EPPO Datasheet: *Microstegium vimineum*

Last updated: 2024-01-02

IDENTITY

Preferred name: *Microstegium vimineum*
Authority: (Trinius) A.Camus
Taxonomic position: Plantae: Magnoliophyta: Angiospermae: Commelinids: Poales: Poaceae: Panicoideae
Other scientific names: *Eulalia viminea* Kuntze
Common names: Japanese stilt grass, Mary's grass, Nepalese browntop, flexible sasa grass
view more common names online...
EPPO Categorization: A2 list, Alert list (formerly)
view more categorizations online...
EU Categorization: IAS of Union concern
EPPO Code: MCGVI



more photos...

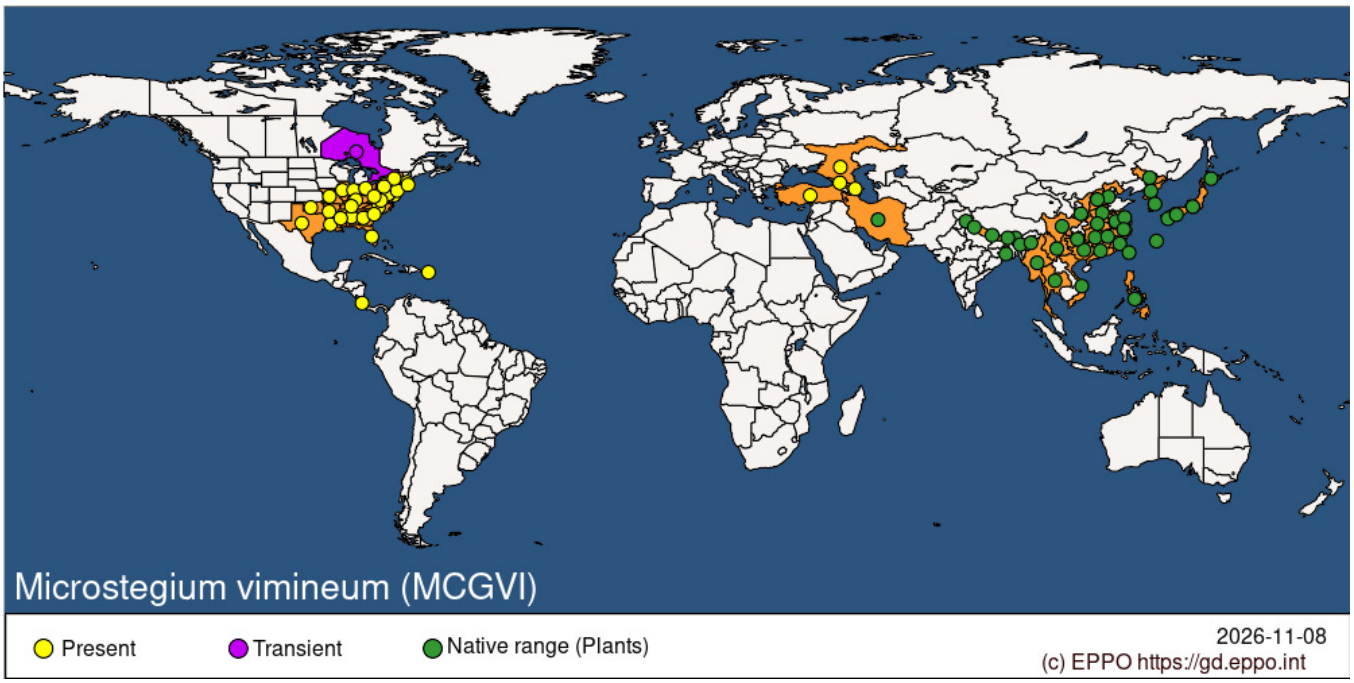
GEOGRAPHICAL DISTRIBUTION

History of introduction and spread

Microstegium vimineum was first identified in 1919 in Tennessee, where it was probably introduced accidentally (Barkworth *et al.*, 2003; Ehrenfeld, 2003; in Fryer, 2011), and by 1960 the species had spread to Ohio and Pennsylvania, and to all Atlantic coastal states from Florida to New Jersey. The species is now established in 27 states (USDA, NRCS, 2014). *M. vimineum* has become a significant problem in forests in many eastern and midwestern states. *M. vimineum* spreads rapidly due to high seed production and is able to out-compete native vegetation; its dissemination is facilitated by deer herbivory (Baiser *et al.*, 2008). It often establishes in locations where moist soils are scoured, such as along streambanks, floodplains, ditches and trails, but can be found in a wide range of habitats and environmental conditions from full sun to full shade.

