

## **An Annotated List of the Coccinellidae (Coleoptera) of Israel and Adjacent Areas**

J. Halperin,<sup>1</sup> O. Merkl<sup>2</sup> and M. Kehat<sup>1</sup>

Seventy-one species of Coccinellidae, their commonness and distribution in Israel and adjacent areas, are listed; 19 of the species are recorded here for the first time. Species expected to occur in Israel but not found in the present studies, probable misidentifications, and introduced species are listed separately.

**KEY WORDS:** Coccinellidae, Coleoptera; new records, Israel.

### **INTRODUCTION**

Most of the Coccinellidae are predators, feeding during larval and adult stages on aphids, scale insects, whiteflies, mites and occasionally on eggs and young larvae of Lepidoptera, Coleoptera and other insects; some are mass-reared and applied in biological control.

Coccinellids have been extensively studied in Israel, with research reported on faunistics (11,14,20,21,24,31,35,47,57), biology, phenology and ecology (1,2,12,28,29,32,33,36,39,43,44), feeding behavior (34,45), food consumption and economic value (13,47,58), natural enemies (59), mass rearing (41), introduction and biological control (3-5,10,26,46,49,50,52-54), effects of insecticides (7,8,37), and sundry (16,25,42,51,55).

The first list of Coccinellidae of Israel was compiled by Bodenheimer (11), who mentioned 37 species. Seven of these were not found by us in the present study; it is therefore assumed that some were included erroneously and others were misidentifications (see Table 2). Subsequently, 22 additional species were recorded by Rivnay and Perzelan (47), Bytinski-Salz (14), Mader (38), Kehat (31), Kehat and Greenberg (35), Fürsch (17-21), Fürsch and Kreissl (22), Iablokoff-Khnzorian (30) and Rubin (49).

The objective of the present paper is to summarize the published information on the species of Coccinellidae in Israel and to provide additional data on new records, based on the collections of the first and the third authors, with emphasis on the regional distribution of the species, their commonness and seasonal occurrence. Thus, this paper is

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<sup>1</sup> Dept. of Entomology, ARO, The Volcani Center, Bet Dagan 50250, Israel [Fax: +972-3-960-4180].

<sup>2</sup> Dept. of Zoology, Hungarian Natural History Museum, 1088 Budapest, Hungary [Fax: +36-1-113-8820].

based on the previous publications as well as on the following collections: (a) material gathered by the first author (J.H.) as part of the entomofaunistic survey of natural and planted woody vegetation (except for fruit orchards) in Israel and some adjacent areas; (b) material collected by the third author (M.K.), mostly in cotton fields, and citrus and date palm groves; (c) the National Entomological Collections at the Zoological Museum of Tel-Aviv University; (d) the Entomological Collections of the Dept. of Entomology, The Volcani Center, Bet Dagan; and (e) some specimens deposited at the Hungarian Museum of Natural History, Budapest.

The material was identified, or re-identified, by the second author (O.M.) and by Dr. Helmut Fürsch (Ruderting, Germany).

The collections made by Halperin and Kehat will be deposited in the National Entomological Collections at Tel-Aviv University.

## RESULTS AND DISCUSSION

Table 1 provides an annotated list of species collected or checked by the present authors. The data presented are: (a) subfamilies in systematical order and species arranged alphabetically; (b) regional distribution in Israel and some adjacent areas (regions are numbered in accordance with Fig. 1); (c) commonness: *cc* – very common (more than 100 records), *c* – common (25-99 records), *r* – rare (7-24 records), *rr* – very rare (1-6 records checked); (d) months of collection of the adults (Roman numerals); and (e) references. The species recorded herein from this area for the first time are marked with an asterisk.

