Plant Host Specificity of Leaf Beetles

Laura Martin, Karl Roeder, Christina Ramos, and Charlotte Ellis

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Introduction:

The family Chrysomelidae consists of small, oval shaped, herbivorous beetles that are monophagous, or more commonly oligophagous. They are one of the largest beetle families and the second largest phytophagous family, and most spend their entire life cycle within a small geographical area (Riley, E. et al., 1992). Their lengths range from one to seventeen millimeters and most have bi-lobed third tarsomeres (Riley, E. Chrysomelidae). Leaf beetles have a great diversity of colors and patterns ranging from solid metallic to dorsally striped. Dominican Chrysomelids generally inhabit open, sunny, weedy areas with low-lying vegetation. Chrysomelidae are commonly found on Solanaceae, Commielnaceae, Heliconiaceae, Arecaceae, Convolvulaceae, Curcurbitaceae, and Passiforaceae. Many of the leaf beetles of Dominica have already been recorded, but most of the host plant association are unknown. The goal of this study was to record leaf beetle and plant interactions, and to test the hypothesis that each species of leaf beetle is either monophagous or oligophagous on particular plant species.

Materials and Methods:

Leaf beetles were collected using aspirators, sweep nets, and beat sheets. The beat sheets were constructed from white cloth squares measuring fifty-five inches diagonally. Two pieces of wood were cut one inch shorter than the diagonal length and attached together using a wingnut screw. Vials, ziplock bags, ethyl acetate, paper envelopes, tissues, global positioning system, beating sticks, and a plant press were used throughout the experiment to help record and store data.

Various plants were examined for leaf beetle damage throughout the island of Dominica at locations including Springfield research station, Mount Joy, and the Elfin forest at Freshwater and Boeri Lake. Leaf beetle feeding damage can be distinguished from other

damage since leaf beetles do not eat the veins of leaves. Previously associated host plants were also checked for feeding damage and various leaf beetles. The reported habitats of leaf beetles helped us to search out the appropriate environment that would contain a high population of leaf beetles. Plants containing large amounts of damage were beat or swept. Individual beetles were also located and aspirated directly off the plant. A GPS reading was taken in the field at every beetle collecting site. A number was given to each group of beetles and their associated host plant. This identification number kept the beetles with their host plant. After returning to the lab, plant specimens were pressed and beetles were killed with ethyl acetate in numbered vials. Before leaving Springfield each beetle group was moved from its vial to an appropriately labeled paper envelope to dry out. Moth balls were used to prevent ants from entering and destroying leaf beetles specimens. Information provided by Ed Riley was used to identify the leaf beetles. These materials include: Annotated list of Chrysomelidae of Dominica, W.I.; 124. Chrysomelidae Latreille 1802; A Field Guide to the Insects; and An introduction to the biology and systematics of Panamanian Tortoise Beetles.

Results:

At least fourteen species of leaf beetles were collected at thirty- two sites around Dominica . The majority of these sites were on or around the Springfield research station, which is close to the capital, Roseau. A large population of leaf beetles was found in an open clearing on the top of Mount Joy. This area, now abandoned, was once used for farming. Another high density location for leaf beetles was located on the trail from the bee house to the mango grove. *Ipomoea* grew abundantly throughout the area. The final high density area was along the roadside from Springfield to Roseau. The site consisted of roadside weeds which had taken over a dirt pile. Many locations with characteristic feeding damage lacked

Chrysomelids. The most common group of leaf beetles found were Alticinae, the flea beetles. The subfamily Cassidinae, or tortoise beetles, was also widely distributed. At most sites there were several different species of leaf beetles feeding in close proximity to one another. The *Ipomoea* species was the host plant to the highest number of leaf beetles.

See the Appendix for Chrysomelidae Collection Site table.

See attached plates for Chrysomelid and host plant photographs..

Discussion:

Leaf beetles appeared less plant specific than was originally believed. Our data suggests that the microenvironment and microclimate are more important to the beetles than the host plant. Often an understory plant had no leaf beetles, but this same plant species in an open disturbed environment had a high density of leaf beetles

Leaf beetle populations could have been suppressed by a large number of ants. Ants were seen on almost all of the hypothesized host plants mentioned in Ed's packet. A journal article was found that stated that ants and aphids were used to control leaf beetle populations. Apparently the ant species remained on the plants even if the aphid populations were removed. Five ants were found attacking a leaf beetle along the roadside; however this is only one circumstantial case.

