

Supplementary Information

| Potential MBCA candidates | Entity type/ common name | Features and possibilities as MBCA | Mistletoe target(s) | Mistletoe host(s) | Refs. |
|--|--|---|--|---|--------------------|
| <i>Acremonium kiliense</i> Grütz | Microbe: Fungi | Strong disease symptoms | <i>Viscum album</i> | Crimean pine (<i>Pinus nigra</i>) | [217] |
| <i>Alternaria alternata</i> (Fr.) Keissl. | Microbe: Fungi | Strong disease symptoms | <i>Viscum album</i> | Crimean pine (<i>Pinus nigra</i>) | [217] |
| <i>Anarsia sagmatica</i> Meyr [Lep.: Gelechiidae] | Insect: fruit fly | Larvae feeding on all foliar parts to completely destroy the host, well synchronized with flowering period of host, multivoltine having up to 4 generations a year. | <i>Dendrophthoe falcata</i> . L.f Ettingsh | As above | [231] |
| <i>Apion variegatum</i> Wenck [Apio: Apioninae] | Insect: Weevil | Can make holes in the stems | Yellow berried mistletoe (<i>Loranthus europae</i>), <i>V. album</i> | Fir tree (<i>Abies alba</i> Mill.) sessile oak (<i>Quercus petraea</i> /Matt./ Liebl.), pedunculate oak (<i>Q. robur</i> L.), narrow-leaved ash (<i>Fraxinus angustifolia</i> Vahl), common locust (<i>Robinia pseudoacacia</i> L.), sycamore (<i>Acer pseudoplatanus</i> L.) and black alder (<i>Alnus glutinosa</i> /L./ Gaertn.). | [144] [397,398] |
| <i>Bacillus megaterium</i> | Microbe: Bacteria | Showed pathogenic symptoms when injected into mistletoe, but not when sprayed. | <i>Viscum album</i> | Crimean pine (<i>Pinus nigra</i>) | [217] |
| <i>Bacillus pumilus</i> | Microbe: Bacteria | Showed pathogenic symptoms when injected into mistletoe, but not when sprayed. | <i>Viscum album</i> | Crimean pine (<i>Pinus nigra</i>) | [217] |
| <i>Burkholderia cepacia</i> | Microbe: Bacteria | Showed pathogenic symptoms when injected into mistletoe, but not when sprayed. | <i>Viscum album</i> | Crimean pine (<i>Pinus nigra</i>) | [217] |
| <i>Cacopsylla visci</i> Curtis,1835 [Hemi:Psyllidae] | Insect: British bug, jumping plant louse | Monophagous on mistletoe, sap sucking | Yellow berried mistletoe (<i>Loranthus europae</i>), <i>V. album</i> | Fir tree (<i>Abies alba</i> Mill.) sessile oak (<i>Quercus petraea</i> /Matt./ Liebl.), pedunculate oak (<i>Q. robur</i> L.), narrow-leaved ash | [144, 397—399] |

| | | | | | |
|---|----------------------------------|--|---|---|----------------------|
| | | | | (<i>Fraxinus angustifolia</i> Vahl), common locust (<i>Robinia pseudoacacia</i> L.), sycamore (<i>Acer pseudoplatanus</i> L.) and black alder (<i>Alnus glutinosa</i> /L./ Gaertn.). | |
| <i>Caliciopsis arceuthobii</i> (formerly <i>Wallrothiella arceuthobii</i>) | Microbe: Fungi | Attacks spring-flowering mistletoes, destroys fruits and seeds, can grow in vitro, potential is limited by large, annual variations of infection. | <i>Arceuthobium pusillum</i> , <i>A. americanum</i> , <i>A. douglasii</i> , and <i>A. vaginatum</i> | Western hemlock (<i>Tsuga heterophylla</i>), lodgepole pine (<i>Pinus contorta</i>) | [197, 198, 255, 400] |
| <i>Carulaspis visci</i> Schrank, 1781 [<i>Dias: Carulaspis</i>] | Insect: Scale | Exclusively occurs on mistletoe, causes galls on leaf. | Yellow berried mistletoe (<i>Loranthus europaeus</i>), <i>V. album</i> | Fir tree (<i>Abies alba</i> Mill.) sessile oak (<i>Quercus petraea</i> /Matt./ Liebl.), pedunculate oak (<i>Q. robur</i> L.), narrow-leaved ash (<i>Fraxinus angustifolia</i> Vahl), common locust (<i>Robinia pseudoacacia</i> L.), sycamore (<i>Acer pseudoplatanus</i> L.) and black alder (<i>Alnus glutinosa</i> /L./ Gaertn.). | [144] [397,398] |
| <i>Celypha woodiana</i> Barret, 1882 [<i>Tort: Olethreutina</i>] | Insect: Mistletoe Marble moth | Threatened insect, needs conservation as priority as for MBCA assessments. | <i>Viscum album</i> | Apple | [238] |
| <i>Ceratitella asiatica</i> Hardy [<i>Dipt.: Tephritidae</i>] | Insect: fruit fly | Larvae Feeds on fruits, no natural enemies known, 2 generations a year. | <i>Dendrophthoe falcata</i> L.f Ettingsh | As above | [231] |
| <i>Colletotrichum gloeosporioides</i> (Sacc.) Penz. | Microbe: Fungi | Not host specific, appear as small, brown to black, necrotic lesions on the nodes of fruits and shoots, not recovered from endophytic system, easy, inexpensive culturing, germinates over a wide temperature range, disrupts development of mistletoe shoots, preventing reproduction. As attacks any time after shoot emergence, so flexible application scheduling. | <i>Arceuthobium</i> spp., <i>Dendrophthoe falcata</i> L.f Ettingsh | Western hemlock, Lodgepole pine | [401—406] |
| <i>Cylindrocarpon cylindroides</i> | Microbe: Fungi | Destroys the endophytic system | Dwarf Mistletoe <i>Arceuthobium tsugense</i> | Western hemlock | [211, 407] |
| <i>Cylindrocarpon gillii</i> | Microbe: Fungi | Causes anthracnose in shoots, needs climate matching as inconclusive | Dwarf mistletoes <i>Arceuthobium americanum</i> , | Western hemlock, Lodgepole pine | [197, 405] |

