

**Host plants, herbivores and natural enemies in Kenyan
horticulture: tritrophic interactions involving *Liriomyza*
leafminers (Diptera: Agromyzidae)**

BY

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Declaration

I, Robert Musundire, declare that the thesis which I hereby submit for the degree *Philosophiae Doctor* (Entomology) at the University of Pretoria is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

Signature.....

Date.....

Dedication

This work is dedicated to my parents Mr. A.L. Musundire and the late Ms C. Kufandikamwe. The way you raised me made it possible for these heights to be reached. To the late Cicilia, the little messages you left behind inspired me throughout and I am proud to have achieved what you always wished for your only son. To my father, thank you for all the necessary support you gave me throughout my early academic life. To my surviving grandmothers, thank you for taking care of me and though in your advanced ages, your wisdom was always there to show me the way during difficult times. Finally, to my family and friends, thank you for being supportive during the entire period of my study. Courtney all those years of absence, surely, you must have been wondering.

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Host plants, herbivores and natural enemies in Kenyan horticulture: tritrophic interactions involving *Liriomyza* leafminers (Diptera: Agromyzidae)

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Abstract

In the Afrotropical region, the accidental introduction of *Liriomyza huidobrensis*, *L. sativae* and *L. trifolii*, like in other parts of the world, has caused considerable economic losses, especially in the production of vegetables and ornamental plants. The management of these *Liriomyza* species and other agromyzid pests requires various sustainable methods of which biological control by parasitoids is a key aspect.

To determine the potential of Afrotropical parasitoids for biological control, data on distribution of Agromyzidae, host plant records and associated parasitoid species was collated from museum collections, available literature and own observations. Most of the 599 agromyzid records comprising 301 species are from East (36 %) and Southern Africa (34 %). Host plant records include 48 plant families. The paucity of parasitoids (105 records) associated with only 7 % of agromyzid species suggests a lack of sampling effort.

Although the exotic biological control agent *Diglyphus isaea* (Hymenoptera: Eulophidae) successfully established after introduction to control *Liriomyza* species in Kenya, no studies have been undertaken on host plant-leafminer-parasitoid interactions. In view of the limited information available on local parasitoids, the tritrophic interactions between the three *Liriomyza* species, four crops and *D. isaea* were assessed in the current study.

Body size, which has previously been positively linked with leafminer fitness, was determined for the three *Liriomyza* species reared on *Phaseolus vulgaris*, *Pisum sativum*, *Solanum lycopersicum* and *Vicia faba* using wing morphometric and hind tibia measurements. Two distinct leafminer morphospecies (*L. huidobrensis* cluster and *L.*

sativae, *L. trifolii* cluster) were recognized across all plant species based on canonical discriminant analyses. Unlike *L. sativae* and *L. trifolii*, rearing *L. huidobrensis*, the largest of the three species, on different host plant species did not result in differences in the size of adult progeny. Hind tibia length was strongly correlated with wing length and could reliably be used as indicators of body size.

To assess plant-leafminer-parasitoid interactions at the third trophic level, rate of parasitism, host feeding and sex ratios of *D. isaea* were determined in no-choice and choice experiments. Results suggest that larval size of the host is not necessarily positively linked with parasitism but that plant related factors influenced parasitism.

To determine why abundance and efficacy of *D. isaea* differ in different habitats in Kenya, the role of olfactory cues of host plants in host finding by the parasitoid has been examined in a Y-tube olfactometer experiment. Results showed that interactions between host plant and leafminer species influence the degree of attraction to leafminer-infested plants. To explain the behavioural pattern by *D. isaea* in the olfaction experiment, an analysis of volatile components emitted by leafminer-damaged plants, showed considerable qualitative variations within the same host plant species infested with different *Liriomyza* species for all plant species except for *S. lycopersicum*.

In conclusion, the suitability of *D. isaea* for controlling *Liriomyza* species is variable and depends mostly on host plant species and leafminer size. A need exists for more intensive collaborative research in the afro-tropic zone to identify other suitable biological control candidates.



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