

PHYTOPHAGOUS INSECTS ASSOCIATED WITH CYNAREAE HOSTS
(ASTERACEAE) IN JORDAN

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ABSTRACT

This paper lists phytophagous insects collected or reared from Jordanian species of the Cynareae genera *Echinops*, *Atractylis*, *Carduus*, *Cynara*, *Notobasis*, *Onopordum*, *Silybum*, *Carthamus* and *Centaurea*. We summarize the host range and geographic distribution of the insects recorded and compare the average species richness of the fauna of Cynareae heads in Europe and Jordan. **KEY WORDS:** Cynareae, phytophagous fauna, host relationships, species richness.

INTRODUCTION

The Eurasian fauna of the Asteraceae tribe Cynareae has been intensively studied (Batra et al., 1981, Pemberton et al., 1980, Sobhian et al., 1985, Zwolfer, 1965, 1980). The primary object of these studies was to provide candidate insect species for the biological control of Cynareae spp. which have become noxious weeds in North America, Australia, New Zealand and other countries (Schroder, 1980). An outgrowth of these studies was the discovery that thistles and their associated insects could serve as model systems to analyse insect-plant relationships. An interdepartment research project of the University of Bayreuth (SFB 137, "Gesetzmassigkeiten und Steuer- mechanismen des Stoffumsatzes in okologischen Systemen"), financed by the German Research Foundation, enabled us to investigate Jordanian insect-Cynareae complexes, the results of which will be published elsewhere. This paper summarizes the insect-host records gathered by the senior author in Jordan in 1984. We also comment on several weevil and tephritid species encountered in the survey and we compare the Jordanian and the European thistle fauna.

All collection localities are from northern Jordan, the southernmost being South Shuna near the northern end of the Dead Sea. With the exception of this site, all collections were made in the western highlands, predominantly in the Mediterranean climatic region.

The Cynareae species were identified by Dr. A. El Oglah (Irbid University, Jordan). The phytophagous weevil species were determined according to Ter-Minasyan (1978). The remaining insect species were identified according to the reference

collection of Cynareae insects at the Bayreuth University.

This paper is dedicated to Professor Jehoshua Kugler in recognition and appreciation of his scientific work.

PLANT-INSECT RECORDS

SUBTRIBE ECHINOPEAE CASS.

Echinops gaillardotii Boiss

Collected on plant:

Larinus (s.str.) *inaequalicollis* Capiomont (Um Queis, 26.IV.84, Aidun Valley, 25.V.84)

Lixus scolopax Boheman (Um Queis, 26.IV.84)

Bangasternus orientalis Capiomont (Aidun Valley, 25.V.84)

SUBTRIBE CARLINEAE CASS.

Atractylis phaeolensis Pomel

Collected on plant:

Larinus (s.str.) *ursus* Fabricius *bedeli* Reitter (Kufr Anjeh, 10.IV.84; Deir Abu Seid, 12.IV.84)

Atractylis or *Carlina* sp.

Collected on plant:

Larinus (s.str.) *ursus* Fabricius *bedeli* Reitter (Irbid, 21.IV.84)

SUBTRIBE CARDUEAE CASS. – CARDUINAE DUMORT

Carduus argentatus Linnaeus

Collected on plant:

Rhynocyllus cf. *conicus* Fröhlich. (Irbid, 1.IV.84)

Bruchidius sp. (Irbid, 3.IV.84)

Lixus elongatus Goeze (Irbid, 3.IV.84)

Reared from flower heads and collected on plant:

Chaetostomella onotrophes Loew (Irbid, 1.IV.84; 2.IV.84; 22.IV.84; 26.IV.84)

Cynara syriaca Boiss.

Collected on plant:

Lixus scolopax Bohemann (Irbid, 24.V.84)

Notobasis syriaca (L.) Cass.

Collected on plant:

Larinus (*Larinodontes*) *ovaliformis* Capiomont (Ajlun, 29.III.84; Deir Abu Seid, 12.IV.84; Irbid, 22.IV.84)

Lixus scolopax Bohemann (Irbid, 3.IV.84)

Reared from flower head and collected on plant:

Rhynocyllus cf. *conicus* Fröhlich (Ajlun, 29.III.84; Irbid, 3.IV.84; 17.V.84)

Lasioderma sp. (Irbid, 17.V.84)

Chaetostomella onotrophes Loew (Irbid, 3.IV.84; 6.V.84; Deir Abu Seid, 12.IV.84)

Onopordum alexandrinum Boiss.