Altogether 71 species of Coccinellidae, belonging to six sub-families, are recorded. Almost half of the species belong to the small-sized Scymninae, and approximately 20% to the larger Coccinellinae. Most common are four species of the former (*Scymnus subvillosus*, *S. flavicollis*, *S. levaillanti* and *S. pallipediformis*) and six species of the latter (*Cheilomenes propinqua*, *Coccinella septempunctata*, *C. undecimpunctata*, *Hippodamia variegata*, *Oenopia conglobata* and *Propylea quatuordecimpunctata*). These ten species, along with *Rodolia cardinalis* and *Chilocorus bipustulatus*, are among the most important natural enemies of insect pests, mostly Coccoidea and Aphidoidea, in Israel.

The 19 species first recorded from Israel and adjacent areas belong to six subfamilies. Ten of the species are Scymninae, some very similar and difficult to identify, for instance, *Nephus merkli* was described by Fürsch (21) from material previously identified as *N. quadrimaculatus* (31,35).

Coccinellidae occur mainly in the northern and central parts of the country. Some Coccinellinae (such as *C. septempunctata*, *C. undecimpunctata* and *H. variegata*) were found in all regions; *Bulaea lichatschovi* was found only in central and southern Israel, and *Oenopia oncina* only on Mt. Hermon and in Sinai. Some species were found only in the north and others in the south, but because of their rarity their distribution in Israel requires further investigation.

The most common species were recorded in all seasons of the year. As the intensity of our survey in some years was high in the spring, moderate in the autumn, and low in mid-summer and mid-winter, the data presented in Table 1 do not reflect, in the case of rare and very rare species, their actual seasonal activity.

