

## Aphids and their Host Affinity- IV: *Lipaphis* spp.

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### ABSTRACT

Thirteen species of *Lipaphis* (including two subspecies) revealed that they exclusively feed on dicotyledons. 95.83% host species were from herbaceae, whereas less than 5% from lignosae. Except *L. erysimi* and *L. pseudobrassicae*, all other species were exclusively Brassica feeders. *L. erysimi* and *L. pseudobrassicae* consumed 79.25 and 86.36% plants from Brassicaceae, respectively. There were six monophagous, four oligophagous and three polyphagous species of *Lipaphis*. In most of the cases GAI values did not vary much because of strong affinity of *Lipaphis* to Brassica hosts.

**Key words:** GAI, *Lipaphis* spp., Dicotyledons, Monocotyledons, Lignosae.

### INTRODUCTION

Species in the genus *Lipaphis* (Aphidinae: Macrosiphini) are mostly western palaeartic species associated with crucifers and related to *Brevicoryne*<sup>1, 2</sup>. There are 13 species in the genus (including 2 subspecies). However, there was uncertainty between the species *erysimi* and *pseudobrassicae*; some regarded *pseudobrassicae* as a subspecies of *erysimi*. European species are darker in colour and apparently also prefer other host plants than

species from India and North America. For these reasons, European form of mustard aphid has been referred to as *L. erysimi erysimi* as distinguished from *L. erysimi pseudobrassicae*<sup>3,4,5</sup>. In contrast to Indian aphid, European *L. erysimi erysimi* has only occasionally been observed on mustard<sup>5, 6</sup>. Now these are two distinct species. *L. erysimi* is a holocyclic species with 2n=10 karyotypes, whereas *Lipaphis* population throughout the world has 9 chromosome karyotypes<sup>7</sup>.

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Thorsteinson<sup>8</sup> reported that most of the insects select their host plants from certain plant taxonomic groups while others feed indiscriminately. Rathore and Tiwari<sup>9</sup> observed that monophagous species of *Hyadaphis* select plants from Caprifoliaceae or Apiaceae; *Uroleucon compositae* selects 87% plants from Asteraceae and *Vitis vitifolius* exclusively feeds on Vitaceae. Authors, therefore, attempted to examine host affiliation of *Lipaphis* species.

### MATERIALS AND METHODS

Host plants of various species reported in the literature<sup>1,7</sup> were aligned with the families and orders following the taxonomic classification of Hutchinson<sup>10</sup>. Phylum angiosperm was divided into two subphyla-dicotyledons and monocotyledons. Dicotyledons were further divided in lignosae (fundamentally woody group of plants) and herbaceae (fundamentally herbaceous group of plants). In monocotyledons three groups were recognized viz., calyciferae (calyx bearers), corolliferae (calyx and corolla are similar) and glumiflorae (perianth is reduced or replaced by lodicules). The terms mono-, oligo- and polyphagous were used following the categorization of Barnays and Chapman<sup>11</sup>. General Affiliation Index was calculated as per method described by Rathore and Tiwari<sup>12</sup>. Other details are provided in first part of this publication<sup>13</sup>.

### RESULTS AND DISCUSSION

Thirteen *Lipaphis* species (including two subspecies) with their host taxonomic groups are reported in Table 1. Results demonstrate that out of 13 species, six were monophagous, four oligophagous and three polyphagous.

Both the subspecies *L. lepidii* ssp. *lepticardiariae* and *L. rossi* ssp. *Conringiae* feed on *Lipidium* and *Conringia*, respectively from Brassicaceae with GAI values of 1.000-1.333. The other four monophagous species were also exclusively *Brassica* feeders and their GAI values were in the range of 1.000-1.333. The oligophagous species viz., *L. fritzmulleri*, *L. lepidii*, *L. ruderalis* and *L. turritella* were also hosting on cruciferous plants from Brassicaceae. Their GAI values ranged from 1.000 to 1.500 demonstrates their close affinity with *Brassica* group of plants. *L. erysimi*, *L. jungarica* and *L. pseudobrassicae* were categorized as polyphagous species. *L. jungarica* though grouped as polyphagous feeds on *Hypocoum erectum* of family Fumariaceae in order Rhoadales which possess 59<sup>th</sup> position on evolutionary scale. The other host *Syrenia siliculosa* from Brassicaceae in the order Brassicales is on 60<sup>th</sup> position. Brassicales is a large and climax group derived from family Papaveraceae of Rhoadales. Fumariaceae is highly specialized off shoot from Papaveraceae<sup>10</sup>. Therefore, both the host species are closely related. The host range of other two *Lipaphis* species encompasses large number of host plants but *Brassica* hosts dominated and were to the tune of 79.25 and 86.36% (Brassicaceae, Cleomaceae) in the case of *L. erysimi* and *L. pseudobrassicae*, respectively. Though they are polyphagous but due to their exceptionally greater preference to *Brassica* resulted in low GAI values 1.040 in *L. erysimi* and 1.314 in *L. pseudobrassicae*. In spite of so close to each other, both species differ in selection of *Brassica* species as their host and geographical distribution.