Reared from flower head:

Larinus (s.str.) *latus* Herbst (Aidun Valley, 25.IV.84)

Onopordum cynarocephalum Boiss.

Collected on plant:

Larinus (s.str.) *latus* Herbst (Um Queis, 30.III.84)

Lixus cardui Oliver (Um Queis, 30.III.84; Ajlun, 10.IV.84)

Agapanthia dahli Richter (Um Queis, 30.III.84)

Reared from flower head and collected on plant:

Tephritis postica Loew (Um Queis, 30.III.84; Ajlun, 10.IV.84; Um Queis, 28.V.84)

Chaetostomella onotrophes Loew (Ajlun, 10.IV.84; Um Queis, 28.V.84)

Homoeosoma sp. (larvae) (Um Queis, 28.V.84)

Onopordum palaestinum Eig.

Collected on plant:

Larinus (s.str.) *latus* Herbst (Irbid, 6.V.84)

Chaetostomella onotrophes Loew (Ibbin, 10.IV.84; Irbid, 26.IV.84; 6.V.84)

Silybum marianum (L.) Gaertn.

Collected on plant:

Rhynocyllus cf. *conicus* Fröhlich (Um Queis, 30.III.84)

Lixus scolopax Bohemann (Um Queis, 24.IV.84)

Reared from flower head:

Lasioderma sp. (Irbid, 24.VI.84)

Pyroderces sp. (pupal cases) (Irbid, 24.VI.84)

SUBTRIBE CARDUEAE CASS. – CENTAUREINAE DUMORT

Carthamus nitidus Bois.

Collected on plant:

Larinus (Larinodontes) cf. grisescens Gyllenhal (Deir Abu Seid, 12.IV.84)

Carthamus persicus Wild.

Collected on plant:

Larinus (Larinomesius) flavescens Germar (El Hamme, 28.V.84)

Reared from flower head:

Lasoiderma sp. (El Hamme, 28.V.84)

Carthamus sp.

Collected on plant:

Larinus (Larinodontes) cf. immitis Gyllenhal (Wadi Kufr Anjeh, 8.V.84)

Bangasternus sp. nr. *araxis* Reitter (Wadi Kufr Anjeh, 8.V.84)

Urophora macrura Loew (Wadi Kufr Anjeh, 8.V.84)

Centaurea iberica Trev.

Collected on plant:

Larinus (Larinomesius) sp. nr. obtusus Gyllenhal (Irbid, 17.V.84; Aidun Valley, 25.V.84)

Bangasternus orientalis Capiomont (Gwelbeh, 8.IV.84)

Bruchidius sp. (Irbid, 24.V.84)

Chaetorellia sp. (? *hexachaeta* Loew) (Irbid, 24.V.84)

Reared from flower head:

Larinus (Larinomesius) sp. nr. obtusus Gyllenhal (Irbid, 24.V.84)

Isocolus sp. (Irbid, 24.V.84)

Urophora sp. nr. *affinis* Frauenfeld (Irbid, 24.V.84; Aidun Valley, 25.V.84)

Acanthophilus helianthi Rossi (Irbid, 24.V.84)

Terellia cf. virens Loew (Irbid, 24.V.84)

Centaurea pallescens Del.

Collected on plant:

Bruchidius sp. (Irbid, 3.IV.84)

Reared from flower head and collected on plant:

Bangasternus orientalis Capiomont (Irbid, 3.IV.84; 24.V.84; Shuna, 12.IV.84)

Isocolus sp. (South Shuna, 12.IV.84)

Urophora sp. nr. *affinis* Frauenfeld (Irbid, 3.IV.84; 26.IV.84; 24.V.84; Um Al Besertine, 10.IV.84)

Acanthophilus helianthi Rossi (Shuna, 12.IV.84; Deir Alla, 8.V.84; Irbid, 24.V.84)

Terellia virens Loew (South Shuna, 12.IV.84)

Chaetorellia sp. nr. *carthami* Stackelberg (South Shuna, 12.IV.84)
Chaetorellia cf. *hexachaeta* Loew (South Shuna, 14.IV.84)

Centaurea verutum L.