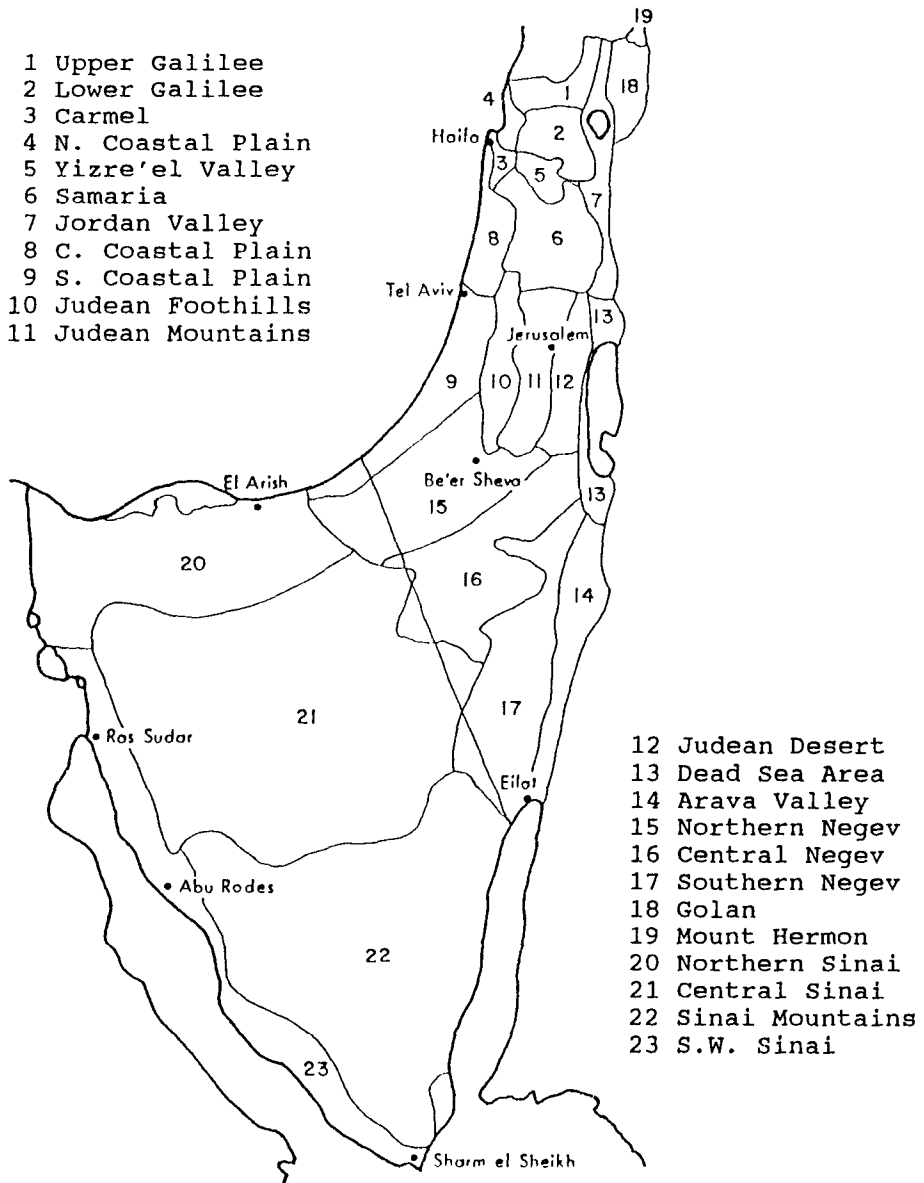


FIG. 1. The *Fauna Palestina Committee* map of Israel and nearby areas.

TABLE 1. Annotated list of Coccinellidae of Israel and adjacent areas

Subfamilies and species	Occurrences (see Fig. 1)	Common- ness	Months of collection	References
<b>Coccinellinae</b>				
<i>Adalia (Adalia) decempunctata</i> (L.)	1-6,8-12,19	<i>c</i>	II-VIII	13,31,35
* <i>Anisosticta novemdecimpunctata</i> (L.)	1,9	<i>rr</i>	IV,VI	
<i>Bulaea lichatschovi albiventris</i> (Fürsch)	6,7,12-17	<i>c</i>	III-VI,IX,XI	11,20,27
<i>Cheilomenes propinqua nilotica</i> Mulsant	3-5,8,13	<i>cc</i>	IV-IX,XII	35
<i>Coccinella (Coccinella) septempunctata</i> L.	1-21	<i>cc</i>	III-XI	6,9,12,31,35
<i>C. (Neococcinella) undecimpunctata</i> L.	1-21	<i>cc</i>	II-IX,XII	6,11,28,31,35
* <i>Coccinula quatuordecimpustulata</i> (L.)	1,18,19	<i>r</i>	IV-X	
* <i>C. sinuatmarginata</i> (Faldermann)	18,19	<i>rr</i>	VI-IX	
* <i>Harmonia quadripunctata</i> (Pontoppidan)	1,3,10	<i>rr</i>	III-V, VIII, XI	
<i>Hippodamia (Adonia) variegata</i> (Goeze)	1-21	<i>cc</i>	I-XII <sup>(1)</sup>	11,31,35
<i>Oenopia conglobata</i> (L.)	1-13,18,19	<i>cc</i>	II-XI	11,13,31,35
<i>O. oncina</i> (Olivier)	19,21,22	<i>r</i>	I-X	11
<i>Propylea quatuordecimpunctata</i> (L.)	1-6,8-10	<i>cc</i>	X-XII	18,31,36
<i>Psyllobora bisoetona</i> (Mulsant)	7-9,1,13	<i>r</i>	I-XI	11,27
<b>Epilachninae</b>				
* <i>Henosepilachna argus</i> (Fourcroy)	1-6,8,9	<i>r</i>	I-VII,X	
<i>Henosepilachna elaterii</i> (Rossi) (= <i>Epilachna chrysomelina</i> (F.))	1-13,15,20	<i>c</i>	II-X	6,9,11,39
