

**Supplementary Table 1** Distribution (outside their North or South American native range) of the four main *Ambrosia* species recorded in Europe. Data source GISD (2009) and EPPO (2011) for *A. artemisiifolia*, EPPO (2011) for *A. psilostachya* and *A. trifida*, and Behçet (2004) and DAISIE (2009) for *A. tenuifolia*.

| Species                           | Europe  | Asia   | Africa    | Central, North &<br>South America  | Oceanía                |
|-----------------------------------|---|--|-----------|--|------------------------|
| <i>Ambrosia artemisiifolia</i> L. | Austria, Belgium, Croatia, Czech Republic, Denmark, France, Finland, Georgia, Germany, Hungary, Italy, Latvia, Lithuania, Moldavia, Netherlands, Norway, Poland, Portugal, Romania, Russia (Krasnodar territory, Primorskii territory), Slovakia, Slovenia, Spain, Sweden, Switzerland, UK, Ukraine | Azerbaijan, China, India, Iran, Japan, Kazakhstan, South Korea, Taiwan, Turkey | Mauritius | Argentina, Bolivia, Brazil, Chile, Cuba, Colombia, Guadeloupe, Guatemala, Martinique, Jamaica, Paraguay, Peru, Uruguay | Australia, New Zealand |

|  |  |   |           |           |
|--|--|---|-----------|-----------|
| <i>Ambrosia psilostachya</i> DC<br>(syn. <i>A. coronopifolia</i> Torr.<br>& A. Gray) | Belgium, Denmark, France, Germany,<br>Hungary, Italy, Netherlands, Poland,<br>Russia (limited areas in the South of<br>European Russia), Spain, Sweden,<br>Switzerland | Kazakhstan,<br>Asiatic Russia,                  | Mauritius | Australia |
| <i>Ambrosia tenuifolia</i> Spreng.   | France, Italy, Spain   | Israel, Turkey,                                 | USA       | Australia |
| <i>Ambrosia trifida</i> L.   | Belgium, Czech Republic, France, Georgia,<br>Germany, Italy, Netherlands, Norway,<br>Russia (South of European Russia),<br>Sweden, Switzerland, former Yugoslavia      | Asiatic Russia,<br>Japan, China,<br>South Korea |           |           |

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**Supplementary Table 2** Herbivores and pathogens recorded on *Ambrosia artemisiifolia* in the introduced range in Eurasia.

| Taxon                                    | Country                    | Source                      |
|--|----------------------------|-----------------------------|
| INSECTA                                  |                            |                             |
| COLEOPTERA                               |                            |                             |
| Chrysomelidae                            |                            |                             |
| <i>Cryptocephalus sericus</i> L.         | former Yugoslavia          | (Maceljski & Igrc, 1989)    |
| <i>Galeruca tanacetii</i> L.             | former Yugoslavia          | (Maceljski & Igrc, 1989)    |
| Curculionidae                            |                            |                             |
| <i>Lixus</i> sp.                         | former Yugoslavia          | (Maceljski & Igrc, 1989)    |
| <i>Phyllobius pyri</i> L.                | former Yugoslavia          | (Maceljski & Igrc, 1989)    |
| <i>Sitona suturalis</i> Steph.           | former Yugoslavia          | (Maceljski & Igrc, 1989)    |
| <i>Tanymecus pallidus</i> R.             | Russia, former Yugoslavia  | (Maceljski & Igrc, 1989)    |
| Mordellidae                              |                            |                             |
| <i>Morellistena</i> sp.                  | Russia                     | (Maceljski & Igrc, 1989)    |
| HETEROPTERA                              |                            |                             |
| Cercopidae                               |                            |                             |
| <i>Philaenus spumarius</i> L.            | Hungary, former Yugoslavia | (Kiss <i>et al.</i> , 2008) |
| <i>Coreus marginatus</i> L.              | Russia, former Yugoslavia  | (Maceljski & Igrc, 1989)    |
| <i>Adelphocoris lineoletus</i> Goeze     | Hungary                    | (Kiss <i>et al.</i> , 2008) |
| <i>Lygus rugulipennis</i> Poppius        | Hungary                    | (Kiss <i>et al.</i> , 2008) |
| <i>Eurydema oleraceum flinata</i> Schr.  | former Yugoslavia          | (Maceljski & Igrc, 1989)    |
| <i>Eurydema oleraceum interrupta</i> Ry. | former Yugoslavia          | (Maceljski & Igrc, 1989)    |
| HOMOPTERA                                |                            |                             |
| Aphididae                                |                            |                             |
| <i>Aphis fabae</i> Scopoli               | Hungary, former Yugoslavia | (Kiss <i>et al.</i> , 2008) |
| <i>Aphis</i> sp.                         | former Yugoslavia          | (Maceljski & Igrc, 1989)    |

|  |                               |                             |
|--|-------------------------------|-----------------------------|
| <i>Brachycaudus helichrysi</i><br>(Kaltenbach) | Hungary, former<br>Yugoslavia | (Basky, 2009)               |
| <i>Myzus persicae</i> (Sulzer)                 | Hungary                       | (Basky, 2009)               |
| <i>Protaphis</i> sp.                           | Russia                        | (Maceljski & Igrc, 1989)    |
| Cicadellidae                                   |                               |                             |
| <i>Emelyanoviana mollicula</i> (Boheman)       | Hungary                       | (Kiss <i>et al.</i> , 2008) |
| <i>Eupteryx atropunctata</i> (Goeze)           | Hungary                       | (Kiss <i>et al.</i> , 2008) |
| Diaspididae                                    |                               |                             |
| <i>Parthenolicaneum corni</i> Bouché           | Russia                        | (Maceljski & Igrc, 1989)    |
| LEPIDOPTERA                                    |                               |                             |
| Crambidae                                      |                               |                             |
| <i>Ostrinia nubialis</i> Hbn.                  | former Yugoslavia             | (Maceljski & Igrc, 1989)    |
| <i>Ostrinia orientalis</i> Mutuura &<br>Munroe | China                         | (Wan <i>et al.</i> , 2003)  |
| Geometridae                                    |                               |                             |
| <i>Cosymbia</i> sp                             | former Yugoslavia             | (Maceljski & Igrc, 1989)    |
| Unidentified                                   | former Yugoslavia             | (Maceljski & Igrc, 1989)    |
| Unidentified                                   | former Yugoslavia             | (Maceljski & Igrc, 1989)    |
| Lymantriidae                                   |                               |                             |
| <i>Orgyia recens</i> Hbn.                      | former Yugoslavia             | (Maceljski & Igrc, 1989)    |
| Noctuidae                                      |                               |                             |
| <i>Autographa confusa</i> Steph.               | Russia                        | (Kovalev, 1971)             |
| <i>Autographa gamma</i> L.                     | Russia, former<br>Yugoslavia  | (Kovalev, 1971)             |
| <i>Chloridea scutosa</i> Schiff.               | Russia                        | (Maceljski & Igrc, 1989)    |
| <i>Hypena proboscidalis</i> L.                 | former Yugoslavia             | (Maceljski & Igrc, 1989)    |
| <i>Peridroma saucia</i> Hbn.                   | former Yugoslavia             | (Maceljski & Igrc, 1989)    |
| <i>Scotia ipsilon</i> Rott.                    | Russia                        | (Kovalev, 1971)             |
| Sphingidae                                     |                               |                             |
| <i>Herse convolvuli</i> L.                     | former Yugoslavia             | (Maceljski & Igrc, 1989)    |
| SALTATORIA                                     |                               |                             |
| Acrididae                                      |                               |                             |