Reared from flower head:
Isocolus sp. (Irbid, 24.V.84)

COMMENTS ON SINGLE INSECT SPECIES

COLEOPTERA

CURCULIONIDAE – CLEONINAE

Larinus Germar

This large genus is mainly associated with flower heads of Cynareae. Except for some African species the distribution of *Larinus* is Palearctic. Its center of diversity coincides with the center of diversity of the tribe Cynareae. This information plus the fact that many *Larinus* spp. have evolved morphological adaptations to their Cynareae hosts indicates that this plant taxon has been the platform of the evolutionary radiations of *Larinus*.

Subgenus *Larinus* s. str.

Larinus inaegualicollis Capiomont

According to Ter-Minasyan (1978) this species, which is recorded from “*Echinops pungens*”, occurs in the lower Volga and Caucasus area, southern Kazakhstan, Uzbekistan, Tadzhikistan, Asia minor and Syria. Two closely related *Larinus* spp. (*L. vulpes* Olivier, *L. onopordi* Fabricius) are recorded from *Echinops sphaerocephalus*. *Echinops gaillardotii* is a likely breeding host for *L. inaegualicollis*.

Larinus latus Herbst

L. latus, which is often treated as a subspecies of *Larinus cynareae* Fabricius, is an east-Mediterranean and west-Asian vicariant of *L. cynareae*. Personal breeding records are available from *Onopordum tauricum* and *O. illyricum* in northern Greece. Ter-Minasyan (1978) lists “*Onopordum armena*” and *Cynara* as hosts of *L. latus*. We found that *Onopordum alexandrinum* in Jordan is attacked by this species. Very likely *O. cynarocephalum* and *O. palestinum* are also breeding hosts of this species.

Larinus ursus F. var. *bedeli* Reitter

This is a colour form of *L. ursus* which might have subspecific or even specific rank. Reitter (1924) records this form from Greece, southern Russia and Syria, and restricts the subspecies *L. ursus pseudovittatus* Hoffman to the western Mediterranean.

All forms of *Larinus ursus* are specialized on the Carlineae genera *Carlina* and *Atractylis*. We consider *Atractylis phaeolensis* to be a breeding host of *L. u. bedeli* in Jordan.

Subgenus *Larinodontes*

Weevils in this subgenus seem to restrict their attack to members of the closely related Cynareae subtribes Carduinae and Centaureinae.

Larinus grisescens Gyllenhal

Ter-Minasyan (1978) records this species from southern Europe, Asia minor, Iran and Iraq, without giving hosts. Since we have only field-collected adults it remains doubtful whether *Carthamus nitidus* is a breeding host of *L. grisescens*.

Larinus immitis Gyllenhal

This species is known from Spain, Algeria and the Transcaucasus region. There are no host records in the literature (Ter-Minasyan, 1978). We collected adults on *Carthamus* sp. but did not rear the species from flower heads.

Larinus ovaliformis Capiomont

Ter-Minasyan (1978) gives the distribution of the species as southern European USSR, Caucasus, Syria and Turkey without giving host records. The fact that in Jordan *L. cf. ovalipennis* adults were regularly found on *Notobasis syriaca* but not on other Cynareae suggests that *Notobasis* might be a breeding host of this weevil.

Subgenus *Larinomesius* Reitter

As far as host plants are known, members of this subgenus seem to be almost exclusively associated with Centaureinae spp. (*Carthamus*, *Centaurea*, *Serratula*, *Rhaponticum*)

This species belongs to the *Larinus australis-obtusus-curtus-minutus-canescens*-group which is exclusively associated with *Centaurea* spp. (Zwölfer et al., 1971). It occupies an intermediate position between *australis* Capiomont (southern France, breeding records from *Centaurea nigra*) and *obtusus* Gyllenhal (E. Alps, south eastern Europe, Caucasus, Asia minor, Turkestan, northern Africa, personal breeding records from *Centaurea jacea*, *C. nigrescens*, *C. pseudophrygia*). In Jordan, this species was only associated with *C. iberica*.

Larinus flavescens Germar

This species is widely distributed over southern Europe and northern Africa, where its main breeding host is *Carthamus lanatus* (Zwölfer et al., 1971). There is one personal record from *Centaurea nicaeensis* in southern Italy, and Hoffman (1954) records the species from heads of *Carduncellus*, a genus closely related to *Carthamus*, as a breeding host for the species in Southern France. *Carthamus persicus* may be a larval host plant of *L. flavescens* in Jordan.

