Dipteran leafminers in the vicinity of glasshouses and plant markets in Lithuania*

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Areas surrounding the glasshouses of 60 growers, and 16 plant markets, were surveyed in 2001/2003 to determine the distribution of dipterous leafminers in Lithuania, including regulated species. In total, 152 species belonging to 7 families were discovered, and the infested host plants represented 46 families. The relative frequency of *Liriomyza bryoniae* was 32% in the vicinity of glasshouses and 19% in market places. This species attacked plant genera such as: *Amaranthus*, *Beta*, *Bryonia*, *Chenopodium*, *Cucumis*, *Datura*, *Gypsophila*, *Lycopersicon*, *Nicandra*, *Nicotiana*, *Physalis*, *Petunia*, *Sisymbrium*, *Solanum*, *Spinacia* and *Viola*. The same plant genera also potentially provide sites for the survival of economically important species, *Liriomyza huidobrensis* and *Liriomyza trifolii*, in Lithuania.

Introduction

In view of on the distribution of the dipteran leafminer *Liriomyza bryoniae* in Lithuanian glasshouses (Taluntytė, 2001, 2002; Nečajeva *et al*., 2003), and on the presense of other dipteran leafminers in this artificial habitat (Ostrauskas *et al*.), it is of great interest to investigate the occurrence of these insects in the immediately surrounding environment, since glasshouses in Lithuania are not closed systems (no insect nets on windows or wind fences). International trade may also introduce new species into our country. Detections of regulated species on imported consignments by the NPPO confirm this risk (Ostrauskas, 2002). The present study is a continuation of work on the populations of dipteran leafminers in areas surrounding glasshouses in Lithuania (Ostrauskas *et al*., 2003), extended also to markets where ornamental plants are sold. The aim of the investigation was to determine which were the most frequent species, and what are their potential hosts.

Materials and methods

The vicinity of the glasshouses of 46 growers was investigated in 2003. These areas included land with a high density of herbaceous vegetation (meadow land, not ploughed), ploughed land, compost storage areas (low density of plants), yards (ground covered, low density of plants), gardens (moved soil, medium density of plants) and outskirts (fences and ditches, high density of plants). The plants growing around 3 market places were studied in 2002 and around 13 in 2003. Results from earlier surveys of glasshouse surroundings (2001, 2002) were also included, so the land of 60 growers and of 16 market places was surveyed, and 105 inspections were carried out in total.

The surveys were done once per season in July/August, and the site areas ranged from 0.02 to 80 ha. Most Diptera were identified according to the mines formed by larvae *in situ*, and the plants were determined on site. Some plant parts with larvae were transported to the laboratory, and the insects reared to the imago stage there. A reactivation method (Ostrauskas *et al*., 2003) was applied if necessary. Male genitalia were mounted, and special keys and descriptions (Aukema *et al*., 1996; Spencer, 1973, 1976, 1990) were used. The host plants for economically important dipteran miners not occurring in Lithuania were evaluated as a risk, because the polyphagous species *Liriomyza huidobrensis* and *Liriomyza trifolii* may attack the same plants as *Liriomyza bryoniae*.

Results

Species frequency, distribution, trophic relation

143 species belonging to 7 families of Diptera were found in the vicinity of glasshouses (Appendix I). *Chromatomyia horticola* was a habitual species, mostly attacking common weeds: *Sonchus* (80% of inspections), *Cirsium* (47%), *Galinsoga* (49%), *Taraxacum*(39%). Frequent species included: *Liriomyza strigata*, particularly on *Beta vulgaris* (29%), *Galeopsis* spp. (17%), *Lycopersicon esculentum* (16%); *Liriomyza congesta* on *Trifolium* (46%) and *Medicago* (31%) in preference to other Fabaceae; *Phytomyza artemisivora*, only on *Artemisia vulgaris* (68%); *Liriomyza sonchi* especially on *Sonchus* (60%). *L. bryoniae* was not frequent (32%), and its hosts were mostly *Lycopersicon* (11%), and *Amaranthus*, *Beta*, *Chenopodium*,

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Fig. 1 The distribution data of *Agromyza lathyri* (1 – previous, 2 – new), *A. marionae* (3 – previous, 4 – new), *Liriomyza obliqua* (5 – previous, 6 – new), *L. pseudopygmina* (7 – previous, 8 – new), *Ophiomyia disordens* (9 – previous, 10 – new), *O. spenceri* (11 – previous, 12 – new), *O. tranquilla* (13 – previous, 14 – new) and *Ptochomyza asparagi* (15 – previous, 16 – new) in Lithuania (cf. Pakalniškis, 1993, 1994, 1996, 1998a,b; Pakalniškis *et al*., 2000).

