

First records of *Melanagromyza cuscutae* Hering, 1958 (Diptera: Agromyzidae) from Slovakia and its new host plant

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The occurrence of *Melanagromyza cuscutae* Hering was observed in the agroecosystems of Slovakia. These findings were the first records of the species in Slovakia. Four dodder species were recorded at Slovakian cropland during the study. From those, *Cuscuta europaea*, *C. lupuliformis* and *C. campestris* served as hosts for *M. cuscutae*. There was no infestation of *C. epithimum*. Larvae fed within flower heads of *C. europaea* and *C. lupuliformis* but within the stems of *C. campestris*, where gall formation occurred. *C. campestris* was recorded as a host of *M. cuscutae* for the first time.

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1. Introduction

Melanagromyza cuscutae Hering, 1958 was described for the first time in Germany (Hering 1958). The adult is entirely black, without any metallic coloration of the mesonotum or abdomen, the squama is whitish-grey with the margin and squamal fringe dark (Spencer 1973). Male genitalia were illustrated by Spencer (1962: Fig. 11, 1966: Fig. 19) and the larva by Hering (1958: 218). The genitalia of *M. cuscutae* (cf. Spencer 1966) are entirely typical of the genus and cannot be directly associated with the very similar species *M. albocilia* Hendel (also widespread in Slovakia, Tóth *et al.* 1998) feeding on *Convolvulus* (Spencer 1990). Although *M. cuscutae* ap-

pears to occur primarily as a seed-feeder, it is also found in stems and the genitalia are typical of stem-boring species (Spencer 1966).

In Europe, *M. cuscutae* is only known to feed in seed-heads of *Cuscuta europaea* L., but in West Pakistan at Rawalpindi the larvae were found feeding exclusively in young stems of *C. reflexa* Roxb. (Spencer 1973). Elsewhere in the plains of West Pakistan, stems of other species of *Cuscuta* have been attacked, including *C. approximata* Babington, *C. hyalina* Roth and *C. planiflora* Tenore (Baloch *et al.* 1967). In India, it is known from stems and fruits of *C. reflexa* in Bihar (Sehgal 1965). In Kazakhstan, it feeds on the stems and fruits of *C. europaea* and *C. lupuliformis* (Ivannikov 1969).

Host specificity tests showed that for normal maturation the female must be able to feed on *Cuscuta* sap oozing from punctures, which it makes with its ovipositor. Thus, *M. cuscutae* is believed to be highly host specific and therefore safe for use as a biocontrol agent (Baloch *et al.* 1967). The Pakistan and European populations have been observed attacking only dodders on shrubs and trees and not on field crops, which have thinner vines.

There are four species from Cuscutaceae known in Slovakian agroecosystems. They are *Cuscuta epithimum* L., *C. europaea* L., *C. lupuliformis* Krockner and *C. campestris* Yuncker (Tóth & Cagaň 2001). The objectives of this study were to determine the following: (1) presence of *M. cuscutae* in agroecosystems of Slovakia; (2) host range of *M. cuscutae* within the genus *Cuscuta* in Slovakia.

2. Material and methods

During the growing season 2001 the occurrence of *M. cuscutae* was observed irregularly in the agroecosystems of Slovakia following the natural phenology of dodders. Together 45 localities were chosen in different geographic and climatic regions throughout Slovakia. Collecting sites were *Cuscuta* spp. – infested croplands planted with various crops, fallow fields and roadsides. At each locality, plant species were identified.

Identification of *Cuscuta* spp. was based on the flower structure according to Dostál and Červenka (1992).

At each collecting site, *Cuscuta* plants were inspected for the presence of *M. cuscutae* larvae or pupae. The infested flower heads and stem galls were hand picked from the plants. The localities were inspected to record the presence of the *M. cuscutae*. Starting with a sample of 20 flower heads or stem galls per site, the number reached a maximum of 80 per site if less than three larvae or pupae were found from the first 20 flowerheads or stem galls.

To assess the adult emergence, field-collected flower heads or stem galls were placed in plastic tubes (8 cm diameter, 4.5 cm high) with perforated tops for aeration under laboratory conditions (20 °C ± 1 °C). Emerged adults were identified.

3. Results

Melanagromyza cuscutae was found at 12 localities (Table 1). These findings are the first records of the species in Slovakia.