Table 1: Affinity of *Lipaphis* species to host taxonomic groups

<i>Lipaphis</i> species	Host families and their groups	No. of host plants	GAI	Status
<i>L. alliariae</i>	<b>Dicot-herbaceae:</b> Brassicaceae (1) ( <i>Alliaria petiolata</i> )	1	1.000	Monophagous
<i>L. cochleariae</i>	<b>Dicot-herbaceae:</b> Brassicaceae (1) ( <i>Cochlearia officinalis</i> )	1	1.000	Polyphagous
<i>L. erysimi</i>	<b>Dicot-lignosae:</b> Cucurbitaceae (1), Ericaceae (1), Linaceae (1) <b>Dicot-herbaceae:</b> Asteraceae (3), Brassicaceae (42), Caryophyllaceae (1), Chenopodiaceae (1), Ranunculaceae (1), Solanaceae (1), Tropaeolaceae (1)	53	1.040	Polyphagous
<i>L. fritzmulleri</i>	<b>Dicot-herbaceae:</b> Brassicaceae (3) ( <i>Sisymbrium alliaria</i> , <i>S. loeselii</i> , <i>Erysimum diffusum</i> )	3	1.250	Oligophagous
<i>L. jungarica</i>	<b>Dicot-herbaceae:</b> Brassicaceae (1) ( <i>Syrenia siliculosa</i> ), Fumariaceae (1) ( <i>Hypecoum erectum</i> )	2	0.666	Polyphagous
<i>L. lepidii</i>	<b>Dicot-herbaceae:</b> Brassicaceae (4) ( <i>Brassica pekinensis</i> , <i>Lepidium latifolium</i> , <i>L. repens</i> , <i>L. ruderales</i> )	4	1.500	Oligophagous
<i>L. lepidii</i> ssp.	<b>Dicot-herbaceae:</b> Brassicaceae (2) ( <i>Lepidium campestre</i> , <i>L. lepidiicardiariaedra</i> )	2	1.333	Monophagous
<i>L. pseudobrassicae</i>	<b>Dicot-lignosae:</b> Rubiaceae (1) <b>Dicot-herbaceae:</b> Asteraceae (1), Basellaceae (1), Brassicaceae (34), Chenopodiaceae (1), Cleomaceae (4), Papaveraceae (1), Solanaceae (1)	44	1.314	Polyphagous
<i>L. rossi</i>	<b>Dicot-herbaceae:</b> Brassicaceae (2) ( <i>Arabis hirsuta</i> , <i>A. thaliana</i> )	2	1.333	Monophagous
<i>L. rossi</i> ssp.	<b>Dicot-herbaceae:</b> Brassicaceae (1) ( <i>Conringia orientalis</i> )	1	1.000	Monophagous
<i>L. ruderalis</i>	<b>Dicot-herbaceae:</b> Brassicaceae (4) ( <i>Berteroa incana</i> , <i>Lepidium apetalum</i> , <i>L. ruderales</i> , <i>L. sativum</i> )	4	1.500	Oligophagous
<i>L. turritella</i>	<b>Dicot-herbaceae:</b> Brassicaceae (2) ( <i>Arabis glabra</i> , <i>Erysimum cheiranthoides</i> )	2	1.000	Oligophagous
<i>L. unguibrevis</i>	<b>Dicot-herbaceae:</b> Brassicaceae (1) ( <i>Brassica</i> spp.)	1	1.000	Monophagous

An overall picture of host affinity to taxonomic groups is presented in Table 2 revealed that in general *Lipaphis* spp. preferred to feed exclusively on dicotyledons as not a single host species was recorded from any group of monocotyledons. Among dicotyledons, 95.83% host plants were from herbaceae. Woody plants in lignosae shared less than 5% plants and that too was due to *L. erysimi* and *L. pseudobrassicae* (Table 1). Perhaps these two species are diversifying their host preference. *L. erysimi* feeds on

plants from Cucurbitaceae (order-Cucurbitales), Ericaceae and Linaceae (order-Malpighiales). Both these orders derived from Bixales group but distantly located on evolutionary scale as on 30<sup>th</sup> and 34<sup>th</sup> position, respectively in lignosae. In herbaceae, aphid selected host plants from very primitive order Ranales (Ranunculaceae), and further from Caryophyllales (Caryophyllaceae), Chenopodiales (Chenopodiaceae), Asterales (Asteraceae), Solanales.

Table 2: Host taxonomic affinity with *Lipaphis* species

Parameters	Host plants					Total
	Dicotyledons		Monocotyledons			
	Lignosae	Herbaceae	Calyciferae	Corolliferae	Glumiflorae	
Species	5 (4.17)	115 (95.83)	0	0	0	120
Genera	5 (7.14)	65 (92.86)	0	0	0	70
Families	5 (16.67)	25 (83.33)	0	0	0	30
Orders	5 (17.86)	23 (82.14)	0	0	0	28
<b>Total</b>	<b>20 (8.06)</b>	<b>228 (91.94)</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>248</b>

Figures in parentheses are % values

(Solanaceae) and Geraniales (Geraniaceae) and they were on 55<sup>th</sup>, 64<sup>th</sup>, 76<sup>th</sup>, 77<sup>th</sup> and 79<sup>th</sup> position on evolutionary scale. Ranales—Caryophyllales—Chenopodiales appears to be a probable evolutionary lineage.

In *L. pseudobrassicae* host plant species in lignosae were different from *L. erysimi* and ,i.e., from Rubiaceae (Rubiales), 52<sup>nd</sup> position on evolutionary scale. In herbaceae, this aphid did not feed on primitive order Ranales. Nevertheless, in advanced evolution Ranales on one side gave rise to Rhoadales (Papaveraceae)—Brassicales (Brassicaceae, Cleomaceae) and on the other side Chenopodiales (Basellaceae, Chenopodiaceae). Host plants from Solanales (Solanaceae) and climax order Asterales (Asteraceae) were also selectively utilized. Both *L. erysimi* and *L. pseudobrassicae* share families like Asteraceae, Chenopodiaceae and Solanaceae.

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