Cucumis, *Datura*, *Gypsophila*, *Nicandra*, *Nicotiana*, *Physalis*, *Petunia*, *Solanum*, *Spinacia* occasionally. *Ophiomyia cunctata* was not frequent, and found on *Sonchus* (38%) and *Carduus*, *Cichorium*, *Cirsium*, *Mycelis*, *Lactuca*, *Lapsana*, *Picris*, occasionally *Taraxacum*. Other dipteran leafminer species occurred on fewer genera, varying from 1 to 6 (Appendix I).

Rare and little known European species such as *Agromyza marionae*, *Liriomyza obliqua*, *Liriomyza pseudopygmina*, *Ophiomyia disordens*, *Ophiomyia spenceri* and *Ophiomyia tranquilla* were found, providing new knowledge on their distribution (Fig. 1). Further localities for *Agromyza lathyri* and *Ptochomyza asparagi*, which are evidently introduced and rare in Lithuania, were confirmed as well.

The first host plant of *Liriomyza obliqua* was ascertained. This is *Picris hieracioides* (Asteraceae). The larva forms a very short, initially linear mine, later producing a wide blotch, which quickly turns brownish to dark brown, well visible on the upper surface of the leaf. Pupation takes place in the ground. The puparium is brownish; the posterior spiracles are conical, adjoined basally, each having an ellipse of 9 minute bulbs and the 10th being slightly elongate, finger-like and protuberant downwards.

Four new host plant genera – S*edum* (*Crassulaceae*), *Silene* (*Caryophyllaceae*), *Silphium* (*Asteraceae*) and *Thunbergia* (*Acanthaceae*) were confirmed for polyphagous *Liriomyza strigata*. This is a first finding of this species on *Acanthaceae* and *Crassulaceae* as well.

74 species from 4 families were determined around plant markets (Appendix I). *Chromatomyia horticola* was very frequent here, too, and it attacked 28 plant genera, common weeds mostly: *Sonchus* (62% of inspections), *Taraxacum* (44%), *Galinsoga* (37%), wild *Lactuca* spp. (37%), *Cirsium* (31%). Frequent species included: *Liriomyza strigata* on plants of 26 genera, particularly on *Calendula* (19%), *Lycopersicon* (19%), *Galinsoga* (12%), *Galeopsis* (12%), *Plantago* (12%); *Calycomyza artemisiae*, *Phytomyza artemisivora* and *Trypeta artemisiae* on *Artemisia* (75%, 69% and 62%, respectively), *Phytomyza plantaginis* on *Plantago*. *Liriomyza bryoniae* was not frequently found (19%) occurring on *Bryonia alba*, self-sown *Lycopersicon esculentum*, *Sisymbrium officinale*, *Solanum nigrum* and *Viola arvensis*.

In the vicinity of both glasshouses and markets, 152 dipteran species were found, including *Chromatomyia horticola* as very frequent, *Liriomyza strigata* and *Phytomyza artemisivora* as frequent. The species found make up 37% of all the dipteran leafminers in the known Lithuanian fauna.

Host plants

173 plant genera from 45 families were determined as hosts for dipteran leafminers in the vicinity of glasshouses (Appendix II). Several genera of *Asteraceae* were most often attacked:

Sonchus – *Chromatomyia horticola* (80% of investigation sites), *Liriomyza sonchi* (60%), *Cystiphora sonchi* (39%), *Ophiomyia cunctata* (38%), *Ophiomyia heringi* (16%), *Liriomyza bulgarica* (15%), *Napomyza lateralis* (2%), *Liriomyza strigata* (1%), *Ophiomyia beckeri* (1%), *Ophiomyia pulicaria* (1%), *Phytomyza marginella* (1%)