Rhinocyllus Germar

This genus is closely related to *Larinus* but attacks only members of the Carduinae. In contrast to *Larinus*, the eggs of *Rhinocyllus* are not introduced into Cynareae heads but glued to the bracts and covered with a protective cap. The larval biology is similar to that of *Larinus*.

Rhinocyllus cf. *conicus* Fröhlich

This species is distributed from western Europe and northern Africa to central Asia where its host range covers the Carduinae genera *Carduus*, *Cirsium*, *Silybum*, *Onopordum*. A number of biotypes of *R. conicus* differ in host preference and their ability to develop in a given host species (Zwölfer & Preiss, 1983). The *Rhinocyllus conicus* biotype associated with *Carduus nutans* has been used as a highly successful biological control agent in North American and New Zealand (Zwölfer & Harris, 1984). Our Jordanian records show that *Notobasis*, a genus closely related to *Carduus* and *Cirsium*, is also a larval host plant of *R. conicus*. It is likely that the Jordanian populations of *R. conicus* breed also in heads of *Carduus argentatus* and *Silybum*.

Bangasternus Gozis

This genus is related to *Rhinocyllus*, having a very similar morphology and biology, but it differs by attacking only Centaureinae hosts. It can be postulated that the common ancestors of *Rhinocyllus* and *Bangasternus* were already associated with Cardueae and that the adaptive radiation of the two ecologically vicariant weevil genera took place after the separation of the Carduinae and the Centaureinae.

Bangasternus orientalis Capiomont

According to Ter-Minasyan (1978) this species is distributed in south-east Europe, Turkey, Caucasus, Armenia, Azerbaijan and Tadzhikistan. Sobhian & Zwölfer (1985) studied *B. orientalis* populations attacking *Centaurea solstitialis* in Greece and suggested the use of the weevil as a biocontrol agent of *C. solstitialis* in California. The only other published host records are *C. iberica* and safflower (Ter-Minasyan, 1978). According to screening tests made by Sobhian & Zwölfer (1985) safflower is obviously not a breeding host of *B. orientalis*. Our Jordanian records from *C. pallescens* are new but fit well into the general host pattern, as *C. solstitialis*, *C. iberica* and *C. pallescens* are very closely related.

Bangasternus sp. nr *araxis* Reitter

This species, which was caught on *Carthamus* sp. in Jordan belongs to the *B. planifrons* Brullé – *araxis* Reitter – group. Personal records of *B. planifrons* (Greece) are from *Carthamus lanatus*, thus this species may breed in Jordan. The host plants of *B. araxis*, a species distributed in central Asia (Ter-Minasyan, 1978), are unknown.

Lixus Fabricius

Together with *Larinus*, *Rhinocyllus* and *Bangasternus* this genus forms the tribe Lixini. *Lixus* spp., however, are developing in the stems of herbaceous plants. Members

of the subgenus *Lixochelus* Reitter which are mainly associated with Cynareae plants, were encountered during this survey.

Lixus (Lixochelus) cardui Oliver

Although this is mainly a Mediterranean species, it has been found in the southern parts of central and eastern Europe and in the Caucasus. All personal rearings records are from *Onopordum* (*O. acanthium*, *O. tauricum*, *O. illyricum*). In Jordan, we have only observed the adults on *Onopordum cynarocephalum*, which doubtlessly serves as breeding host.

Lixus (Lixochelus) elongatus Goeze

The species is distributed over central and southern Europe, Algeria, and parts of western and central Asia (Ter-Minasyan, 1978). Personal breeding records (Zwölfer, 1965) indicate that a broad range of *Carduus* and *Cirsium* species serve as host plants. Our survey suggests that larvae of this species develop in the stems of *Carduus argentatus* and *Notobasis syriaca* in Jordan.

Lixus (Lixochelus) cf. scolopax Bohemann

Ter-Minasyan (1978) records *L. scolopax* from the Mediterranean region, southern and south-eastern Europe and the Caucasus as living "on various compositaceous plants". We found adults on several Cynareae genera (*Echinops*, *Silybum*, *Cynara*, *Notobasis*) in Jordan but nothing definite can be said about the larval host plants of this species.

CERAMBYCIDAE

Agapanthia sp. nr. *dahli* Richter

A. dahli adults are common on a broad range of Cynareae species in the Mediterranean region and in the southern parts of central Europe. The insect is not host specific as the larvae develop within the stems of various Compositae.

BRUCHIDAE

Bruchidius spp.