<b>Coccidulinae</b>				
<i>Lithophilus cribratellus</i> Fairmaire <sup>(2)</sup>	3	<i>rr</i>		11,38
<i>L. grandis</i> Pic	13	<i>rr</i>		38
<i>L. marginatus</i> Reitter	8-11,18	<i>rr</i>	I,III-VI	11,38,46
<i>L. ovipennis</i> Crotch	3,8-10,20,21	<i>rr</i>	III	11,38
* <i>Rhyzobius chrysomeloides</i> (Herbst)	18	<i>rr</i>	II	
* <i>R. litura</i> (F.)	5,6,8,9,18,19	<i>r</i>	I-V, VII	
<i>R. lophantae</i> Blaisdell <sup>(3)</sup>	5-10,13,15,16	<i>c</i>	II-VII	18,31,35
<i>Rodolia cardinalis</i> (Mulsant) <sup>(3)</sup>	1,8-11,15,18	<i>cc</i>	I-VII,X-XII	6,9,10,31,35
<b>Chilocorinae</b>				
<i>Chilocorus bipustulatus</i> (L.)	1-11,13,15,16	<i>c</i>	II-XI	1,29,33,36,41, 42, 44,45,48,58,59
<i>Exochomus nigripennis</i> (Erichson)	6,13-16,21	<i>rr</i>	III-X	14
<i>E. nigromaculatus</i> Goeze <sup>(4)</sup>	1-15,18	<i>c</i>	II,V-XII	6,11,13,27,31,35
<i>E. pubescens</i> Küster	4,7,11-16,21	<i>c</i>	II-XII	11,18
<i>E. quadripustulatus</i> (L.)	1-4,6,8,9,18	<i>c</i>	I-XI	27,31,35
<i>E. undulatus</i> Weise	21,22	<i>rr</i>	VII	38
<i>Platynaspis luteorubra</i> (Goeze)	1-6,8-11,18	<i>r</i>	II,V-IX	11,18,27,31
<b>Sticholotidinae</b>				
* <i>Coelopterus salinus</i> Mulsant	15	<i>rr</i>	V	
* <i>Pharoscyrnus fleischeri</i> (Weise)	2,7,13-15	<i>c</i>	IV-VIII,X	
<i>P. numidicus</i> (Pic)	5,7,13,14	<i>c</i>	IV-VIII	18,31-34
<i>P. ovoideus</i> Sicard	13,15	<i>r</i>	V,X	31,33
<i>P. pharoides</i> (Marseul)	1-11,15,16,18	<i>cc</i>	II-VIII,X	2,11,31,33,35
<i>P. setulosus</i> (Chevrolat)	7,13,14	<i>r</i>	VI-VIII	18,31,33