Artemisia – *Phytomyza artemisivora* (68%), *Trypeta artemisiae* (54%), *Calycomyza artemisiae* (44%), *Liriomyza demeijerei* (26%), *Liriomyza artemisicola* (11%), *Chromatomyia horticola* (6%), *Liriomyza strigata* (1%)

Tripleurospermum – *Phytomyza pullula* (53%), *Chromatomyia horticola* (19%), *Napomyza lateralis* (10%)

Galinsoga – *Chromatomyia horticola* (49%), *Liriomyza strigata* (9%)

Achillea – *Liriomyza ptarmicae* (48%), *Liriomyza flavopicta* (11%), *Chromatomyia horticola* (6%), *Phytomyza pullula* (3%), *Ophiomyia curvipalpis* (1%), *Ophiomyia disordens* (1%)

Cirsium – *Chromatomyia horticola* (47%), *Phytomyza spinaciae* (37%), *Liriomyza soror* (25%), *Melanagromyza aeneoventris* (15%), *Liriomyza strigata* (9%), *Pegomya steini* (3%).

One genus of Fabaceae (***Trifolium***) was often attacked: *Liriomyza congesta* (46%), *Agromyza nana* (29%), *Phytomyza brischkei* (16%), *Chromatomyia horticola* (2%).

84 plant genera belonging to 29 families were found as hosts for dipteran leafminers in market places (Table 2). A few genera of Asteraceae were very often attacked:

Artemisia – *Calycomyza artemisiae* (75%), *Phytomyza artemisovora* (69%), *Trypeta artemisiae* (62%), *Liriomyza artemisicola* (19%), *Liriomyza demeijerei* (12%), *Liriomyza strigata* (6%), *Ophiomyia disordens* (6%)

Sonchus – *Chromatomyia horticola* (62%), *Liriomyza sonchi* (25%), *Ophiomyia cunctata* (19%), *Cystiphora sonchi* (12%), *Liriomyza bulgarica* (12%), *Liriomyza strigata* (6%)

Achillea – *Liriomyza ptarmicae* (56%), *Chromatomyia horticola* (6%), *Liriomyza flavopicta* (6%)

Taraxacum – *Chromatomyia horticola* (44%), *Liriomyza taraxaci* (25%)

Cirsium – *Phytomyza spinaciae* (44%), *Phytomyza cirsii* (37%), *Chromatomyia horticola* (31%), *Liriomyza soror* (12%), *Liriomyza strigata* (6%), *Melanagromyza aeneoventris* (6%).

One genus of Plantaginaceae (***Plantago***) was often attacked: *Phytomyza plantaginis* (62% of investigation sites).

In total at all locations, 186 plant genera belonging to 46 families were found attacked by dipteran leafminers, and *Sonchus* and *Artemisia* were the genera most attacked.

Conclusions

In the vicinity of Lithuanian glasshouses, *Chromatomyia horticola* is very frequent, while *Liriomyza strigata*, *Liriomyza congesta*, *Liriomyza sonchi* and *Phytomyza artemisivora* are frequent species. In market places, *C. horticola* is again the most frequent species, while *Liriomyza strigata* is frequent, but other species (*Calycomyza artemisiae*, *Phytomyza artemisivora*, *Phytomyza plantaginis*, *Trypeta artemisiae*) are frequent.

Picris hieracioides is the first host plant established for *Liriomyza obliqua*. *Sedum*, *Silene*, *Silphium* and *Thunbergia* are new host plant genera for *Liriomyza strigata*, and *Crassulaceae* and *Acanthaceae* new host families. The genera *Amaranthus*, *Beta*, *Bryonia*, *Chenopodium*, *Cucumis*, *Datura*, *Gypsophila*, *Lycopersicon*, *Nicandra*, *Nicotiana*, *Physalis*, *Petunia*, *Sisymbrium*, *Solanum*, *Spinacia* and *Viola* growing in the vicinity of greenhouses and market places are particulary suitable for the potential survival of the economically important species *Liriomyza huidobrensis* and *Liriomyza trifolii* in Lithuania.

