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Invasive Species Compendium

Detailed coverage of invasive species threatening livelihoods and the environment worldwide

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Datasheet Additional resources (datasheet/additionalresources/109283?scientificName=Drosophila%20suzukii)

Drosophila suzukii (spotted wing drosophila)

Toolbox

Invasives Open Data

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Horizon Scanning Tool

(https://www.cabi.org/HorizonScanningTool)

Mobile Apps

(https://play.google.com/store/apps/dev?id=8227528954463674373&hl=en_GB)

Country Pest Alerts

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Datasheet

Drosophila suzukii (spotted wing drosophila)

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Summary

Last modified
27 February 2020

Datasheet Type(s)
Invasive Species
Pest
Natural Enemy

Preferred Scientific Name
Drosophila suzukii

Preferred Common Name
spotted wing drosophila

Taxonomic Tree
Domain: Eukaryota
Kingdom: Metazoa
Phylum: Arthropoda
Subphylum: Uniramia

(datasheet/109283#toPictures)
More information
(datasheet/109283#toPictures)

Class: Insecta

Summary of Invasiveness

The fruit fly *D. suzukii* is a fruit crop pest and is a serious economic threat to soft summer fruit. A polyphagous pest, it infests a wide range of fruit crops, included grape, as well as an increasing number...

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More information
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(datasheetreport/109283)

Pictures

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Picture	Title	Caption	Copyright
	Adult male	Spotted Wing Drosophila (Cherry Vinegar Fly) Drosophila suzukii: Adult flies have characteristic bright red eyes. Males also have a prominent dark spot on the distal margin of the wings. Approx. body length 2.6-2.8mm.	©Dr Gevork Arakelian/Dept. of Agriculture, Los Angeles County, USA.
	Damage symptoms	Spotted Wing Drosophila (Cherry Vinegar Fly) Drosophila suzukii; damage to cherry fruit from female oviposition.	©Dr Gevork Arakelian/Dept. of Agriculture, Los Angeles County, USA

Identity

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Preferred Scientific Name

Drosophila suzukii Matsumura

Preferred Common Name

spotted wing drosophila

Other Scientific Names

Drosophila (Sophophora) suzukii (Matsumura)
Drosophila suzukii (Matsumura) Kanzawa

International Common Names

English: cherry fruit fly; spotted wing drosophila; spotted-wing drosophila

Local Common Names

: cherry vinegar fly
Germany: Kirschessigfliege
Japan: oto shojobae; outou shoujyou bae

Summary of Invasiveness

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The fruit fly *D. suzukii* is a fruit crop pest and is a serious economic threat to soft summer fruit. A polyphagous pest, it infests a wide range of fruit crops, included grape, as well as an increasing number of wild fruits. *D. suzukii* is an economically damaging pest because the females are able to infest thin-skinned fruits before harvest and the larvae destroy the fruit pulp by feeding. The species is endemic in Asia. It was first recorded as invasive in Hawaii in 1980 and then simultaneously in California and in Europe in 2008. Since 2008 it has spread rapidly throughout the temperate regions of North America and Europe, due to global trade and the initial lack of regulation over the spread of any *Drosophila.* This species has a high reproductive rate and short generation time; *D. suzukii* can theoretically have up to 13 generations per year, which may contribute towards rapid spread, given available suitable hosts. *D. suzukii* is listed on the EPPO alert list.

Taxonomic Tree

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Domain: Eukaryota
Kingdom: Metazoa
Phylum: Arthropoda
Subphylum: Uniramia
Class: Insecta
Order: Diptera
Family: Drosophilidae
Genus: Drosophila
Species: Drosophila suzukii

Notes on Taxonomy and Nomenclature

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In June, 1916, maggots were found to be infesting pre-harvest cherries (*Prunus avium*) in Yamacho, Higashi Yamanashi County, Yamanashi Prefecture, Japan (Kanzawa, 1935 (datasheet/109283#C5BAAABC-FCFC-41A8-8B47-609B6182DB37)). Infested fruit was collected and the adult flies that emerged were confirmed as a species of *Drosophila* (Kanzawa, 1935 (datasheet/109283#C5BAAABC-FCFC-41A8-8B47-609B6182DB37)). The species was later described in 1931 by Dr Shounen Matsumura as *Drosophila suzukii* Matsumura, and he gave it the common name of cherry drosophila (Kanzawa, 1935 (datasheet/109283#C5BAAABC-FCFC-41A8-8B47-609B6182DB37)).

D. suzukii has also been described in the Kashmir region of India as the *D. suzukii* subsp. *indicus* (Parshad and Paika, 1965).

D. suzukii belongs to the *melanogaster* species group of the subgenus Sophophora. The *melanogaster* group is further divided into species subgroups, one of which (the *suzukii* subgroup) comprises, together with 6 other subgroups, the 'oriental lineage' (Kopp and True, 2002 (datasheet/109283#1C409780-F539-4BC5-AD79-E5C173F17C63); Schawaroch, 2002 (datasheet/109283#317E0356-6EB3-4567-81F1-284CC4416381); van der Linde et al., 2010 (datasheet/109283#DA86362B-88CD-4A51-A61D-04DA0D815AAB)).Relationships between and within these subgroups are still far from being resolved, and the *suzukii* subgroup itself is commonly regarded as polyphyletic (Kopp and True, 2002 (datasheet/109283#1C409780-F539-4BC5-AD79-E5C173F17C63)). Recent papers suggested *D. biarmipes* is the sister taxon of *D. suzukii* (Yang et al., 2011; Chiu et al., 2013 (datasheet/109283#A935F06B-603C-4728-9E78-A4F0141B6C64); Ometto et al., 2013 (datasheet/109283#0656B57C-5749-40DE-9B2D-E81D64FFBDB7); Rota Stabelli et al., 2013), in accordance with previous findings (Kopp and True, 2002 (datasheet/109283#1C409780-F539-4BC5-AD79-E5C173F17C63); Barmina and Kopp, 2007 (datasheet/109283#BF3C5914-0673-49E5-946C-984DC5F01141)); however, Prud'homme et al. (2006) and van der Linde and Houle (2008) (datasheet/109283#F2B381B6-C4AE-4C47-9D05-5879745C8F8C), instead supported *D. subpulchrella* as the sister species of *D. suzukii* (with *D. biarmipes* being the sister species of *D. subpulchrella* + *D. suzukii*). Genome scale data may help explore the relationship between *D. suzukii* and *D. subpulchrella*.

Description

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D. suzukii adults are 2-3 mm long with red eyes, a pale brown or yellowish brown thorax and black transverse stripes on the abdomen. The antennae are short and stubby with branched arista. Sexual dimorphism is evident: males display a dark spot on the leading top edge of each wing and females are larger than males and possess a large serrated ovipositor.

The eggs are oval (minor axis is 0.2 mm), milky-white, with two filaments (aeropyle or spiracle) at one end, 0.4 to 0.6 mm long.

The maggot-like larvae are white with visible internal organs and black mouthparts. They grow throughout three larval stages and when fully grown can reach 5.5 mm long and 0.8 mm wide.

The pupae are spindle-shaped, reddish-brown and bear two stalks with small finger-like projections, 3.5 mm long and 1.2 mm wide).

Distribution

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Native Distribution

D. suzukii is thought to be native of eastern and southeastern Asia, including China, Japan and Korea (Walsh et al., 2011 (datasheet/109283#0DA6D6C4-0EA5-429F-817E-FC10945C2D96)), although little is known about its geographical origin. According to references reported by Hauser (2011) (datasheet/109283#7B63AEB7-4F57-4D35-86F3-6903EE8BD6D5) there is the possibility that the species is not native to Japan, but had been introduced into the country at the turn of the century.

Introduced Distribution

D. suzukii has been introduced to several Hawaiian islands, including Oahu (Hauser, 2011 (datasheet/109283#7B63AEB7-4F57-4D35-86F3-6903EE8BD6D5)). It has also been introduced into North America and Europe. *D. suzukii* has recently been recorded in Iran, indicating expansion of its territory into the Middle East (Parchami-Araghi et al., 2015 (datasheet/109283#B6C0B4A5-1EE2-493E-A7F6-4A7565F6D3DF)). It has also been recorded in Réunion (EPPO, 2018 (datasheet/109283#b838563e-b438-4715-9932-d2afded09783)).

Distribution Table

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The distribution in this summary table is based on all the information available. When several references are cited, they may give conflicting information on the status. Further details may be available for individual references in the Distribution Table Details section which can be selected by going to Generate Report.