|  |                   |   |
|--|-------------------|---|
| <i>Chortippus paralellus</i> Zett.   | former Yugoslavia | (Maceljski & Igrc, 1989)                                  |
| <i>Chortippus</i> sp.  | former Yugoslavia | (Maceljski & Igrc, 1989)                                  |
| Decticinae   |                   |   |
| <i>Pholidoptera</i> sp.  | former Yugoslavia | (Maceljski & Igrc, 1989)                                  |
| Gryllidae  |                   |   |
| <i>Oecanthus pellucens</i> Scop.   | former Yugoslavia | (Maceljski & Igrc, 1989)                                  |
| Tettigidae   |                   |   |
| <i>Tetrix undulata</i> Serv.   | former Yugoslavia | (Maceljski & Igrc, 1989)                                  |
| <i>Leptophytes bosci</i> Fieb.   | former Yugoslavia | (Maceljski & Igrc, 1989)                                  |
| ACARINA  |                   |   |
| Tetranychidae  |                   |   |
| <i>Tetranychus urtica</i> Koch.  | Russia            | (Maceljski & Igrc, 1989)                                  |
| FUNGI <sup>a</sup>   |                   |   |
| OOMYCOTA   |                   |   |
| OOMYCETES  |                   |   |
| ALBUGINALES  |                   |   |
| Albuginaceae   |                   |   |
| <i>Pustula tragopogonis</i> (Pers.)<br>Thienes 2005 ( <i>Albugo tragopogonis</i><br>(D.C.) S.F. Gray 1821) | Hungary, Austria  | (Bohár & Vajna, 1996;<br>Voglmayr & Riethmuller,<br>2006) |
| PERONOSPORALES   |                   |   |
| Peronosporaceae  |                   |   |
| <i>Plasmopara angustiterminalis</i><br>Novot. 1962   | Ukraine           | (Dudka & Hayova, 2007)                                    |
| <i>Plasmophora halstedii</i> (Farl.) Berl.<br>& De Toni 1988   | Hungary           | (Vajna, 2002)   |
| ASCOMYCOTA   |                   |   |
| DOTHIDEOMYCETES  |                   |   |
| BOTRYOSPHAERIALES  |                   |   |
| Botryosphaeriaceae   |                   |   |
| <i>Macrophomina phaseolina</i> (Tassi)   | Hungary           | (Bohár & Kiss, 1999)                                      |

Goid 1947

## CAPNODIALES

### Davidiellaceae

*Cladosporium herbarum* (Pers.) Link    China    (Li & Li, 1993)  
1816

### Mycosphaerellaceae

*Septoria ambrosiae* Hemmi & N.    Japan    (Naito, 1940)  
Naito 1940

*Septoria epambrosia* D.F. Farr 2001    Hungary    (Bohár & Schwarzing, 1999)

## PLEOSPORALES

### Pleosporaceae

*Alternaria alternata*    China    (Li & Li, 1993)  
(Fr.) Keissl 1912 (*Alternaria tenuis*  
Nees 1816)

### Incertae sedis

*Phoma* sp.    Hungary    (Bohár *et al.*, 2009)

## LEOTIOMYCETES

## HELOTIALES

### Sclerotiniaceae

*Botrytis cinerae* Pers. 1794    Hungary    (Bohár & Vajna, 1996)

*Sclerotinia sclerotium* (Lib.) de    Hungary    (Bohár & Kiss, 1999)  
Bary 1884

## ERYSIPHALES

### Erysiphaceae

*Golovinomyces cichoracearum*    Korea, Mauritius    (Orieux & Felix, 1968; Shin,  
(DC.) V.P. Heluta 1988 (*Erysiphe*  
*cichoracearum* DC. 1805)    2000)

*Golovinomyces cichoracearum* var.    Germany    (Braun, 1995)  
*latisporus* (U. Braun) U. Braun 1999  
(*Erysiphe cichoracearum* var.  
*latispora* U. Braun 1983)

*Leveillula taurica* (Lév.) G. Arnaud    former USSR    (Amano, 1986)

1921

SORDARIOMYCETES

HYPOCREALES

Netriaceae

|   |       |                 |
|---|-------|-----------------|
| <i>Fusarium avenaceum</i> (Fr.).<br>Sacc.1886 | China | (Li & Li, 1993) |
|---|-------|-----------------|

INCERTAE SEDIS

Plectosphaerellaceae

|  |         |                       |
|--|---------|-----------------------|
| <i>Verticillium dahliae</i> Kleb. 1913 | Hungary | (Bohár & Vajna, 1996) |
|--|---------|-----------------------|

PHYLLACHORALES

Phyllachoraceae

|   |         |               |
|---|---------|---------------|
| <i>Phyllachora ambrosiae</i> (Berk. &<br>M.A. Curtis) Sacc.1883 | Hungary | (Vajna, 2002) |
|---|---------|---------------|

AGARICOMYCETES

CANTHARELLALES

Ceratobasidiaceae

|  |         |                       |
|--|---------|-----------------------|
| <i>Thanatephorus cucumeris</i> (A.B.<br>Frank) Donk 1956 ( <i>Rhizoctonia</i><br><i>solani</i> J.G. Kühn 1858) | Hungary | (Bohár & Vajna, 1996) |
|--|---------|-----------------------|

EXOBASIDIOMYCETES

ENTYLOMATALES

Entylomataceae

|  |         |                              |
|--|---------|------------------------------|
| <i>Entyloma polysporum</i> (Peck)<br>Farl.1883 | Hungary | (Vanky <i>et al.</i> , 1988) |
|--|---------|------------------------------|

INCERTAE SEDIS

INCERTAE SEDIS

INCERTAE SEDIS

Incertae sedis

|   |       |                 |
|---|-------|-----------------|
| <i>Athelia rolfsii</i> (Curzi) C.C. Tu<br>& Kimbr.1978 ( <i>Sclerotium rolfsi</i><br>Sacc.1911) | China | (Li & Li, 1993) |
|---|-------|-----------------|

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<sup>a</sup> fungal taxonomy is in accordance to “Index Fungorum”  
(<http://www.indexfungorum.org/Index.htm>)



**Supplementary Table 3** Selected attributes of phytophagous organisms recorded exclusively from *Ambrosia* spp. (and some closely related species within the subtribe Ambrosiinae) in North America. Organisms not identified to the species level are not considered in the list.

