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First record of *Amaranthus tuberculatus* in mainland France

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Titre

Première observation d'*Amaranthus tuberculatus* en France métropolitaine

Abstract

The article reports the first observation of *Amaranthus tuberculatus* in mainland France, on an INRAE experimental plot. The species is compared with other amaranth species historically observed in France and Europe. Information is provided on the history of its spread, ecological preferences, and biological characteristics. Due to its high seed production capacity, dioecious nature, herbicide resistance, and strong competitive potential in crops, attention is required to prevent its establishment in France.

Résumé

L'article relate la première observation d'*Amaranthus tuberculatus* en métropole, sur une parcelle expérimentale INRAE. L'espèce est comparée aux autres amarantes historiquement observées en France et en Europe. Des informations sur l'historique de sa propagation, ses préférences écologiques et ses caractéristiques biologiques sont fournies. De par sa forte capacité de production

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de graines, son caractère dioïque, sa faculté de résistance aux herbicides et son fort potentiel compétitif sur les cultures, une attention accrue est nécessaire pour éviter son installation sur le territoire français.



Photo 1. Herbarium sheet added to the collection of the Muséum-Jardin de l'Arquebuse de Dijon; J. Lallemand, CC BY-NC-ND.

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1. Introduction

During monitoring of an INRAE experimental plot in Dijon, Bruno Chauvel and Guillaume Adeux (INRAE) discovered three female plants and one male plant of a dioecious amaranth on 1 September 2025. Following this discovery, a group that also included Guillaume Fried (Anses) and Johann Lallemand (Muséum-Jardin de l'Arquebuse de Dijon) was formed to compare our analyses and identifications. This collaborative work enabled us to reach a determination and assign the plants observed to the species *Amaranthus tuberculatus*. This is the first record of this species in France, which led us to consult foreign floras, particularly *Flora of North America* (Mosyakin & Robertson, 2003) and *Jepson eFlora* (Costea *et al*., 2005a).

The origin of the seeds from which these plants grew remains uncertain. Maize seed used in an experiment may have been the introduction pathway, but the lot could not be traced. The same origin may explain the nearby presence of two other non-native taxa that are uncommon north of the Loire: *Amaranthus albus* and *Abutilon theophrasti* (Chauvel *et al*., 2017).

After the Muséum-Jardin de l'Arquebuse de Dijon prepared several herbarium sheets (Photo 1) for its collection and for the various partners (INRAE, Anses, CBNBFC), the site was cleared and all plants were collected, placed in a plastic bag and destroyed by incineration to prevent any spread. This article places the record in the broader context of the amaranths occurring in France and considers its implications.

2. Species account

2.1. Taxonomic position

Family: Amaranthaceae
Genus: *Amaranthus* L.
Species: *Amaranthus tuberculatus* (Moq.) J.D. Sauer, 1955.
Basionym: *Acnida tuberculata* Moq., 1849.
Synonyms: *Acnida altissima* (Riddell) Standley, 1917; *Acnida altissima* Riddell ex Moq., 1849; *Acnida altissima var. prostrata* (Uline & W.L. Bray) Fernald, 1941; *Acnida altissima var. subnuda* (S. Watson) Fernald, 1941; *Acnida concatenata* (Nutt.) Alph. Wood, 1861; *Acnida subnuda* Standley, 1917; *Acnida tamariscina* J.D. Sauer, 1955; *Acnida tamariscina var. concatenata* (Moq.) Uline & W.L. Bray, 1894; *Acnida tamariscina var. tuberculata* (Moq.) Uline & W.L. Bray, 1894; *Acnida tuberculata* Moq., 1849; *Amaranthus altissima* Riddell, 1835; *Amaranthus ambigens* J.D. Sauer, 1957; *Amaranthus rudis* J.D. Sauer, 1957.
Common names: rough-fruited amaranth, tall waterhemp, tuberculate waterhemp, rough amaranth, tuberculate amaranth (OEPP, 2026a).