*cc* – very common (>100 records); *c* – common (25–99 records); *r* – rare (7–24 records); *rr* – very rare (1–6 records checked).

TABLE 1. (continued)

Subfamilies and species	Occurrences (see Fig. 1)	Common- ness	Months of collection	References
<b>Scymninae</b>				
* <i>Clitostethus arcuatus</i> (Rossi) <sup>(5)</sup>	1,7,8	c	IX,X	
<i>Cryptolaemus montrouzieri</i> Mulsant <sup>(3)</sup>		r		6,26,46,54,57
<i>Hyperaspis guttulata</i> Fairmaire	21	rr	VI,VII,X	9
<i>H. polita</i> Weise	2-10,12-16	c	IV-X	30,31,46
<i>H. reppensis quadrimaculata</i> Redtenbacher	9,11,19	c	III-VI	11,15
<i>H. syriaca</i> Weise	1,6-12,18	c	III-XI	30
<i>Nephus (Bipunctatus) includens</i> Kirsch	1,2,4,7-13,18	r	III,VI-XII	47
<i>N. (B.) kiesewetteri</i> (Mulsant)	13,21,22	rr	III-VIII,XII	11
<i>N. (B.) nigricans</i> (Weise)	7	rr	V-VIII	18
<i>N. (Diomus) anemicus</i> Fürsch	6,7	r	VI	
<i>N. (D.) rubidus</i> (Motschulsky)	7,10	rr	X	50
<i>N. (Geminosopho) fenestratus</i> (J. Sahlberg)	1-11,15,18	c	III-XI	6,11,47
* <i>N. (Nephus) ludyi</i> (Weise)	19	rr	VI-VIII	
<i>N.(N.) merkli</i> Fürsch <sup>(6)</sup>	4,6-9	r	IV-VI,IX-XI	21
<i>N. (N.) quadrimaculatus pictus</i> (Ggib.) <sup>(6)</sup>	1-11,18,19	c	IV-XII	11,23,27,31,35,47
* <i>N. (Sidis) biflammulatus</i> (Motschulsky)	6	rr	VIII	
<i>N. (S.) hiekei riyadensis</i> Fürsch	2,5,7-10,13,15	c	II,III,VI-X	18,19
* <i>N.S. macilentus</i> Stenius	6	rr	V,VI,VIII	
* <i>Scymnus (Mimopullus) flagellisiphonatus</i> Fürsch <sup>(7)</sup>	7-11,15,16	c	V-VIII,XI	
<i>S. (M.) mediterraneus</i> Khnzorian <sup>(7)</sup> (= <i>S. pallidivestis</i> Mulsant)	5-8	r	VI	31,35
<i>S. (Pullus) araraticus</i> Khnzorian	1-11,15,18	r	VI-XI	18,19
* <i>S. (P.) auritus</i> (Thunberg)	19	rr	VIII	
* <i>S. (P.) belophallus</i> Capra	13	rr	VII	
* <i>S. (P.) fraxini</i> (Mulsant)	1,7,18,19	r	V-VIII	
<i>S. (P.) subvillosus</i> (Goeze)	1-19	cc	II-XII	11,27,31,35
<i>S. (P.) syriacus</i> (Marseul)	1-11,15,18	c	III-XII	9,11,18,27
<i>S. (Scymnus) apetzi</i> Mulsant	1-13,18,19	c	III-XI	11,31,35,47
<i>S. (S.) bivulnerus</i> Capra et Fürsch	3	rr	?	22
<i>S. (S.) flavicollis</i> Redtenbacher	1-13,16,18	cc	III-XII	11,22
<i>S. (S.) levaillanti</i> (Mulsant) <sup>(8)</sup>	1,16,18	cc	I-X	6,11,27,47
* <i>S. (S.) mimulus</i> Capra et Fürsch	9	rr	V	
<i>S. (S.) pallipediformis</i> Günther <sup>(9)</sup>	1-13	cc	III-XII	11,27,31,35
<i>S. (S.) quadriguttatus</i> Fürsch et Kressl	3	rr	?	22
<i>Stethorus gilvifrons</i> (Mulsant) <sup>(10)</sup>	1-15	c	I,II,V-IX,XII	11,31,35,43

(1) VIII on Mt. Hermon and in Sinai. (2) As *L. latus* Reitter. (3) Introduced species; *C. montrouzieri* is still recolonized in citrus orchards. (4) As *E. flavipes* Thunberg. (5) It was very rare until the 1970s; its populations increased after *Dialeurodes citri* was accidentally introduced. In 1989, beetles shipped from Sicily and Germany were released in some infested orchards (3). (6) The two species are very similar; therefore the exact distributions of both need further investigation. (7) The two species are similar and might be confused. (8) As *S. suturalis* (Thunberg) (6,11,47). (9) As *S. quadrivulneratus* Mulsant (11), and as *S. frontalis* F. (27,31,35). (10) As *S. punctillum* Weise (11,31,43).