Adults of *Bruchidius* spp., which have not been identified, were found on flower heads of *Centaurea pallescens* and *Carduus argentatus* in Jordan. *Bruchidius* spp. that have been reared from the heads of *Centaurea* and *Carduus* in Mediterranean Europe are not identical to the specimens from Jordan.

ANOBIIDAE

Lasioderma spp.

Several species of *Lasioderma* attack mature flower heads of Cardueae in Mediterranean Europe. In Jordan we found the larvae of a presently unidentified species in heads of *Notobasis syriaca*, *Silybum marianum* and *Carthamus persicus*, and adults were reared from *S. marianum*.

LEPIDOPTERA

The lepidopterous fauna of the flower heads of Cynareae from Jordan was astonishingly poor, and only two genera were found. Heads of *Silybum marianum* were attacked by *Pyroderces* sp. (Morphidae) which may be the polyphagous species *P. argyrogrammos* Zeller (Zwölfer, 1965). Larvae of *Homoeosoma* sp. (Pyalidae) were found in the heads of *Onopordum cynarocephalum*. *Homoeosoma* species are common, non host specific inhabitants of Cardueae flower heads in Europe.

DIPTERA

TEPHRITIDAE

Urophora Meigen

This large genus is exclusively associated with Cynareae, particularly the subtribes Carduinae and Centaureinae. The great majority of the species develop in distinct galls formed in the receptacle or the ovarioles of the flower heads. Two species were found in Jordan.

Urophora macrura Loew

The species is widely distributed in the Mediterranean region and west Asia. All personal records (Zwölfer, unpublished) are from *Carthamus lanatus* (Tunisia, Spain, southern France, Greece, Iran). Freidberg (1974) swept *U. macrura* in Israel (Mt. Hermon) from *Carthamus glaucus*. In Jordan we bred the species from *Carthamus persicus* and collected adults on *Carthamus* sp.. *U. macrura* seems to be host specific on the Centaureinae genus *Carthamus* where it forms multilocular galls in flower heads.

Urophora sp. nr. *affinis* Frauenfeld

Our material from Jordan keys to *U. affinis* but the specimens are distinctly larger than European *U. affinis* bred from *Centaurea maculosa* or *C. diffusa*. The distribution of *U. affinis* ranges from western Europe and northern Africa to Afghanistan. *U. affinis* populations from *Centaurea maculosa* and *C. diffusa* have been introduced into North America where they have become effective biocontrol agents of the introduced knapweed (Harris, 1980). In Europe, the host pattern of *U. affinis* largely coincides with the *Centaurea maculosa-diffusa*-group, but Freidberg (1974) bred the species from flower heads of *Centaurea iberica* in Israel. In Jordan, *U. sp. nr. affinis* adults were collected on several Cynareae genera, but larvae were only found in galls in the flower heads of *Centaurea iberica* and *C. pallescens*. They were heavily parasitized by *Eurytoma tibialis* Bohemann, *Eurytoma robusta* Mayr and *Torymus* sp. (Chalcidoidea).

Chaetorellia Hendel

This genus is badly in need of revision. Available host records suggest that

Chaetorellia spp. are restricted to species of Centaureinae.

Chaetorellia cf. *hexachaeta* Loew

This species is similar to, and often has been confused with, *C. jaceae* Robineau-Desvoidy. Females of the latter species, however, have a much longer ov scape. Characteristic host plants of this species are *Centaurea* spp. of the *maculosa-diffusa-paniculata* group, as well as *C. solstitialis* (Sobhian & Zwölfer, 1985). In Jordan, we reared specimens very similar to *C. hexachaeta* from heads of *Centaurea pallescens* and *C. iberica*, two species closely related to *C. solstitialis*.

Chaetorellia cf. *carthami* Stackelberg

C. carthami is a well known pest of safflower (*Carthamus tinctorius*) in western Asia. Morphologically very similar specimens have been bred from *Centaurea solstitialis* heads in southern Italy and Greece (Sobhian & Zwölfer, 1985). Adults closely resembling those obtained from *C. solstitialis* were reared from heads of *C. pallescens* in Jordan.

Terellia virens Loew

The species ranges from western Europe and northern Africa to Kazakhstan and Afghanistan (Leclercq, 1967). In central Europe it is exclusively associated with *Centaurea maculosa* but we have reared it from the heads of *Centaurea calcitrapa*, *C. aspera*, *C. melitensis*, *C. coerulescens*, *C. nicaeensis*, *C. solstitialis*, *C. paniculata* and *C. diffusa* collected in the Mediterranean region. Freidberg (1974) obtained it from heads of *Centaurea iberica* in Israel. In Jordan, we reared it from *Centaurea pallescens*.

