

## Integrated pest management studies in newly established citrus orchard

Nedim UYGUN\*

Erdal ŞEKEROĞLU\*

### Summary

To initiate a integrated pest management programs in Eastern mediterranean, pest complex and natural enemies have been investigated in the newly established citrus orchard since 1977. The data presented here is for the years of 1980-1982 and is the continuation of the study conducted by the authors (Uygun and Şekeroğlu 1981).

*Aphis citricola* v.d. Goot rise in population density was observed in mandarin and orange plots during spring and early summer, but the activity of natural enemies, mostly coccinellids, and hot summer conditions never allowed this pest to gain an economic importance. A local infestation of *Icerya purchasi* Mask. was taken under control by *Rodolia cardinalis* (Muls.) immediately. First occurrence of medfly, *Ceratitis capitata* (Wiedeman), was observed by September of 1982. Fruit infestation in mandarin and orange plots was 10 and 80 %, respectively. Partial bait spray gave good control of *C. capitata* but its impact on citrus ecosystem to be determined yet.

*Aonidiella aurantii* Mask. was the primary pest. Although present, the scale predators were inefficient against *A. aurantii*. The carefully timed mineral oil applications twice a year, one in winter and one in early summer, were good enough to keep *A. aurantii* populations at low levels during the study period.

### Introduction

In Turkey, the control of citrus pests in eastern mediterranean used to rely on naturally-occurring biological control, non-selective broad spectrum insecticides were rarely applied and there was a occasional use of mineral oils against scale insects. Within last decades citrus culture expanded very rapidly, even into cotton areas. This rapid development providing new habitats to pests; insecticidal drift from cotton fields, sporadic use of non-selective insecticides in citrus areas, plus the demand of clean product by local and export markets has resulted steady increase in pesticide use which in turn, showed outbreaks of various

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\* Ç.Ü. Agricultural Faculty, Plant Protection Department, Adana-Turkey.  
Alınış (Received) : 30.11.1983

pests due to the upset of natural equilibrium.

It seems relatively easier to apply integrated control programs to citrus pests because of the high proportion of successful biological control projects on citrus. It, however, bears many problems to apply successful integrated control programs after the upset of natural balance in well established orchards. One of the main problems in Turkey is to persuade the growers who, in his traditional technology, hardly accepts new developments with a fear of decline in his annual yield. But in newly established orchards action can be taken as the pests begin to gain economic importance and the owners are more open to recent technology.

We therefore initiated the study in newly established orchard to study pest development, their sequence and interactions with natural enemies, and thus hoped to gather data for application of successful integrated control programs.

### **Material and Method**

The study was conducted in 6-year old citrus orchard in Çukurova University, Agricultural Research Farm, Adana. The orchard consisted of orange, lemon, mandarin, and grapefruit groves having 1987, 4874, 2004 and 1440 trees respectively.

Samples were taken monthly from October to March and twice a month during the rest of the year. For citrus aphid, *Aphis citricola* v.d. Goot, percent infestation was recorded by counting 100 trees randomly in each grove, and trees having aphids on more than three shoots were taken as infested. Other pests observed were also recorded from 100 trees. Mediterranean fruit fly, *Ceratitidis capitata* (Wiedeman), damage was determined by checking 5 fruits/tree taken randomly from 50-100 trees in each grove. All scale insects were counted on 100 randomly taken leaves from each grove. Fifty leaves were also kept in brown bags for parasite emergence. A 100 fruit samples were also taken during fruiting period.

Predators were sampled by Steiner (1962) method. Predators were collected into a jar placed to the bottom of heavy cloth funnel with 50x50 cm. opening. The collecting bag was held under a branch and the branch was struck three times strongly. Hundred branches, one/tree, were sampled in each grove.

The data presented here is for the years of 1980-1982 and is continuation of the study conducted by authors (Uygun and Şekeroğlu, 1981).

## Results and Discussion

During the period of the study California red scale, *Aonidiella aurantii* Mask., was found to be the primary pest. Citrus aphid, *A. citricola*, v.d. Goot rise in population density was observed on mandarin and orange plots during spring and early summer, but the activity of various natural enemies; mostly coccinellids, and hot dry summer conditions never allowed this pest to gain an economic importance. A local infestation by *Icerya purchasi* Mask. was immediately taken under control by *Rodolia cardinalis* (Muls.) before reaching any economic densities. First occurrence of *C. capitata* (Wiedeman) was observed in orange and mandarin plot by September of 1982. The fruit counts indicated that the degree of infestation in mandarin and orange plots was 10 and 80%, respectively. A partial bait sprays, containing protein hydrolysates and small amount of malathion were applied against *C. capitata*. Although it gave good control of medfly, its degree of reel success and effect on citrus eco-system have not been determined yet.

Predators collected were belonged to two families in Coleoptera and one family in Neuroptera (Table 1).

The results of California red scale were only given for leaf samples, since the population trends of California red scale on leaves and fruits were similar, and leaf counts indicated the year around development of California red scale.

Table 1. Predators collected during 1980-1982.