2.2. The genus *Amaranthus* L.

The name *Amaranthus derives* from the Ancient Greek amárantos, meaning 'that does not fade or wither'. It combines the privative prefix a ('without') and the verb *maraín*, meaning 'to fade' or 'to waste away'. The name reflects the plant's ability to remain intact for a long time at the end of the season, notably because of its persistent perianth.

Worldwide, approximately seventy species are recognised in this genus (POWO, 2025), occurring mainly in tropical, subtropical and temperate regions. Twenty-two species have been recorded in mainland France (Table 1; J.-M. Tison, pers. comm., 2026), nine of which are naturalised, while one subspecies, *Amaranthus graecizans subsp. sylvestris*, is considered native.

Although several distinct genera have been proposed and sometimes recognised, reflecting its morphological diversity*, Amaranthus is* now accepted in a broad sense, with three recognised subgenera: *Acnida* (comprising the dioecious species)*, Amaranthus and Albersia*. It consists of herbaceous plants, the great majority of which are annuals (85–90%; e.g. *A. blitum, A. retroflexus,* etc.), with a minority of perennials, which are more prevalent in tropical and subtropical regions (10–15%; e.g. *A. deflexus*, *A. muricatus*, etc.). The leaves are alternate and petiolate, ovate to obovate or lanceolate, with entire or irregularly toothed margins. The inflorescences are paniculate or more or less spike-like and consist of unisexual flowers accompanied by scarious bracts and bracteoles. The flowers have 0–5 sepals, 5 stamens

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and an ovary formed of 2–3 carpels. The fruit is a utricle or a capsule opening by irregular dehiscence (Mosyakin & Robertson, 1996; *Flora of North America Editorial Committee*, 2003; Bayón, 2015).

Hybridisation is widespread in *Amaranthus* (Table 1). Nevertheless, it remains difficult to assess because of the phenotypic plasticity of some species (Mosyakin & Robertson, 2003).

Of all *Amaranthus species*, only nine are dioecious, six of which are known in Europe (Table 2), excluding the many possible hybrids among all species, whether dioecious or not. Among these species, *Amaranthus palmeri* and *A. tuberculatus* are problematic weeds of agricultural crops in the United States, but they remain casual in France and have not yet affected crops.

2.3. Morphological description of *Amaranthus tuberculatus*

The following description is based on the treatment in *Flora of North America* (Mosyakin & Robertson, 2003). *A. tuberculatus* is a summer therophyte, i.e. an annual plant that survives the adverse season (winter) only as seeds, all vegetative parts being killed by frost. It has a taproot system that provides firm anchorage in the soil and is often accompanied by secondary roots.

The glabrous, furrowed stems (Photos 2 and 3) are erect and branched, commonly reaching 0.5–2(–3) metres in height.

The leaves are alternate and simple, 1.5–15 cm long and 0.5–3 cm wide, and borne on a long petiole generally one-quarter to one-half the length of the blade (Photo 4). The character ‘petiole shorter than the blade’ distinguishes the species from *A. palmeri*. The blade is smooth, glabrous and glossy; depending on its position on the plant, its shape ranges from ovate or obovate at the base to lanceolate at the apex, with entire margins and an obtuse to acute apex.

Flowering extends from summer to autumn. The flowers are grouped in branched terminal inflorescences, forming linear spikes or panicles that may be interrupted into spaced glomerules. This is a dioecious amaranth (Photo 5). Pistillate flowers have three purplish bracts with a broad greenish midrib, rudimentary tepals (1–2 or 0), three stigmas and a superior ovary (Photo 6). Staminate flowers comprise five tepals and five free stamens that produce a large quantity of pollen (Photo 7). Dioecy precludes self-pollination; pollination is anemophilous, promoting long-distance pollen dispersal while increasing genetic mixing.

The fruit is a small, thin, rough utricle, ranging from pink and green to reddish brown according to maturity (Photo 8), obovoid to subglobose (1.5–2 mm), opening either irregularly or by circumscissile dehiscence, or remaining indehiscent. It releases a single seed, usually ovoid but sometimes round or oval, lenticular and glossy, red, reddish brown or dark brown, 0.7–1 mm in diameter (Photo 9), with a smooth surface (Photo 10) that is striate in the hilar region. This region is concave and appears pinched in lateral view (Photo 11); the hilum is located in a notch near the seed apex (Photos 10 and 11), and tissue frequently persists around it. The rim around the outside of the seed, a feature common to species of *Amaranthus*, is reduced or absent in this species.