Last updated: 12 Mar 2020

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
Africa							
Morocco (datasheet/108493)	Present					EPPO (2019) (datasheet/109283#REF-DDB-151267)	
Réunion (datasheet/108546)	Present, Localized			2013		EPPO (2018) (datasheet/109283#REF-DDB-181072); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Asia							
Bangladesh (datasheet/108369)	Present		Native			Pansa et al. (2011) (datasheet/109283#REF-DDB-131588)	
China (datasheet/108398)	Present		Native			Peng (1937) (datasheet/109283#REF-DDB-671); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	Eastern
-Anhui (datasheet/108667)	Present					DAFF (2013) (datasheet/109283#REF-DDB-166238); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	Cited as recorde Kai et al
-Beijing (datasheet/108668)	Present					DAFF (2013) (datasheet/109283#REF-DDB-166238)	
-Fujian (datasheet/108670)	Present					DAFF (2013) (datasheet/109283#REF-DDB-166238); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Guangdong (datasheet/108671)	Present					DAFF (2013) (datasheet/109283#REF-DDB-166238); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
-Guangxi (datasheet/108673)	Present					DAFF (2013) (datasheet/109283#REF-DDB-166238); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Guizhou (datasheet/108674)	Present					EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Hainan (datasheet/108675)	Present					DAFF (2013) (datasheet/109283#REF-DDB-166238); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Heilongjiang (datasheet/108679)	Present					DAFF (2013) (datasheet/109283#REF-DDB-166238); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Henan (datasheet/108680)	Present					DAFF (2013) (datasheet/109283#REF-DDB-166238); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Hubei (datasheet/108676)	Present					EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Hunan (datasheet/108681)	Present					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Jiangsu (datasheet/108683)	Present					DAFF (2013) (datasheet/109283#REF-DDB-166238); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Jiangxi (datasheet/108684)	Present					DAFF (2013) (datasheet/109283#REF-DDB-166238); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
-Jilin (datasheet/108682)	Present					DAFF (2013) (datasheet/109283#REF-DDB-166238); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Liaoning (datasheet/108685)	Present					DAFF (2013) (datasheet/109283#REF-DDB-166238); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Shandong (datasheet/108692)	Present					DAFF (2013) (datasheet/109283#REF-DDB-166238); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Shanghai (datasheet/108690)	Present					DAFF (2013) (datasheet/109283#REF-DDB-166238)	
-Shanxi (datasheet/108693)	Present					DAFF (2013) (datasheet/109283#REF-DDB-166238); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Sichuan (datasheet/108691)	Present					DAFF (2013) (datasheet/109283#REF-DDB-166238); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Yunnan (datasheet/108698)	Present		Native			Wu SuRan et al. (2007) (datasheet/109283#REF-DDB-115440); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Zhejiang (datasheet/108699)	Present					DAFF (2013) (datasheet/109283#REF-DDB-166238); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
India (datasheet/108459)	Present, Localized					EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
-Chandigarh (datasheet/108725)	Present					EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Jammu and Kashmir (datasheet/108736)	Present		Native			EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Karnataka (datasheet/108738)	Present					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Uttar Pradesh (datasheet/108753)	Present					DAFF (2013) (datasheet/109283#REF-DDB-166238); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Iran (datasheet/108462)	Present		Introduced			Parchami-Araghi et al. (2015) (datasheet/109283#REF-DDB-175134)	
Japan (datasheet/108467)	Present, Widespread		Introduced		Invasive	Kanzawa (1935) (datasheet/109283#REF-DDB-172577); Uchino (2005) (datasheet/109283#REF-DDB-107928); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	The four Islands Japan, R Bonin, K jima and Iriomote Islands (2013)
-Hokkaido (datasheet/108760)	Present					EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Honshu (datasheet/108761)	Present					Sasaki and Sato (1995) (datasheet/109283#REF-DDB-74474); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Kyushu (datasheet/108762)	Present					EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
-Ryukyu Islands (datasheet/108763)	Present					EPPO (2013) (datasheet/109283#REF-DDB-150701); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Myanmar (datasheet/108503)	Present, Widespread					Toda (1991) (datasheet/109283#REF-DDB-57230); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	The cen northern regions highland
North Korea (datasheet/108476)	Present, Widespread		Native			Kanzawa (1939) (datasheet/109283#REF-DDB-918); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Pakistan (datasheet/108537)	Present					EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); CABI (Undated) (datasheet/109283#REF-DDB--27)	
South Korea (datasheet/108477)	Present, Widespread		Native			Kanzawa (1939) (datasheet/109283#REF-DDB-918); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Taiwan (datasheet/108590)	Present					Okada (1976) (datasheet/109283#REF-DDB-174923); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Thailand (datasheet/108580)	Present		Native			Hauser (2011) (datasheet/109283#REF-DDB-132742); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
Turkey (datasheet/108587)	Present, Few occurrences					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Europe							
Austria (datasheet/108361)	Present, Widespread		Introduced	2011		Lethmayer (2011) (datasheet/109283#REF-DDB-173360); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); EPPO (2019) (datasheet/109283#REF-DDB-151267)	
Belgium (datasheet/108370)	Present, Localized		Introduced	2011		Mortelmans et al. (2012) (datasheet/109283#REF-DDB-135778); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Bosnia and Herzegovina (datasheet/108367)	Present, Localized					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); Ostojić et al. (2014) (datasheet/109283#REF-DDB-137925)	
Bulgaria (datasheet/108372)	Present, Localized					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Croatia (datasheet/108452)	Present, Localized			2010	Invasive	Milek et al. (2011) (datasheet/109283#REF-DDB-134424); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Cyprus (datasheet/108408)	Present, Localized					EPPO (2019) (datasheet/109283#REF-DDB-151267)	
Czechia (datasheet/108409)	Present, Localized					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); Máca et al. (2015) (datasheet/109283#REF-DDB-139977)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
France (datasheet/108429)	Present, Localized		Introduced	2010	Invasive	Mandrin et al. (2010) (datasheet/109283#REF-DDB-131860); Rouzes et al. (2012) (datasheet/109283#REF-DDB-134839); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Corsica (datasheet/108704)	Present, Localized					EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Germany (datasheet/108410)	Present, Localized					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); EPPO (2014) (datasheet/109283#REF-DDB-150700)	
Greece (datasheet/108443)	Present, Few occurrences					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Crete (datasheet/108711)	Present, Few occurrences					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Hungary (datasheet/108454)	Present, Few occurrences					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); IPPC (2013) (datasheet/109283#REF-DDB-166778); Kiss et al. (2013) (datasheet/109283#REF-DDB-136057); EPPO (2014) (datasheet/109283#REF-DDB-150700); Lengyel et al. (2015) (datasheet/109283#REF-DDB-139266)	
Ireland (datasheet/108456)	Present					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
Italy (datasheet/108464)	Present, Localized		Introduced	2009		EPPO (2011) (datasheet/109283#REF-DDB-150703); Grassi et al. (2011) (datasheet/109283#REF-DDB-133106); Pansa et al. (2011) (datasheet/109283#REF-DDB-131588); Grassi and Pallaoro (2012) (datasheet/109283#REF-DDB-148024); EPPO (2014) (datasheet/109283#REF-DDB-150700); Mori and Marchesini (2014) (datasheet/109283#REF-DDB-137826); Baser et al. (2015) (datasheet/109283#REF-DDB-139701); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Sardinia (datasheet/108758)	Present, Localized					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Sicily (datasheet/108757)	Present, Localized					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); EPPO (2014) (datasheet/109283#REF-DDB-150700)	
Montenegro (datasheet/108496)	Present, Localized					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Netherlands (datasheet/108522)	Present, Localized		Introduced	2012		NPPO (2012) (datasheet/109283#REF-DDB-167186); Helsen et al. (2013) (datasheet/109283#REF-DDB-150271); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Poland (datasheet/108538)	Present, Few occurrences					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); CABI (Undated) (datasheet/109283#REF-DDB--27);	
Portugal (datasheet/108542)	Present, Few occurrences		Introduced	2012		EPPO (2013) (datasheet/109283#REF-DDB-150701); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	

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Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
-Madeira (datasheet/108777)	Present					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Romania (datasheet/108548)	Present, Localized					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Russia (datasheet/108550)	Present, Few occurrences					EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Russian Far East (datasheet/108785)	Present, Few occurrences					Sidorenko (1992) (datasheet/109283#REF-DDB-176603); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Serbia (datasheet/108549)	Present, Localized					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); Toševski et al. (2014) (datasheet/109283#REF-DDB-148475)	
Slovakia (datasheet/108561)	Present, Few occurrences					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Slovenia (datasheet/108559)	Present		Introduced	2010		Seljak (2011) (datasheet/109283#REF-DDB-132124); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Spain (datasheet/108421)	Present, Localized					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); Arnó et al. (2012) (datasheet/109283#REF-DDB-135341); EPPO (2014) (datasheet/109283#REF-DDB-150700)	
Sweden (datasheet/108556)	Present		Introduced	2014		Manduric (2017) (datasheet/109283#REF-DDB-148792)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
Switzerland (datasheet/108393)	Present, Widespread		Introduced	2011		Kehrli et al. (2012) (datasheet/109283#REF-DDB-172695); Kehrli et al. (2013) (datasheet/109283#REF-DDB-136135); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
United Kingdom (datasheet/108431)	Present, Few occurrences		Introduced	2012		IPPC (2012) (datasheet/109283#REF-DDB-166766); EPPO (2013) (datasheet/109283#REF-DDB-150701); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649);	
North America							
Canada (datasheet/108388)	Present, Localized		Introduced	2009		IPPC (2010) (datasheet/109283#REF-DDB-181115); Walsh et al. (2011) (datasheet/109283#REF-DDB-131779); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Alberta (datasheet/108653)	Present		Introduced			EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-British Columbia (datasheet/108654)	Present, Widespread		Introduced	2009		Thistlewood et al. (2012) (datasheet/109283#REF-DDB-147641); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); CABI (Undated) (datasheet/109283#REF-DDB--27)	
-Manitoba (datasheet/108655)	Present		Introduced			EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
-New Brunswick (datasheet/108656)	Present					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Newfoundland and Labrador (datasheet/108657)	Present					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Nova Scotia (datasheet/108658)	Present					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Ontario (datasheet/108661)	Present		Introduced	2010		OMAFRA (2013) (datasheet/109283#REF-DDB-167224); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Prince Edward Island (datasheet/108662)	Present					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Quebec (datasheet/108663)	Present		Introduced	2012		Saguez et al. (2013) (datasheet/109283#REF-DDB-149846); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Costa Rica (datasheet/108402)	Absent, Unconfirmed presence record(s)					EPPO (2014) (datasheet/109283#REF-DDB-150700); Hauser (2011) (datasheet/109283#REF-DDB-132742)	
Mexico (datasheet/108513)	Present, Localized		Introduced	2011	Invasive	NAPPO (2011) (datasheet/109283#REF-DDB-167046); EPPO (2014) (datasheet/109283#REF-DDB-150700); Naranjo-Lázaro et al. (2014) (datasheet/109283#REF-DDB-137716); Lasa and Tadeo (2015) (datasheet/109283#REF-DDB-139741); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); CABI (Undated) (datasheet/109283#REF-DDB--27)	Aguasca Baja Ca Colima, Guanaju Jalisco, Michoac Estado d México Veracru

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
United States (datasheet/108597)	Present, Localized		Introduced	2008		IPPC (2010) (datasheet/109283#REF-DDB-181115); Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Alabama (datasheet/108796)	Present		Introduced	2011		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Arkansas (datasheet/108797)	Present		Introduced	2012		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-California (datasheet/108799)	Present, Widespread		Introduced	2008		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); CABI (Undated) (datasheet/109283#REF-DDB--27)	
-Colorado (datasheet/108800)	Present		Introduced	2012		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Connecticut (datasheet/108801)	Present, Widespread		Introduced	2011		Maier (2012) (datasheet/109283#REF-DDB-137506); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Delaware (datasheet/108803)	Present		Introduced	2011		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
-Florida (datasheet/108804)	Present, Widespread		Introduced	2009		Price and Nagle (2009) (datasheet/109283#REF-DDB-175534); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); CABI (Undated) (datasheet/109283#REF-DDB--27)	
-Georgia (datasheet/108805)	Present		Introduced	2011		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Hawaii (datasheet/108806)	Present, Widespread		Introduced	1980	Invasive	EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); CABI (Undated) (datasheet/109283#REF-DDB--27)	
-Idaho (datasheet/108808)	Present		Introduced	2012		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Illinois (datasheet/108809)	Present		Introduced	2012		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Indiana (datasheet/108810)	Present		Introduced	2012		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Iowa (datasheet/108807)	Present		Introduced	2012		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Kansas (datasheet/108811)	Present, Localized					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
-Kentucky (datasheet/108812)	Present		Introduced	2012		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Louisiana (datasheet/108813)	Present		Introduced	2011		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Maine (datasheet/108816)	Present		Introduced	2011		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); University of Maine (2012) (datasheet/109283#REF-DDB-167503); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Maryland (datasheet/108815)	Present		Introduced	2011		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Massachusetts (datasheet/108814)	Present		Introduced	2011		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Michigan (datasheet/108817)	Present, Widespread		Introduced	2010	Invasive	Isaacs et al. (2010) (datasheet/109283#REF-DDB-172249); EPPO (2014) (datasheet/109283#REF-DDB-150700); Timmeren and Isaacs (2014) (datasheet/109283#REF-DDB-137804); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Minnesota (datasheet/108818)	Present		Introduced	2012		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
-Mississippi (datasheet/108820)	Present		Introduced	2010		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Missouri (datasheet/108819)	Present		Introduced	2013		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Montana (datasheet/108821)	Present		Introduced	2011		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-New Hampshire (datasheet/108825)	Present		Introduced	2011		CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-New Jersey (datasheet/108826)	Present		Introduced	2011		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-New Mexico (datasheet/108827)	Present					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-New York (datasheet/108829)	Present		Introduced	2011		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-North Carolina (datasheet/108822)	Present		Introduced	2010		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-North Dakota (datasheet/108823)	Present		Introduced	2013		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982)	
-Ohio (datasheet/108830)	Present		Introduced	2011		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
-Oklahoma (datasheet/108831)	Present					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Oregon (datasheet/108832)	Present, Widespread		Introduced	2009		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); CABI (Undated) (datasheet/109283#REF-DDB--27)	
-Pennsylvania (datasheet/108833)	Present		Introduced	2011		Freda and Braverman (2013) (datasheet/109283#REF-DDB-136310); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Rhode Island (datasheet/108834)	Present		Introduced	2011		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-South Carolina (datasheet/108835)	Present		Introduced	2010		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Tennessee (datasheet/108837)	Present		Introduced	2011		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Texas (datasheet/108838)	Present		Introduced	2012		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Utah (datasheet/108839)	Present		Introduced	2010		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
-Vermont (datasheet/108841)	Present		Introduced	2011		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Virginia (datasheet/108840)	Present		Introduced	2011		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Washington (datasheet/108842)	Present, Widespread		Introduced	2009		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); CABI (Undated) (datasheet/109283#REF-DDB--27)	
-West Virginia (datasheet/108844)	Present		Introduced	2011		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Wisconsin (datasheet/108843)	Present		Introduced	2010		Burrack et al. (2012) (datasheet/109283#REF-DDB-135982); EPPO (2014) (datasheet/109283#REF-DDB-150700); CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Wyoming (datasheet/108845)	Present					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
Oceania							
French Polynesia (datasheet/108533)	Present, Localized					EPPO (2019) (datasheet/109283#REF-DDB-151267)	
South America							
Argentina (datasheet/108359)	Present					Lue ChiaHua et al. (2017) (datasheet/109283#REF-DDB-148515)	