Of 300 *Cuscuta* spp. infested flowerheads and 100 stem galls collected during 2001 throughout Slovakia, 75 pupae were successfully reared to adult emergence (Table 2). The remaining larvae or pupae died before pupation and adult emergence respectively. The sex ratio of recorded *M.*

Table 1. Details of localities where *M. cuscutae* was recorded.

Locality	District ^a	Altitude (m)	Coordinates	Grid reference number ^b
Biňovce	W	198	48°30'N 17°29'E	7470
Čoltovo	C	227	48°30'N 20°23'E	7588
Drieňov	E	226	48°52'N 21°16'E	7193
Dubovec	C	182	48°17'N 20°10'E	7786
Hostie	W	300	48°27'N 18°27'E	7576
Koplotovce	W	165	48°28'N 17°49'E	7472
Machulince	W	255	48°25'N 18°26'E	7576
Mužla	W	121	47°48'N 18°36'E	8277
Nová Ves n/Žitavou	W	164	48°17'N 18°20'E	7775
Obyce	W	250	48°26'N 18°27'E	7576
Sikenica	W	150	48°07'N 18°46'E	7978
Želiezovce	W	137	48°03'N 18°40'E	7977

^a W – West Slovakia; E – East Slovakia; C – Central Slovakia.

^b Grid reference number of the Databank of the fauna of Slovakia.

Table 2. Host range of recorded *M. cuscutae* specimens in Slovakia.

Locality	Date	<i>Cuscuta</i> species	<i>Cuscuta</i> host plant	Specimens reared	
				♂	♀
Biňovce	15.VIII.2001	<i>europaea</i>	<i>Urtica dioica</i>		1
Čoltovo	5.VII.2001	<i>lupuliformis</i>	<i>Rubus</i> spp.	1	1
	8.VIII.2001	<i>lupuliformis</i>	<i>Rubus</i> spp.	24	26
Drieňov	9.VIII.2001	<i>europaea</i>	<i>Urtica dioica</i> , <i>Calystegia sepium</i>	2	
Dubovec	8.VIII.2001	<i>europaea</i>	<i>Robinia pseudoacacia</i>	2	
Hostie	27.VIII.2001	<i>europaea</i>	<i>Urtica dioica</i> , <i>Rubus</i> spp.	2	4
Koplotovce	15.VIII.2001	<i>europaea</i>	<i>Clematis</i> spp., <i>Rubus</i> spp.	1	
Machulince	16.VIII.2001	<i>europaea</i>	<i>Urtica dioica</i> , <i>Rubus</i> spp.	1	
Mužla	13.VI.2001	<i>campestris</i>	<i>Medicago sativa</i>	1	1
	3.VII.2001	<i>campestris</i>	<i>Medicago sativa</i>	1	
Nová Ves n/Žitavou	14.VIII.2001	<i>europaea</i>	<i>Urtica dioica</i> , <i>Rubus</i> spp.		2
Obyce	2.VIII.2001	<i>europaea</i>	<i>Urtica dioica</i> , <i>Rubus</i> spp.	2	
Sikenica	8.VII.2001	<i>campestris</i>	<i>Medicago sativa</i>		1
Zeliezovce	22.VIII.2001	<i>campestris</i>	<i>Solanum tuberosum</i>	1	1

Table 3. Wing span of recorded *M. cuscutae* specimens.

Locality	Date	Wing span (mm)	
		♂	♀
Biňovce	15.VIII.2001		2.53
Čoltovo	5.VII.2001	2.00–2.52	1.93–2.56
	8.VIII.2001	2.11	2.35
Drieňov	8.VIII.2001	2.28	
	9.VIII.2001	2.46	
Dubovec	8.VIII.2001	1.90–2.07	
Hostie	27.VIII.2001	2.32–2.46	2.11–2.46
Koplotovce	15.VIII.2001	2.18	
Machulince	16.VIII.2001	2.35	
Mužla	13.VI.2001	cannot be measured ^a	cannot be measured ^a
	3.VII.2001	2.25	
Nová Ves n/Žitavou	14.VIII.2001		2.04–2.35
Obyce	2.VIII.2001	2.25–2.28	
Sikenica	8.VII.2001		1.97
Zeliezovce	22.VIII.2001	2.25	2.46

cuscutae specimens was 1.00 ♂ : 1.03 ♀. The wingspan within the specimens reared varied from 1.90–2.52 mm in males and from 1.93–2.56 mm in females (Table 3).