| | | | | | |
|---|--|---|--|---|---------------------|
| | | results (from inoculating an isolate of a warm, dry climate to a cool, moist condition) | <i>A. douglasii</i> , <i>A. tsugense</i> subsp. <i>tsugense</i> | | |
| <i>Cytospora abietis</i> Sacc. | Microbe: fungi | Kills mistletoe-infected branches, infectivity needs assessment as occasionally also parasitizes non-mistletoe-infected branches. | <i>Arceuthobium abietinum</i> | <i>Abies magnifica</i> A.Murr. and <i>Abies concolor</i> (Gord. & Glend.) Lindl. | [408] |
| <i>Delias eucharis</i> Dr. [Lep.: Pieridae] | Insect: butterfly | Larvae Feeding on leaves, no alternate host. | <i>Dendrophthoe falcata</i> L.f Ettingsh, <i>Loranthus cordifolius</i> | As above | [231] |
| <i>Demarchus pubipennis</i> Jacoby [Col.: Chrysomelidae] | Insect: beetle | Larvae Feeding on leaves, heavily damages host leaves, multivoltine having up to 4 generations a year. | <i>Dendrophthoe falcata</i> L.f Ettingsh | As above | [231] |
| <i>Euzopherodes ephestialis</i> Hamps [Lep.: Pyralidae] | Insect: snout moth | Larvae feeds on flowers, multivoltine with 5-6 generations a year. | <i>Dendrophthoe falcata</i> L.f Ettingsh, <i>Arceuthobium oxycedri</i> (DC.) M. Bieb., <i>Korthalsella opuntia</i> (Thunb.) Merrill., <i>Viscum album</i> L. | <i>Acacia modesta</i> [22] | [231] |
| <i>Gibberidea visci</i> (Fuckel) | Microbe: fungi | Facultative fungi | <i>Viscum album</i> | Crimean pine (<i>Pinus nigra</i>) | [409] |
| <i>Icerya purchase</i> (Maskell) [Hemi.: Monophlebidae] | Insect: cottony-cushion scale | Causes heavy infection on mistletoe, however MCBA potential is limited due to known off target infection possibly on citrus and other trees | <i>Viscum cruciatum</i> (red berried mistletoe) | Olive tree (<i>Olea europaea</i>) | [240] |
| <i>Ixapion variegatum</i> Wencker. 1864 [Apio: Apioninae] | Insect: mistletoe beetle | Lays eggs in mistletoe stem, kills buds | <i>Viscum album</i> | Apple | [238, 410] |
| <i>Mylothris sagala</i> Grose-Smith, 1886 [Lep.: Pieridae] | Insect: Butterfly, dusky dotted border | Feeds on sap, oviposits on mistletoe | Yellow berried mistletoe (<i>Loranthus europae</i> s), <i>V. album</i> , <i>Loranthus freisiorum</i> | Fir tree (<i>Abies alba</i> Mill.) sessile oak (<i>Quercus petraea</i> /Matt./ Liebl.), pedunculate oak (<i>Q. robur</i> L.), narrow-leaved ash (<i>Fraxinus angustifolia</i> Vahl), common locust (<i>Robinia pseudoacacia</i> L.), sycamore (<i>Acer pseudoplatanus</i> L.) and black alder (<i>Alnus glutinosa</i> /L./ Gaertn.). | [144] [397, 398] |
| <i>Myrmex arizonicus</i> [Col.: Curculionidae: Conoderinae] | Insect: Ant-like Stem borer weevil | Can make round exit holes in diameter in the stems, with larval galleries, can kill mistletoe shoots | <i>P. villosum</i> , <i>Phoradendron</i> on oak (Santa Cruz County), <i>P. flavescens</i> (Pursh.) Nutt., <i>P.</i> | Oak, <i>Quercus lobata</i> , <i>Juglans major</i> , <i>Juniperus</i> sp., <i>Prosopis</i> sp. | [226] |