Mineuses diptères à proximité des serres et des marchés en Lituanie

Les environs des serres de 60 agriculteurs et de 16 marchés ont été prospectés de 2001 à 2003 pour déterminer la distribution des mineuses diptères, dont les espèces réglementées, en Lituanie. Au total 152 espèces ont été découvertes, appartenant à 7 familles, et les plantes-hôtes infestées représentaient 46 familles. La fréquence relative de *Liriomyza bryoniae* était de 32% dans les environs des serres et de 19% près des marchés. Cette espèce attaque les plantes des genres suivants: *Amaranthus*, *Beta*, *Bryonia*, *Chenopodium*, *Cucumis*, *Datura*, *Gypsophila*, *Lycopersicon*, *Nicandra*, *Nicotiana*, *Petunia*, *Physalis*, *Sisymbrium*, *Solanum*, *Spinacia* et *Viola*. Ces genres de plantes créent également un chance de survie pour des espèces d'importance économique – *Liriomyza huidobrensis* et *Liriomyza trifolii* en Lituanie.

Двукрылые листовые минёры, обнаруженные в непосредственной близости от теплиц и сельскохозяйственных рынков в Литве

В 2001–2003 гг. зоны, прилегающие к теплицам 60 производителей и 16 сельскохозяйственных рынков, подвергались наблюдению, с тем чтобы установить распределение двукрылых минёров в Литве, включая регулируемые виды. В общей сложности было вы-явлено 152 вида, принадлежащих к 7 семействам, в то время как зараженные растения-хозяева представляли 46 семейств. Относительная встречаемость *Liriomyza bryoniae* составила 32% в непосредственной близости от теплиц и 19% в непосредственной близости от сельскохозяйственных рынков. Среди заражённых родов растений были отмечены: *Amaranthus, Beta, Bryonia, Chenopodium, Cucumis, Datura, Gypsophila, Lycopersicon, Nicandra, Nicotiana, Physalis, Petunia, Sisymbrium, Solanum, Spinacia* и *Viola.* Те же рода растений предоставляют собой места обитания для выживания потенциально экономически значимых для Литвы видов, *Liriomyza huidobrensis* and *Liriomyza trifolii*.

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Appendix I List of dipteran leafminers identified in the vicinity of glasshouses and markets in Lithuania in 2001/2003

Each species is followed by six numbers, separated by commas. These indicate, respectively: relative frequency (%) around glasshouses, relative frequency (%) around market places, number of plant genera around glasshouses, number of plant genera around market places, number of plant families around glasshouses, number of plant families around market places (0 – not found; – no hosts confirmed).