Within the EPPO region, *M. vimineum* is established in the Southern Caucasus including Azerbaijan, the Republic of Georgia and Turkey (Valdés *et al.*, 2009). The species is native to the Russian Far East (Tsvelev, 1976) and introduced to the Northern Caucasus (Valdés *et al.*, 2009).

Note: there is a herbarium record of the species in the Democratic Republic of Congo from 1929. There are no additional records since that date, thus the record is not interpreted as an established population in the absence of further information.



EPPO Region: Azerbaijan, Georgia, Russian Federation (Southern Russia), Türkiye
Asia: Bhutan, China (Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hebei, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Jilin, Shaanxi, Shanxi, Sichuan, Yunnan, Zhejiang), India (Himachal Pradesh, Meghalaya, Nagaland, Sikkim, Uttarakhand, West Bengal), Iran, Islamic Republic of, Japan (Hokkaido, Honshu, Kyushu, Ryukyu Archipelago, Shikoku), Korea, Democratic People's Republic of, Korea, Republic of, Myanmar, Nepal, Philippines, Taiwan, Thailand, Vietnam
North America: Canada (Ontario), United States of America (Alabama, Arkansas, Connecticut, Delaware, District of Columbia, Florida, Georgia, Illinois, Indiana, Kentucky, Louisiana, Maryland, Massachusetts, Mississippi, Missouri, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Virginia, West Virginia)
Central America and Caribbean: Costa Rica, Puerto Rico

MORPHOLOGY

Plant type

Annual grass species.

Description

Microstegium vimineum is an annual C4 grass species with a sprawling habit which resembles a small bambootype plant. It germinates in spring and grows slowly until mid-summer ultimately reaching a height of 0.6–1.5 m. Reclining stems can grow to a length of up to 2 m. In unfavourable conditions, the plant can be as small as 10–20 cm in height but it is still capable of producing flowers and seed. The plant produces a sparse, very short root system. The lanceolate leaf blades are 5–8 cm long, 2– 15 mm wide and sparsely pubescent on both sides. The ligules are membranous, usually ciliate, and are 0.5–2 mm long. The fruit or caryopsis (grain) is yellowish to reddish and ellipsoid in shape, 2.8–3.0 mm long. Slender stalks of tiny flowers are produced in August through to September or early October. In late autumn they fade to pale greenishyellow or turn pale purple in colour (Mehrhoff, 2000).

BIOLOGY AND ECOLOGY

General

Microstegium vimineum possesses characteristics typical of many invasive alien species: it grows quickly, fruits within a single season, produces abundant seed and readily invades habitats that have been disturbed by natural (e.g. flooding) and anthropogenic (e.g. mowing, tilling) factors. It is also capable of invading natural areas and swiftly replacing natural communities with nearly monospecific stands (Tu, 2000; Oswalt & Oswalt, 2007).

Microstegium vimineum has a high degree of phenotypic plasticity, self-fertilization, an annual life history with a persistent seed bank and high seed production in dense stands (Claridge & Franklin, 2002; Gibson *et al.*, 2002; Droste *et al.*, 2010). Individual plants can produce thousands of seeds, resulting in an estimated 0.1–4 million seeds per m² (Barden, 1987; Gibson et al., 2002; Judge, 2005; Cheplick, 2006). However, flowering and seed production vary considerably between years and across populations growing in different environmental conditions (Gibson *et al.* , 2002; Wilson *et al.*, 2015).