| Taxon   | Feeding<br>niche | Feeding<br>mode | Origin        | Host range <sup>a</sup>            | Source   |
|---|------------------|-----------------|---------------|------------------------------------|--|
| INSECTA   |                  |                 |               |                                    |  |
| COLEOPTERA  |                  |                 |               |                                    |  |
| Anthribidae   |                  |                 |               |                                    |  |
| <i>Trigonorhinus tomentosus</i> (Say)<br>(Syn.: <i>Brachytarsus tomentosus</i> (Say)) | flowers          | endo            | USA (CA)      | Ambca, Ambce, FRSCO, AMBDU, AMBER  | (Harris & Piper, 1970; Goeden & Ricker, 1974b, 1975, 1976a, 1976c) |
| Chrysomelidae   |                  |                 |               |                                    |  |
| <i>Galerucella notulata</i> Fabricius   | leaves           | ecto            | North America | AMBTR                              | (Harris & Piper, 1970)   |
| <i>Nodonota convexa</i> (Say)   | ?                | ?               | North America | <i>Ambrosia</i>                    | (Harris & Piper 1970)  |
| <i>Ophraella notulata</i> (Fabricius)   | leaves           | ecto            | North America | AMBEL, AMBPS, Ambce, FRSCO, AMBDU, | (Welch, 1978; Goeden & Ricker, 1985; Futuyma &                     |

|   |        |                                    |               |   |   |
|---|--------|------------------------------------|---------------|---|---|
|   |        |                                    |               | AMBER, Ambil,<br><i>Xanthium, Iva</i>     | McCafferty, 1990; Keese,<br>1997)                       |
| <i>Ophraella slobodkini</i> (Futuyma)   | leaves | ecto                               | USA (FL)      | AMBEL, <i>Iva frutescens</i> <sup>b</sup> | (Futuyma, 1991; Keese,<br>1998)                         |
| <i>Pachybrachys lodingi</i> Bowditch    | leaves | ecto                               | North America | <i>Ambrosia</i>                           | (Harris & Piper, 1970)                                  |
| <i>Zygogramma bicolorata</i> Pallister  | leaves | ecto                               | North America | AMBEL                                     | (Teshler <i>et al.</i> , 2002)                          |
| <i>Zygogramma disrupta</i> Rogers       | leaves | ecto                               | North America | AMBEL                                     | (Piper, 1978)   |
| <i>Zygogramma suturalis</i> (Fabricius) | leaves | ecto                               | North America | AMBEL                                     | (Harris & Piper, 1970;<br>Teshler <i>et al.</i> , 2002) |
| <i>Zygogramma tortuosa</i> Rogers       | leaves | ecto                               | USA (CA)      | AMBER                                     | (Goeden & Ricker, 1976c)                                |
| Curculionidae                           |        |                                    |               |   |   |
| <i>Baris dilatata</i> Cas.              | shoots | endo<br>(sometimes<br>gall former) | North America | <i>Ambrosia</i>                           | (Kovalev, 1971)   |
| <i>Baris interstitialis</i> Say.        | shoots | endo<br>(sometimes<br>gall former) | North America | <i>Ambrosia</i>                           | (Kovalev, 1971)   |
| <i>Conotrachelus atokanus</i> Fall.     | ?      | endo                               | North America | AMBTR                                     | (Harris & Piper, 1970;<br>Kovalev, 1971)                |

|  |        |      |               |                        |  |
|--|--------|------|---------------|------------------------|--|
| <i>Conotrachelus cribricollis</i> Schoenherr                               | ?      | endo | North America | AMBTR                  | (Harris & Piper, 1970;<br>Kovalev, 1971)   |
| <i>Cylindrocopturus mammilatus</i> group<br>prob. <i>littoralis</i> (Fall) | shoots | endo | USA (CA)      | Ambca                  | (Goeden & Ricker, 1974b)                   |
| <i>Lixus capitatus</i> Chittenden  | shoots | endo | North America | <i>Ambrosia</i>        | (Harris & Piper, 1970;<br>Kovalev, 1971)   |
| <i>Lixus ivae</i> Chittenden   | shoots | endo | North America | <i>Ambrosia</i>        | (Harris & Piper, 1970;<br>Kovalev, 1971)   |
| <i>Lixus marginatus</i> Say<br>(Syn. <i>L. sylvius</i> )                   | shoots | endo | North America | AMBTR, <i>Ambrosia</i> | (Harris & Piper, 1970;<br>Kovalev, 1971)   |
| <i>Rhyssomatus aequalis</i> Horn   | ?      | endo | North America | AMBTR, <i>Ambrosia</i> | (Harris & Piper, 1970;<br>Kovalev, 1971)   |
| <i>Smicronyx californicus</i> Dietz  | leaves | endo | USA (CA)      | FRSAC, AMBPS           | (Kovalev, 1971; Goeden &<br>Ricker, 1976b) |
| <i>Smicronyx convexus</i> Anderson   | seeds  | endo | North America | <i>Ambrosia</i>        | (Harris & Piper, 1970;<br>Kovalev, 1971)   |
| <i>Smicronyx corniculatus</i> (Fahraeus)                                   | ?      | endo | North America | <i>Ambrosia</i>        | (Harris & Piper, 1970;<br>Kovalev, 1971)   |
| <i>Smicronyx flavicans</i> LeC.  | seeds  | endo | North America | AMBTR, <i>Ambrosia</i> | (Harris & Piper, 1970;<br>Kovalev, 1971)   |

|                                     |              |                       |               |   |   |
|-------------------------------------|--------------|-----------------------|---------------|---|---|
| <i>Smicronyx perpusillus</i> Casey  | seeds        | endo                  | North America | AMBEL                                   | (Harris & Piper, 1970; Kovalev, 1971)   |
| <i>Smicronyx squalidus</i> Cas.     | seeds        | endo                  | North America | AMBTR, <i>Ambrosia</i>                  | (Harris & Piper, 1970; Kovalev, 1971)   |
| <i>Smicronyx tessellatus</i> Dietz  | ?            | endo                  | North America | AMBEL, <i>Ambrosia</i>                  | (Harris & Piper, 1970; Kovalev, 1971)   |
| Mordellidae                         |              |                       |               |   |   |
| <i>Mordella oculata</i> Say         | ?            | ?                     | North America | <i>Ambrosia</i>                         | (Harris & Piper, 1970)  |
| DIPTERA                             |              |                       |               |   |   |
| Agromyzidae                         |              |                       |               |   |   |
| <i>Agromyza ambrosivora</i> Spencer | leaves       | endo                  | North America | AMBEL                                   | (Kovalev, 1971)   |
| <i>Calycomyza ambrosiae</i> (Frick) | leaves       | endo<br>(gall former) | North America | AMBEL, FRSCO,<br>AMBTR, <i>Ambrosia</i> | (Harris & Piper, 1970; Kovalev, 1971; Stegmaier, 1971; Goeden & Ricker, 1975) |
| <i>Calycomyza jucunda</i> Wulp      | leaves       | endo                  | North America | AMBTR                                   | (Kovalev, 1971)   |
| Cecidomyiidae                       |              |                       |               |   |   |
| <i>Asphondylia ambrosiae</i> Gagne  | buds, shoots | endo<br>(gall former) | USA           | AMBEL, AMBDU,<br>AMBER?, Ambmo,         | (Gagné, 1975; Goeden & Ricker, 1976a, c)                                      |