Agromyzidae: *Agromyza abiens* Zetterstedt,10,6,5,1,1,1; *A. albitarsis* Meigen,1,0,1,-,1,-; *A. alnibetulae* Hendel,5,6,1,1,1,1; *A. alnivora* Spencer,0,6,-,1,-,1; *A. anthracina* Meigen,2,0,1,-,1,-; *A. filipendulae* Spencer,0,6,-,1,-,1; *A. flaviceps* Fallén,1,6,1,1,1,1; *A. frontella* Rondani,19,6,1,1,1,1; *A. idaeiana* Hardy,9,6,2,1,1,1; *A. lathyri* Hendel,3,0,1,-,1,-; *A. marionae* Griffiths,3,6,1,1,1,1; *A. nana* Meigen,38,6,4,1,1,1; *A. nigrescens* Hendel,2,0,1,-,1,-; *A. reptans* Fallén,28,6,1,1,1,1; *A. rufipes* Meigen,0,13,-,1,-,1; *A. spiraeoidearum* Hering,1,25,1,1,1,1; *A. vicifoliae* Hering, 17,19,1,1,1,1; *Amauromyza chenopodivora* Spencer,23,6,1,1,1,1; *A. flavifrons* (Meigen),28,13,6,1,2,1; *A. labiatarum* (Hendel), 3,13,3,2,1,1; *A. obscura* (Rohdendorf-Holmanová),1,6,1,1,1,1; *Aulagromyza buhri* (de Meijere),0,6,-,1,-,1; *A. caraganae* (Rohdendorf-Holmanová),1,6,1,1,1,1; *A. luteoscutellata* (de Meijere),0,13,-,2,-,1; *A. populi* (Kaltenbach),1,19,1,1,1,1; *A. populicola* (Walker),0,6,-,1,-,1; *A. similis* (Brischke),1,0,1,-,1,-; *A. tremulae* (Hering),5,6,1,1,1,1; *A. tridentata* (Loew),0,6,-,1,-,1; *A. trivittata* (Loew),1,0,1,-,1,-; *Calycomyza artemisiae* (Kaltenbach),44,75,1,1,1,1; *Cerodontha incisa* (Meigen),5,0,3,-,1,-; *C. muscina* (Hendel),1,0,1,-,1,-; *C. pygmaea* (Meigen),1,0,1,-,1,-; *C. suturalis* (Hendel),1,0,1,-,1,-; *Chromatomyia centaurii* Spencer,1,0,1,-,1,-; *C. horticola* (Goureau),98,94,96,28,21,8; *C. milii* (Kaltenbach),1,0,1,-,1,-; *C. primulae* (Robineau-Desvoidy),0,6,-,1,-,1; *C. ramosa* (Hendel),7,0,1,-,1,-; *Hexomyza simplicoides* (Hendel),1,0,1,-,1,-; *Liriomyza amoena* (Meigen),2,13,1,1,1,1; *L. artemisicola* de Meijere,11,6,1,1,1,1; *L. bryoniae* (Kaltenbach),32,19,13,5,6,4; *L. buhri* Hering, 2,0,2,-,1,-; *L. bulgarica* Beiger,15,13,1,1,1,1; *L. cannabis* Hendel,3,0,1,-,1,-; *L. centaureae* Hering,6,13,1,1,1,1; *L. congesta* (Becker),67,56,10,5,1,1; *L. demeijerei* Hering,26,13,1,1,1,1; *L. endiviae* Hering,10,31,2,2,1,1; *L. eupatorii* (Kaltenbach), 32,13,2,1,1,1; *L. flaveola* (Fallén),1,0,1,-,1,-; *L. flavopicta* Hendel,11,6,1,1,1,1; *L. obliqua* Hendel,1,0,1,-,1,-; *L. pisivora* Hering,10,0,2,-,1,-; *L. pseudopygmina* (Hering),2,0,1,-,1,-; *L. ptarmicae* de Meijere,48,56,2,1,1,1; *L. pusilla* (Meigen),7,0,2,-,1,-; *L. sonchi* Hendel,60,19,2,1,1,1; *L. soror* Hendel, 25,13,2,1,1,1; *L. strigata* (Meigen),75,81,59,26,19,9; *L. tanaceti* de Meijere,15,19,1,1,1,1; *L. taraxaci* Hering,24,25,2,1,1,1; *L. tragopogonis* de Meijere,3,0,1,-,1,-; *L. violicaulis* Hering,3,0,1,-,1,-; *L. virgo* (Zetterstedt),1,0,1,-,1,-; *Melanagromyza