TABLE 2. Records of Coccinellidae requiring qualification

Record	Probable identification	References
<i>Adalia (Adalia) bipunctata</i> (L.)	Occurrence possible	11
<i>Bulaea lichatschovi pallida</i> Motschulsky	<i>B.l. albiventris</i> (Fürsch)	11
<i>Cheilomenes vicina</i> Mulsant	<i>C. propinqua nilotica</i> (Mulsant)	35
<i>Synharmonia (Oenopia) lyncea</i> (Ol.)	? <i>Propylaea 14-punctata</i> (L.)	11
<i>Psyllobora vigintiduopunctata</i> (L.)	<i>P. bisoetonata</i> Mulsant	38
<i>Lithophilus graecus</i> Reitter	Occurrence possible	11
<i>Lithophilus latus</i> Reitter	? <i>L. ciribratellus</i> Fairmaire	11,38
<i>Novius (=Rodolia) cruentatus</i> Mulsant	Occurrence possible	11
<i>Exochomus flavipes</i> Thunberg	? <i>E. nigromaculatus</i> Goeze	6,11,13,27,31,35
<i>E. melanocephalus</i> (Zoubkoff)	<i>E. pubescens</i> Küster	11
<i>Hyperaspis pumila</i> Mulsant	? <i>H. polita</i> Weise	9,11,47
<i>H. reppensis</i> Herbst	<i>H.r. quadrimaculata</i> Redtenbacher	11
<i>Nephus bipunctatus bipunctatus</i> Kugelann	<i>N. fenestratus</i> (J. Sahlberg)	27,31,35
<i>Scymnus apetzoides</i> Capra et Fürsch	? <i>S. pallipediformis</i> Günther	18
<i>S. argutus</i> (Mulsant)	? <i>S. (Pullus) syriacus</i> (Marseul)	11
<i>S. clarus</i> Weise	? <i>nomen nudum</i>	11,46
<i>S. frontalis</i> (F.)	? <i>S. pallipediformis</i> Günther	27,31,35
= <i>S. quadrivulneratus</i> Mulsant		11
<i>S. (Scymnus) interruptus</i> Goeze	Occurrence possible	31,35
<i>S. quadrimaculatus</i> Herbst	<i>Nephus 4-maculatus pictus</i> (Gglb.)	6,11,31,35
<i>S. suturalis</i> (Thunberg)	<i>Scymnus (S.) levaillanti</i> Mulsant	6,11,46,47
<i>Stethorus punctillum</i> Weise	<i>Stethorus gilvifrons</i> (Mulsant)	6,11,18,31,43,46

The common and very common species were found, in general, on a broad range of plant families, with the exception of *Hyperaspis syriaca*, which was found mostly on *Vitex agnus-castus* (Verbenaceae). Among the rare and very rare species, *Coelopterus salinus* was found on *Thymelaea hirsuta* (Thymelaeaceae), and *Nephus kiesenwetteri* on *Tamarix* spp. (Tamaricaceae). *Henosepilachna elaterii*, a plant feeder, is associated with Cucurbitaceae; it is noxious because it feeds on cucumber, melon and watermelon and is a vector of the squash mosaic virus (16). *Psyllobora bisoetonata* feeds on mildews.

The most investigated species in Israel was *Chilocorus bipustulatus* (see Table 1).

Table 2 lists 21 species recorded by various authors and not included in Table 1. Some of them, such as *Adalia bipunctata*, *Lithophilus graecus* and *Novius cruentatus*, being known from neighboring countries, are likely to occur here; the others probably do not occur in Israel and might therefore have been identified incorrectly. The identity of *Scymnus interruptus* remains obscure, since it is not clear with which species it has been confused: *Scymnus clarus* is presumably a *nomen nudum*.

At least 20 species of Coccinellidae have been introduced into this country since 1910, mostly to control scale insects and whiteflies, in citrus and avocado groves. The acclimatization of *R. cardinalis* was most successful (6,46), that of *Rhyzobius lophantae* and *Cryptolaemus montrouzieri* much less (26,54,57). These three species have for many years been an integral part of the local fauna and are therefore included in Table 1. Fourteen of the introduced species were never recovered, but the acclimatization of *Rhyzobius forestieri* (5) and *Serangium parcesetosum* (3) is likely. *Delphastus pusillus* is repeatedly released in avocado and citrus groves as well as in greenhouses, to control *Bemisia tabaci* and other Aleyrodidae (53).