Continent/Country/Region	Distribution	Last Reported	Origin	First Reported	Invasive	Reference	Notes
Brazil (datasheet/108381)	Present, Localized					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); Deprá et al. (2014) (datasheet/109283#REF-DDB-137941)	
-Distrito Federal	Present, Few occurrences					EPPO (2019) (datasheet/109283#REF-DDB-151267)	
-Espirito Santo (datasheet/108632)	Present, Localized					EPPO (2019) (datasheet/109283#REF-DDB-151267)	
-Minas Gerais (datasheet/108636)	Present					EPPO (2019) (datasheet/109283#REF-DDB-151267)	
-Parana (datasheet/108643)	Present, Localized					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Rio de Janeiro (datasheet/108644)	Present, Few occurrences					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Rio Grande do Sul (datasheet/108648)	Present					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Santa Catarina (datasheet/108649)	Present					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649)	
-Sao Paulo (datasheet/108651)	Absent, Intercepted only					CABI and EPPO (2016) (datasheet/109283#REF-DDB-140649); Vilela and Mori (2014) (datasheet/109283#REF-DDB-138737)	
Chile (datasheet/108396)	Present, Localized					EPPO (2019) (datasheet/109283#REF-DDB-151267)	
Ecuador (datasheet/108416)	Absent, Unconfirmed presence record(s)					EPPO (2014) (datasheet/109283#REF-DDB-150700); Hauser (2011) (datasheet/109283#REF-DDB-132742)	
Uruguay (datasheet/108598)	Present, Localized					EPPO (2019) (datasheet/109283#REF-DDB-151267)	

History of Introduction and Spread

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Although considered native to East Asia, it is possible that *D. suzukii* is not native to Japan but was introduced into the country at the turn of the century. A detailed historic account of the dispersion of *D. suzukii* outside of its native area is given in Hauser (2011) (datasheet/109283#7B63AEB7-4F57-4D35-86F3-6903EE8BD6D5).

North America and Hawaii

In 1980 it was collected in Hawaii without any report of it causing economic damage. In September 2008 a sample of flies collected in a raspberry field in Santa Cruz County, California, USA, was the first detection of *D. suzukii* in mainland USA. The following spring several records of maggots were found in cherries. In 2009 *D. suzukii* had spread to more than 20 counties in California, the other Pacific Coast states of Oregon, Washington and British Columbia (Canada), as well as in Florida, USA.

In 2010 *D. suzukii* was detected in six other states in the USA (Utah, North Carolina, South Carolina, Wisconsin, Michigan and Mississippi). *D. suzukii* rapidly spread into other 15 states in USA in 2011, an additional nine States in 2012 and a further two in 2013. By late 2013, only eight US states were not invaded by *D. suzukii*: Arizona, Nevada, New Mexico, Oklahoma, Kansas, Nebraska, South Dakota and Wyoming (Burrack et al., 2012 (datasheet/109283#D76027C7-A967-43B7-8A9B-87B97AED464E)).

In Canada, *D. suzukii* spread rapidly in 2010. Already present in British Columbia, in that year it was also recorded in Alberta, Manitoba, Ontario and Quebec (Hauser, 2011 (datasheet/109283#7B63AEB7-4F57-4D35-86F3-6903EE8BD6D5)).

Europe

The first detection and spread of *D. suzukii* in Europe was detailed by Cini et al. (2012) (datasheet/109283#75F552C6-0DDF-4554-BD49-288C20573BBB). The first adults of *D. suzukii* were caught at the same time in Rasquera Province, Spain (Calabria et al., 2012 (datasheet/109283#2CBF56E2-DE3A-453F-BCD4-B10EEA352C4F)) and in the Tuscany region, Italy (Raspi et al., 2011 (datasheet/109283#7238B9AD-1744-423C-AF6B-CA37320FD403)) in 2008. In 2009 *D. suzukii* adults were recorded in traps in other regions of Spain (Bellaterra, near Barcelona), France (Montpellier and Maritimes Alpes) and Italy (Trentino) (Grassi et al., 2009 (datasheet/109283#2FCE869E-5E63-4491-83F2-1054E0279B68); Mandrin et al, 2010; Calabria et al., 2012 (datasheet/109283#2CBF56E2-DE3A-453F-BCD4-B10EEA352C4F)). In Trentino, both first oviposition on wild hosts (*Vaccinium*, *Fragaria* and *Rubus* spp.) and economically significant damage on several species of cultivated berries were reported (Grassi et al., 2009 (datasheet/109283#2FCE869E-5E63-4491-83F2-1054E0279B68)).

By 2010-2011, the range of *D. suzukii* enlarged further, including other regions in Italy and France (Cini et al, 2012; Weydert et al, 2012) as well as expanding north and east, invading Switzerland (Baroffio and Fisher, 2011 (datasheet/109283#352C477F-5AAD-4197-8A06-F22753394C7F)), Slovenjia (Seljiak, 2011), Croatia (Milek et al., 2011 (datasheet/109283#74CD6831-01C3-4C43-BFB7-EDB6CB2B22AC)), Austria (Lethmayer, 2011 (datasheet/109283#7CB07207-D40C-44D2-8411-CEB5559454DF)), Germany (Vogt et al., 2012 (datasheet/109283#5064C562-B0A3-4119-8BA1-0CF0163992D6)), Belgium (Mortelmans et al., 2012 (datasheet/109283#443C5FB2-0E76-4143-B170-7977D32EF551)), the Netherlands (NPPO, 2012 (datasheet/109283#0DCAC4DC-BDB1-4D37-B74B-060B3E0E88D1)), the UK (EPPO, 2012 (datasheet/109283#EAE5A596-B8D6-4F73-90C5-9020930D01A5)) and Hungary (Kiss et al, 2013).

Risk of Introduction

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The global fresh fruit trade, coupled with the cryptic nature of the larvae to hide inside the fruit undetected until after transportation, facilitate the increasing distribution of this pest. Given its very rapid spread in Europe and North America in recent years, it seem likely that *D. suzukii* will continue to expand its range in these continents to some extent. Calabria et al. (2012) (datasheet/109283#2CBF56E2-DE3A-453F-BCD4-B10EEA352C4F) estimated that *D. suzukii* was able to spread approximately 1400 km a year.

Habitat

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D. suzukii development is fostered by widespread cultivation of susceptible crops (mainly soft fruits and cherry) (Lee et al., 2011; Bellamy et al., 2013 (datasheet/109283#ACDAB577-E14D-4A80-9EED-6022C93D105B)), distribution of cultivated land at different altitudes (offering a differentiated and extended fruit ripening period), proximity of forests and uncultivated or marginal areas with susceptible wild fruits. *D. suzukii* seems to have important relationships with forests and woodland, where it can find a suitable microclimate and host plants year-round (Grassi et al, 2011).

The establishment of *D. suzukii* in more northern regions, where there are harsh winters, is likely to depend on the presence of favourable overwintering sites that are generally associated with human habitation (Dalton et al., 2011 (datasheet/109283#9DE22467-1B9C-44F6-AA7B-4AE187A73561); EPPO, 2013a (datasheet/109283#BA1320C2-5DCA-4E2F-86C0-ADCFBD1F7667)).

Habitat List

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Category	Sub-Category	Habitat	Presence	Status
Terrestrial	Terrestrial – Managed	Cultivated / agricultural land	Principal habitat	
		Protected agriculture (e.g. glasshouse production)	Principal habitat	
		Managed forests, plantations and orchards	Principal habitat	
		Urban / peri-urban areas	Secondary/tolerated habitat	
	Terrestrial - Natural / Semi-natural	Natural forests	Principal habitat	
		Scrub / shrublands	Principal habitat	

Hosts/Species Affected

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D. suzukii is predisposed towards infesting and developing in undamaged, ripening fruit. Fruits become susceptible to *D. suzukii* as they start to change colour, which coincides with softening skins and higher sugar levels (Burrack et al., 2013 (datasheet/109283#33AE7D75-35FD-4E8E-BCCE-B98C3CB714E7)). There are differences in fruit susceptibility within species and among varieties within the same fruit species (Lee et al., 2011). Fruit penetration force is one potential measure of host susceptibility, but host attractiveness will likely depend upon additional factors, such as soluble sugar content (Burrack et al., 2013 (datasheet/109283#33AE7D75-35FD-4E8E-BCCE-B98C3CB714E7)). If there is no suitable fruit available, then *D. suzukii* will attack damaged or deteriorating fruit (Kanzawa, 1935 (datasheet/109283#C5BAAABC-FCFC-41A8-8B47-609B6182DB37); Lee et al., 2011). Non-commercially marketed fallen fruit or damaged fruit of the following plant hosts may also be attacked: *Prunus persica*, *Malus pumila* var. *domestica, Prunus triflora, Prunus armeniaca, Pyrus pyrifolia, Pyrus sinensis, Eriobotrya japonica, Lycopersicum esculentum* (Kanzawa, 1939 (datasheet/109283#99D9BA76-F7F6-4B4F-8C9F-7E6A5FB51BFC)) and *Rubus microphyllus* (Mitsui et al., 2010), as well as over-ripe figs still on the tree (*Ficus carica*) (Yu et al., 2013 (datasheet/109283#5CCFD46E-E2CD-4363-ACFA-D1503FB7808F)).

D. suzukii has been reared from rotting strawberry guava fruits (*Psidium cattleianum*) collected from trees and on the ground (Kido et al., 1996 (datasheet/109283#EB3862C5-58E5-4CA8-944B-9C52245C6C3A)). It has been observed feeding upon injured or culled fruit including apple and oranges (Walsh et al., 2001).