Microstegium vimineum produces both cleistogamous (closed, self-fertilizing) and chasmogamous (open, outcrossing) flowers, and the proportion of chasmogamous seeds appears to increase with greater light (Cheplick, 2006). This trait enables the plant to reproduce by facultative outcrossing when the gene pool is narrow. In the Eastern USA, *M. vimineum* germinates in early to mid spring (depending on latitude) and reaches full growth potential in mid to late summer when it can reach a length of 2 m and eventually produce numerous seeds in autumn (Barden, 1987; Hunt & Zaremba, 1992; Redman, 1995; Wilson *et al.*, 2015). Seeds are dispersed by water, animals and through human activities on clothing and vehicles.

Seeds may remain viable in the soil for 5 years (Barden, 1987). Seeds require 90 days' dormancy but not necessarily cold stratification (Judge, 2005).

Habitats

Microstegium vimineum can colonize natural environments, transport corridors and wastelands. Common habitats associated with *M. vimineum* are moist areas such as mesic roadsides, railway tracks, ditches, logging roads, roadsides, floodplain forest, forest wetland, herbaceous and shrub wetland, early and late successional forest, planted forest, forest edges and margins, woodland borders, floodplains, grassy areas, vacant lots, managed landscapes and stream sides. The plant is also found in mesic upland sites, usually in moderate to dense shade.

Disturbances due to management such as grazing, mowing, irrigation, fire and timber harvest may increase the susceptibility of habitats to establishment but intensively cultivated areas will be less susceptible (Oswalt & Oswalt, 2007; Shelton, 2010). Although mowing can reduce the reproductive capacity of existing stands (Shelton, 2010), mowing can also spread seeds and encourage the establishment of new populations if it is conducted following seed set.

Environmental requirements

Microstegium vimineum can perform well in a wide range of environments with maximum productivity under conditions of high soil moisture and light. Water availability is a limiting factor for distribution of *M. vimineum* (Touchette & Romanello, 2010), thus, well-drained sandy soils or other conditions that reduce soil moisture availability may be less susceptible to invasion. Although *M. vimineum* is a C4 plant, it can perform well across a wide range of light conditions. While it performs best at high light intensities, seed production can occur at <5% light (Wilson *et al.*, 2015). Thus, forest disturbances that result in more light reaching the ground may influence the spread of *M. vimineum* by creating a more favourable environment (Cole & Weltzin, 2004; Droste *et al.*, 2010; Hull, 2010; Flory *et al.*, 2011a; Wilson *et al.*, 2015). While early studies of *M. vimineum* in North America characterized its presence on acidic soils (e.g. Redman, 1995), subsequent expansion of its invasive range has occurred over a wide variety of soil types.

Natural enemies

Although a wide variety of fungal species are reported for the genus *Microstegium* (Zheng *et al.*, 2006; Farr & Rossman, 2014), *Bipolaris* spp. have been found on *M. vimineum* in the USA (Kleczewski et al., 2011); some of

these species occur in the EPPO region but the extent to which these pathogens limit *M. vimineum* populations is unknown. While the ability of these organisms to suppress *M. vimineum* populations remains unknown, during invasion in North America, native fungi have switched host to *M. vimineum* and reduced its fecundity (Flory *et al.*, 2011b) – the same could happen in the EPPO region.

Uses and benefits

Microstegium vimineum has been used for basket weaving (Tu, 2000), but other than this the species has no other benefits.

PATHWAYS FOR MOVEMENT

Entry as a contaminant of travellers (their clothes and shoes), machinery, hay, bird seed and soil has been important for the introduction of *M. vimineum* in new regions.

As a contaminant of used machinery

Microstegium vimineum has been observed being transported on motor vehicles in the USA (Mehrhoff, 2000). In addition, roads play an important role in plant invasions (Trombulak & Frissell, 2000; Mortensen *et al.*, 2009). Road grading and construction equipment also represent a high risk (Mortensen *et al.*, 2009). Movement of agricultural machinery is considered a possible pathway for the entry and spread of *M. vimineum*.

As a contaminant of bird seed

Microstegium vimineum was introduced into Britain in birdseed. It was detected by the cultivation of samples of bird seed and the waste separated from commercial seed carried out by the authors Hanson & Mason (1985). In the British Isles, the plant is recorded to have been cultivated from bird seed (Ryves *et al.*, 1996).