|   |                               |                                    |               |  |  |
|---|-------------------------------|------------------------------------|---------------|--|--|
|   |                               |                                    |               | AMBPS  |  |
| <i>Contarinia</i> n. sp.                    | ?                             | ?                                  | Argentina     | originally identified as<br>AMBTE, probably<br>AMBEL               | (McFadyen, 1976)   |
| <i>Contarinia</i> n. sp.                    | flowers,<br>leaves,<br>shoots | endo                               | USA (CA)      | Ambca, FRSCO   | (Goeden & Ricker, 1974b,<br>1975)  |
| <i>Contarinia partheniicola</i> (Cockerell) | buds,<br>inflorescence        | endo<br>(gall former)              | USA, Mexico   | Ambca, FRSCO, AMBDU,<br>AMBER, AMBPS,<br><i>Parthenium incanum</i> | (Gagné, 1975; Goeden &<br>Ricker, 1976a, b, c; Goeden<br>& Palmer, 1995) |
| <i>Neolasioptera ambrosiae</i> Felt         | shoots                        | endo<br>(sometimes<br>gall former) | USA           | AMBEL, FRSCO,<br>AMBPS, AMBTR                                      | (Harris & Piper, 1970;<br>Gagné, 1975; Goeden &<br>Ricker, 1975)         |
| <i>Neolasioptera</i> n. sp.                 | shoots                        | endo                               | USA (CA)      | AMBDU  | (Goeden & Ricker, 1976a)   |
| <i>Rhopalomyia ambrosiae</i> Gagne          | buds                          | endo<br>(gall former)              | USA (FL)      | AMBEL, AMBPS   | (Gagné, 1994)  |
| Tephritidae                                 |                               |                                    |               |  |  |
| <i>Callachna gibba</i> (Loew)               | shoots                        | endo<br>(gall former)              | North America | AMBEL, AMBPS   | (Harris & Piper, 1970;<br>Kovalev, 1971)                                 |

|   |                                   |      |               |                                      |  |
|---|-----------------------------------|------|---------------|--------------------------------------|--|
| <i>Euaresta bella</i> (Loew)            | flowers                           | endo | North America | AMBEL                                | (Kovalev, 1971)  |
| <i>Euaresta festiva</i> (Loew)          | seeds                             | endo | North America | AMBTR                                | (Harris & Piper, 1970;<br>Kovalev, 1971)   |
| <i>Euaresta jonesi</i> Curran           | seeds                             | endo | North America | Ambca, Ambst                         | (Harris & Piper, 1970;<br>Kovalev, 1971)   |
| <i>Euaresta stelligera</i> (Coquillett) | seeds                             | endo | North America | Ambca                                | (Norrbon, 2002)  |
| <i>Euaresta stigmatica</i> Coquillett   | seeds,<br>staminate<br>involucres | endo | North America | FRSAC, Ambam,<br>AMBDE, Ambil, AMBPS | (Harris & Piper, 1970;<br>Goeden & Ricker, 1974a,<br>1976c; Headrick <i>et al.</i> , 1995) |
| <i>Euaresta toba</i> (Lindner)          | seeds                             | endo | Argentina     | AMBEL, AMBCU,<br>AMBTE               | (McFadyen, 1976; Norrbom,<br>2009)   |
| <i>Procecidochares</i> n. sp.           | shoots                            | ecto | USA (CA)      | AMBDU, AMBER                         | (Goeden & Ricker, 1976a, c)  |

#### HEMIPTERA

##### Cicadellidae

|                                    |                   |      |          |              |                          |
|------------------------------------|-------------------|------|----------|--------------|--------------------------|
| <i>Aceratagallia truncata</i> Oman | leaves            | ecto | USA (CA) | FRSAC, AMBDU | (Goeden & Ricker, 1976a) |
| <i>Aceratagallis nitidula</i> Oman | leaves            | ecto | USA (CA) | FRSCO        | (Goeden & Ricker, 1975)  |
| <i>Ballana vesca</i> (Ball)        | leaves,<br>shoots | ecto | USA (CA) | Ambca        | (Goeden & Ricker, 1974b) |
| <i>Ceratagallia lobata</i> Oman    | leaves            | ecto | USA (CA) | AMBDU, AMBER | (Goeden & Ricker, 1976c) |

|   |                   |      |               |                                   |  |
|---|-------------------|------|---------------|-----------------------------------|--|
| <i>Ceratagallia longipes</i> Oman   | leaves            | ecto | USA (CA)      | AMBDU                             | (Goeden & Ricker, 1976a)               |
| <i>Empoasca lauta</i> DeLong  | leaves            | ecto |               | Ambce, AMBDU, AMBER, Ambil        | (Goeden & Ricker, 1976a, c)            |
| <i>Scleroracus bullatus</i> (Ball)  | leaves            | ecto | USA (CA)      | FRSAC                             | (Goeden & Ricker, 1974a)               |
| Coccidae  |                   |      |               |                                   |  |
| <i>Chorizococcus dentatus</i> Lobdell<br>(Syn. <i>Pseudococcus dentatus</i> ) | ?                 | ?    | North America | AMBTR                             | (Harris & Piper, 1970)                 |
| Delphacidae   |                   |      |               |                                   |  |
| <i>Stobaera caldwelli</i> Kramer  | leaves,<br>shoots | ecto |               | FRSAC, FRSCO, AMBDU, AMBER, AMBPS | (Goeden & Ricker, 1975, 1976a, b, c)   |
| <i>Stobaera concinna</i> (Stål)   | leaves,<br>shoots | ecto | USA (CA)      | FRSCO, AMBPS, <i>Parthenium</i>   | (Goeden & Ricker, 1976b; McClay, 1983) |
| <i>Stobaera mui</i> Kramer  | leaves,<br>shoots | ecto | USA (CA)      | Ambca, AMBPS                      | (Goeden & Ricker, 1974b; McClay, 1983) |
| Dictyopharidae  |                   |      |               |                                   |  |
| <i>Scolops pallidus</i> Uhler   | shoots            | ecto | USA (CA)      | FRSCO                             | (Goeden & Ricker, 1975)                |
| Flatidae  |                   |      |               |                                   |  |