Three other species occurring in France also have seeds less than 1 mm in diameter: two naturalised species (*A. albus*, *A. viridis*) and one casual species (*A. spinosus*). *A. tuberculatus* can nevertheless be distinguished by a combination of characters: smooth surface, reddish-brown colour, absence of a well-defined rim, and a concave hilar region with protruding hilar lobes.

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Table 1. List and status of taxa of the genus *Amaranthus occurring* in France. Naturalised or native taxa are shown in bold.

Taxon[1]	Status in France[2]	Distribution, period
Amaranthus acutilobus Uline & W.L. Bray	Historical casual	1915
***Amaranthus albus* L.**	Naturalised	Paris Basin, SW, South, Corsica
***Amaranthus blitoides* S. Watson**	Naturalised	Paris Basin, SW, South, Corsica
Amaranthus blitum* L. subsp. *blitum	Naturalised	Scattered, sharply declining
Amaranthus *blitum* subsp. *emarginatus* (Moq. ex Uline & W.L. Bray) Carretero, Muñoz Garm. & Pedrol	Naturalised	France-wide, expanding
Amaranthus capensis subsp. *uncinatus* (Thell.) Brenan	Historical casual	1934
Amaranthus caudatus L.	Casual (cultivated)	1838-2024
Amaranthus crispus (Lesp. & Thevenau) N. Terracc.	Historical casual	1848-1899
Amaranthus cruentus L.	Casual (cultivated)	1785-2024
***Amaranthus deflexus* L.**	Naturalised	France-wide, more frequent in the South
Amaranthus graecizans subsp. *graecizans*	Casual	1962-1999
***Amaranthus graecizans* L. subsp. *sylvestris* (Vill.) Brenan**	Native	-
***Amaranthus hybridus* L.**	Naturalised	Corsica; casual elsewhere
Amaranthus hypochondriacus L.	Casual	1871-2019
***Amaranthus muricatus* (Gillies ex Moq.) Hieron.**	Naturalised	Pyrénées-Orientales, Var
Amaranthus palmeri S. Watson	Casual	1962, Illzach (Haut-Rhin)
Amaranthus polygonoides L.	Casual	-
***Amaranthus powellii* subsp. *bouchonii* (Thell.) Costea & Carretero**	Hybridogenous neotaxon	Most of France
***Amaranthus powellii* subsp. *powellii* S. Watson**	Naturalised	France-wide
Amaranthus quitensis Kunth	Historical casual	1846-1853
***Amaranthus retroflexus* L.**	Naturalised	France-wide
Amaranthus spinosus L.	Casual	1998
Amaranthus standleyanus Parodi ex Covas	Casual	-
Amaranthus tricolor L.	Historical casual	1893
***Amaranthus viridis* L.**	Naturalised	Corsica and Languedoc; expanding
Amaranthus ×*ozanonii* Priszter [*A. hybridus* × *A. retroflexus*]	Hybrid	-
Amaranthus ×*ralletii* nothosubsp. *ralletii* Contré [*A. powellii* subsp. *bouchonii* × *A. retroflexus*]	Hybrid	-
Amaranthus × *ralletii* nothosubsp. *soproniensis* (Priszter & Kárpáti) J.-M.Tison [*A. powellii* × *A. retroflexus*]	Hybrid	-

[1]We use here the most recent treatment of the genus *Amaranthus* in France (J.-M. Tison, pers. comm., 2026). It should be noted that plants usually named *A. hybridus* in France actually correspond to *A. powellii*, whereas true *A. hybridus* is currently confirmed only in Corsica.

[2]Statuses are based on the categories defined in Fried *et al.* (2024).

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Table 2. Dioecious *Amaranthus species* and their occurrence in Europe. Countries in which the species is considered naturalised are shown in bold.