A recently extensive study on seasonal life cycles and food resources of *D. suzukii* from low to high altitudes in central Japan (Mitsui et al., 2010) confirmed that *D. suzukii* emerges almost only from fruits. Some *D. suzukii* individuals emerged from the fruits of *Rubus crataegifolius*, *Alangium platanifolium, Cornus kousa*, *Torreya nucifera* and *Viburnum dilatatum*. Grassi et al. (2011) (datasheet/109283#FD576480-5DB6-46B3-9D25-43FB46FEEB74) reared *D. suzukii* also on *Prunus laurocerasus* and Mann and Stelinski (2011) (datasheet/109283#ACA1B987-1E73-4E52-BB79-944F29F039C3) reported *Ribes* spp. as host plant of *D. suzukii*, but this latest observation has not been confirmed in Europe. *D. suzukii* adults also emerged from the flowers of *Styrax japonicus* (Mitsui et al., 2010), and in early spring in southern Japan it was also observed to breed on the flowers of *Camellia japonica* (Nishiharu, 1980).

This field of work is not well described, and so the list of Host Plants and Other Plants Affected contains probable as well as reported hosts.

Host Plants and Other Plants Affected

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Plant name	Family	Context
Actinidia (datasheet/7763)	Actinidiaceae	Main
Actinidia arguta (tara vine) (datasheet/7764)	Actinidiaceae	Other
Ampelopsis (datasheet/4812)	Vitaceae	Other
Ampelopsis brevipedunculata (Amur amelopsis) (datasheet/4815)	Vitaceae	Wild host
Arbutus unedo (arbutus) (datasheet/6808)	Ericaceae	Wild host
Aucuba japonica (Japanese aucuba) (datasheet/7936)	Cornaceae	Wild host
Basella alba (Malabar spinach) (datasheet/8273)	Basellaceae	Other
Cornus (Dogwood) (datasheet/16285)	Cornaceae	Other
Cornus controversa (giant dogwood) (datasheet/16293)	Cornaceae	Other
Cornus kousa (Kousa dogwood) (datasheet/16300)	Cornaceae	Wild host
Diospyros kaki (persimmon) (datasheet/19575)	Ebenaceae	Main
Diospyros virginiana (persimmon (common)) (datasheet/19639)	Ebenaceae	Other
Elaeagnus multiflora (cherry silverberry) (datasheet/114049)	Elaeagnaceae	Wild host
Elaeagnus umbellata (autumn olive) (datasheet/20728)	Elaeagnaceae	Wild host
Eugenia uniflora (Surinam cherry) (datasheet/23099)	Myrtaceae	Wild host
Ficus (datasheet/24049)	Moraceae	Other
Ficus carica (common fig) (datasheet/24078)	Moraceae	Main
Fragaria (strawberry) (datasheet/24405)	Rosaceae	Main
Fragaria ananassa (strawberry) (datasheet/24406)	Rosaceae	Main
Frangula alnus (alder buckthorn) (datasheet/47001)	Rhamnaceae	Other
Gaultheria adenothrix (datasheet/120211)	Ericaceae	Wild host
Lindera benzoin (spicebush) (datasheet/30723)	Lauraceae	Other
Lonicera (honeysuckles) (datasheet/31177)	Caprifoliaceae	Wild host
Lonicera caerulea (datasheet/31180)	Caprifoliaceae	Other
Malus domestica (apple) (datasheet/31964)	Rosaceae	Other
Morus (mulberrytree) (datasheet/34815)	Moraceae	Other
Morus alba (mora) (datasheet/34816)	Moraceae	Other
Morus bombycis (Japanese mulberry) (datasheet/34818)	Moraceae	Wild host
Morus rubra (red mulberrytree) (datasheet/34832)	Moraceae	Wild host
Murraya paniculata (orange jessamine) (datasheet/35178)	Rutaceae	Wild host
Myrica rubra (datasheet/35495)	Myricaceae	Other
Phytolacca americana (pokeweed) (datasheet/40651)	Phytolaccaceae	Wild host
Prunus (stone fruit) (datasheet/44239)	Rosaceae	Main
Prunus armeniaca (apricot) (datasheet/44249)	Rosaceae	Other

Plant name	Family	Context
Prunus avium (sweet cherry) (datasheet/44250)	Rosaceae	Main
Prunus domestica (plum) (datasheet/44278)	Rosaceae	Main
Prunus japonica (Japanese bush cherry tree) (datasheet/44299)	Rosaceae	Wild host
Prunus laurocerasus (cherry laurel) (datasheet/44309)		Other
Prunus mahaleb (mahaleb cherry) (datasheet/44312)	Rosaceae	Wild host
Prunus mume (Japanese apricot tree) (datasheet/44320)	Rosaceae	Other
Prunus nipponica (datasheet/120217)	Rosaceae	Wild host
Prunus persica (peach) (datasheet/44340)	Rosaceae	Main
Prunus persica var. nucipersica (nectarine) (datasheet/44337)	Rosaceae	Other
Prunus sargentii (sargent's cherry) (datasheet/44346)	Rosaceae	Other
Ribes (currants) (datasheet/47527)	Grossulariaceae	Main
Rubus (blackberry, raspberry) (datasheet/47977)	Rosaceae	Main
Rubus armeniacus (Himalayan blackberry) (datasheet/116780)	Rosaceae	Main
Rubus fruticosus (blackberry) (datasheet/47995)	Rosaceae	Main
Rubus hirsutus (datasheet/108128)	Rosaceae	Wild host
Rubus idaeus (raspberry) (datasheet/48002)	Rosaceae	Main
Rubus laciniatus (cutleaf blackberry) (datasheet/48004)	Rosaceae	Main
Rubus loganobaccus (loganberry) (datasheet/48005)	Rosaceae	Main
Rubus spectabilis (salmonberry) (datasheet/48020)	Rosaceae	Other
Rubus triphyllus (datasheet/120220)	Rosaceae	Wild host
Rubus ursinus (boysenberry) (datasheet/48024)	Rosaceae	Main
Sambucus nigra (elder) (datasheet/48259)	Caprifoliaceae	Other
Solanum dulcamara (bittersweet nightshade) (datasheet/117225)	Solanaceae	Other
Solanum luteum (datasheet/117232)	Solanaceae	Other
Symphoricarpos albus (common snowberry) (datasheet/52359)	Caprifoliaceae	Other
Taxus baccata (English yew) (datasheet/52812)	Taxaceae	Other
Vaccinium (blueberries) (datasheet/55994)	Ericaceae	Main
Vaccinium angustifolium (Lowbush blueberry) (datasheet/55996)	Ericaceae	Main
Vaccinium corymbosum (blueberry) (datasheet/56000)	Ericaceae	Main
Vaccinium myrtillus (blueberry) (datasheet/56011)	Ericaceae	Wild host
Viscum album (mistletoe) (datasheet/56462)	Viscaceae	Other
Vitis (grape) (datasheet/56493)	Vitaceae	Main
Vitis labrusca (fox grape) (datasheet/56499)	Vitaceae	Other
Vitis vinifera (grapevine) (datasheet/56504)	Vitaceae	Main

Symptoms

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D. suzukii larvae cause damage by feeding on the pulp inside fruit and berries. The infested fruit begins to collapse around the feeding site causing a depression or visible blemish on the fruit. The oviposition scar exposes the fruit to secondary attack by pathogens and other insects, which may cause rotting (Hauser et al., 2009 (datasheet/109283#C4E6DC4E-0F8F-4E71-A7FA-A2DB76AF3179); Walton et al., 2010 (datasheet/109283#473354BC-AD2D-4239-A1F0-93F7945CD010)).

List of Symptoms/Signs

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Sign	Life Stages	Type
Fruit / internal feeding		
Inflorescence / external feeding		

Biology and Ecology

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Genetics

The *D. suzukii* genome is comparable in size and repeat content to other *Drosophila* species. Genome-scale relaxed clock analyses indicate a late Miocene origin of *D. suzukii*, concomitant with paleo-geological and climatic conditions that suggest an adaptation to temperate climates. Furthermore, all the analyses support a close genetic relationship between *D. suzukii* and *D. biarmipes* but a low nucleotide substitution rate in comparison with the lineage leading to *D. biarmipes* (Yang et al., 2012 (datasheet/109283#E1CB586A-CC5C-497A-9A24-A181187C8B0A); Chiu et al., 2013 (datasheet/109283#A935F06B-603C-4728-9E78-A4F0141B6C64); Ometto et al., 2013 (datasheet/109283#0656B57C-5749-40DE-9B2D-E81D64FFBDB7)).

Reproductive Biology

Detailed information about the biology of *D. suzukii* is available in Kanzawa (1935) (datasheet/109283#C5BAAABC-FCFC-41A8-8B47-609B6182DB37). *D. suzukii* overwinter as adults (Dalton et al., 2011 (datasheet/109283#9DE22467-1B9C-44F6-AA7B-4AE187A73561)). Flies emerge in spring, but some adults may be active during warm winter days. Eggs are laid in ripening fruits and the number of eggs per fruit ranges from one to several, scattered over the fruit. *D. suzukii* host selection under field conditions may differ among species and among varieties within a species, and laboratory observations suggest that fruit firmness may be one driver of this selection (Burrack et al., 2013 (datasheet/109283#33AE7D75-35FD-4E8E-BCCE-B98C3CB714E7)). Egg-laying lasts 10-65 days with up to 21 eggs laid per day. Each female can lay 195 eggs during her lifetime (Kanzawa, 1939 (datasheet/109283#99D9BA76-F7F6-4B4F-8C9F-7E6A5FB51BFC); Tochen et al., 2014 (datasheet/109283#985626D9-05D1-4D89-9F21-E9EA0A85FF24)). Eggs hatch in 1-3 days, larvae mature in 3-13 days and most of them pupate in the fruit, but some drop and creep into the soil. Pupae period lasts between 4 and 43 days. The minimum, optimal and maximum intrinsic rate of natural increase was estimated at 13.4, 21.0 and 29.4°C by Tochen et al. (2014) (datasheet/109283#985626D9-05D1-4D89-9F21-E9EA0A85FF24).

Mating of new adults can happen any time of the day, but it can be observed more often during the day when the temperature is relatively high. Males are always active, but females are passive. Courtship was described by Kanzawa (1939) (datasheet/109283#99D9BA76-F7F6-4B4F-8C9F-7E6A5FB51BFC) and the role of the visual stimulus in the courtship was investigated by Fuyama (1979) (datasheet/109283#B92B62D2-29F7-44C6-90E9-32F648718E3D). The crucial role of specific substrate-borne vibrations during courtship in *D. suzukii* was demonstrated by Mazzoni et al. (2013) (datasheet/109283#7534A28A-A147-4034-A8D6-83B81A45DB22). Females oviposit after mating and repeat mating days later (Kanzawa, 1939 (datasheet/109283#99D9BA76-F7F6-4B4F-8C9F-7E6A5FB51BFC)). Oviposition generally occurs from April to November. Mitsui et al. (2010) reported that *D. suzukii* individuals collected in autumn were reproductively immature, suggesting a winter reproductive diapause. No reproductive behaviour was observed during laboratory experiments where *D. suzukii* was kept for the entire life cycle at temperatures below 10°C (Mitsui et al., 2010; Tochen et al., 2014 (datasheet/109283#985626D9-05D1-4D89-9F21-E9EA0A85FF24)). Mitsui et al. (2010) assumed that the males which were emerging in those experimental conditions were rendered sterile and were unable to mate successfully with emerged females. Low levels of reproduction or no reproduction were found at temperatures above 30°C (Tochen et al., 2014 (datasheet/109283#985626D9-05D1-4D89-9F21-E9EA0A85FF24)).