|   |                   |                       |               |   |  |
|---|-------------------|-----------------------|---------------|---|--|
| <i>Ormenis saucia</i> Van Duzee           | leaves,<br>shoots | ecto                  | USA (CA)      | FRSAC, AMBDU,<br>AMBER, AMBPS           | (Goeden & Ricker, 1976a, b,<br>c)                |
| Miridae                                   |                   |                       |               |   |  |
| <i>Ceratocapsus fuscusignatus</i> Knight  | leaves,<br>shoots | ecto                  | USA (CA)      | AMBPS                                   | (Goeden & Ricker, 1976b)                         |
| <i>Chlamydatus suavis</i> (Reuter)        | leaves,<br>shoots | ecto                  | USA (CA)      | FRSCO, AMBDU,<br>AMBTR, <i>Ambrosia</i> | (Harris & Piper, 1970;<br>Goeden & Ricker, 1975) |
| <i>Dicyphus elongatus</i> Van Duzee       | leaves,<br>shoots | ecto                  | USA (CA)      | Ambil                                   | (Goeden & Ricker, 1976c)                         |
| <i>Ilnacora stalii</i> Reut               |                   |                       | North America | AMBTR, Xanthium                         | (Harris & Piper, 1970)                           |
| <i>Plagionathus blatchleyi</i> Reuter     | leaves,<br>shoots | ecto                  | North America | <i>Ambrosia</i>                         | (Harris & Piper, 1970)                           |
| HYMENOPTERA                               |                   |                       |               |   |  |
| Cynipidae                                 |                   |                       |               |   |  |
| <i>Aulacidea ambrosiaeicola</i> (Ashmead) | shoots            | endo<br>(gall former) | North America | <i>Ambrosia</i>                         | (Harris & Piper, 1970;<br>Kovalev, 1971)         |
| LEPIDOPTERA                               |                   |                       |               |   |  |
| Coleophoridae                             |                   |                       |               |   |  |



|   |        |      |                                     |  |   |
|---|--------|------|-------------------------------------|--|---|
| <i>Coleophora</i> sp. near <i>annulatella</i> Braun                             | leaves | endo | USA (CA)                            | FRSCO, AMBDU,<br>AMBPS   | (Goeden & Ricker, 1975,<br>1976a, c)                                    |
| Cosmopterigidae   |        |      |                                     |  |   |
| <i>Cosmopterix opulenta</i> Braun   | leaves | endo | Nearctic                            | AMBPS  | (Harris & Piper, 1970;<br>Kovalev, 1971; Robinson <i>et al.</i> , 2010) |
| Gelechiidae   |        |      |                                     |  |   |
| <i>Chionodes mediofuscella</i> Clemens<br>(Syn. <i>Gelechia mediofusiella</i> ) | seeds  | endo | Nearctic                            | AMBTR, <i>Ambrosia</i>   | (Harris & Piper, 1970;<br>Robinson <i>et al.</i> , 2010)                |
| <i>Gelechia subalbusella</i> (Chambers)<br>(Syn. <i>Brachmia subalbusella</i> ) | leaves | ecto | USA (CA)                            | FRSCO, AMBPS   | (Goeden & Ricker, 1975,<br>1976b)                                       |
| <i>Trichotaphe serrativitella</i> (Zeller)                                      | ?      | ?    | USA (FL)                            | <i>Ambrosia</i>  | (Stegmaier, 1971)   |
| <i>Helcystogramma chambersella</i> Murtfeldt                                    | ?      | ?    | Nearctic,<br>Neotropical,<br>Mexico | <i>Ambrosia</i> , AMBEL,<br>AMBPS, AMBTR,<br><i>Parthenium</i> | (Robinson <i>et al.</i> , 2010)   |
| Geometridae   |        |      |                                     |  |   |
| <i>Animomyia morta</i> Dyar   | ?      | ?    | USA                                 | AMBDU  | (Robinson <i>et al.</i> , 2010)   |
| <i>Animomyia smithi</i> (Pearsall)  | leaves | ecto | USA (CA)                            | AMBDU  | (Goeden & Ricker, 1976a)  |
| Lyonetiidae (Bucculatricidae)   |        |      |                                     |  |   |

|   |        |             |                        |                        |   |
|---|--------|-------------|------------------------|------------------------|---|
| <i>Bucculatrix agnella</i> Clemens          | leaves | endo & ecto | Nearctic               | AMBEL                  | (Kovalev, 1971; Stegmaier, 1971; Robinson <i>et al.</i> , 2010)                       |
| <i>Bucculatrix ambrosiafoliella</i> Cham.   | leaves | endo & ecto | North America          | <i>Ambrosia</i>        | (Harris & Piper, 1970; Kovalev, 1971; Stegmaier, 1971; Robinson <i>et al.</i> , 2010) |
| <i>Bucculatrix franseriae</i> Braun         | leaves | endo        | Nearctic               | AMBDE                  | (Robinson <i>et al.</i> , 2010)   |
| <i>Bucculatrix transversata</i> Braun       | leaves | endo        | Nearctic               | AMBPS                  | (Robinson <i>et al.</i> , 2010)   |
| Noctuidae                                   |        |             |                        |                        |   |
| <i>Conochoares acutus</i> Smith             | ?      | ?           | USA                    | <i>Ambrosia</i>        | (Robinson <i>et al.</i> , 2010)   |
| <i>Conochoares arizonae</i> (Henry Edwards) | leaves | ecto        | USA (CA)               | AMBDU                  | (Goeden & Ricker, 1976a)  |
| <i>Plagiomimicus expallidus</i> Grote       | ?      | ?           | Nearctic               | <i>Ambrosia, Iva</i>   | (Harris & Piper, 1970; Robinson <i>et al.</i> , 2010)                                 |
| <i>Plagiomimicus pityochromus</i> Grote     | ?      | ?           | North America, Florida | AMBTR, <i>Ambrosia</i> | (Harris & Piper, 1970; Stegmaier, 1971; Robinson <i>et al.</i> , 2010)                |
| <i>Platysenta apameoides</i> Guenée         | leaves | ecto        | North America          | <i>Ambrosia</i>        | (Stegmaier, 1971)   |
| <i>Ponometria sutrix</i> (Grote)            | leaves | ecto        | USA (CA)               | FRSAC                  | (Goeden & Ricker, 1974a)  |
| <i>Schinia dobla</i> Smith                  |        |             | Nearctic               | AMBDU                  | (Robinson <i>et al.</i> , 2010)   |
| <i>Schinia rivulosa</i> Guenée              | leaves | ecto        | Nearctic               | AMBEL, AMBPS,          | (Harris & Piper, 1970;  |

|   |                    |      |                                    |   |   |
|---|--------------------|------|------------------------------------|---|---|
| (Syn. <i>S. marginata</i> )               |                    |      |                                    | <i>Ambrosia</i>                         | Stegmaier, 1971; Robinson <i>et al.</i> , 2010)   |
| <i>Schinia thoreau</i> (Grote & Robinson) | flowers,<br>fruits | ?    | North America                      | AMBTR, <i>Ambrosia</i>                  | (Harris & Piper, 1970;<br>Kovalev, 1971; Robinson <i>et al.</i> , 2010)                   |
| <i>Schinia sexplagiata</i> Smith          | flowers            | ecto | USA (CA)                           | FRSAC, FRSCO,<br>AMBDU, AMBER,<br>AMBPS | (Goeden & Ricker, 1975,<br>1976a, b, c; Robinson <i>et al.</i> ,<br>2010)                 |
| <i>Tarachidia candefacta</i> Huebner      | leaves             | ecto | USA, Nearctic                      | AMBEL, FRSCO, AMBPS                     | (Harris & Piper, 1970;<br>Goeden & Ricker, 1975,<br>1976b; Robinson <i>et al.</i> , 2010) |
| <i>Tarachidia erastrionoides</i> (Gn.)    | ?                  | ?    | North America                      | <i>Ambrosia</i>                         | (Harris & Piper, 1970)  |
| Oecophoridae                              |                    |      |                                    |   |   |
| <i>Epiblema sosana</i> Kearfott           | shoots             | endo | USA (CA)                           | FRSAC, Ambca?, FRSCO?                   | (Goeden & Ricker, 1974a, b,<br>1975; Robinson <i>et al.</i> , 2010)                       |
| <i>Exaeretia gracilis</i> Walsingham      |                    |      | Nearctic                           | AMBPS                                   | (Robinson <i>et al.</i> , 2010)   |
| <i>Martyrhilda gracilis</i> (Walsingham)  | leaves             | endo | USA (CA)                           | AMBPS                                   | (Goeden & Ricker, 1976b)  |
| Pterophoridae                             |                    |      |                                    |   |   |
| <i>Adagia ambrosiae</i> Murtfeldt         | leaves             | ecto | Nearctic, Bermuda,<br>Jamaica, USA | FRSAC, AMBEL, Ambca,<br>AMBER, AMBPS    | (Harris & Piper, 1970;<br>Kovalev, 1971; Goeden &   |

