A survey of the Tephritoidea (Insecta: Diptera) of Israel

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Fig. 1. *Otites vitalii* n.sp.

INTRODUCTION AND SCIENTIFIC BACKGROUND

The Tephritoidea is one of the largest and most important superfamilies of the order Diptera (true flies) (Freidberg, 2006). It comprises about 7,000 species in nine families. Six of these families are represented in Israel (Freidberg, 1988): Lonchaeidae, Pallopteridae, Piophilidae, Platystomatidae, Tephritidae and Ulidiidae. Of the other three families, the Pyrgotidae might eventually be found in Israel, whereas the American Richardiidae and the Palaeotropic Ctenostylidae are not expected to be represented in the local fauna.

Bodenheimer (1937) recorded 19 tephritoid species from Palestine (Tephritidae – 13; Lonchaeidae – 3; Ulidiidae – 2; Piophilidae – 1). However, based on more recent literature and AF's personal knowledge, the local fauna probably comprises at least 150 species. The Tephritidae have been monographed for Israel (Freidberg and Kugler, 1989; 85 species), and the

Lonchaeidae of Israel have been partially treated taxonomically (MacGowan and Freidberg, 2009; 12 species). Otherwise, there are almost no published data on the local fauna of this superfamily.

The core and largest family of the superfamily is the Tephritidae or fruit flies, which are also the most important economically. Out of about 4,500 known species, approximately 200 are agricultural pests, with the Mediterranean fruit fly, *Ceratitis capitata* Wiedemann, being one of the most serious pests of fruits in Israel and world-wide. Agricultural pests are also known in some of the related families, especially in the Ulidiidae and Lonchaeidae, although to a lesser extent. Among the local fauna, *Silba adipata* MacAlpine (Lonchaeidae) is especially significant as a pest of figs. Conversely, several species of Tephritidae, including some that occur in Israel, have been used as biocontrol agents against introduced weeds, notably Palaearctic *Urophora* species that infest the flowerheads of thistles recently introduced into North America. *Piophila casei* L., the cheese-skipper (Piophilidae), is occasionally involved in cases of enteric (digestive system) myiasis. It was briefly studied in Israel as part of a study on a related piophilid species (Freidberg, 1981). Since the publication of Freidberg and Kugler's monograph on the Tephritidae of Israel (1989, in the Fauna Palaestina series of the Israel Academy of Sciences and Humanities), about ten additional species of Tephritidae have been discovered in Israel (Freidberg, unpublished data), including at least two serious invasive agricultural pests. However, none of these species have been treated locally in the taxonomic literature, and the local distributions of most of them have not been recorded adequately.

As noted above, the life history of tephritoid flies is quite diverse, with the majority of the local species being phytophagous (all local tephritids and at least some species of the other families except Piophilidae). The Piophilidae appear to have evolved through associations with animals, live or dead, and they are mostly scavengers of small or large dead mammals, sometimes parasites of birds (not known in Israel), or scavengers of plant material. All pyrgotids with known biology are parasitoids of adult scarab beetles, which they usually attack during nocturnal flight. The majority of Platystomatidae and Ulidiidae are thought to be scavengers of plant material, but some Platystomatidae have been recorded to breed in nitrogen nodules of Papilionaceae.

Our project aims at collecting, preserving and studying the tephritoid fauna of Israel focusing on the family Ulidiidae (the M.Sc. project of Elizabeth Morgulis), and also dealing with the Tephritidae and Lonchaeidae. The remaining three families (comprising only about 10% of the total species number) remain the subject for another M.Sc. project. Our aims were stated in the grant proposal as follows:

<u>Short-term aims for the (first) year financed by the ITI</u>

1. A concerted effort of tephritoid collection throughout the entire country, with special attention paid to focal regions and biotopes, using diverse methods.
2. Sorting, identification and curation of the entire collection.
3. Preparation of illustrated keys to all the local taxa.

RESULTS (presented in the same order as the aims)

1. The existing collections of Tephritidae, Lonchaeidae and Ulidiidae were augmented considerably, with the Ulidiidae collection growing the fastest and approximately doubled. This collection now comprises about 7000 specimens belonging to 39 species, 14 of which are undescribed (“new”; Fig. 1; see list in appendix 1).