Four dodder species were recorded in Slovakian croplands. From those, only *C. europaea*, *C. lupuliformis* and *C. campestris* served as hosts for *M. cuscutae* (Table 2). During the study, there was no infestation of *C. epithymum* caused by *M.*

cuscutae. *C. epithymum* was checked at 30 localities (alfalfa fields) throughout Slovakia. *C. campestris* was recorded as a host of *M. cuscutae* for the first time.

Larvae of *M. cuscutae* fed within flower heads of *C. europaea* and *C. lupuliformis*. A typical feeding pattern was the destruction of single seeds. The larvae destroyed most of the developing seeds within the flower head and pupated di-

rectly on the base of the flower heads. On the other hand, flower heads of *C. campestris* were untouched by larvae. In the case of *C. campestris*, the larvae fed within the stem, where gall formation occurred. The larvae pupated directly within the galls.

4. Discussion

Although, *M. cuscutae* is only known to feed within seed-heads of *C. europaea* in Europe (Spencer 1990), our results showed the species also feeds within flower heads of *C. lupuliformis* and stems of *C. campestris*. The only *Cuscuta* species without *M. cuscutae* attack was *C. epithimum* in Slovakia. Even though we recorded *M. cuscutae* at 12 localities, it is possible to expect that the species is widespread in Slovakia as *C. europaea* and *C. campestris* were noticed throughout the country (Bertová 1988, Dostál & Červenka 1992, Tóth & Cagaň 2001). The most severe infestations by *M. cuscutae* within dodder plants were recorded on *C. lupuliformis* during the study (Table 2). The species was found only at one locality (Čoltovo), because it turns out to be more rare in Slovakia because of lack of suitable habitats (Tóth & Cagaň 2001, Cagaň *et al.*, 2001).

Volkov (1989) mentioned that the larvae of the 1st *M. cuscutae* generation mined in the stems, while those of the 2nd destroyed the seeds of *C. europaea* and *C. lupuliformis* in Kazakhstan. However, we did not find infestation of stems in our study with the exception of the new host, *C. campestris*.

Spencer (1966) cited the wing length of *M. cuscutae* from 2.4 mm in males to 2.7 in females in European specimens and up to 2.8 mm in those from Pakistan (Spencer 1973). The wing span of Slovakian specimens varied only from 1.90–2.52 mm in males to 1.93–2.56 mm in females (Table 3). The presumable reason may be that Slovakia is on the northern border of its distribution. There are no records of the species from more northern countries (Spencer 1976).

Spencer (1965) stated: “When a species from family Agromyzidae is feeding on stems or seeds, there are a high degree of probability that the species will be strictly monophagous”. In regard to *M. cuscutae*, this was confirmed by Baloch *et al.*

(1967) who carried out host specificity trials with plants from 36 different families. Single eggs were laid only on *Tradescantia* sp. (Commelinaceae) and *Ipomoea batatas* (Convolvulaceae). The eggs hatched but the larvae failed to develop.

We expect that *M. cuscutae* is a very promising biological control agent of *Cuscuta* spp., even if degree of parasitism should be carefully evaluated. This species is promising primarily because of its damage: the stem boring feeding causes gall formation on *C. campestris* and seed destruction of other *Cuscuta* spp. Especially important is its attack on invasive (within Europe) *C. campestris*. If the stem of the species is not attached to its host plant beyond the attacked (galled) part, the entire section is killed (Baloch *et al.* 1967). In addition, *M. cuscutae* can cause secondary damage, opening the door to several pathogens, such as fungi and bacteria, which can increase the ultimate damage and cause the death of the target plant.

Augmentation of *M. cuscutae* in Kazakhstan has been carried out by annual release of flies to overcome high winter mortality. For this purpose, infested plants were collected in autumn and held indoors over winter. In the spring the flies that emerged were released in the infested field (Ivannikov 1972). There have been no further published report on the use of *M. cuscutae* for biological control (CAB 1987), so it does not seem that the method was successful until now. To know more about its habit, life history and impact on host plants a detailed study will be required.

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