The life cycle from egg hatching to adult emergence ranges from about 9-10 days to 21-25 days at 25°C and 15°C, respectively (Kanzawa, 1939 (datasheet/109283#99D9BA76-F7F6-4B4F-8C9F-7E6A5FB51BFC)). Recent laboratory observations recorded the development from egg to egg-laying female as ranging from about a week to 12-15 days at 21.1°C and at 18.3°C, respectively (Walsh et al., 2011 (datasheet/109283#0DA6D6C4-0EA5-429F-817E-FC10945C2D96)).

Observation across a wide geographical range in Asia indicated that the number of generation per year could range from 3 to 13 depending on the climatic conditions (Kanzawa, 1939 (datasheet/109283#99D9BA76-F7F6-4B4F-8C9F-7E6A5FB51BFC)). According to the degree-day model developed by Coop (2010) (datasheet/109283#578D9F5B-AAA7-4B06-BF47-8F414727C0D5), *D. suzukii* is estimated to carry out 3 to 9 generations per year in the West United States, Canada and northern Italy.

Longevity

The lifespan of adults is 20-56 days, but some overwintering adults lived for more than 200 days (Kanzawa, 1935 (datasheet/109283#C5BAAABC-FCFC-41A8-8B47-609B6182DB37)). Female adult longevity ranged from 35 days at 10°C to 2 days at 30°C (Tochen et al., 2014 (datasheet/109283#985626D9-05D1-4D89-9F21-E9EA0A85FF24)). Acclimated adult *D. suzukii*

can survive for up to 88 days at a constant 10°C, with no marked change in mortality when flies are subjected to a 7-day freeze period. Adult longevity decreases progressively at a constant temperature below 10°C (Dalton et al., 2011 (datasheet/109283#9DE22467-1B9C-44F6-AA7B-4AE187A73561)).

Activity Patterns

Some adults (males and females) overwinter under extended suboptimal cold conditions (Dalton et al., 2011 (datasheet/109283#9DE22467-1B9C-44F6-AA7B-4AE187A73561)). The lifespan of overwintering adults is considerably longer than non-overwintering adults and many survive until next May or June (Kanzawa, 1939 (datasheet/109283#99D9BA76-F7F6-4B4F-8C9F-7E6A5FB51BFC)). Females are more likely to overwinter than males.*D. suzukii* becomes mobile above 5°C, and if the average temperature rises beyond 10°C it starts to become active. If the temperature is high enough during the day, *D. suzukii* starts to oviposit. It is the most active between 20° and 25°C, but not very active when the temperature reaches 30°C (Kanzawa, 1939 (datasheet/109283#99D9BA76-F7F6-4B4F-8C9F-7E6A5FB51BFC); Hamby et al., 2013 (datasheet/109283#FE369AE6-1A98-4EB6-8A89-BFF20A5DA831)). Hamby et al. (2013) (datasheet/109283#FE369AE6-1A98-4EB6-8A89-BFF20A5DA831) reported dawn and dusk as the most active periods.

Nutrition

Adults often feed on fruits that has been split or damaged by birds. *D. suzukii* gathers on fruit that have dropped onto the ground and are spoiled or fermented. If there is no fruit juice available, *D. suzukii* can feed on sap from wounded oak trees (Kanzawa, 1939 (datasheet/109283#99D9BA76-F7F6-4B4F-8C9F-7E6A5FB51BFC); Lee et al., 2011; Bellamy et al., 2013 (datasheet/109283#ACDAB577-E14D-4A80-9EED-6022C93D105B)).

Associations

D. suzukii has been reported to vector yeasts and bacteria (Hamby et al., 2012 (datasheet/109283#41826A01-3B6F-411D-8385-C7C8296240A8); DAFF, 2013 (datasheet/109283#8CEBCAC2-AFE4-4B17-8915-66595E70F6B7)). Both larvae and adult of *D. suzukii* have been reported to be associated with yeast, predominantly *Hanseniaspora uvarum* (Hamby et al., 2012 (datasheet/109283#41826A01-3B6F-411D-8385-C7C8296240A8)).

Environmental Requirements

No differences have been observed in thermal tolerance between cool and warm temperate strains of *D. suzukii*. Their evolutionary capacity to increase cold tolerance seems to be limited (Kimura, 2004 (datasheet/109283#B6B5E7B5-499C-4E2D-AABB-E95F6EC6A25C)). To overcome deficiencies in cold tolerance, it is possible that *D. suzukii* may be behaviorally adapted to overwinter in man-made protected habitats (Kimura, 2004 (datasheet/109283#B6B5E7B5-499C-4E2D-AABB-E95F6EC6A25C); Dalton et al., 2011 (datasheet/109283#9DE22467-1B9C-44F6-AA7B-4AE187A73561)).

Climate

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Climate	Status	Description	Remark
C - Temperate/Mesothermal climate	Preferred	Average temp. of coldest month > 0°C and < 18°C, mean warmest month > 10°C	
Cf - Warm temperate climate, wet all year	Preferred	Warm average temp. > 10°C, Cold average temp. > 0°C, wet all year	
Cs - Warm temperate climate with dry summer	Tolerated	Warm average temp. > 10°C, Cold average temp. > 0°C, dry summers	
Cw - Warm temperate climate with dry winter	Preferred	Warm temperate climate with dry winter (Warm average temp. > 10°C, Cold average temp. > 0°C, dry winters)	
D - Continental/Microthermal climate	Preferred	Continental/Microthermal climate (Average temp. of coldest month < 0°C, mean warmest month > 10°C)	
Dw - Continental climate with dry winter	Preferred	Continental climate with dry winter (Warm average temp. > 10°C, coldest month < 0°C, dry winters)	

Natural enemies

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Natural enemy	Type	Life stages	Specificity	References	Biological control in	Biological control on
Asobara japonica (datasheet/120224)	Parasite	Larvae/Pupae	to genus			
Asobara rufescens (datasheet/7399)	Parasite	Larvae	to genus			
Asobara tabida (datasheet/7401)	Parasite	Larvae	to genus			
Cardiastethus fasciventris (datasheet/119174)	Predator			Arnó et al., 2012 (datasheet/109283#371C8FF7-EC0D-492D-A99F-6E85505C4E20)		
Cardiastethus nazarenus (datasheet/16703)	Predator			Arnó et al., 2012 (datasheet/109283#371C8FF7-EC0D-492D-A99F-6E85505C4E20)		
Dicyphus tamaninii (datasheet/18864)	Predator			Arnó et al., 2012 (datasheet/109283#371C8FF7-EC0D-492D-A99F-6E85505C4E20)		
Ganaspis xanthopoda (datasheet/24912)	Parasite	Larvae	to genus			
Isaria fumosorosea (datasheet/109964)	Pathogen			Naranjo-Lázaro et al., 2014 (datasheet/109283#F5BE7886-1131-44F9-883D-81D81B0CF71A)		
Leptopilina boulardi (datasheet/31449)	Parasite	Larvae	to genus			
Leptopilina heterometra (datasheet/31452)	Parasite	Larvae	to genus			
Metarhizium anisopliae (datasheet/35110)	Pathogen			Naranjo-Lázaro et al., 2014 (datasheet/109283#F5BE7886-1131-44F9-883D-81D81B0CF71A)		
Orius (datasheet/37821)	Predator	Larvae	not specific			
Orius laevigatus (datasheet/37828)	Predator			Arnó et al., 2012 (datasheet/109283#371C8FF7-EC0D-492D-A99F-6E85505C4E20)		
Pachycrepoideus vindemmiae (datasheet/39136)	Parasite	Pupae	to genus			
Trichopria (datasheet/55060)	Parasite	Pupae	to genus			

Notes on Natural Enemies

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Parasitoid wasps target *Drosophila* spp. and have potential as biocontrol agents of *D. suzukii* (Kanzawa, 1939 (datasheet/109283#99D9BA76-F7F6-4B4F-8C9F-7E6A5FB51BFC)). A number of hymenopteran parasitoids have been reported in association with *D. suzukii* in its native area. In particular, species of the genera *Ganaspis* and *Leptopilina* (Hymenoptera: Figitidae) and *Trichopria* (Hymenoptera: Diapriidae) are reported as parasitoids of *D. suzukii* in Japan (Cini et al., 2012 (datasheet/109283#75F552C6-0DDF-4554-BD49-288C20573BBB)). *Ganaspis* species showed the highest rates of *D. suzukii* parasitism. *Ganaspis* species lay eggs in larvae that are feeding in fruits and exhibit a high level of specificity for *D. suzukii*. By contrast, *Leptopilina japonica* and *Asobara japonica* (Hymenoptera: Braconidae) were only able to attack *D. suzukii* larvae and pupae in fallen decaying fruits, and also attacked a wide range of drosophilid hosts (Mitsui et al., 2007; Ideo et al., 2008 (datasheet/109283#8DCD714E-A7DB-4D4F-A5E1-8109256CE58B); Mitsui and Kimura, 2010 (datasheet/109283#0B881603-D416-4131-9699-43A46546B2B2); Novkovic et al., 2011 (datasheet/109283#E039598C-7C4F-4AE6-9B2B-A48129436F61); Kasuya et al., 2013 (datasheet/109283#C6D4E85B-4D56-4240-9090-2CFF6A34E516)). *Leptopilina heterotoma* and *Pachecrepoides vindemiae* have been found to attack *D. suzukii* in newly-invaded production regions in Pacific North America and in northern Italy (Rossi-Stacconi et al., 2013).

Entomopathogenic fungi such as *Isaria fumosorosea* and *Metarhizium anisopliae* are also being assessed as potential biological control agents (Naranjo-Lázaro et al., 2014 (datasheet/109283#F5BE7886-1131-44F9-883D-81D81B0CF71A)).

Means of Movement and Dispersal

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Natural Dispersal (Non-Biotic)

D. suzukii, as a fruit-specialist species among drosophilid flies, performs seasonal migration between low altitudes, which can be resource-poor in the summer, and high altitudes, where it is thought to exploit further resources (Mitsui et al., 2010). However, additional data needed in order to support this hypothesis.

Accidental Introduction

The key pathway for the introduction of *D. suzukii* into new areas is by traded host fruits. Its rapid dispersal worldwide is in part due to increasing global fresh fruit trade and the cryptic nature of larvae hidden inside fruit, which means they are often undetected until after transportation (Gerdeman and Tanagoshi, 2011 (datasheet/109283#43DF27A8-FC4B-41E2-97D3-D175B7BE6677)). Consequently, passive diffusion is likely the main cause of the spread of *D. suzukii* (Westphal et al., 2008 (datasheet/109283#0C4E442E-680C-45E6-84F1-15F76D51BB37); Cini et al, 2012; EPPO, 2013a (datasheet/109283#BA1320C2-5DCA-4E2F-86C0-ADCFBD1F7667)). Even though additional analyses on a larger number of specimens are needed, the similarities of the introduction dates in North America and in Europe, along with the same COI haplotype found in both areas, suggest that the two invasions could be related (Calabria et al. 2012 (datasheet/109283#2CBF56E2-DE3A-453F-BCD4-B10EEA352C4F); Freda and Braverman, 2013 (datasheet/109283#B276101E-5355-4FE0-AD3E-2D3A0DFF31E6)). Calabria et al. (2012) (datasheet/109283#2CBF56E2-DE3A-453F-BCD4-B10EEA352C4F) stated that *D. suzukii* was able to spread approximately 1400 km in one year, but they could not say if the dispersion was active or passive via infested fruits. *D. suzukii* may also be introduced to new areas via the transport of flowers, although this is less likely.