The Tephritidae collection also grew, including additions of species that are new to the fauna or had been rare in collections. A list of all the species (96) and another, of the species new to the fauna, plus hitherto unpublished host plant associations are also included in Appendix 1.

The Lonchaeidae fauna, with 12 species, was studied, and the results published recently (MacGowan and Freidberg, 2009). However, since then a species of *Lonchaea*, new to Israel, was collected and reared, as part of the current endeavor.

2. The above-mentioned collections have all been sorted, identified (with minor exceptions) and curated, and these collections are probably qualified to the highest grade 7 in the Collection Health Scale of Dr. D. Furth (personal communication).

3. Printed results: Ulidiidae: The taxonomic monograph of the Ulidiidae of Israel was practically completed. The study of the species of *Dorycera* (7), within the M.Sc. work of Hanan Ackerman, was completed several years ago. The study of the remaining 32 species is being completed now within the framework of the M.Sc. thesis of EM. Both works contain illustrated keys to all the species, descriptions of the new species (see Results 1 above) and additional information (e.g. biology). A plate, with examples of several illustrations out of approximately 150 that were prepared by EM, is presented in this report, and a copy of her M.Sc. thesis will be submitted to ITI when ready.

All these results will eventually be incorporated, together with similar data on the remaining three families, into a single large manuscript that will be submitted to the Academy of Sciences as a volume in the Fauna Palaestina series in due time.

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Appendix 1

The Tephritoidea of Israel (excluding Pallopteridae, Piophilidae and Platystomatidae)

Lonchaeidae (13)

1. *Dasiops calvus* Morge
2. *D. latifrons* Meigen
3. *D. mucronatus* Morge
4. *Lamprolonchaea smaragdi* (Walker)
5. *Lonchaea longitarsis* MacGowan and Freidberg
6. *L. tarsata* Fallén
7. *Lonchaea* sp.
8. *Protearomyia graeciana* McAlpine
9. *P. hermonensis* MacGowan and Freidberg
10. *Setisquamalonchaea fumosa* (Egger)
11. *Silba adipata* McAlpine
12. *S. israel* MacGowan and Freidberg
13. *S. viresvens* (Macquart)

Tephritidae (96)

Tephritinae

Ditrichini

Oedaspidina

1. Oedaspis trotteriana Bezzi
2. Oedaspis villeneuvi Bezzi

Myopitini

3. Myopites apicatus Freidberg
4. Myopites cypriacus Hering
5. Myopites stylatus (Fabricius)
6. Myopites variofasciatus Becker
7. Urophora calcitrapae White and Korneyev
8. Urophora hermonis Freidberg
9. Urophora mauritanica Macquart
10. Urophora nigricornis (Hendel)
11. Urophora quadrifasciata (Meigen)
12. Urophora sirunaseva (Hering)
13. Urophora stylata (Fabricius)
14. Urophora dzieduszyckii Frauenfeld
15. Urophora n. sp.

Noeetini

16 Ensina sonchi (Linnaeus)
17 Hypenidium graecum Loew

Schistopterini

18 Schistopterum moebiusi Becker

Tephrellini
19. Aciura coryli (Rossi)
20. Katonaia aida Hering
21. Metasphenisca negeviana (Freidberg)
22. Metasphenisca tetrachaeta (Bezzi)
23. Oxyaciura tibialis (Robineau-Desvoidy)
24. Parasphenisca debskii (Efflatoun)
25. Sphaeniscus filiola (Loew)