| | | | | | |
|---|---|--|---|--|-----------------|
| | | | <i>juniperinum tomentosum</i> Engelm., P. | | |
| <i>Myrmex</i> sp. [Col.: Curculionidae: Conoderinae] | Insect: Stem borer weevil | Can make round exit holes about 2 mm in diameter in the stems, with larval galleries, can kill mistletoe shoots | <i>Phoradendron serotinum</i> | Water oak (<i>Quercus lobata</i>) | [225] |
| <i>Neonectria neomacrospora</i> | Microbe: Fungi | Selective to mistletoe infected host branches, invades host without wounding, proven pathogenicity, host girdling, reduces mistletoe shoot growth, rapid cankering, abundant sporulation, awaits MBCA formulation and delivery technology improvement. | <i>Arceuthobium tsugense</i> , <i>A. occidentale</i> | Western hemlock, <i>Pinus miricata</i> D.Don | [213, 405, 410] |
| <i>Pandoraea pulminicola</i> | Microbe: bacteria | Showed pathogenic symptoms when injected into mistletoe, but not when sprayed. | <i>Viscum album</i> | Crimean pine (<i>Pinus nigra</i>) | [217] |
| <i>Phaeobotryosphaeria visci</i> Arx & E. Mull. [Syn.: <i>Botryosphaeria visci</i> (Kalchbr.)] | Microbe: Fungi | Induces chlorotic symptoms on leaves, complete destruction of mistletoe. | <i>Viscum album</i> | <i>Populus nigra</i> , <i>Acer saccharinum</i> , <i>A. pseudoplatanus</i> | [129, 411, 412] |
| <i>Pinalitus viscicola</i> Pumton, 1988 [syn: <i>Orthops viscicola</i> , <i>Lygus viscicola</i>] [Hemi:Miridae] | Insect: plant bug | Monophagous on mistletoe, sap sucking | <i>Viscum album</i> | Apple | [238, 399] |
| <i>Pseudaulacaspis cockerelli</i> (Cooley) [Hemi.: Diaspididae] | Insect: False oleander scales, Scale insect | Infection on leaf and haustorial structures, no infection on host, higher density of flakes on mid-rib and veins in leaves. Requires further evaluation. | <i>Dendrophthoe falcata</i> L.f Ettingsh | Cassia tree (<i>Senna siamea</i>) | [37] |
| <i>Sphaeropsis visci</i> Fr. | Microbe: fungi | Facultative, found on mistletoe leaves and fruits | <i>Phoradendron</i> spp., <i>Dendrophthoe falcata</i> L.f Ettingsh, <i>Viscum coloratum</i> | Various trees | [413-416] |
| <i>Stugeta bowkeri</i> Trimen, 1864 [Lep.: Lycaenidae] | Insect: Butterfly, Bowker's Sapphire | Feeds on sap, oviposits on mistletoe | Yellow berried mistletoe (<i>Loranthus europae</i>), <i>Viscum album</i> , <i>Viscum rotundifolium</i> , <i>Loranthus elegans</i> and <i>L. oleaefolius</i> | Fir tree (<i>Abies alba</i> Mill.) sessile oak (<i>Quercus petraea</i> /Matt./ Liebl.), pedunculate oak (<i>Q. robur</i> L.), narrow-leaved ash (<i>Fraxinus angustifolia</i> Vahl), common locust (<i>Robinia pseudoacacia</i> L.), sycamore (<i>Acer</i> | [144, 397, 398] |

| | | | | | |
|--|----------------|---|--|---|---------------|
| | | | | <i>pseudoplatanus</i> L.) and black alder (<i>Alnus glutinosa</i> /L./ Gaertn.). | |
| <i>Synanthedon loranthe</i> Kralicek, 1966 [Lep.: Sesiidae] | Insect: Moth | Sap feeding larvae. | Yellow berried mistletoe (<i>Loranthus europaeus</i>), <i>V. album</i> , <i>Viscum album abietis</i> , <i>Viscum album austriacum</i> , <i>Viscum laxum</i> and <i>Loranthus europaeus</i> | As above and Scot pine. | [144,397-398] |
| <i>Timorus sarcophagoides</i> [Col.: Curculionidae: Conoderinae] | Insect: Weevil | Lives exclusively on the mistletoe, exhibits evasive mimicry (potentially consistent efficacy as MBCA), pieces holes into mistletoe endophytic system during oviposition, life cycle matches with mistletoe flowering peak. | Parrot flower mistletoe (<i>Psittacanthus robustus</i>) | Not available | [229, 228] |
| <i>Zelleria loranthevora</i> Meyr. [Lep.: Yponomeutidae] | Insect: moth | Larvae destroy flowers by feeding and boring, no alternate host known. | <i>Dendrophthoe falcata</i> L.f Ettingsh | As above | [231] |

Table S1. List of potential MBCAs yet known for some mistletoe genera. Note: *Dendrophthoe falcata* was formerly known as *Loranthus longiflorus*. Also, Lep.: Lepidoptera, Dipt.: Diptera; Col.: Coleoptera, Tort.: Tortricidae, Apion: Apionidae.