Chaetostomella onotrophes Loew (= *cylindrica* Robineau-Desvoidy)

This widespread species occurs, over much of Europe, as well as Algeria, Asia Minor, the Caucasus and Afghanistan (Leclercq, 1967). In Europe we have reared it from heads of numerous *Cirsium* spp. and *Carduus* spp. and also from three *Centaurea* spp., *Microlonchus* sp. and *Serratula* sp. However, we never obtained it from *Onopordum* spp. In Israel, Freidberg (1974) bred the species from *Onopordum floccosum* and *Cousinia hermonis*. Our Jordanian rearing records are from *Onopordum cynarocephalum*, *Notobasis syriaca* and *Carduus argentatus*. Thus, *C. onotrophes* has a broad host range within the Cardueae showing regional differences in host preference.

Tephritis postica Loew

The general distribution of this species covers central and southern Europe, the Caucasus, Asia minor, Kazakhstan, Iran and parts of North Africa (Hendel, 1927). Freidberg (1974) records it from Mt. Hermon (Israel). Personal breeding records are available from *Onopordum acanthium*, *O. tauricum* and *O. illyricum*. In Jordan another member of this plant genus, *O. cynarocephalum*, was a breeding host.

Acanthiophilus helianthi Rossi

The species occurs in Europe (north to Austria and Switzerland), northern Africa, Asia minor, western and central Asia. It is by far the most polyphagous tephritid associated with Cynareae. Breeding records (Zwölfer, unpublished) are available for *Carduus*, *Cirsium*, *Onopordum*, *Serratula*, *Centaurea* (14 species!),

Crupina, *Carthamus*, *Xeranthemum* and *Carlina*. Freidberg (1974) reared the species at Mt. Hermon (Israel) from heads of *Centaurea iberica*. In Jordan, we obtained it from the same species and also from *C. palleescens*.

HYMENOPTERA

CYNIPIDAE

Isocolus sp.

In their morphology and biology the Jordanian specimens of *Isocolus* resemble *I. jacea* Schrank. *Isocolus* larvae inhabit largely inflated *Centaurea* achenes which are transformed into galls. In Jordan, we bred *Isocolus* adults and their Chalcidoid parasites (*Monobaeus* cf. *gratiosus* Foerster, *Ormyrus* sp., both Ormyridae) from the heads of *Centaurea palleescens*, *C. iberica* and *C. verutum*.

DISCUSSION

The relatively small number of Cynareae samples from Jordan allow us to come to some tentative conclusions which are given below.

1. Similar trends in insect species richness were observed in the European and Jordanian members of the Cynareae (Table 1).

TABLE 1. AVERAGE SPECIES RICHNESS (PHYTOPHAGOUS INHABITANTS OF FLOWER HEADS) OF CYNAREAE GENERA IN EUROPE AND JORDAN.

Host genus	No. host spp. investigated		average phytophages spp/host sp.	
	Europe	Jordan	Europe	Jordan
<i>Echinops</i>	2	1	3.5	1
<i>Carlina</i> + <i>Atractylis</i>	4	2	5.75	1
<i>Carduus</i>	10	1	8.7	3
<i>Onopordum</i>	3	3	8.7	2.3
<i>Silybum</i>	1	1	8.0	3
<i>Carthamus</i>	2	2	14.5	2.3
<i>Centaurea</i>	7	3	17.7	5.7

The European values are from unpublished data of Zwölfer, the preliminary estimates for Jordan are based on the 1984 survey.

Table 1 shows that the Cynareae genera *Echinops*, *Carlina* and *Atractylis* are exploited by a few species, the genera *Carduus*, *Onopordum* and *Silybum* have an intermediate richness of phytophagous species, and *Centaurea* is attacked by the highest number of phytophages.

2. The general structure of the guild of insects exploiting Cynareae flower heads is similar in Europe and in Jordan: There are species such as *Urophora* and *Isocolus* which form structural galls in the receptacle and the ovarioles of the head; there are genera which induce callus growth in the receptacle (*Rhinocyllus*, *Tephritis*); and there are achene feeders such as *Chaetorellia*, *Terellia*, *Chaetostomella*. With regard to the host range, specialists and species with a relatively broad host spectrum (e.g. *Acanthiophilus*) occur in Europe as well as in Jordan.

