatment of a range of medical complaints including tumours, skin problems and, poor lactation and for pain relief (PFAF). **Fodder:** No use reported.

Edible rating: 1 **Medicinal rating: 3**

Websites: https://pfaf.org, www.tela-botanica.org, www.wikipedia.org

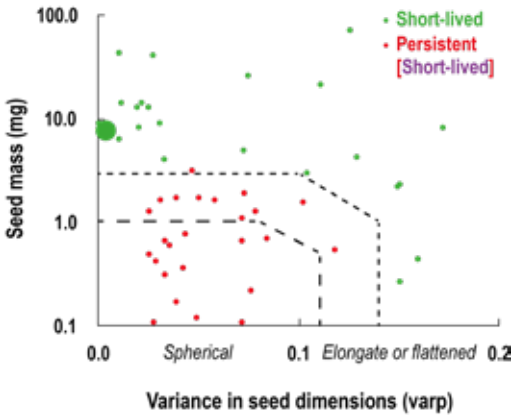
ECOLOGY

Type of weed: Cereal mimic (a traditional arable weed). **Impact on agricultural production:** Low. (A rare weed.) **Conservation status - Europe:** 70 % threatened; **France:** Rare. **Main agricultural habitats in France:** [Winter cereals.] **Occurrence in 2013 arable survey:** Uncommon. In 13 % of fields and at low population densities.

HABITAT

Climatic distribution: Weakly Mediterranean. **Soil type:** Dry clayey to sandy soils. **Soil reaction:** Basic to neutral. **Soil fertility:** Intermediate.

REGENERATION



Only by seed.

Seed size: Large, 7.3 mg; **Shape:** Rounded; **Varp:** 0.00. **Predicted number of seeds per plant:** Few, 191 [Measured: 444, Saatkamp *et al*. 2011]. **Plant diameter:** Medium.

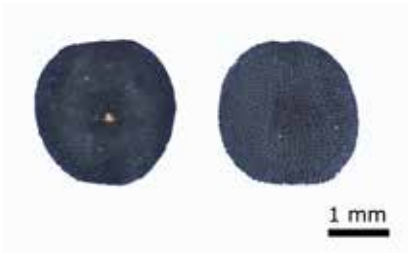
Seed dispersal in time

The large seeds are predicted, and have been observed (see Martínez-Duro *et al*., 2007), to be short-lived in the soil.

Seed dispersal in space

With the harvest: Yes. **In soil transported by machinery and feet:** Yes. **Other:** No strong specialisations apparent for either wind or animal dispersal.

SEEDS



Seeds of Cowherb (left), image on the same scale as Einkorn (right)

VEGETATIVE GROWTH

Habit: A medium to large, leafy, much-branched arable annual.

Seasons of growth

Seed germination: Probably mainly autumn.

Plant growth: Vegetative growth 'cool-season' (autumn–early summer) with flowering and seed-set in summer.

Impact on crop establishment and yield: A serious weed. Predicted to have a competitive ability similar to or slightly less than that of wheat (Tanji *et al*., 1997; Dutoit *et al*., 2001) and can cause reductions of 40 % in yield. Also a potential contaminant of crop seed. However, it is decreasing and too uncommon to be considered an important weed in the organic arable fields of Provence.

LIFE HISTORY STRATEGY

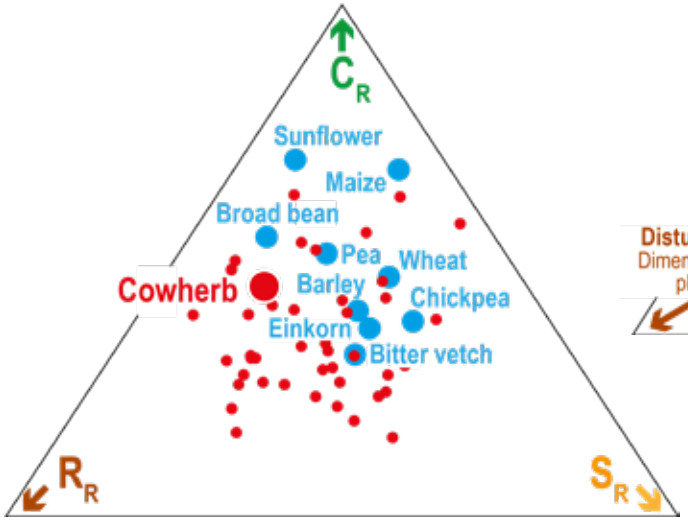
Comparison with wheat

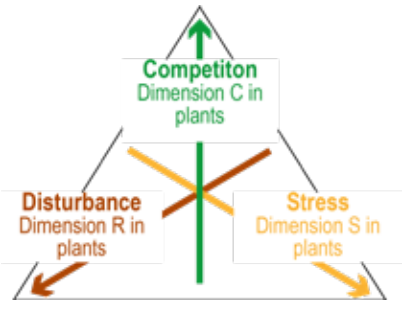
Seed yield: - -

Soil fertility: +

Competitiveness: =

Disturbance: +





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