Species	Occurrence in Europe (GBIF.org, 2026)
Amaranthus acanthochiton J.D. Sauer	-
Amaranthus arenicola I.M. Johnst.	Sweden
Amaranthus australis (A. Gray) J.D. Sauer	Germany, Switzerland
Amaranthus cannabinus (L.) J.D. Sauer	Albania, Germany
Amaranthus floridanus (S. Watson) J.D. Sauer	-
Amaranthus greggii S. Watson	-
Amaranthus palmeri S. Watson	Germany, Belgium, Denmark, **Spain**, Russian Federation, France, Greece, **Italy**, Latvia, Lithuania, Luxembourg, Norway, Netherlands, Poland, Portugal, Czech Republic, Romania, Serbia, Sweden, Switzerland, Ukraine
Amaranthus tuberculatus (Moq.) J.D. Sauer	Germany, Austria, Belgium, Bosnia and Herzegovina, **Croatia**, Denmark, Spain, Russian Federation, Finland, **Italy**, Netherlands, **Portugal**, Czech Republic, Romania, United Kingdom, **Serbia**, Sweden, Switzerland, Ukraine
Amaranthus watsonii Standl.	United Kingdom



Photo 2. Stem form and colour; J. Lallemand, CC BY-NC-ND.



Photo 3. Furrowed, glabrous stem; J. Lallemand, CC BY-NC-ND.

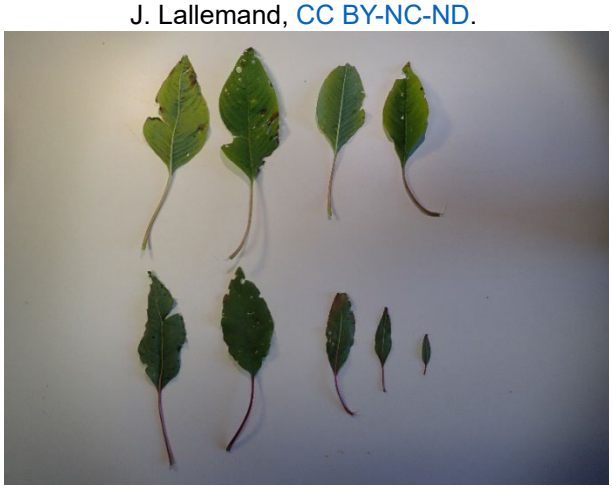


Photo 4. Morphological variation in leaves; J. Lallemand, CC BY-NC-ND.

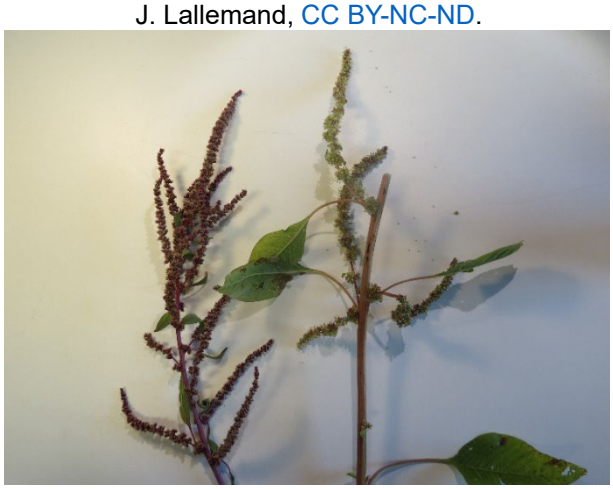


Photo 5. Inflorescence of a female plant (left) and of a male plant (right); J. Lallemand, CC BY-NC-ND.

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Photo 6. Female flowers; J. Lallemand, CC BY-NC-ND.



Photo 7. Male flowers; J. Lallemand, CC BY-NC-ND.