As a contaminant of growing media adherent to plants for planting

An individual plant of *M. vimineum* can produce thousands of seeds (Wilson *et al.*, 2015), which remain viable in the soil for 3–5 years (Barden, 1987; Gibson *et al.*, 2002; Judge, 2005; Huebner, 2011). Seeds may be present in growing media adherent to plants for planting. Movement of plants for planting with adherent soil exists among EPPO countries.

As a contaminant of travellers, their clothes and shoes

Adhesion of fruits to passing hikers is thought to explain the spread of *M. vimineum* through otherwise undisturbed natural areas in the USA (Miller, 2011). Furthermore, M. vimineum can form near monospecific stands making it impossible for hikers to avoid (e.g. woodlands, roadsides, etc.).

IMPACTS

Effects on plants

Microstegium vimineum is not currently considered an agronomic weed. However, extensive invasion occurs in economically managed hardwood and pine forests in the USA and there is evidence that invasions can reduce natural tree regeneration (Oswalt & Oswalt, 2007; Flory & Clay, 2010a). Invasions may also increase fire intensities and further reduce survival of tree seedlings (Flory, pers. comm., 2014).

Differential effects on tree species may inhibit succession and cause a shift in the composition of forest communities over time (Flory & Clay, 2010a). The effect of invasion by *M. vimineum* on different tree life-history stages was studied in a long-term experiment in Indiana. A subset of plots was created in a blocked design where either tree saplings were planted or tree seeds sown. Seeds were planted to simulate old-field succession, while planted saplings simulated later-successional stages. Some tree saplings showed higher mortality in invaded plots, and recruitment

was more than four times greater in uninvaded compared with the invaded plots. Greater impact was observed for early successional simulations, particularly for small-seeded tree species. Invasion had no significant effect on large-seeded tree species (oaks or hickories), although there was a trend for decreased survival of *Quercus palustris* Munchh., *Quercus alba* L. and *Quercus macrocarpa* Michx. The number of small-seeded tree species, *Liquidambar styraciflua* L., *Liriodendron tulipifera* L. and *Fraxinus pennsylvanica* Marshall decreased in invaded plots (Flory & Clay, 2009, 2010a). This effect was dramatic for *L. styraciflua*, in contrast to the results of Wright (2010), where *M. vimineum* leaf leachate increased germination of this species. Additionally, a survey of invaded areas found reduced natural regeneration for *Acer negundo* L., *Acer rubrum* L. and *Lindera benzoin* (L.) Blume (Flory & Clay, 2010b). However, removal of *M. vimineum* using grass-specific herbicides significantly increased natural tree recruitment, including species of economic importance (Flory & Clay, 2009).

Microstegium vimineum threatens native understorey vegetation in full sun to deep shade. It readily invades disturbed shaded areas, such as floodplains, that are prone to natural scouring, and areas subject to mowing, tilling and other soil-disturbing activities including movement of white-tailed deer. It spreads opportunistically following disturbance to form dense patches, displacing native wetland and forest vegetation as the patch expands (Swearingen *et al.*, 2010). Invasions of *M. vimineum* can quickly crowd out native species resulting in significant reductions in the productivity and diversity of herbaceous species. Invasions can also reduce tree regeneration and alter the growth of trees.

*Microstegium vimineum*changes plant community richness (the number of species), plant diversity and overall groundcover, out-competing other species (Adams & Engelhardt, 2009; Flory & Clay, 2010a,b; Meiners, 2010). It may have negative impacts on native species through multiple mechanisms including competitive exclusion, changing soil properties, reducing light availability and increasing native consumer activity.

Environmental and social impact

Invasion of *M. vimineum* has cascading ecological effects on the arthropod community. In a study in the USA, the arthropod community in invaded and uninvaded plots was sampled in June and September. Invaded plots showed a 19% decrease in arthropod species richness and a 39% decrease in abundance. Abundance and diversity of carnivores and herbivorous arthropods was reduced, although the effect on carnivores was much larger (Flory, 2010). Baiser *et al.* (2008) found that *M. vimineum* altered forest food webs in New Jersey, USA, during the period 1980–2005, specifically via a reduction of breeding woodland birds, due to the alteration of sub-canopy community structure by the invading plant.