. Fewer leaf beetles were collected than expected. This might have occurred because of misidentification of recent feeding damage. Also, the best leaf beetle collecting can be done in the first two months of the wet season. This rainy period normally starts late May to early June in Dominica (Riley, E. et al., 1992). It was noted that substantial rain was delayed by several weeks. As a result of this climatic change, the leaf beetle population may not have yet reached its adult stage.

Acknowledgements:

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Literature Cited:

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Riley, E. 2006. Annotated list of the Chrysomelidae (leaf beetles excluding Bruchinae) of Dominica, W. I.

Riley, E., Clark, S., Flowers, R.,Gilbert, A. Chrysomelidae.

Riley, E., Windsor, D., Stockwell, H. 1992. An introduction to the biology and systematics of Panamanian Tortoise Beetles. In Insects of Panama and Mesoamerica. Oxford University Press.

Apendix one:

Chrysomelidae Collection Sites 2006

Site	Date	GPS (degree/min/sec)	Elevation (ft)	Location	Plant(s)	Leaf Beetle
1	5/24	15 20 49 N 61 22 06 W	1203	springfield driveway	Heliconia bihai	Aedmon sp1
2	5/24	15 20 48 N 61 22 09 W	1159	front veranda springfield	Ipomoea	Charidotella sexpuntalus ?
3	5/24	15 21 06 N 61 21 48 W	1761	top of the trail to mount joy	Robus rosifolus	Charidotella sexpuntalus ?
4	5/25	15 20 52 N 61 22 05 W	1261	trail to beehouse	Ipomoea	No beetles
5	5/25	15 20 52 N 61 22 05 W	1261	trail to beehouse	Croton	No beetles
6	5/25	15 20 53 N 61 22 04 W	1305	trail to beehouse	Unidentified	No beetles
7	5/25	15 20 53 N 61 22 04 W	1305	trail to beehouse	Inga	Charidotella sexpuntalus, Heikertingerella sp1
8	5/25	15 20 54 N 61 22 04 W	1311	trail to beehouse	Ipomoea (2 spc)	Cassidinae sp1, Alticinae sp1, Donaciinae sp1
9	5/26	15 20 42 N 61 20 55 W	1322	trail to middleham falls	Ipomoea	Cassidinae sp1
10	5/28	15 21 06 N 61 21 48 W	1761	top of the trail to mount joy	Unidentified	Alticinae sp1
11	5/28	15 21 06 N 61 21 48 W	1761	top of the trail to mount joy	Unidentified	Aphthona insularis
12	5/28	15 21 06 N 61 21 48 W	1784	top of the trail to mount joy	Unidentified	Alticinae, Galerucinae sp1
13	5/28	15 21 07 N 61 21 47 W	1715	top of the trail to mount joy	lemon grass	Aphthona insularis
14	5/28	15 21 07 N 61 21 47 W	1724	top of the trail to mount joy	Unidentified	Alticinae sp1
15	5/28	15 21 07 N 61 21 48 W	1753	top of the trail to mount joy	Unidentified	Aphthona insularis, Charidotella sp1
16	5/28	15 21 07 N 61 21 47 W	1717	top of the trail to mount joy	Unidentified	Aphthona insularis
17	5/28	15 21 07 N 61 21 47 W	1717	top of the trail to mount joy	Ipomoea	Charidotella sexpuntalus, Aphthona insularis
18	5/28	15 20 51 N 61 21 59 W	1711	trail to beehouse, old dorms	Unidentified	purple shiny beetle Cassidinae
19	5/28	15 20 51 N 61 21 59 W	1711	trail to beehouse, old dorms	Unidentified	Cassidinae sp1, Altincinae
20	5/28	15 20 51 N 61 21 59 W	1711	trail to beehouse, old dorms	Ipomoea	Charidotella sp1, Cassidina sp2
21	5/28	15 20 51 N 61 21 59 W	1711	trail to beehouse, old dorms	Unidentified	Cassidinae sp1
22	5/29	N/A	N/A	trail to fig tree	Unidentified	No beetles
23	5/29	15 20 36 N 61 22 21 W	1760	trail to fig tree	Piperacea	No beetles
24	5/31	15 20 48 N 61 22 06 W	1203	springfield entrance	Unidentified	Alticinae sp2, Aedmon sp1
25	5/31	15 20 48 N 61 22 06 W	1203	passion vine next to archobold house	Passion Vine	No beetles
26	5/31	15 20 48 N 61 22 06 W	1203	garden next to archobold house	Coconut palm, young	Apthona insularis
27	5/31	15 20 48 N 61 22 06 W	1203	garden next to archobold house	Coleus, Ipomoea	Charidotella sp1, Apthona incularis, Alticinae
28	5/31	15 20 48 N 61 22 06 W	1203	garden next to archobold house	Squash	Alticinae sp1
29	5/31	15 20 48 N 61 22 06 W	1203	garden next to archobold house	Caggage, greens	Alticinae sp2
30	5/31	15 20 48 N 61 22 06 W	1203	garden next to archobold house	Ipomoea	tiny leaf beetle?
31	6/1	15 20 26 N 61 18 31 W	2517	freshwater lake	Unidentified	Alticinae sp1
32	6/1	15 21 04 N 61 19 09 W	2527	Boeri Lake	Unidentified	Heikertingerella sp1
33	6/1	15 21 04 N 61 19 09 W	2527	Boeri Lake	Unidentified	Homoschema dominicae
34	6/5	15 20 43 N 61 22 06 W	1203	Springfield roadside	Piperacea	purple shiny beetle Cassidinae
35	6/5	15 20 40 N 61 21 57 W	1203	Springfield roadside	Unidentified	Donaciinae
36	6/5	15 20 40 N 61 21 57 W	1203	Springfield roadside	Unidentified	Galerucinae sp2
37	6/5	15 20 43 N 61 21 59 W	1203	Springfield roadside	Unidentified	Alticinae sp1, Cassidinae sp1, Galerucinae sp1 Donaciinae sp1, sp2
38	6/5	15 20 48 N 61 22 06 W	1203	Springfield roadside	Unidentified	Alticinae sp1, Donaciinae sp1, sp2