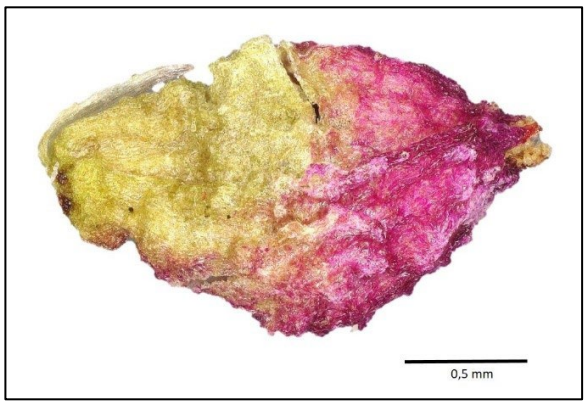


Photo 8. Utricle containing a seed; S. Bastin, CC BY-NC-ND.



Photo 9. General view of the seeds; S. Bastin, CC BY-NC-ND.

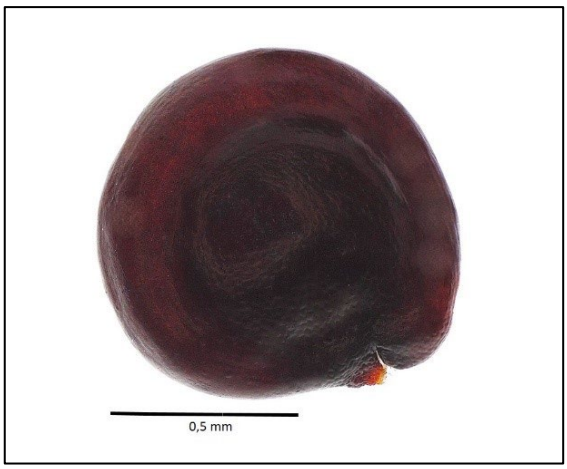


Photo 10. Smooth seed surface; S. Bastin, CC BY-NC-ND.

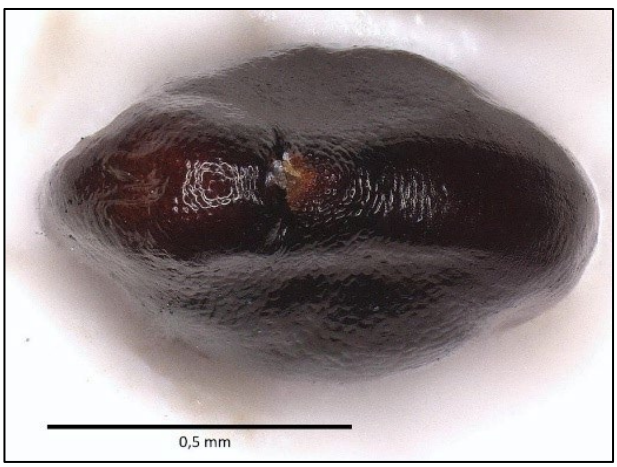


Photo 11. Hilar region; S. Bastin, CC BY-NC-ND.

3. Distribution and history of introductions into Europe

3.1. Native range

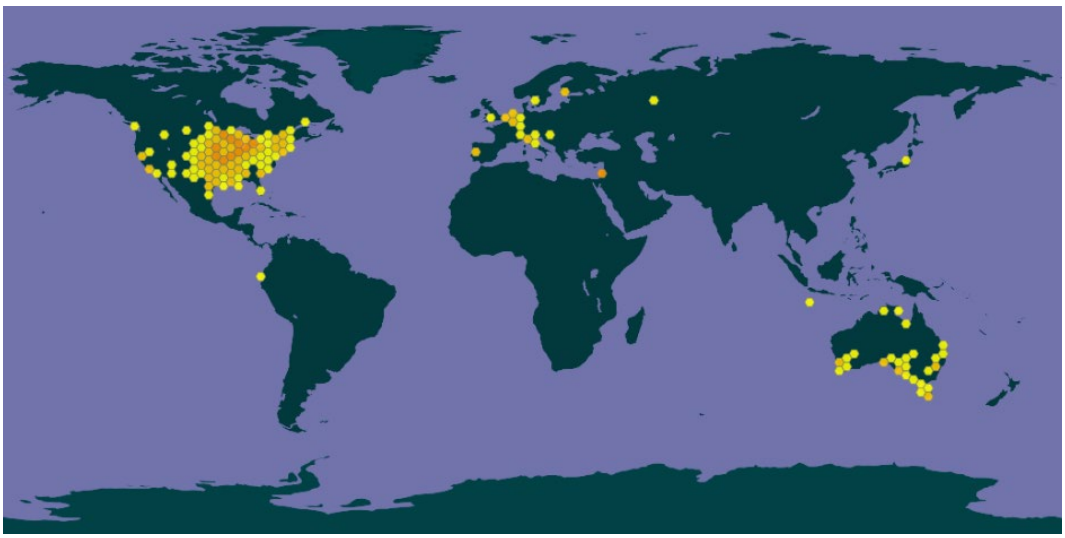
Amaranthus tuberculatus is native to North America (see reference in Costea *et al*., 2005b). Its natural range mainly covers the central and east-central United States (from northern Missouri and Tennessee to