aeneoventris* (Fallén),15,6,1,1,1,1; *M. albocilia* Hendel,1,0,1,-,1,-; *M. angeliciphaga* Spencer,1,0,1,-,1,-; *M. cunctans* (Meigen),1,0,1,-,1,-; *M. lappae* (Loew),3,0,1,-,1,-; *M. nigrissima* Spencer,6,0,1,-,1,-; *M. submetallescens* Spencer, 2,0,2,-,1,-; *M. tschirnhausi* Pakalniškis,3,0,1,-,1,-; *Napomyza lateralis* (Fallén),11,0,2,-,1,-; *Ophiomyia alliariae* Hering, 11,6,4,1,1,1; *O. beckeri* (Hendel),1,0,1,-,1,-; *O. bohemica* éerný,13,13,5,2,1,1; *O. cunctata* (Hendel),42,31,9,3,1,1; *O. curvipalpis* (Zetterstedt),2,0,2,-,1,-; *O. disordens* Pakalniškis,1,6,1,1,1,1; *O. galii* Hering,3,0,1,-,1,-; *O. heracleivora* Spencer,1,0,1,-,1,-; *O. heringi* Starý,21,25,5,2,2,1; *O. labiatarum* Hering,6,0,2,-,1,-; *O. longilingua* (Hendel),1,6,1,1,1,1; *O. melandricaulis* Hering,9,19,2,1,1,1; *O. ononidis* Spencer,10,6,1,1,1,1; *O. orbiculata* (Hendel),1,6,1,1,1,1; *O. pulicaria* (Meigen),3,0,2,-,1,-; *O. ranunculicaulis* Hering,2,0,1,-,1,-; *O. rostrata* Hendel,3,6,1,1,1,1; *O. slovaca* éerný,1,0,1,-,1,-; *O. spenceri* éerný,1,0,1,-,1,-; *O. tranquilla* Pakalniškis,1,0,1,-,1,-; *O. vitiosa* Spencer,1,0,1,-,1,-; *Phytoliriomyza melampyga* (Loew),3,0,1,-,1,-; *Phytomyza agromyzina* Meigen,1,19,1,1,1,1; *P. angelicae* Kaltenbach,5,0,1,-,1,-; *P. angelicastri* Hering, 3,0,1,-,1,-; *P. aquilegiae* Hardy,1,6,1,1,1,1; *P. artemisivora* Spencer,68,69,1,1,1,1; *P. brischkei* Hendel,16,0,1,-,1,-; *P. chaerophylli* Kaltenbach,25,6,4,1,1,1; *P. cinerea* Hendel,0,6,-,1,-,1; *P. cirsii* Hendel,44,37,2,1,1,1; *P. clematidis* Kaltenbach,2,0,1,-,1,-; *P. conyzae* Hendel,1,0,1,-,1,-; *P. crassiseta* Zetterstedt,13,13,1,1,1,1; *P. erigerophila* Hering,6,6,1,1,1,1; *P. fallaciosa* Brischke,1,0,1,-,1,-; *P. flavicornis* Fallén,5,0,1,-,1,-; *P. glabra* Hendel,2,0,1,-,1,-; *P. glechomae* Kaltenbach,13,6,1,1,1,1; *P. heracleana* Hering,8,6,1,1,1,1; *P. heringiana* Hendel, 1,6,1,1,1,1; *P. lappae* Goureau,46,50,1,1,1,1; *P. leucanthemi* Hering,3,0,1,-,1,-; *P. marginella* Fallén,5,0,3,-,1,-; *P. mylini* Zetterstedt,19,0,1,-,1,-; *P. nigritula* Zetterstedt,5,0,1,-,1,-; *P. obscurella* Fallén,21,19,1,1,1,1; *P. pastinacae* Hendel,11,0,3,-,1,-; *P. pauliloewi* Hendel,2,0,2,-,1,-; *P. petoei* Hering,2,0,1,-,1,-; *P. pimpinellae* Hendel,1,0,1,-,1,-; *P. plantaginis* Robineau-Desvoidy,16,62,1,1,1,1; *P. pullula* Zetterstedt,57,31,4,2,1,1; *P. ranunculi* (Schrank),1,0,1,-,1,-; *P. ranunculivora* Hering,7,0,1,-,1,-; *P. spinaciae* Hendel,37,44,2,1,1,1; *P. solidaginis* Hendel,2,0,1,-,1,-; *P. stolonigena* Hering,2,0,1,-,1,-; *P. tanaceti* Hendel,16,25,1,1,1,1; *P. tetrasticha* Hendel,1,0,1,-,1,-; *Ptochomyza asparagi* Hering,1,0,1,-,1,-