Pathway Causes

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Cause	Notes	Long Distance	Local	References
Cut flower trade (datasheet/109027)		Yes		
Food (datasheet/109033)		Yes		
Hitchhiker (datasheet/109037)		Yes		
Ornamental purposes (datasheet/109051)		Yes		
Self-propelled (datasheet/109057)			Yes	

Pathway Vectors

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Vector	Notes	Long Distance	Local	References
Aircraft (datasheet/109061)		Yes		
Bulk freight or cargo (datasheet/109064)		Yes		
Consumables (datasheet/109065)		Yes		
Debris and waste associated with human activities (datasheet/109068)			Yes	
Plants or parts of plants (datasheet/107789)		Yes		
Wind (datasheet/109086)			Yes	

Impact Summary

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Category	Impact
Economic/livelihood	Negative
Environment (generally)	Positive and negative
Human health	None

Economic Impact

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The damage caused by *D. suzukii* larvae renders the fruit unmarketable (Bolda et al., 2010 (datasheet/109283#9B4BCBF2-8CDE-4AD5-94D6-63ED0B789E2B)). Assessments of the economic impact of *D. suzukii* are relatively scarce and most focus on California, USA (Bolda et al., 2010 (datasheet/109283#9B4BCBF2-8CDE-4AD5-94D6-63ED0B789E2B); Goodhue et al., 2011 (datasheet/109283#C95637B8-602D-4D5A-AC7B-D0115F5683FC)), or the Trentino region in Europe (De Ros et al., 2013).

In 2008 economic losses (based on maximum reported yield losses) for California, Oregon and Washington were estimated at 40% for blueberries, 50% for caneberries, 33% for cherries and 20% for strawberries. Production in these three states could sustain $511 million in damages annually because of *D. suzukii* (Bolda et al., 2010 (datasheet/109283#9B4BCBF2-8CDE-4AD5-94D6-63ED0B789E2B)). In California alone, the estimated decrease of the gross revenue due to *D. suzukii* infestation in the absence of management has been estimated at 37% for raspberry and 20% for processed strawberries (Goodhue et al., 2011 (datasheet/109283#C95637B8-602D-4D5A-AC7B-D0115F5683FC)).

Crop losses of 20-40% were reported from both Washington and Oregon states' 2009 late season blueberries and caneberries (Gardeman and Tanigoshi, 2011). Growers in small fruit production regions in coastal Pacific Northwest, USA, currently apply pesticides from 5-7 times per season on average (J Flake, pers comm.). When taking into consideration current crop levels, input costs, fruit drop due to machinery rubbing against fruit canopies and loss due to *D. suzukii* infection, the annual costs to control *D. suzukii* in Oregon's affected small fruit industries ranged between $12 and$16 million dollars annually, depending on the level of infestation that season (Julian et al., 2011 (datasheet/109283#326E2FCF-C4C5-4002-A36C-D375324B87BB)). These costs are only associated with management techniques and do not take into consideration market loss or losses associated with altered processing practices, or downgrading of fruit.

Chemical control of *D. suzukii* may also lead to the rejection of exported fruits due to residual pesticide levels exceeding the maximum residue limits (Haviland and Beers, 2012 (datasheet/109283#74767870-A1B9-4AD8-B332-A6C782A53AAC)).

Risk and Impact Factors

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Impact mechanisms

- Parasitism (incl. parasitoid)

Likelihood of entry/control

- Highly likely to be transported internationally accidentally
- Difficult to identify/detect as a commodity contaminant
- Difficult to identify/detect in the field
- Difficult/costly to control

Uses

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Apart from the use of laboratory cultures for research purposes, no human uses of *D. suzukii* have been described.

Uses List

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General

- Research model

Diagnosis

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Molecular identification is possible by amplification of the barcode COI gene with universal primers (Folmer et al., 1994 (datasheet/109283#020FA553-4719-4AD8-8EE6-D22A70083E8F), Grassi et al., 2011 (datasheet/109283#FD576480-5DB6-46B3-9D25-43FB46FEEB74); Calabria et al., 2012 (datasheet/109283#2CBF56E2-DE3A-453F-BCD4-B10EEA352C4F); Freda and Braverman, 2013 (datasheet/109283#B276101E-5355-4FE0-AD3E-2D3A0DFF31E6); Chiu et al., 2013 (datasheet/109283#A935F06B-603C-4728-9E78-A4F0141B6C64)). DNA barcoding is the only fully reliable identification method (Freda and Braverman, 2013 (datasheet/109283#B276101E-5355-4FE0-AD3E-2D3A0DFF31E6)).

Detection and Inspection

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Detailed morphological description of each stage is given by Kanzawa (1935) (datasheet/109283#C5BAAABC-FCFC-41A8-8B47-609B6182DB37). A more recently updated description, including references for additional morphological details, is given by Hauser (2011) (datasheet/109283#7B63AEB7-4F57-4D35-86F3-6903EE8BD6D5), and another by Vlach (2010), who published a dichotomous key for easy identification. An easy-to-use description of the combination of diagnostic characters that could be used for tentative identification of *D. suzukii* within its subgroup is given by both Hauser (2011) (datasheet/109283#7B63AEB7-4F57-4D35-86F3-6903EE8BD6D5) and Cini et al. (2012) (datasheet/109283#75F552C6-0DDF-4554-BD49-288C20573BBB). Fruit infestation symptoms are described by Walton et al. (2010) (datasheet/109283#473354BC-AD2D-4239-A1F0-93F7945CD010).

The dark spots on the male wings together with two sets of black tarsal combs make the identification of the males relatively easy, although the males of some other species do also have wing spots. The wing spots of *D. subpulchrella* are particularly similar in shape and position to those of *D. suzukii.* Males without dark wing spots can occur, as it takes two full days before the spots become obvious, although they start to appear within 10 hours of emergence at high temperatures.

The situation is complex for the eggs, larvae and pupae, as no reliable morphological diagnostic features have been identified (Okada, 1968). The eggs of *D. suzukii* have two respiratory appendages but this character is not species-specific. Instar stages can be estimated by the size of larvae and the colour of the mouthparts, but it is most accurately judged by pre-respiratory ducts (Kanzawa, 1935 (datasheet/109283#C5BAAABC-FCFC-41A8-8B47-609B6182DB37); Walsh et al., 2011 (datasheet/109283#0DA6D6C4-0EA5-429F-817E-FC10945C2D96)).

Larvae are often undetected inside the fruit. The infested fruits can be detected only by visual inspection under optical magnification (15-20 x magnification). Detection of larvae inside the fruits can also be performed by immersion of fruit samples in sugar or salt solution. Sugar solution can be prepared using approximately 1 part sugar to 6 parts water in order to reach at least 15°Brix. Gently crush the fruits and wait for 10 minutes until the larvae in the sample float to the surface. The same procedure can also be followed using a salt solution, adding 1 part salt to 16 parts water (BCMA, 2013 (datasheet/109283#1C9DB2A8-1A14-4856-95A4-3A0CAE81E68D)).

Traps baited with different baits have been proposed for detecting adults in the field. Traps can be installed around a site where fruits for shipment are stored, and for early detection in potentially newly-invaded areas, such as near fruit markets, warehouses of food retailers and sites where rotten fruits are disposed. For more information on traps and baits, see the Monitoring and Surveillance section in Prevention and Control.

Similarities to Other Species/Conditions

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The distinguishing features of the two sexes (serrated ovipositor and black wing spots) are also present in 150 other *Drosophila* species, making species identification difficult in areas where they are sympatric. *D. subpulchrella* Takamori and Watabe males' black spots are very similar in shape and position to those of *D. suzukii* (Takamori et al., 2006). The occasional lack of wing black spots in teneral male *D. suzukii* could lead to misidentification with other closely related *Drosophila* species whose males do not have spots on the wing, including: *D. ashburneri* Tsacas, *D. immacularis* Okada, *D. lucipennis* Lin, *D. mimetica* Bock and Wheeler, *D. oshimai* Choo and Nakamura and *D. unipectinata* Duda.

Other characteristics can instead be used for identification, such as the sex combs on the foretarsi; *D. suzukii* has one row of combs on the first and one row on the second tarsal segment while *D. biarmipes* has two combs on the first tarsomere,

Females can also pose problems with identification. On the basis of the shape and length of the ovipositor, *D. suzukii* can be easily discriminated from related species, such as *D. biarmipes*, but not easily from other species such as *D. immigrans* Sturtevant and *D. subpulchrella* (Takamori et al., 2006), which possess very similar ovipositors (Hauser, 2011 (datasheet/109283#7B63AEB7-4F57-4D35-86F3-6903EE8BD6D5)). In such cases, a final determination should be made by a taxonomist, based on the relative size of spermatheca compared to the size of the ovipositor (Hauser, 2011 (datasheet/109283#7B63AEB7-4F57-4D35-86F3-6903EE8BD6D5)).

Prevention and Control

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Due to the variable regulations around (de)registration of pesticides, your national list of registered pesticides or relevant authority should be consulted to determine which products are legally allowed for use in your country when considering chemical control. Pesticides should always be used in a lawful manner, consistent with the product's label.

SPS Measures

Emergency measures to prevent the introduction of *D. suzukii* via host fruits (and, to a lesser extent, flowers) included carbon dioxide/sulphur dioxide fumigation. According to the preliminary data available the treatment causes 100% mortality of *D. suzukii*. Verification of the treatment efficacy by inspection of fruit cuts under optical magnification is an additional emergency measures (DAFF, 2013 (datasheet/109283#8CEBCAC2-AFE4-4B17-8915-66595E70F6B7)).

Early Warning Systems

Contrary to some other potentially invasive pests, *D. suzukii* is not subject to regulation either in Europe or the United States. Consequently there are neither official limits on the movement of host crops from infested areas, nor coordinated actions for monitoring its presence in new areas. An early warning system with baited traps is sometimes established as a volunteer-based monitoring network (Burrack et al., 2012 (datasheet/109283#D76027C7-A967-43B7-8A9B-87B97AED464E)).

Due to its high reproductive capacity and dispersal abilities of this pest, early warning systems should be considered vital in areas currently free of *D. suzukii.* By the time *D. suzukii* was detected in both Europe and USA it had already established itself to such an extent that eradication was deemed impossible in both continents (EPPO, 2013).

Cultural Control and Sanitary Measures

Sanitation measures include the removal and destruction of both infested fruit and any ripe, overripe and rotten fruit at the crop site that could serve as a host. Research is underway to evaluate solarizing, burying, bagging, crushing, and spraying infested fruit to discourage *D. suzukii* colonization (Walsh et al., 2011 (datasheet/109283#0DA6D6C4-0EA5-429F-817E-FC10945C2D96)).

Physical/mechanical control

A fly-screen with 0.98-1.0 mm mesh prevents *D. suzukii* fruit damage on blueberry (Kawase and Uchino, 2005 (datasheet/109283#E528047C-D3A7-416E-954B-AC10AE4370B9)). Physical crop protection by using anti-insect nets are under experimental evaluation and seem to be a promising alternative control strategies for use in the near future (Ioriatti et al., 2012 (datasheet/109283#6EE38E64-89DF-4CC7-B0EB-B6DD90D8191C)).