|   |        |      |               |   |   |
|---|--------|------|---------------|---|---|
|   |        |      | (CA)          |   | Ricker, 1974b, 1975, 1976c;<br>Robinson <i>et al.</i> , 2010)             |
| <i>Leioptilus inquinatus</i> Zeller             | ?      | ?    | Puerto Rico   | AMBPE   | (Robinson <i>et al.</i> , 2010)   |
| <i>Oidaematophorus inconditus</i> (Walsingham)  | shoots | endo | USA (CA)      | AMBDU   | (Goeden & Ricker, 1976a)  |
| <i>Oidaematophorus inquinatus</i> Zell.         |        |      | USA           | AMBEL, <i>Ambrosia</i> ,<br><i>Parthenium</i> | (Kovalev, 1971; Stegmaier,<br>1971; Robinson <i>et al.</i> , 2010)        |
| Pyralidae                                       |        |      |               |   |   |
| <i>Ancylosis morrisonella</i> Ragonot           | ?      | ?    | North America | Ambbi   | (Robinson <i>et al.</i> , 2010)   |
| <i>Conchylodes platinalis</i> Guenée            | ?      | ?    | USA           | AMBTR   | (Robinson <i>et al.</i> , 2010)   |
| <i>Frechinia laetalis</i> (Barnes & McDunnough) | leaves | endo | USA (CA)      | FRSCO, AMBDU                                  | (Goeden & Ricker, 1975,<br>1976a)   |
| Tischeriidae                                    |        |      |               |   |   |
| <i>Tischeria ambrosiaeella</i> Chambers         | leaves | endo | North America | AMBEL, AMBTR                                  | (Harris & Piper, 1970;<br>Stegmaier, 1971; Robinson <i>et al.</i> , 2010) |
| Tortricidae                                     |        |      |               |   |   |
| <i>Carolella beevorana</i> Comstock             | leaves | endo | Nearctic      | AMBDU   | (Robinson <i>et al.</i> , 2010)   |
| <i>Epiblema cataclystiana</i> Walker            | shoots | endo | North America | <i>Ambrosia</i> , <i>Xanthium</i>             | (Kovalev, 1971)   |
| <i>Epiblema minutana</i> (Kearfott)             | shoots | endo | USA, Mexico   | <i>Ambrosia</i>                               | (Blanchard, 1979; Miller &  |

|   |        |                       |               |                           |                               |
|---|--------|-----------------------|---------------|---------------------------|-------------------------------|
|   |        |                       |               |                           | Pogue, 1984)                  |
| <i>Epiblema otiosana</i> Clem.            | shoots | endo                  |               | <i>Ambrosia, Xanthium</i> | (Kovalev, 1971)               |
| ORTHOPTERA                                |        |                       |               |                           |                               |
| Tettigoniidae                             |        |                       |               |                           |                               |
| <i>Scudderia furcata</i> Brunner          | leaves | ecto                  | North America | AMBTR                     | (Harris & Piper, 1970)        |
| ARACHNIDA                                 |        |                       |               |                           |                               |
| ACARINA                                   |        |                       |               |                           |                               |
| Eriophyidae                               |        |                       |               |                           |                               |
| <i>Eriophyes (Aceria) boycei</i> Keifer   | leaves | endo<br>(gall former) | North America | AMBPS, <i>Ambrosia</i>    | (Keifer, 1943; Kovalev, 1971) |
| <i>Phyllocoptes ambrosiae</i> Keifer      | leaves | ecto                  | USA           | AMBPS                     | (Keifer, 1943)                |
| Tenuipalpidae                             |        |                       |               |                           |                               |
| <i>Brevipalpus aeoloides</i> Prit.& Baker | ?      | ?                     | North America | <i>Ambrosia</i>           | (Kovalev, 1971)               |
| <i>Brevipalpus aeolus</i> Prit.& Baker    | ?      | ?                     | North America | <i>Ambrosia</i>           | (Kovalev, 1971)               |

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<sup>a</sup> Plant species: EPPO (Bayer) codes used when available (in capital letters; see <http://eppt.eppo.org/index.php>); FRSAC: *A. acanthicarpa*; Ambam: *A. ambrosioides*; AMBEL: *A. artemisiifolia*; Ambbi: *A. bipinnatifida*; Ambca: *A. chamissonis*; FRSCO: *A.*

*confertiflora*; Ambce: *A. chenopodiifolia*; AMBCU: *A. cumanensis*; AMBDU: *A. dumosa*; AMBDE: *A. deltoideae*; AMBER: *A. eriocentra*; Ambil: *A. ilicifolia*; Ambmo: *A. monophylla*, AMBPE: *A. peruviana*; Ambpu: *A. pumila*; AMBPS: *A. psilostachya*; Ambst: *A. stigmatica*; AMBTE: *A. tenuifolia*; AMBTR: *A. trifida*

<sup>b</sup> host recorded in host specificity tests only.

**Supplementary Table 4** Fungi recorded exclusively from *Ambrosia* spp. (and some closely related species within the subtribe Ambrosiinae) in North America. Country names given in brackets are likely to indicate records from the introduced range of a fungus.

| Taxon                               | Synonym                           | Countries recorded<br>from     | Known host genera                       | Source   |
|-------------------------------------|-----------------------------------|--------------------------------|---|--|
| OOMYCOTA                            |                                   |                                |   |  |
| OOMYCETES                           |                                   |                                |   |  |
| ALBUGINALES                         |                                   |                                |   |  |
| Albuginaceae                        |                                   |                                |   |  |
| <i>Pustula tragopogonis</i> (Pers.) | <i>Albugo tragopogonis</i> (D.C.) | USA, Canada (Austria, Hungary) | many host genera within the Asteraceae, | (Anonymous, 1960; Shaw, 1973; Gilbertson <i>et al.</i> , 1979; but evidence of <i>formae speciales</i> Hartmann & Watson, 1980b; Ginns, 1986; Bohár & Vajna, |
| Thines 2005                         | Gray 1821                         |                                |   |  |

1996; Teshler *et al.*, 2002;  
Voglmayr & Riethmuller,  
2006)

## CHYTRIDIOMYCOTA

## CHYTRIDIOMYCETES

## INCERTAE SEDIS

## Olpidiaceae

*Monochytrium stevensianum*

USA

*Ambrosia* (only this  
record) (Grand, 1985)

Griggs 1910

## ASCOMYCOTA

## DOTHIDEOMYCETES

## CAPNODIALES

## Davidiellaceae

*Cladosporium ambrosiae* (collect.