Anthomyiidae: *Pegomya betae* (Curtis),8,0,1,-,1,-; *P. bicolor* (Wiedemann),22,0,2,-,1,-; *P. hyoscyami* (Panzer),13,0,3,-,1,-; *P. laticornis* (Fallén),2,0,1,-,1,-; *P. steini* (Hendel),3,0,1,-,1,-

Cecidomyiidae: Cystiphora sonchi (Bremi),39,13,1,1,1,1; C. taraxaci (Kieffer),3,0,1,-,1,-

Drosophilidae: *Scaptomyza flava* (Fallén),18,0,6,-,1,-; *S. graminum* (Fallén),31,13,3,2,1,1

Ephydridae: *Hydrellia griseola* (Fallén),5,0,1,-,1,-

Sciaridae: *Phytosciara halterata* Lengersdorf,3,0,1,-,1,-

Tephritidae: *Acidia cognata* (Wiedemann),13,13,2,1,1,1; *Euleia heraclei* (Linnaeus),1,0,1,-,1,-; *Trypeta artemisiae* (Fabricius),56,62,3,2,1,1; *T. zoe* Meigen,3,0,2,-,1,-.

Appendix II List of plants found as hosts of dipteran leafminers found in the vicinity of glasshouses and market places in Lithuania in 2001/2003

Codes following each genus name indicate: C/W – cultivated/wild, number of leafminer species (families in brackets) in vicinity of glasshouses, number of species (families in brackets) in vicinity of market places.

Acanthaceae: *Thunbergia*,C,1,0

Amaranthaceae: *Amaranthus*,W,2 (1),0

Apiaceae: *Aegopodium*,W,1,1; *Anethum*,C,1,0; *Angelica*,W,4 (1),1; *Anthriscus*,W,3 (1),1; *Apium*,C,4 (2),0; *Chaerophyllum*,W,2 (1),0; *Daucus*,C & W,3 (1),1; *Heracleum*,W,3 (1),0; *Levisticum*,C,1,0; *Pastinaca*,W,0,1; *Peucedanum*,W,1,0; *Pimpinella*,W,3 (1),0; *Selinum*,W,1,0; *Torilis*,W,1,0

Asparagaceae: *Asparagus*,C,1,0

Asteraceae: *Achillea*,W,6 (1),3 (1); *Anthemis*,W,2 (1),0; *Arctium*,W,5 (2),2 (1); *Artemisia*,W,7 (2),8 (2); *Aster*,C,1,0; *Bellis*,C,2 (1),0; *Bidens*,W,1,0; *Calendula*,C,1,2 (1); *Callistephus*,C,3 (1),0; *Carduus*,W,6 (1),0; *Centaurea*,W,3 (1),4 (1); *Chrysanthemum*,C,4 (2),0; *Cichorium*,W,3 (1),3 (1); *Cineraria*,C,1,0; *Cirsium*,W,8 (2),6 (1); *Coreopsis*,C,1,0; *Cosmos*,C,1,0; *Crepis*,W,1,0; *Dahlia*,C,2 (1),2 (1); *Doronicum*,C,1,0; *Erigeron*,W,2 (1),3 (1); *Eupatorium*,W,1,0; *Galinsoga*,W,2 (1),2 (1); *Gazania*,C,2 (1),0; *Gnaphalium*,W,1,0; *Helenium*,C,1,0; *Helianthus*,C,2 (1),1; *Hieracium*,W,1,0; *Hypochoeris*,W,1,0; *Inula*,C,1,0; *Lactuca*,W,4 (1),3 (1); *Lapsana*,W,4 (1),0; *Leontodon*,W,3 (1),1; *Leucanthemum*,C & W,2 (1),1; *Matricaria*,W,2 (1),2 (1); *Mycelis*,W,1,0; *Petasites*,W,1,0; *Picris*,W,5 (1),1; *Rudbeckia*,C,2 (1),1; *Senecio*,W,2 (1),2 (1); *Silphium*,C,1,0; *Solidago*,W,1,0; *Sonchus*,W,11 (2),6 (6); *Tagetes*,C,1,0; *Tanacetum*,C & W,6 (2),4 (2); *Taraxacum*,W,7 (2),2; *Tragopogon*,W,1,0; *Tripleurospermum*,W,3 (1),1; *Tussilago*,W,4 (3),1; *Zinnia*,C,2 (1),0

Balsaminaceae: *Impatiens*,W,1,0

Betulaceae: *Alnus*,W,0,1; *Betula*,W,1,1

Boraginaceae: *Anchusa*,W,2 (1),1; *Borago*,C,2 (1),0; *Echium*,W,2 (1),0; *Myosotis*,C & W,2 (1),0; *Symphytum*,W,1,0

Brassicaceae: *Armoracia*,C,2 (2),0; *Barbarea*,W,2 (1),0; *Berteroa*,W,1,0; *Brassica*,C,3 (2),0; *Capsella*,W,2 (1),2 (1); *Erucastrum*,W,1,0; *Erysimum*,W,3 (1),2 (1); *Hesperis*,C,2 (2),0; *Raphanus*,C & W,4 (2),0; *Rorippa*,W,3 (2),1; *Sinapis*,W,5 (2),1; *Sisymbrium*,W,1,3 (1); *Thlaspi*,W,1,0