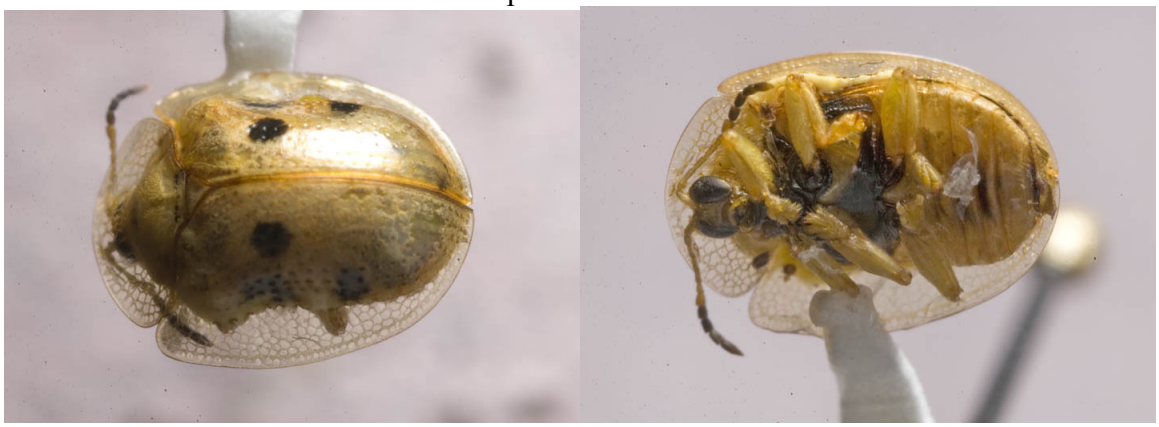
Aedmon sp 1

Alticinae sp1

Alticinae sp2

Alticinae sp3

Aphthona



Cassidinae sp1

Charidotella sp1

Donaciinae sp1

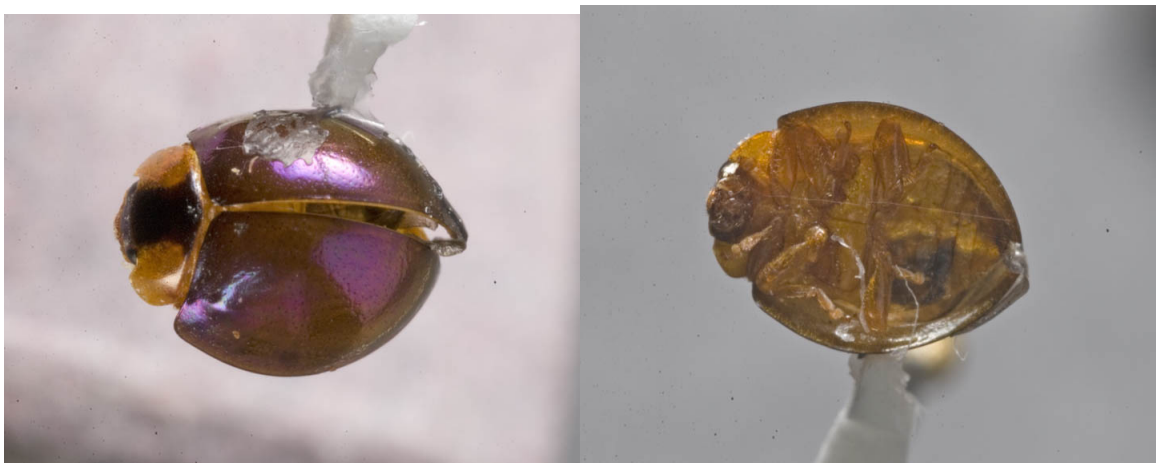
Donaciinae sp2

Galerucinae sp1

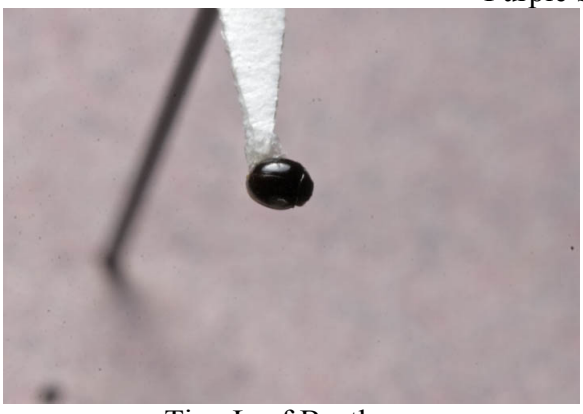
Galerucinae sp2

Heikertingerella

Homoschema



Purple Small Beetle



Tiny Leaf Beetle

Plant Plates