USA

*Ambrosia* (only this  
record) (Dugan *et al.*, 2004)

House 1925)



# Mycosphaerellaceae

|   |   |   |   |
|---|---|---|---|
| <i>Passalora ambrosiae</i> (Chupp)<br>Crous & U. Braun 2001 | <i>Cercospora ambrosiae</i> Chupp<br>1930   | Colombia, Cuba, Puerto Rico, Venezuela, Virgin Islands, West Indies | <i>Ambrosia</i><br>(Dennis, 1970; Stevenson, 1975; Arnold, 1986; Crous & Braun, 2001; Minter <i>et al.</i> , 2001)  |
| <i>Passalora trifidae</i> (Chupp) U. Braun & Crous 2003     | <i>Cercospora trifidae</i> Chupp<br>1949, <i>Cercospora ferruginea</i><br>var. <i>ambrosiae</i> (Seym. & Earle) Davis 1942 ;<br><i>Mycovellosiella ambrosiae</i><br>(Olive) Deighton 1974;<br><i>Mycovellosiella trifidae</i><br>(Chupp) Deighton | USA   | <i>Ambrosia</i> , <i>Ranunculus</i><br>(Gilman & Archer, 1929; (one doubtful record Greene, 1949; Chupp, 1953; from <i>Ranunculus</i> ) Anonymous, 1960; Crous & Braun, 2003) |
| <i>Septoria ambrosiicola</i> Speg. 1910                     |   | USA   | <i>Ambrosia</i><br>(Anonymous, 1960; Urtiaga, 1986; Bai, 2003)  |

|  |   |                               |                                       |                                   |
|--|---|-------------------------------|---------------------------------------|-----------------------------------|
| <i>Septoria epambrosiae</i> D.F. Farr<br>2001                  | <i>Septoria bacilligera</i> G. Winter<br>(1885) | USA, Canada                   | <i>Ambrosia</i>                       | (Farr & Castlebury, 2001)         |
| DOTHIDEALES  |   |                               |                                       |                                   |
| Dothioraceae   |   |                               |                                       |                                   |
| <i>Metasphaeria ambrosiaecola</i> G.F.<br>Atk. 1897            |   | USA                           | <i>Ambrosia, Iva</i>                  | (Brenckle, 1917; Hanlin,<br>1963) |
| <i>Metasphaeria ambrosiaecola</i> var.<br><i>praetans</i> Rehm |   | USA                           | <i>Ambrosia</i> (only this<br>record) | (Brenckle, 1917)                  |
| PLEOSPORALES   |   |                               |                                       |                                   |
| Incertae sedis   |   |                               |                                       |                                   |
| <i>Phoma heliopsidis</i> (H.C. Greene)<br>Aa & Boerema 2002    |   | Canada, USA,<br>(Netherlands) | <i>Ambrosia, Heliopsis</i>            | (Boerema <i>et al.</i> , 2004)    |
| Phaeosphaeriaceae  |   |                               |                                       |                                   |
| <i>Stagonospora ambrosiae</i> Savile<br>1946                   |   | USA                           | <i>Ambrosia</i> (only this<br>record) | (Anonymous, 1960)                 |

|   |                                      |                        |                                    |                                   |
|---|--------------------------------------|------------------------|------------------------------------|-----------------------------------|
| <i>Stagonospora trifidae</i> H.C. Greene  |                                      | USA                    | <i>Ambrosia</i> (only this record) | (Greene, 1966)                    |
| 1967                                      |                                      |                        |                                    |                                   |
| Pleosporaceae                             |                                      |                        |                                    |                                   |
| <i>Alternaria franseriae</i> E.G. Simmons |                                      | USA                    | <i>Ambrosia (Franseria)</i>        | (Simmons, 1997)                   |
| 1997                                      |                                      |                        | (only this record)                 |                                   |
| LEOTIOMYCETES                             |                                      |                        |                                    |                                   |
| ERYSIPHALES                               |                                      |                        |                                    |                                   |
| Erysiphaceae                              |                                      |                        |                                    |                                   |
| <i>Golovinomyces cichoracearum</i>        | <i>Erysiphe cichoracearum</i> DC.    | Canada, USA,           | numerous genera, but               | (Preston 1947; Parris 1959;       |
| var. <i>chicoracearum</i> (DC.)           | 1805                                 | Argentina,( Mauritius) | reported <i>formae</i>             | Anonymous 1960; Orieux &          |
| V.P.Heluta 1988                           | ( <i>Erysiphe cichoracearum</i> var. |                        | <i>speciales</i>                   | Felix 1968; Alfieri <i>et al.</i> |
|   | <i>cichoracearum</i> DC. 1821),      |                        |                                    | 1984; Ginns 1986)                 |
|   | <i>Golovinomyces cichoracearum</i>   |                        |                                    |                                   |
|   | (DC.) V.P.Heluta 1988                |                        |                                    |                                   |
| SORDARIOMYCETES                           |                                      |                        |                                    |                                   |

## XYLARIALES

### Hyponectriaceae

|   |  |     |                                       |                  |
|---|--|-----|---------------------------------------|------------------|
| <i>Nectriella dakotensis</i> Seaver &<br>Lowen 1999 | <i>Hyponectria dakotensis</i> Seaver<br>1909 | USA | <i>Ambrosia</i> (only this<br>record) | (Brenckle, 1917) |
|---|--|-----|---------------------------------------|------------------|

### Taphrinales

## BASIDIOMYCOTA

## PUCCINIOMYCETES

### PUCCINIALES

### Pucciniaceae

|   |  |             |   |   |
|---|--|-------------|---|---|
| <i>Puccinia franseriae</i> Syd. & P. Syd.<br>1903 |  | USA, Mexico | <i>Ambrosia</i> ( <i>Franseria</i> as<br>syn of <i>Ambrosia</i> ) | (Solheim & Cummins, 1979;<br>Gallegos & Cummins, 1981)<br>(Payne, W.W. (1964),<br><i>Hymenoclea</i> |
| <i>Puccinia sonorae</i> Parmelee 1969             |  | Mexico      | <i>Ambrosia</i>   | (Gallegos & Cummins,<br>1981)   |

*Puccinia xanthii* Schwein. 1822

USA, Canada, Mexico, *Ambrosia*, *Xanthium* (Anonymous, 1960;  
Cuba, Dominican (Parmelee 1969) and Parmelee, 1969, 1977;  
Republic, Puerto Rico, numerous genera of the Solheim & Cummins, 1979;  
Hawaii, Colombia, Asteraceae (Hennen *et* Alfieri *et al.*, 1984; Buritica  
West Indies (Japan, *al.* 2005), evidence of & Pardo Cardona, 1996;  
Spain, Greece, *formae speciales* Hennen *et al.*, 2005)  
Romania, Bulgaria,  
Hungary, Australia,  
South Africa,  
Zimbabwe, Namibia)

*Puccinia xanthii* f. sp. *ambrosiae*-  
*trifidae* S.W.T. Batra 1981

USA, Canada, (China) *forma specialis* specific (Batra, 1979; Lu *et al.*, 2004)  
to *A. trifida*

<sup>a</sup> fungal taxonomy is in accordance to “Index Fungorum” (<http://www.indexfungorum.org/Index.htm>)

<sup>b</sup> CABI Herbarium held at Kew Gardens, London, UK

**Supplementary Appendix 1** Biology and host-range data of herbivores previously considered for classical biological control against *A. artemisiifolia*.