Tephritini
26 Acanthiophilus helianthi (Rossi)
27 Campiglossa producta (Loew)
28 Capitites ramulosa (Loew)
29 Dectodesis augur (Frauenfeld)
30 Dioxyna sororcula (Wiedemann)
31 Dioxyna bidentis (Robineau-Desvoidy)
32 Euaresta bullans (Wiedemann)
33 Euarestella iphionae (Efflatoun)
34 Euarestella kugleri Freidberg
35 Euarestella pninae Freidberg
36 Goniurellia lacerata (Becker)
37 Goniurellia longicauda Freidberg
38 Goniurellia persignata Freidberg
39 Goniurellia spinifera Freidberg
40 Goniurellia tridens Hendel
41 Hyalotephritis planiscutellata (Becker)
42 Oxyna nebulosa (Wiedemann)
43 Oxyna superflava Freidberg
44 Spathulina acroleuca (Schiner)
45 Spathulina sicula Rondani
46 Sphenella marginata (Fallén)
47 Tephritis bimaculata Freidberg
48 Tephritis cometa israelis Freidberg
49 Tephritis formosa (Loew)
50 Tephritis hurvitzi Freidberg
51 Tephritis jabeliae Freidberg
52 Tephritis postica (Loew)
53 Tephritis praecox (Loew)
54 Tephritis separata Rondani
55 Tephritis simplex (Loew)
56 Tephritis stictica Loew
57 Tephritis sp.
58 Tephritis sp.
59 Tephritomyia lauta (Loew)
60 Tephritomyia n. sp.
61 Trupanea amoena (Frauenfeld)
62 Trupanea erigeroni Freidberg
63 Trupanea pseudoamoena Freidberg

64 Trupanea stellata (Fuessly)
65 Trupanea tubulata Munro
66 Urelliosoma desertorum (Efflatoun)
67 Urelliosoma pulcherrimum (Efflatoun)

Terelliini
68 Chaetorellia carthami Stackelberg
69 Chaetorellia conjuncta (Becker)
70 Chaetorellia succinea (O. Costa)
71 Chaetostomella cylindrica (Robineau-Desvoidy)
72 Orellia falcata (Scopoli)
73 Terellia colon (Meigen)
74 Terellia fuscicornis (Loew)
75 Terellia gynaecochromata (Hering)
76 Terellia luteola (Wiedemann)
77 Terellia pseudovirens Hering
78 Terellia quadratula (Loew)
79 Terellia serratulae (Linnaeus)
80 Terellia virens (Loew)
81 Terellia n. sp.

Trypetinae

Carpomyini
Carpomyina
82 Carpomya incompleta (Becker)
83 Carpomya schineri (Loew)
84 Goniglossum liat n. sp.
85 Myiopardalis pardalina (Bigot)
86 Rhagoletis sp.

Notommatina
87 Notomma mutilum (Bezzi)

Dacini
Ceratitidina
88 Capparimyia savastani (Martelli)
89 Ceratitis capitata (Wiedemann)
90 Neoceratitis efflatouni (Hendel)

Dacina
91. Bactrocera oleae (Gmelin)
92. Dacus ciliatus Loew
93. Bactrocera zonata (Saunders)

Trypetini
94 Chetostoma curvinerve Rondani

Notrariomyiina
95 Nitrariomyia lukjanovitshi Rohdendorf

Trypetina
96 Euleia heraclei (Linnaeus)

Ulidiidae (39)

1. *Cephalia rufipes* Meigen
2. *Ceroxys confusa* Becker
3. *C. robusta* Loew
4. *C. urticae* Linnaeus
5. *Dorycera inornata* Loew
6. *D. pictipennis* Hennig
7. *D. syriaca* Becker
8. *D.* n. sp. 1
9. *D.* n. sp. 2
10. *D.* n. sp. 3
11. *D.* n. sp. 4
12. *Euxesta pechumani* Curran
13. *Herina aartseni* Merz
14. *H.* n. sp. 1
15. *Melieria nigritarsis* Becker
16. *M. omissa* Meigen
17. *Myennis octopunctata* Coquebert
18. *Otites grata* Loew
19. *O.* n. sp. 1
20. *O.* n. sp. 2
21. *O.* n. sp. 3
22. *Physiphora alceae* Preyssler
23. *P. smaragdina* Loew
24. *Ulidia erythrophthalma* Loew
25. *U. nigripennis* Loew
26. *U. omani* Steyskal
27. *U. ruficeps* Becker
28. *U. wadicola* Steyskal
29. *U.* n. sp. 1
30. *U.* n. sp. 2
31. *U.* n. sp. 3
32. *U.* n. sp. 4
33. *Timia anomala* Becker
34. *T.* ?*berlandi* Séguy
35. *T. jakowlewi* Hendel
36. *T. libani* Gregor
37. *T. xanthaspis* Loew
38. *T.* n. sp. 1
39. *T.* n. sp. 2