Microstegium vimineum may affect native plant and animal species by altering environmental conditions such as light availability. In an experimental field study, thatch biomass was over 120% greater in invaded plots than in control plots when measured in early spring. In addition, significantly more light reached ground level in the invaded plots than in control plots in June, but this pattern was reversed in September, with more light reaching ground level in control plots than in invaded plots (Flory & Clay, 2010b).

Multiple studies have shown that *M. vimineum* decomposes more slowly than co-occurring native species. DeMeester & Richter (2010) showed that plots invaded by *M. vimineum* accumulated approximately half the annual nitrogen biomass of the diverse community where *M. vimineum* had been removed. In addition, decomposition and release of nitrogen from *M. vimineum* detritus was much less than in the uninvaded community. In another study, in contrast, *M. vimineum* litter decomposed more slowly than the native species litter and it immobilized nitrogen (Ehrenfeld *et al.*, 2001).

Flory *et al.* (2015) showed that maximum fire temperatures were on average 57% greater in sites invaded by *M. vimineum* than in uninvaded control areas. In addition, fires burned at temperatures of over 300°C for nearly twice as long and flame heights were 98% higher in invaded compared with uninvaded habitats. *M. vimineum* invasion reduced survival of experimental trees by 37% in areas exposed to prescribed fire compared with uninvaded areas, and tree survival in invaded, burned plots was 53% lower than invaded, unburned plots. Controlled burning increased natural tree regeneration overall but there were 60% and 57% fewer tree seedlings in burned and unburned invaded plots, respectively, compared with control plots with the same treatments. Burning increased *M. vimineum* biomass by five-fold the following growing season.

Multiple studies have shown that *M. vimineum* can alter soil carbon cycling. For example, Strickland *et al.* (2011) evaluated soil carbon at *M. vimineum* invaded and nearby uninvaded areas across eight sites in the South-East USA.

They found significant declines in mass of faster-cycling particulate organic matter carbon pools, which resulted in an 11% decline in carbon in the top 10 cm of the soil profile. Carbon added by *M. vimineum* partially offset those effects, resulting in a net carbon loss of about 6%. Their results suggest that invasions of *M. vimineum* may cause faster carbon cycling in invaded forests and result in an overall loss of soil carbon (also see Strickland *et al.*, 2010).

CONTROL

Hand pulling is the preferred method of removal when carried out at the end of the summer, i.e. before seed release, and when new seedlings have germinated. Mowing is effective if carried out in late summer as well. Grazing is not a control option since cattle; deer and even goats do not feed on the plant. Spring burns are ineffective since seeds will germinate after the burn, but burns in late autumn may control the species. Large patches can be sprayed with grassselective herbicides.

REGULATORY STATUS

In the EU, *M. vimineum* is listed as a species of Union concern within the EU Regulation 1143/2014.

Microstegium vimineum is listed by the US Forest Service as one of only 26 Category 1 invasive plants in the Eastern Region of the USA; these are described as highly invasive plants which invade natural habitats and replace native species (http://www.fs.fed.us/). Furthermore, *M. vimineum* was recently ranked as the number one invasive plant of concern by researchers and land managers in the Eastern USA.

PHYTOSANITARY MEASURES

EPPO (2014) recommends: (1) Contaminant of bird seed - Confirmation that the consignment is free from *Microstegium vimineum* seed should be provided by the country of origin. Surveillance and monitoring methods adopted should be specified by the exporting country. (2) Contaminant of growing media adherent to plants for planting - In addition to the existing requirement for a phytosanitary certificate (PC) by the exporting country, confirmation of pest free production from country of origin should be provided. Surveillance and monitoring methods adopted should be specified by the exporting country. In certain circumstances, an additional declaration on the PC may be needed (see EPPO Standard PM 1/1(2) Use of phytosanitary certificates). (3) Contaminant of used machinery - Decontaminate machinery that has come into contact with populations of the plant (see ISPM 41). (4) Contaminant of travellers, their clothes and shoes - Raise awareness on the species, including publicity.

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Datasheet history

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