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the Great Lakes region), extending into southern Ontario and western Quebec in Canada, between latitudes 30° and 45° (USDA-NRCS, 2019). Over the past thirty years, this species has changed from a relatively inconspicuous crop weed into one of the most frequent and problematic weeds in agriculture, particularly in soybean and maize fields in the American Midwest (Sarangi & Jhala, 2018; Sarangi *et al*., 2019).

3.2. Introduced range

In North America, *Amaranthus tuberculatus* has considerably expanded its range (Map 1) and now occurs in most states, far beyond its natural range. In Europe, *A. tuberculatus* was introduced in limited quantities, probably in the mid-twentieth century, although some evidence suggests an earlier introduction, as shown by a herbarium specimen collected in Switzerland as early as 1847 (OEPP, 2020). The first European records mainly concerned isolated observations of small, often short-lived populations, particularly in highly anthropogenic areas such as ports, railway lines and commodity storage sites (for example in Austria, the United Kingdom, Belgium and Germany). The concentration of the earliest occurrences around major logistics hubs suggests introduction through agricultural supply chains. The introduction of the species into Europe is very probably linked to contamination of seed and grain lots imported from the United States (maize, soybean, cereals, pulses, oilseed rape, sunflower and millet; OEPP, 2020).



Map 1. Global distribution of *Amaranthus tuberculatus*; source: GBIF.org (2026).

From the mid-1970s, *A. tuberculatus* began to show clear signs of naturalisation in some parts of Europe, particularly northern Italy, where the first established populations were observed along major rivers, notably the Po and its tributaries. The species subsequently spread gradually through several Italian regions, locally becoming invasive, particularly in Lombardy, Veneto, Emilia-Romagna and Marche (Galasso *et al*., 2018). It is now also considered naturalised along the Sava basin (Croatia and Serbia), and probably in Bosnia and Herzegovina (Verloove, 2026). It was recently detected (September 2024) in Portugal, where it occurs along approximately 60 km of the Tagus (Verloove, 2026). This record confirms the species' continuing expansion in Europe and its high invasive potential. Overall, its current distribution in Europe remains heterogeneous, with a gradient from isolated casual occurrences (northern Europe) to naturalised and invasive populations in the southern half of the continent (Croatia, Italy, Portugal and Serbia).

In the Near East (Israel and Lebanon), *A. tuberculatus* was until recently considered a rare introduced species, usually casual or very locally naturalised, with no current evidence of large-scale invasive behaviour comparable to that observed in southern Europe or North America (OEPP, 2020). However, the species has spread rapidly in recent years and now occurs across much of Israel, along watercourses and roadsides as well as in agricultural crops (Roth *et al*., 2023).

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4. Habitats and ecological requirements

In its native range, *Amaranthus tuberculatus* is associated with riparian habitats, riverbanks and the margins of ponds, marshes and lakes. These dynamic habitats, characterised by alternating flooding and drying, constitute the species' historical ecological environment. It has gradually colonised anthropogenic habitats—cultivated fields, roadsides, ditches and railway lines—up to an altitude of 1,000 metres.