Campanulaceae: *Campanula*,W,3 (1),0; *Jasione*,W,1,0

Cannabaceae: *Cannabis*,C,1,0; *Humulus*,W,1,1

Capparaceae: *Cleome*,C,2 (1),0

Caprifoliaceae: *Lonicera*,C,0,1; *Sambucus*,W,1,1; *Symphoricarpos*,C,0,1

Caryophyllaceae: *Cerastium*,W,2 (2),0; *Gypsophila*,C,3 (1),0; *Lychnis*,C,1,0; *Saponaria*,W,1,1; *Silene*,W,5 (2),2 (1); *Stellaria*,W,3 (2),1

Chenopodiaceae: *Atriplex*,W,1,0; *Beta*,C,4 (2),0; *Chenopodium*,W,3 (2),1; *Spinacia*,C,2 (2),0

Cistaceae: *Cistus*,C,1,0

Convolvulaceae: *Convolvulus*,W,2 (1),1

Cornaceae: *Cornus*,C,1,1

Crassulaceae: *Sedum*,C,1,0

Cucurbitaceae: *Bryonia*,C,0,2; *Cucumis*,C,3 (1),1; *Cucurbita*,C,2 (1),0

Cyperaceae: *Carex*,W,1,0

Dipsacaceae: *Knautia*,W,2 (1),1

Equisetaceae: *Equisetum*,W,1,0

Fabaceae: *Anthyllis*,W,1,1; *Caragana*,C,3 (1),2 (1); *Lathyrus*,C & W,3 (1),1; *Lotus*,W,3 (1),0; *Lupinus*,C,1,0; *Medicago*,C & W,6 (1),4 (1); *Melilotus*,W,4 (1),0; *Ononis*,W,1,0; *Phaseolus*,C,2 (1),0; *Pisum*,C,5 (1),0; *Trifolium*,W,4 (1),1; *Vicia*,C & W,7 (1),4 (1)

Gentianaceae: *Centaurium*,W,1,0

Geraniaceae: *Geranium*,W,1,0

Goodeniaceae: *Scaevola*,C,1,0

Lamiaceae: *Ajuga*,C,1,1; *Galeopsis*,W,5 (1),3 (1); *Glechoma*,W,1,1; *Lamium*,W,3 (1),2 (1); *Melissa*,C,2 (1),0; *Mentha*,W,2 (1),1; *Origanum*,W,1,0; *Salvia*,C,2 (1),0; *Stachys*,C & W,5 (1),1

Malvaceae: *Alcea*,C,2 (1),2 (1); *Lavatera*,C,2 (1),0; *Malva*,W,1,0

Papaveraceae: *Papaver*,C,2 (1),1

Plantaginaceae: *Plantago*,W,2 (1),2 (1)

Poaceae: *Dactylis*,W,4 (1),0; *Echinochloa*,W,2 (2),0; *Elytrigia*,W,1,0; *Milium*,W,1,0

Polemoniaceae: *Phlox*,C,1,0

Polygonaceae: *Persicaria*,W,1,0; *Rumex*,C & W,1,0

Primulaceae: *Primula*,C,0,1

Ranunculaceae: *Aquilegia*,C,1,1; *Ranunculus*,W,7 (1),0

Rosaceae: *Filipendula*,W,0,1; *Malus*,C,1,1; *Potentilla*,W,1,1; *Rubus*,C,1,0; *Spiraea*,C,1,1

Rubiaceae: *Galium*,W,2 (1),1

Rutaceae: *Ruta*,C,1,1

Salicaceae: *Populus*,W,3 (1),3 (1); *Salix*,W,1,1

Scrophulariaceae: *Antirrhinum*,C,2 (1),1; *Chaenorhinum*,W,1,1; *Linaria*,W,2 (1),2 (1); *Verbascum*,W,1,0; *Veronica*,W,1,1

Solanaceae: *Datura*,C,2 (1),0; *Lycopersicon*,C,3 (1),2 (1); *Nicandra*,C,1,0; *Nicotiana*,C,2 (1),0; *Petunia*,C,3 (1),2 (1); *Physalis*,C,1,0; *Solanum*,C & W,1,2 (1)

Tropaeolaceae: *Tropaeolum*,C,2 (1),1

Urticaceae: *Urtica*,W,4 (1),1

Valerianaceae: *Valeriana*,W,2 (1),0

Violaceae: *Viola*,W,1,1