Biological Control

Early experiments tested the efficacy of *Phaenopria* spp. (Hymenoptera: Diapriidae) under laboratory conditions, but results were unsatisfactory (Kanzawa, 1939 (datasheet/109283#99D9BA76-F7F6-4B4F-8C9F-7E6A5FB51BFC)).

Studies to determine the current presence of indigenous parasitoid biological control agents and their efficacy in controlling *D. suzukii* were undertaken both in North America and in Europe by different research groups (Brown et al., 2011 (datasheet/109283#22AFEBC9-C4A8-435E-A300-353C854BEB59); Chabert et al., 2012 (datasheet/109283#8C0D5D62-F421-4BCA-BCFB-5B3D4B7FE54A); Rossi Stacconi et al., 2013 (datasheet/109283#E91EEE3E-51CE-48E0-9703-7D89DA302F6A)). Under laboratory conditions several naturally occurring parasitoids of drosophilids in France were able to successfully parasitize *D.suzukii*. These included two larval parasitoids, *Leptopilina heterotoma* and *Leptopilina boulardi*, and two pupal parasitoids, *Pachycrepoideus vindemiae* (Hymenoptera: Pteromalidae) and *Trichopria drosophilae* (Hymenoptera: Diapriidae). Both *Leptopilina* parasitoids displayed high parasitism rates on *D. suzukii*, but because of the strong immune response of the host larvae, they did not give rise to an adult wasp (Chabert et al., 2012 (datasheet/109283#8C0D5D62-F421-4BCA-BCFB-5B3D4B7FE54A)).

D. suzukii produces up to five times more hemocytes than *D. melanogaster*, making it significantly more resistant to wasp parasitism (Kacsoh and Schlenke, 2012 (datasheet/109283#AAE71C66-4E69-4A0F-831D-0AAAE72A8104)) and making it less likely for indigenous specialized parasitoids to shift host onto it. While parasitization by *L. heterotoma* induced a decrease in the number of circulating haemocytes in *D. melanogaster*, it led to a large increase in the total haemocyte counts of *D. suzukii* (Poyet et al., 2013 (datasheet/109283#49032C9F-E5AE-4B30-9F84-6A29292C39B0)).

The observed difference between the immune response towards *L. heterotoma* in *D. suzukii* and *D. melanogaster* could suggest that European populations of *L. heterotoma* are not adapted to this new exotic host (Poyet et al., 2013 (datasheet/109283#49032C9F-E5AE-4B30-9F84-6A29292C39B0)); however, this hypothesis disagrees with the recent observations of a European-wide strain of *L. heterotoma* that is able to develop and emerge from *D. suzukii.* (Rossi Stacconi et al., 2013 (datasheet/109283#E91EEE3E-51CE-48E0-9703-7D89DA302F6A)). It is probable that the European-wide strain of *L. heterotoma* has more effective venom, or that the strain of *L. heterotoma* used in the original study had lost its ability to develop on *D. suzukii* because of continued laboratory rearing on *D. melanogaster.*

Pupal parasitoids seem less susceptible to the high hemocyte levels of *D. suzukii* and they appear to have the highest potential for use in biocontrol of *D. suzukii* (Kacsoh and Schlenke, 2012 (datasheet/109283#AAE71C66-4E69-4A0F-831D-0AAAE72A8104)). This was confirmed by the successful parasitism rate obtained with a pupal parasitoid by Chabert et al. (2012) (datasheet/109283#8C0D5D62-F421-4BCA-BCFB-5B3D4B7FE54A).

The pupal ectoparassitoid *P. vindemiae* has also been found in association with *D. suzukii* in orchards and vineyards, both in USA and in Europe (Brown et al., 2011 (datasheet/109283#22AFEBC9-C4A8-435E-A300-353C854BEB59); Rossi Stacconi et al. 2013 (datasheet/109283#E91EEE3E-51CE-48E0-9703-7D89DA302F6A)).

Predators of *D. suzukii* include several species of the bug genus *Orius*, a generalist predator, which were observed feeding on *D. suzukii* larvae in backyard raspberries in the autumn of 2009 (Walsh et al., 2011 (datasheet/109283#0DA6D6C4-0EA5-429F-817E-FC10945C2D96)). Preliminary laboratory studies with *O. insidiosus* (Walsh et al., 2011 (datasheet/109283#0DA6D6C4-0EA5-429F-817E-FC10945C2D96)), *O. laevigatus* and *O. maiusculus* (V. Malagnini, personal comm.) indicated that they can feed on *D. suzukii* larvae infesting blueberries, but their effective control of the pest population have not been proved yet.

The activity of microorganisms, as well as the intimate association of the pest species with endosymbionts, has not yet been exploited for biocontrol purpose.

Recently, DNA viruses have been isolated in *Drosophila* species (Unkless, 2011) and were found to be related to other viruses used for pest control.

Strains of endosymbiotic bacterium *Wolbachia* associated with *D. suzukii* populations have been collected in both the USA and Italy (Siozios et al., 2013 (datasheet/109283#304B02FE-1056-4F5B-92EB-C23AB6F46D2F); Tochen et al., 2014 (datasheet/109283#985626D9-05D1-4D89-9F21-E9EA0A85FF24)). These findings suggest the possibility of control of *D. suzukii* based on pathogens.

Chemical Control

Current control efforts for *D. suzukii* rely heavily on the use of insecticides. The range of insecticides available for use on *D. suzukii* includes spinosyns, organophosphates, pyrethroids and neonicotinoids. However, the active ingredients are not very persistent. In addition, the fast generation turnover of *D. suzukii* requires many chemical interventions at the ripening stage, which can increase the risk of residues in fruits, promote insect resistance and negatively affect pollinators and other beneficial species. Moreover, the efficacy of the current available insecticides against *D. suzukii* larvae within fruits is limited, and *D. suzukii* control is focused on treatments based on chemicals targeting adults (Cini et al., 2012 (datasheet/109283#75F552C6-0DDF-4554-BD49-288C20573BBB)).

Significant adult *D. suzukii* mortality resulted from bioassays performed using formulated products of spinosyns, organophosphates and pyrethroids when directly applied on the insect (Bruck et al., 2011 (datasheet/109283#E4DF905C-E15F-4738-9719-CBB4C7D15768)). In the same studies, neonicotinoids organic pyrethroid (pyrethrin) and azadiractin provided from moderate to low control, with significantly higher levels of male mortality (Bruck et al., 2011 (datasheet/109283#E4DF905C-E15F-4738-9719-CBB4C7D15768); Beers et al., 2011 (datasheet/109283#95B06EE8-F512-47D5-AD6F-E02B9B3AF437)). High level of mortality was also obtained when *D. suzukii* adult were exposed to fresh residue of spinosyns, organophosphates and pyrethroids on fruits (Bruck et al., 2011 (datasheet/109283#E4DF905C-E15F-4738-9719-CBB4C7D15768)). Malathion, bifenthrin and spinetoram also provided high mortality levels when *D. suzukii* adults were exposed to one-day field aged residue (Bruck et al., 2011 (datasheet/109283#E4DF905C-E15F-4738-9719-CBB4C7D15768); Beers et al., 2011 (datasheet/109283#95B06EE8-F512-47D5-AD6F-E02B9B3AF437)). Tolfenpyrad had relatively good activity by topical exposure, but residual activity has yet to be determined. Mortality of flies exposed to cyazypyr was relatively low after 16 hours but caused intermediate mortality after 40 hours. The low level of mortality of the flies exposed to residues of imidacloprid, acetamiprid and cyazypyr on fruit seems to be compensated by a reduced adult emergence due to the systemic effect (Beers et al., 2011 (datasheet/109283#95B06EE8-F512-

47D5-AD6F-E02B9B3AF437); Van Timmeren and Isaacs, 2013). Exposure to spinetoram, lambda-cyhalothrin and carbaryl reduced the number of eggs laid in cherries (Beers et al., 2011 (datasheet/109283#95B06EE8-F512-47D5-AD6F-E02B9B3AF437)).

Timely field applications of lambda-cyhalothrin, deltamethrin, dimetoate and phosmet provided good control of the fruit damage with a residual activity lasting up to two weeks, whereas unsatisfactory efficacy was obtained with neonicotinoids (Grassi et al., 2011 (datasheet/109283#FD576480-5DB6-46B3-9D25-43FB46FEEB74); Profaizer et al., 2012 (datasheet/109283#1428D3B8-EE3B-43CE-8615-20E1430B5E2B)). Despite the high adult mortality measured in the semi-field bioassay, malathion did not provide satisfactory effective control of *D. suzukii* infestation in field trials (Profaizer et al., 2012 (datasheet/109283#1428D3B8-EE3B-43CE-8615-20E1430B5E2B)). Van Timmeren and Isaacs (2013) (datasheet/109283#8CD1E818-1C46-43E1-886A-87165ECCBE7B) reported that its effectiveness dropped quickly over time because of its sensitiveness to breakdown from exposure to ultraviolet light.

Organic crop production is seriously threatened by *D. suzukii* as only a few natural insecticides are allowed. The efficacy of these pesticides against *D. suzukii* is lower than organophosphates and pyrethroids. Field trails with pyrethrins and spinosad have a degree of efficacy and short pre-harvest interval, but residual impact is limited to a few days (Walsh et al., 2011 (datasheet/109283#0DA6D6C4-0EA5-429F-817E-FC10945C2D96); Grassi et al., 2011 (datasheet/109283#FD576480-5DB6-46B3-9D25-43FB46FEEB74); Profaizer et al., 2012 (datasheet/109283#1428D3B8-EE3B-43CE-8615-20E1430B5E2B)). Spinosyns, formulated as a bait, are also available for both conventional and organic fruit production, but are not highly effective for *D. suzukii* (Walsh et al., 2011 (datasheet/109283#0DA6D6C4-0EA5-429F-817E-FC10945C2D96)). The addition of sugar-yeast bait to spinosyns significantly increased fly mortality (Knight et al., 2013 (datasheet/109283#F19B1E35-166E-48C4-9546-3AA70C6021A3)). In blueberry production the few available insecticides for the control of *D. suzukii* have provided protection against infestation, but the need for repeated treatments with limited insecticide options increases the chance of resistance developing in the future (Van Timmeren and Isaacs, 2013).

IPM

Traps baited with apple cider vinegar (ACV) were initially used for crop risk assessment and treatment timing in IPM. Insecticide formulations are selected according to their efficacy, residual activity, pre-harvest interval, and the presence of other pests that could be controlled at the same time (Beers et al., 2011 (datasheet/109283#95B06EE8-F512-47D5-AD6F-E02B9B3AF437)). Follow-up applications of pesticides should be applied when monitoring traps indicate the presence of *D. suzukii* (Bruck et al., 2011 (datasheet/109283#E4DF905C-E15F-4738-9719-CBB4C7D15768)). ACV-baited traps are not always a reliable indicator of relative crop risk and it raises the possibility that traps baited with ACV are less attractive than natural ripe hosts. Improved estimation of the seasonal phenology of *D. suzukii* has been obtained by adding wine and sugar to ACV (Grassi and Maistri, 2013 (datasheet/109283#DA13807A-CC7D-4B50-B936-6A954FDE2B5D)).