In Europe and the Mediterranean region, *A. tuberculatus* occurs in various habitat types but is particularly well established on floodplains and the banks of major rivers, notably along the Po in northern Italy (OEPP, 2020), the Sava in Croatia and Serbia, and the Tagus in Portugal (Verloove, 2026). More occasional records have been made on sandbanks of the Meuse and Scheldt in the Netherlands, but the species is not established there (Verloove, 2026). *A. tuberculatus* is also frequent in ruderal and heavily disturbed habitats such as port areas, railway lines, unloading quays, roadsides and adjacent riverbanks, particularly near infrastructure used to transport and store grain (grain conveyors and flour mills). It has also been recorded in cultivated fields, notably soybean crops, where its occurrence currently remains relatively localised, particularly in Italy.

The ecological preferences of *A. tuberculatus* are well characterised: the species is described as thermophilous, heliophilous and nitrophilous, with a moisture range extending from very wet to moderately moist environments, and grows preferentially on nutrient-rich alluvial substrates (Costea *et al*., 2005b). Although it tolerates various soil types and textures, it prefers well-drained, nutrient-rich soils, as found in its primary habitat and in agricultural fields. The plant can survive short periods of flooding but is highly sensitive to salinity and frost. Seed germination requires high temperatures, with an optimum of 25–35 °C under controlled conditions, and becomes very low below 20 °C. Growth is strongly and positively influenced by high temperatures and light intensity.

5. Biology and invasive potential

The persistence and spread of this species are closely linked, as both result from its extremely high reproductive potential (Schwartz *et al*., 2016). A single plant can potentially produce more than one million seeds in one season (see references in Costea *et al*., 2005b), a magnitude rarely reached even among weeds. This level of seed production occurs in only a few other weed species, mainly parasitic plants such as broomrapes and witchweeds.

These small, light seeds, which have no specific adaptation for dispersal, initially fall at the base of the parent plant. They are subsequently dispersed by raindrop splash and surface-water runoff. Seed longevity in the soil under normal conditions is four to five years, but may reach seventeen years under certain conditions (see references in Costea *et al*., 2005b). In infested cultivated fields, seeds of this species may represent 90% of the soil seed bank, amounting to tens of thousands of seeds per m².

The persistence of this species in cultivated fields is due to its ability to develop multiple resistance to different herbicide classes. This makes its control particularly complex for farmers. Early identification and monitoring are therefore required to limit its spread and adverse effects on yields.

Amaranthus tuberculatus can hybridise with several species of the genus, notably *A. powellii* (see note to Table 1) and *A. palmeri*, while experimental crosses have also been obtained with *A. albus* (Trucco *et al*., 2005; Gaines *et al*., 2012; Murphy, 2018). Although these hybridisation events are generally infrequent, they can complicate botanical identification by producing individuals with intermediate morphological characters and can promote gene flow between species. Above all, they pose a major agronomic concern by enabling the transfer of herbicide-resistance alleles. Gaines *et al*. (2012) notably demonstrated the pollen-mediated transfer from *A. palmeri* to *A. tuberculatus* of glyphosate resistance associated with amplification of the EPSPS gene, although at low frequencies. The dioecious, anemophilous nature of *A. tuberculatus* thus makes it a potential donor and recipient of resistance genes. In France, the main potential hybridisation partners are species of the *A. hybridus* complex (*A. hybridus*, *A. powellii* and *A. retroflexus*), potentially joined by *A. palmeri* if that species becomes established. The absence of a species-specific natural pest also contributes to the spread of *A. tuberculatus* in Europe. Predation is limited to generalist organisms that attack the plant without causing enough damage to curb its expansion effectively.

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6. Impacts on crops and management

Amaranthus tuberculatus is considered a major weed of maize and soybean crops in North America (Gage *et al*., 2021), owing to its high seed production (35,000–1,200,000 seeds per plant), great plasticity and ability to tolerate various cropping practices. This high seed output helps maintain and replenish a persistent soil seed bank.