TABLE 3. Introduced but not acclimatized Coccinellidae

Species	Origin	Introduced		crop	Target	Bred in Israel by*	References
		from	year				
<b>Coccinellinae</b>							
<i>Olla abdoninalis</i> (Say)	North/Central America	Texas, Georgia (USA)	1980	Pecan	<i>Monellia costalis</i>	MA	56
<b>Coccidulinae</b>							
<i>Novius cruentatus</i> Mulsant <sup>2</sup>	Mediterranean	Spain	1987	Pine	<i>Palaeococcus fuscipennis</i>	ME	Pers commun.
<i>Rhyzobius forestieri</i> Mulsant	Australia	Antibes (France)	1990	Citrus	<i>Saissetia oleae</i>	A, W	4,5
<i>Rodolia iceryae</i> Jensen	S Africa	S. Africa	1990		<i>Icerya purchasi</i>	ME	40
<b>Chilocorinae</b>							
<i>Chilocorus bisugus infernalis</i> Mulsant	India	S Africa	1987	Citrus	Diaspididae	A	4
<i>C. kuwanae</i> Silvestri	Japan	Japan	1960/1976	Citrus	<i>Ceroplastes floridensis</i> , <i>Aonidella aurantii</i>	A, S	4,46,52
<i>C. nigritus</i> (F)	India, SE Asia	S. Africa	1983	Citrus	<i>A. aurantii</i>	A	4
<b>Sticholotidinae</b>							
<i>Delphastus pusillus</i> (Le Conte)	USA	Florida, Hawaii	1981/21989	Avocado, Citrus	<i>Bemisia tabaci</i> <i>Parabemisia myricae</i>	A,BCI RU, W	3,25,51,53
<i>Pharoscymnus tomeensis</i> Fürsch	São Tomé	S. Africa	1986	Citrus	<i>Aonidiella aurantii</i>	A	4
<i>Serangium parcesetosum</i> Sicaud	India	France	1989	Citrus	<i>Dialeurodes citri</i>	A	3
<b>Scymninae</b>							
<i>Clitostethus arcuatus</i> (Rossi) <sup>2</sup>	Europe, Mediterranean	Germany, Italy	1988/9	Citrus	<i>D. citri</i>	A	3
<i>Hyperaspis japonica</i> Crotch	Japan	Japan	1960	Citrus	<i>Phyllocoptruta oleivora</i>	S	52
<i>Nephaspis oculatus</i> (Blachely)	USA	Hawaii	1981	Avocado, Citrus	<i>Parabemisia myricae</i>	W	53
<i>Nephus (Dionus) flavifrons</i> Milsh.	Australia	California	1984		Pseudococcidae	RU	49
<i>N. peyerimhoffi</i> Sicaud	Algeria	Spain	1977, 1980	Avocado	<i>Protosubnaria pyriformis</i>	W	57
<i>N. (Nephus) reumonti</i> Fürsch	Reunion	S. Africa	1977, 1980	Citrus	Pseudococcidae	RU, A	4
<i>Scymnus</i> sp.	Australia	Australia	1973	Avocado, Citrus	<i>Pseudococcus longispinus</i>	W	54,56

\*A: Yael Argov, Israel Cohen Inst. for Biological Control, Bet Dagan, BCI Biological Control Industries, Kibbutz Sede Eliyahu, M.P. Bet She'an 10810, C&N: J. Cohen and D.J. Nadel, as Argov; G. D. Getling, Dept. of Zoology, Tel-Aviv University, Tel Aviv 69978; I. Y. Izhar, Extension Service, Ministry of Agriculture, HaQarya, Tel Aviv 61070; MA: F. Mansour, Newe Ya'ar Research Center, P.O.B. 90000, Haifa 31999; ME: Z. Mendel, ARO, The Volcani Center, Bet Dagan 50250; P: B. Peleg, as Argov; Ro: Y. Rossler, as Argov, RU: A. Rubini, Biological Control Laboratory, Rehavat Ilan 14, Giv'at Shemu'el 54056; S: E. Swirski, as Mendel; W: M. Wyszoki, as Mendel.

<sup>2</sup> See Table 2. <sup>3</sup> See Table 1

Close examination of the effect of the local 21 species of common and very common Chilocorinae, Scymninae and *Pharoscygnus* spp., which (if not disturbed!) constantly reduce the populations of scale insects (2,29,31-35,46,47,58), may lead to the conclusion that more emphasis should be placed on their protection from non-selective insecticides.

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