Plant #10

Plant #11

Plant #12

Plant #14

Plant # 18

Plant #19

Plant #22

Plant #23

Plant #27

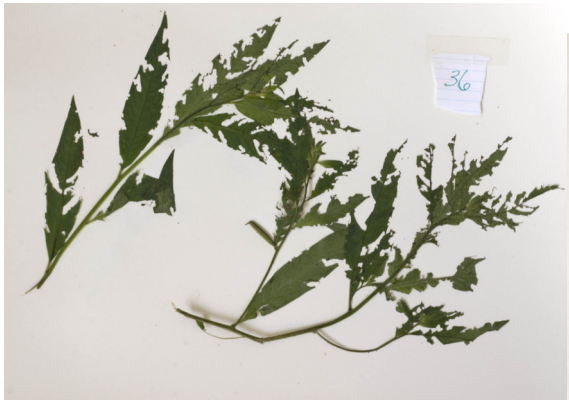
Plant #30

Plant #31

Plant #32

Plant #33

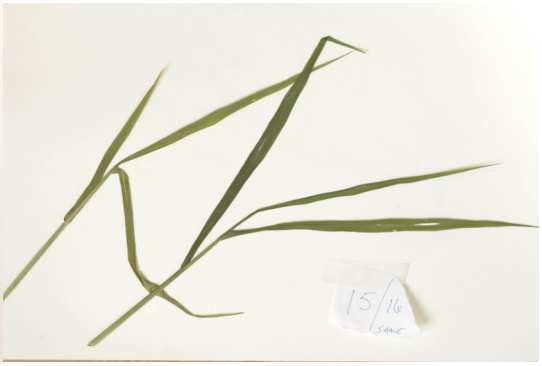
Plant #35



Plant # 36

Plant # 37

Plant # 38



Plant #15/16

Team Leaf Beetle: (L to R: Charlotte Ellis, Christina Ramos, Karl Roeder, and Laura Martin)