Tephritidae – new species and species not yet recorded from Israel

Metasphenisca sp.
Urophora sirunaseva
U. n. sp.
Spathulina acroleuca
Chaetorellia conjuncta
Terellia n. sp.
Rhagoletis sp.
Nitrariomyia lukjanovitsi
Dacus ciliatus
Dacus longistylus
Bactrocera zonata
Bactrocera correcta & verbascifolia

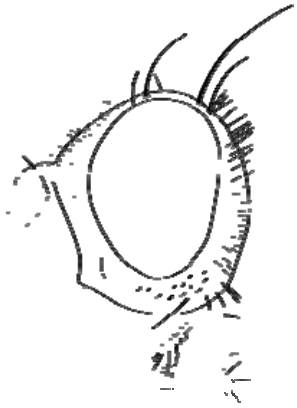
New (unpublished) host associations of Tephritidae in Israel

Family/species	Part infested	Tephritid
Asclepiaceae		
Calotropis procera	FR	?Dacus longistylus
Asteraceae		
Ach. fragrantissima	ST	Oxyna n. sp.
Asteriscus graveolens (Forssk.) Less	FH	Goniurellia longicauda Freidberg
Carduus argenteus L.	FH	Ac. helianthi
	FH	Ter. serratulae
Carthamus spp.	FH	Ter. luteola
Centaurea behen L. var. brachyptera (DC.) Boiss.	FHG	U. n. sp.
Cen. eryngioides Lam	FH	Ter. ?colon Meigen
Cen. solstitialis	FHG?	U. sirunaseva Hering
Cnicus benidictus	FH	Aca. helianthi
Echinops adenocaulos Boiss.	FH	Tephritomyia ?lauta
E. polyceras Boiss.	FH	T. n.sp.?
E. viscosus DC, sbsp. Macrolepis	FH	T. sp.?
Eclipta alba	FH	Spathulina croleuca
Iphiona mucronata	FH	G. tridens Hendel
Picris sp. (Qumran)	FH	Tephritis separate
Soncus maritimus L.	FH	Ensina sonchi (L.)
Serraqtula cerynthifolia (Sm.) Boiss.	FH	Chaetorellia carthami
Silybum marianum (L.) Gaertner	FH	Aca. helianthi
	FH	Terellia fuscicornis
Tanacetum santaloides (reared)	FH	Tephritis jabeliae
Caprifoliaceae		
Lonicera numili	FR	Rhagoletis sp.
Cucurbitaceae		
Various	FR	Dacus ciliatus
Various commercial fruits (citrus)	FR	Bactrocera zonata
?	FR	B. correcta
Limiaceae		
Salvia sp.?	FL	Oxyaciura tibialis (R. D.)
Rosmarinus officinalis	FL	Oxyaciura tibialis (R. D.)
	FL	?Aciura coryli (Rossi)
Stachys aegyptiaca	FL	Paraspheniscus debskii
	FL	Aciura coryli (Rossi)
Stachys palaestina	FL	Aciura coryli (Rossi)
Nitrariaceae		
Nitraria retusa	FR	Nit. lukjanovitsi
Rhamnaceae		
Zizyphus ?mauritiana?	FR	Carpomya incompleta
Rutaceae		
Lemon	FR	Ceratitis capitata

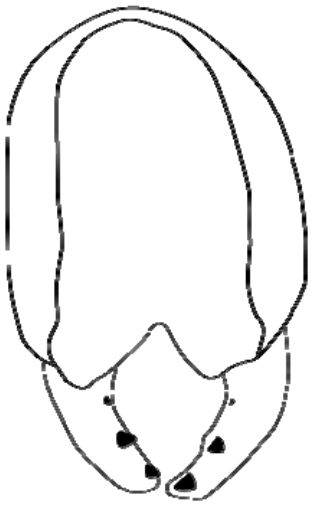
Appendix 2

Ceroxys confusa Becker

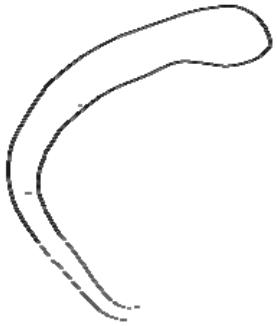
Wing



Head, lateral view



Epandrium



Spermatheca

Aculeus cercal unit

Phallus