For an effective IPM strategy, chemical control has to be coupled with cultural management tactics such as sanitation (proper removal and disposal of unharvested or infested fruits) (Thistlewood et al., 2012 (datasheet/109283#6F4E54F9-5BA5-47AE-9F98-F2438D4E90BA)). The amount and timing of rainfall may also negatively impact the longevity of insecticides due to wash off (Van Timmeren and Issacs, 2013). For short-residual insecticides, evening applications may be recommended. Due to the ability of *D. suzukii* to move up to several kilometers from infested fields, it is essential that management practices are carried out over a wide area (EPPO, 2013a (datasheet/109283#BA1320C2-5DCA-4E2F-86C0-ADCFBD1F7667)). Scattered fruit trees, abandoned orchards, unmanaged host plants in private gardens or in nearby woodland should be considered potential sources of infestation and the associated risk of crop damage should be included in the management program.

As an alternative to chemical control, netting may be useful in keeping flies from attacking fruit on cane berries and cherry, provided they are installed before the fruit begins to ripen (Caprile et al., 2013 (datasheet/109283#065B7ABD-A5D9-45F4-BFDF-11AE5F7BEF1A)). Netting with mesh size of 1 x 1 mm and 1 x 1.6 mm have been applied on blueberry and provided a good level of protection, but Grassi and Pallaoro (2012) (datasheet/109283#7B4C4BE5-A838-425D-B2C4-8EE89393F3C1) suggested using smaller mesh sizes of 1 x 1 mm in order to maximize fruit protection. Netting must be secured at the ground and two layers of netting should be applied at the entrance of the tunnel (Grassi and Maistri, 2013 (datasheet/109283#DA13807A-CC7D-4B50-B936-6A954FDE2B5D)).

Monitoring and Surveillance (incl. Remote Sensing)

The presence of adult *D. suzukii* in the field can be monitored by using traps baited with different attractants. Although field captures of *D. suzukii* in traps indicate their presence, trapping does not appear to accurately predict infestation in all crops (Lee et al., 2012 (datasheet/109283#5845CC6A-3CE0-4561-B857-26180A516ACB); Wilson et al., 2013 (datasheet/109283#122058C4-

3404-4BA0-83CB-664015284FB6); Tochen et al., 2014 (datasheet/109283#985626D9-05D1-4D89-9F21-E9EA0A85FF24)). Any 250-750 ml plastic container with a closely fitting lid can be used as a trap. 0.5 – 1 mm diameter holes should be drilled in the side in order to enable the flies to enter.

A variety of trap prototypes made by researchers and commercial traps are available to monitor adult *D. suzukii*. Comparisons among different trap design (size, colour, volatilization area, entry area) have been performed across different regions and crops in North America (Lee et al., 2012 (datasheet/109283#5845CC6A-3CE0-4561-B857-26180A516ACB); 2013). The number of captures increased as the entry area of traps increased, but small size of the holes slowed evaporation and increased the selectivity against the larger insects. Red, yellow and black traps were preferable over clear or white, but there was an interaction between the trap colour and the crop type. Trap colour had no effect on the selectivity towards other drosophlids (Lee et al., 2013 (datasheet/109283#357A9771-725F-413E-93E4-6ED6B2C31631)). Laboratory bioassays found that flies were attracted to dark colours, ranging from red to black, and that the use of three alternating red, black and red coloured strips significantly increased the number of flies caught (Basoalto et al., 2013 (datasheet/109283#6AE7CF53-7968-42E5-91CB-E0AE6DECFC0D)). Bait is needed to attract the flies to the trap.

Apple cider vinegar was one of the first baits used because it was effective and practical to use (EPPO, 2013a (datasheet/109283#BA1320C2-5DCA-4E2F-86C0-ADCFBD1F7667)). This lure has been lately improved by adding wine (Landolt et al., 2012 (datasheet/109283#F54E42A0-8F5E-45CF-8C8B-5448E1B9DC81)) and wine and sugar (Grassi and Maistri, 2013 (datasheet/109283#DA13807A-CC7D-4B50-B936-6A954FDE2B5D)).

The fly response to the combination of vinegar and wine was greater than the response to acetic acid or the combination of acetic acid and ethanol, which are the principal volatile chemical components of vinegar and wine respectively (Landolt et al. 2012 (datasheet/109283#F54E42A0-8F5E-45CF-8C8B-5448E1B9DC81)). This finding indicates that other volatile chemicals emitted by vinegar and wine, in addition to acetic acid and ethanol, may also be attractive to male and female *D. suzukii*. A sugar-yeast bait has been used successfully and was found to out-perform apple cider vinegar (Knight et al., 2013 (datasheet/109283#F19B1E35-166E-48C4-9546-3AA70C6021A3)). A small drop of dish soap added to the liquid bait as a surfactant, or the placement of a sticky card within the trap, results in more fly captures.

More recently, multi-component volatile blends had been identified (Cha et al., 2012 (datasheet/109283#47AB3929-7E9B-4B36-93E0-371ED0B08DFB); 2013) that may provide a more selective lure and may reduce the time for trap servicing. Additionally, a synthetic chemical lure provided from a controlled release dispenser should remain an attractive bait for longer and would be more selective against non-target insects (Landolt et al. 2012 (datasheet/109283#F54E42A0-8F5E-45CF-8C8B-5448E1B9DC81); Cha et al., 2013).

Mitigation

Emergency mitigation measures include cold treatment or carbon dioxide/sulphur dioxide fumigation of host fruit when exporting from an infested country to an area free of *D. suzukii* (DAFF, 2013 (datasheet/109283#8CEBCAC2-AFE4-4B17-8915-66595E70F6B7)).

Gaps in Knowledge/Research Needs

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Some work has been conducted on the normal temperature ranges at which *D. suzukii* can develop and reproduce (Tochen et al., 2014 (datasheet/109283#985626D9-05D1-4D89-9F21-E9EA0A85FF24)). This information needs to be integrated into automated remotely-sensed weather data to create more accurate real-time and automated seasonal and regional risk maps. The effects of fluctuating temperatures have not yet been studied and need further investigation, as do the lower and upper temperature tolerance limits of *D. suzukii* in all of its invasive areas.

It will be important to explore the relationships between *D. suzukii* and *D. subpulchrella* using genome scale data.

Research into the possibility of controlling *D. suzukii* using viral pathogens is urgently needed.

Making lures more attractive to *D. suzukii* together with optimizing trap design are major objectives of different research teams aiming for an effective tool for mass trapping *D. suzukii* (Lee et al., 2012 (datasheet/109283#5845CC6A-3CE0-4561-B857-26180A516ACB); 2013).

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Links to Websites

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Website	URL	Comment
GISD/IASPMR: Invasive Alien Species Pathway Management Resource and DAISIE European Invasive Alien Species Gateway	https://doi.org/10.5061/dryad.m93f6 (https://doi.org/10.5061/dryad.m93f6)	Data source for updated system data added to species habitat list.

Organizations

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Italy: FEM Fondazione Edmund Mach, Via E.Mach, 38010, San Michele all'Adige - Trento,, http://www.fmach.it/ (http://www.fmach.it/)

USA: OSU Oregon State University, 4017 Agriculture and Life Sciences Building, Corvallis, OR 97331-7304, http://spottedwing.org/ (http://spottedwing.org/)

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Distribution Maps

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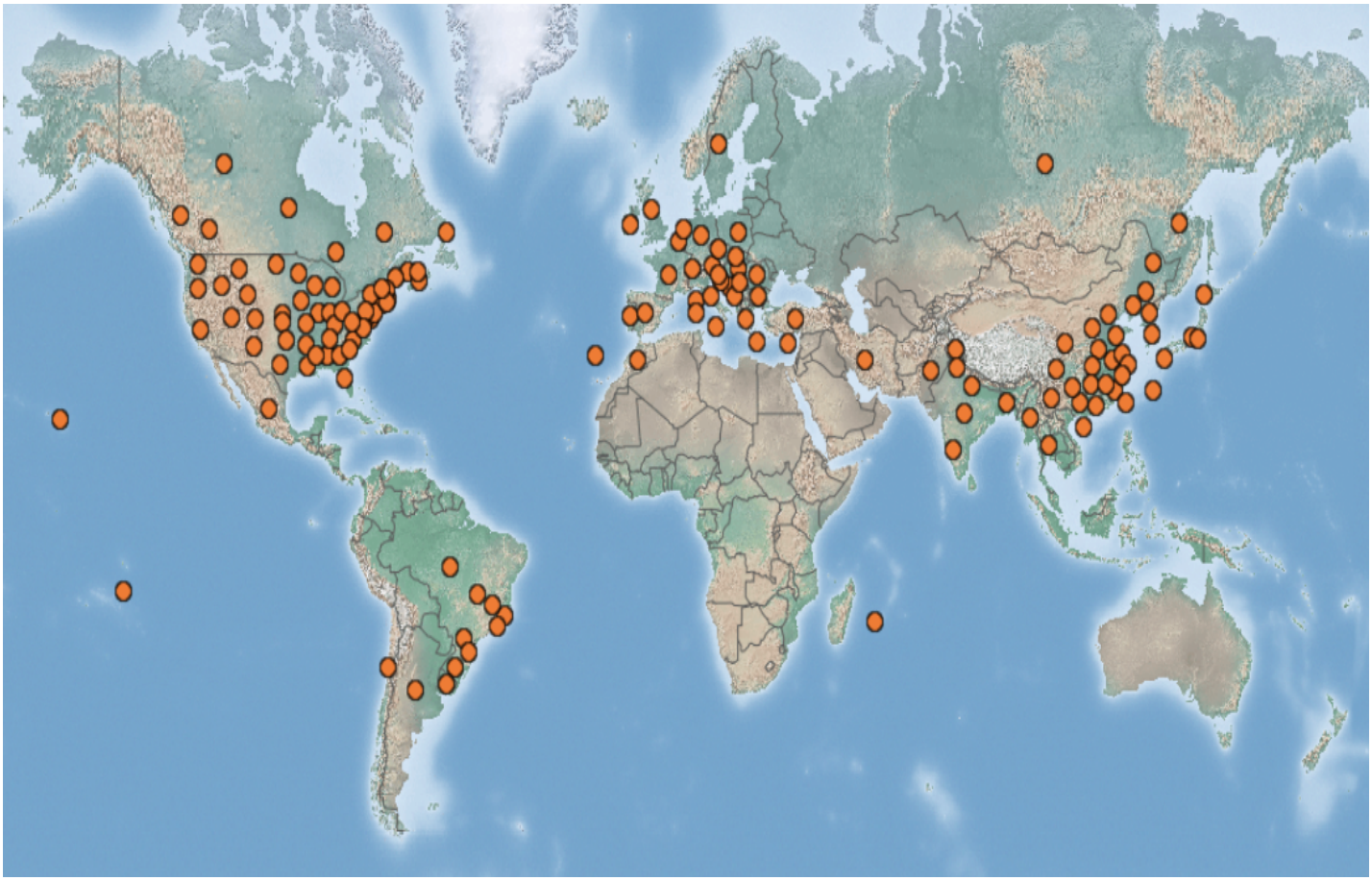
You can pan and zoom the map

Save map



Analyze by: Source
- CABI Summary Data

Analyze by: Invasive
- Invasive
- Not recorded

Analyze by: Extent
- Few occurrences
- Localized
- Not recorded
- Widespread

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