Its impact varies with density and with the timing of emergence relative to the crop. In the United States, an infestation maintained throughout a growing season can cause very large yield losses of 36–74% in maize and 43–73% in soybean.

6.1. Control

In autumn, the species is easier to detect because of its striking height: plants can reach two metres and clearly overtop crops. Once infested areas have been geolocated, rigorous and effective management is crucial because of the species' high seed-production potential, extended germination period, tolerance of varied conditions and adaptability. As emergence is spread over several months, a single herbicide treatment or tillage pass is insufficient to control the species. Germination can continue through much of the growing season and draws on a large, persistent soil seed bank (Costea *et al*., 2005b), in which viability can last at least seventeen years (Burnside *et al*., 1996). This long germination window enables the species to escape conventional management strategies, making it particularly difficult to control in crops both within a single year and over the course of a rotation.

Control of this species is extremely difficult because many *A. tuberculatus* populations on the American continent have developed resistance to several herbicide active ingredients (Heap, 2026), limiting effective chemical control options. In Israel, a population resistant to ALS, EPSPS and PPO inhibitors was identified in the absence of herbicide selection pressure, suggesting the direct introduction of resistant populations from North America (Roth *et al*., 2023).

Moreover, its dioecious nature promotes the rapid spread of resistance genes through pollen, allowing resistance to evolve and disperse more rapidly than in monoecious *Amaranthus species*. Ranked among the most problematic herbicide-resistant weeds, this species poses a major economic threat to European farmers if it becomes established and spreads further.

6.2. Regulatory status

Several countries have introduced strict regulatory measures to prevent introductions of *Amaranthus tuberculatus*:

- United States: Wisconsin law, for example, prohibits the sale of agricultural seed containing seeds of *A. tuberculatus* (OEPP, 2020);
- Canada: the species is classified as a 'primary noxious weed' under the Weed Seeds Order of the Seeds Act;
- Argentina: in 2019, the species was included on the A1 list (absent), indicating that it is regarded as a quarantine pest not present in the country (OEPP, 2020);
- Australia: *Amaranthus tuberculatus*, often listed under the synonym *A. rudis*, is officially classified as a quarantine organism;
- China: the entire genus *Amaranthus is* subject to specific regulation in the country.

In Europe, *Amaranthus tuberculatus* is included on the EPPO A2 List (2026b), which comprises pests recommended for regulation as quarantine pests. To support national authorities, EPPO published Standard PM 9/33 on 22 October 2025 (OEPP, 2025), describing regulatory control systems applicable jointly to *Amaranthus tuberculatus* and *A. palmeri*. The standard provides a harmonised framework for surveillance, prevention of spread and management measures for these species.

7. Conclusion

To our knowledge, the observation of *Amaranthus tuberculatus* on an INRAE experimental plot in Dijon is the first documented record of this species in France. Although it was limited to a few individuals that were rapidly destroyed, the discovery highlights the importance of vigilance in agricultural and experimental

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environments, where alien weeds may be introduced accidentally through seed or the exchange of equipment and tools. Such vigilance is all the more necessary because the arrival of *Amaranthus palmeri*, a related and even more invasive species, is feared (Le Bourgeois *et al*., 2026).

In view of the species' biology—high seed production, persistence of the soil seed bank and ability to develop herbicide resistance—early detection and careful monitoring appear essential to prevent permanent establishment in France. The regulatory approach applicable to *A. tuberculatus* could also be reassessed. Although the species is included on the EPPO A2 List, which recommends its regulation as a quarantine pest, it is not subject to harmonised regulation at European Union level under Regulation (EU) 2016/2031 and Implementing Regulation (EU) 2019/2072. Against this background, EPPO's development of Standard PM 9/33 and the interest expressed by several countries in implementing biosecurity measures highlight the need to assess whether the European regulatory framework adequately addresses the risks associated with the introduction and spread of this species.



Photo 12. General view of female *Amaranthus tuberculatus* plants; G. Adeux, CC BY-NC-ND.



Photo 13. Branching of the female inflorescence of an *Amaranthus tuberculatus* plant; G. Adeux, CC BY-NC-ND.

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