*Zygogramma suturalis*

Prior to the release of this leaf beetle in Croatia in 1985, host specificity tests under no-choice condition were conducted on 128 plant species/varieties and no feeding was reported on any other plant than *A. artemisiifolia* (Igrc, 1987). Prior to its field release in China, additional tests were conducted on 74 plant species/varieties, and feeding was only recorded on *A. artemisiifolia*. Interestingly, the close relative *A. trifida* was not accepted as a host by the beetle (Wan *et al.*, 1989).

In Russia, one complete and a partial second generation are produced and both larvae and adults feed on leaves and flowers of *A. artemisiifolia* from April to mid September (Reznik, pers. comm.). Serious damage of *A. artemisiifolia* plants over large areas provoke oviposition inhibition and can result in summer diapause in female *Z. suturalis* (Reznik, 1991). Population outbreaks and complete destruction of host plant populations as reported by Kovalev (1989), but they can only occur during the short period in spring when young adults emerge and lay eggs, since females of the first generation show little or no reaction to the degree of damage of their host plant (Reznik, 1991). Damage to ragweed was recorded mainly in undisturbed patches, where both *A. artemisiifolia* and beetle densities were higher (Reznik *et al.*, 2007). Data from field surveys conducted between 2005 and 2006 indicate that average population densities in Russia are very low and, consequently, the impact on the target weed is negligible (Reznik *et al.*, 2007).

In Croatia, the species has established as well, but so far densities of beetles in the field are low (Igrc *et al.*, 1995).

*Liothrips sp.*

An undescribed *Liothrips* species collected on *A. elatior* (now an accepted synonym for *A. artemisiifolia*; EPPO, 2011) in northern Argentina was tested in quarantine, but host specificity tests revealed that the species also develops on and severely damages young sunflower seedlings (McFadyen & Weggler-Beaton, 2000). Even though this *Liothrips* sp. was not recorded to attack sunflowers in the field in Argentina, the species was rejected for field release. The species was also considered and rejected for introduction into Canada (McFadyen & Weggler-Beaton, 2000).

*Euaresta bella*

The seed-feeding fly *Euaresta bella* was released into the former Soviet Union from Canada and the USA in 1969 and again in 1990, but it did not establish (Julien & Griffiths, 1998). Also, it was introduced into China in the late 1980s, but as in Russia, this fly failed to establish (Zhou *et al.*, 2009).

*Epiblema strenuana*

In hosts-specificity studies carried out in China, *E. strenuana* was able to complete its development on a local sunflower variety tested (Wan *et al.*, 1995). In subsequent choice-tests (i.e. in the presence of the target weed *A. artemisiifolia*), acceptance and suitability as host varied according to test conditions: sunflowers were attacked and adults emerged from plants that were exposed under multiple choice conditions in a greenhouse (Wan *et al.*, 1995), while sunflowers were attacked but no development was found in a field cage test (Wan and Wang, 2000). Under open field condition, no eggs were laid on sunflowers but larvae moved from *A. artemisiifolia* that had died



prematurely to sunflower and completed their development (Wan and Wang, 2000). Overall, Wan and Wang (2000) considered the risk of *E. strenuana* to cause economic damage to sunflowers to be low. To further avoid potential damage to sunflower, it was recommended to release the species only south of the Yangtze river, i.e. where sunflower is not a major crop (Wan and Wang, 2000). However, *E. strenuana* has also been recorded from members of the genera *Bidens* and *Chenopodium* (Amaranthaceae; Kovalev, 1971), indicating that its host-range includes plant species outside the tribe *Ambrosiinae*, but these recordings need to be verified.

#### *Ophraella communa*

This leaf beetle can cause complete defoliation and death of *A. artemisiifolia* under experimental conditions (Palmer & Goeden, 1991). Originally, this species was reported only from *A. artemisiifolia*, but more recently it also has been recorded in the field from several other species within the subtribe *Ambrosiinae*, including several *Ambrosia* and *Xanthium* species, *Parthenium hyterophorus*, *Iva axillaris* Pursh., *Ratibida pinnata* (Vent.) Barnhart (subtribe *Rudbeckiinae*), as well as from *Helianthus ciliaris* DC. (subtribe *Helianthinae*; Dernovici *et al.*, 2006; Futuyma & McCafferty, 1990; Goeden & Ricker, 1985; McFadyen & McClay, 1981; Palmer & Goeden 1991; Watanabe & Hirai, 2004). Host-specificity tests revealed that *O. communa* can attack and complete its life-cycle on sunflower and the species was subsequently rejected as biological control agent for Australia (Palmer & Goeden, 1991). Recent studies indicate however only a low risk that *O. communa* would cause significant damage to sunflower plants in the field. *Ophraella communa* rarely lays eggs on sunflowers under choice conditions, larval mortality on sunflower is high and newly emerged adults leave the sunflower plants in search of *Ambrosia* plants

(Dernovici *et al.*, 2006). Only if *Ambrosia* plants are completely defoliated, 1<sup>st</sup> instar larvae move to adjacent sunflower (Dernovici *et al.*, 2006). These results are in accordance with field observations from Japan where adults only occasionally feed on sunflower and where reproduction has only been found on *A. trifida* and *A. artemisiifolia* (Watanabe & Hirai, 2004). The distribution of *O. communis* in China is predicted to overlap partially with sunflower cultivation (Cao *et al.*, 2007).

### *Pustula tragopogonis*

Host specificity tests on 59 species from 46 genera indicate that, other than *A. artemisiifolia*, disease symptoms developed only on sunflower cultivars (*Helianthus annuus* L.). However, the disease did not persist and sunflower is therefore considered a non-compatible host for the *P. tragopogonis* accession from *A. artemisiifolia* (Hartmann & Watson, 1980a).

Attack by *P. tragopogonis* can be very damaging and significantly reduce pollen and seed production if systemic infection is achieved, as shown both in laboratory and in field trials. The rate of systemic infection obtained in the laboratory was however low (14%), and Hartmann & Watson (1980b) suggested that multi-cyclic applications of *P. tragopogonis* suspensions would be necessary to increase infection level in a field environment.

*Pustula tragopogonis* was accidentally introduced from Canada into the former USSR in the early 1960s where initially it caused heavy infection of *A. artemisiifolia* and reduction in biomass and seed production, but levels of damage have strongly declined since (Julien & Griffiths, 1998).

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