3. Concerning the taxonomic position of the flower head guild, weevils (*Larinus*, *Rhinocyllus*, *Bangasternus*) are much more dominant and more diversified in Jordan than in most regions of Europe. Tephritids, on the other hand, seem to be less represented in the Jordanian Cynareae fauna.

4. Specialized Cynareae insects (e.g. *Larinus ursus*, *Larinus obtusus*, *Urophora macrura*, *Tephritis postica*, *Terellia virens*) exhibit similar host associations in Europe and in Jordan. The euryphagous tephritid *Chaetostomella onotrophes*, however, shows geographic variation in its host range.

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REFERENCES

- Batra, S.W.T., Coulson, J.R., Dunn, P.H. and P.E. Boldt. 1981. Insects and fungi associated with *Carduus* thistles (Compositae). United States Department of Agriculture, Technical Bulletin 1616, Washington, 100p.
- Freidberg, A. 1974. Tephritidae (Diptera) from Mt. Hermon. *Israel Journal of Entomology* 9:133-139.
- Harris, P. 1980. Effects of *Urophora affinis* Frfld. and *U. quadrifasciata* (Meig.) (Diptera: Tephritidae) on *Centaurea diffusa* Lam. and *C. maculosa* Lam. (Compositae). *Zeitschrift für angewandte Entomologie* 90:190-210.
- Hendel, F. 1927. Trypetidae. In: Die Fliegen der Palaearktischen Region. Nr. 49 E. Lindner Ed. (Stuttgart), 221 pp.
- Hoffman, A. 1954. Coléoptères Curculionides, 2e partie. In: Faune de France, Vol. 59, Paris, p. 487-1208.
- Leclercq, M. 1967. Contribution à l'étude des Trypetidae (Diptera) paléarctiques et leurs relations avec les végétaux. *Bulletin de Recherches Agronomiques de Gembloux*. 2:64-105.
- Pemberton, W. and E.M. Hoover. 1980. Insects associated with wild plants in Europe and the Middle East. Biological control of weeds surveys. United States Department of Agriculture, Miscellaneous Publications 1382, Washington. 33pp.
- Reitter, E. 1924. Die *Larinus*-Arten der Untergruppen *Larinus* s. str., *Larinorhynchus*, *Larinomesius* und *Eustenopus* aus Europa und den angrenzenden Gebieten. *Wiener entomologische Zeitung* 41:61-77.

- Schröder, D. 1980. The biological control of thistles. *Biocontrol news and information (Commonwealth Agricultural Bureaux)* 1:9-26.
- Sobhian, R. and Zwölfer. 1985. Phytophagous insect species associated with flower heads of yellow star thistles (*Centaurea solstitialis* L.). *Zeitschrift für angewandte Entomologie* 99:301-321.
- Ter-Minasyan, M.E. 1978. Weevils of the subfamily Cleoninae in the Fauna of the USSR. Tribe Lixini. Amerind Publishing Company, New Delhi. 166 pp.
- Zwölfer, H. 1965. Preliminary list of phytophagous insects attacking wild Cynarea (Compositae) in Europe. *Technical Bulletin, Commonwealth Institute of Biological Control* 6:81-154.
- Zwölfer, H. 1980. Distelblütenköpfe als ökologische Kleinsysteme: Konkurrenz und Koexistenz in Phytophagenkomplexen. *Mitteilungen der Deutschen Gesellschaft für allgemeine und angewandte Entomologie* 2:21-37.
- Zwölfer, H., Frick, K. and L.A. Andres. 1972. A study of the host plant relationships of European members of the genus *Larinus* (Col. Curculionidae). *Technical Bulletin, Commonwealth Institute of Biological Control* 1:9-26.
- Zwölfer, H. and P. Harris. 1984. Biology and host specificity of *Rhinocyllus conicus* Fröl. (Col. Curculionidae), a successful agent for biocontrol of the thistle *Carduus nutans* L. *Zeitschrift für angewandte Entomologie* 97:36-62.
- Zwölfer, H. and M. Preiss. 1983. Host selection and oviposition behaviour in west-European ecotypes of *Rhinocyllus conicus* Fröl. (Col. Curculionidae). *Zeitschrift für angewandte Entomologie* 95:113-122.