Order	Family	Species
Coleoptera	Coccinellidae	<i>Scymnus apetzi</i> Capra et Fürsch
		<i>Scymnus levaillanti</i> Muls.
		<i>Scymnus rubromaculatus</i> (Goeze)
		<i>Scymnus (Pullus) subvillosus</i> (Goeze)
		<i>Scymnus (Pullus) syriacus</i> Mars.
		<i>Parascymnus pharoides</i> Mars.
		<i>Chilocorus bipustulatus</i> (L.)
		<i>Coccinella septempunctata</i> (L.)
		<i>Rodolia cardinalis</i> (Muls.)
		<i>Lindorus lophanthae</i> (Bleisd.)
Coleoptera	Cybocephalidae	<i>Cybocephalus fodori minor</i> E.Y.
Neuroptera	Chrysopidae	<i>Chrysopa carnea</i> Steph.

The orchard studied had heavy outbreaks of California red scale in its early years (Fig.1) due to contamination of seedlings used during establishment of the orchard (Uygun and Şekeroğlu, 1981). In order to bring the populations to low levels, methidathion had to be sprayed from time to time in addition to oil sprays (Fig.1).

The carefully timed mineral oil applications (at a rate of 1.5 %1), twice a year one in winter and one in early summer, were good enough to keep the California red scale populations at low levels at all plots since 1980 (Fig.2). This success may be due to the absence of another scale insects (Rosen, 1974) in addition to careful timing. Although some activity of several scale predators (e.g. *Chilocorus bipustulatus* (L.) *Lindorus lophanthae* (Bleisd.), *Cybocephalus fodori minor* (E.Y.) was observed, their efficiency in bringing the red scale populations to low level was doubtful, since their numbers were always low, and these predators are high-density feeders. Ben-Dov and Rosen (1969) were also reported that local natural enemies alone were unable to hold the California red scale below the threshold of economic injury in Israel. The high peaks of predators shown in Figure 2 represents mostly aphid predators following spring build-up of *A. citricola*.

California red scale populations were almost at zero level during the first half of 1981, then some increase was observed towards the end of 1981. In contrary to 1981, red scale populations were present in first half of 1982. But red scale populations in the study period never reached to economic injury levels and showed nearly steady populations with small peaks in all plots (Fig.2).

Both visual inspections, and emergence bags indicated no parasitization of California red scale, but adults of *Aphytis melinus* De Bach have been observed occasionally in the field.

Although very few natural activity was observed, the reason of low red scale population during summer period was not very clear. Summer oil application killed most of the scales, but remaining individuals were expected to increase during the hot summer months. Instead, population trends in all plots were very steady and small peaks were followed with decline. This was perhaps due to some undetected natural enemy activity.

In conclusion, careful timing of mineral oil applications seems to effective enough to keep California red scale populations below injury levels, but more detailed studies required to realize the full value of

natural enemies. Once California red scale kept under control with none insecticides means, the other citrus pests, such as aphids and cottony cushion scale were immediately controlled by their natural enemies. Although natural balance seems to be established in the orchard the impact of control measures of various pests. e.g. medfly: future enterence of other pests, and various cultural practices have to be studied in detail to gain necessary knowledge for sound pest management.

## Ö z e t

### Yeni kurulan turunçgil bahçelerinde tüm savaş çalışmaları

Doğu Akdeniz Bölgesi turunçgil bahçelerinde tüm savaş uygulama olanaklarına ışık tutmak amacıyla yeni kurulan bir bahçede zararlılarla, avcı böceklerin sayısal değişimleri 1977 yılından beri incelenmeye başlanmıştır. Bu çalışmada sunulan veriler 1980-1982 yıllarını kapsamakta olup 1981 yılında yayınlanan çalışmanın (Uygun ve Şekeroğlu, 1981) devamı niteliğindedir.

Turunçgil yaprak biti, *Aphis citricola* v.d. Goot, populasyonları ilkbahar ve erken yaz aylarında mandarin ve portakal parsellerinde bir artış göstermiş, ancak doğal düşmanlarının, özellikle Coccinellidlerin etkisi ve sıcak yaz koşulları nedeniyle ekonomik zarar düzeylerine ulaşamamıştır. Yer yer görülen torbalı koşnil, *Icerya purchasi* Mask, avcısı *Rodolia cardinalis* (Muls.) tarafından hemen kontrol altına alınmıştır. Çalışmanın yürütüldüğü bahçede Akdeniz meyve sineği, *Ceratitis capitata* (Wiedeman) ilk defa 1982 Eylül ayında görülmüş, mandarin ve portakal meyvelerinde vuruk yüzdesi sırasıyla % 10 ve 80 olarak saptanmıştır. Çekici yemlerle karışık kısmi ilaçlama *C. capitata*'yı kontrol altına almaya yeterli olmuştur.

Bahçede ana zararlı olarak kırmızı kabuklu bit, *Aonidiella aurantii* Mask., saptanmıştır. Bazı kırmızı kabuklu bit avcılarının bahçede görülmesine karşın bunlar, *A. aurantii*'yi baskı altına alacak etkinlikte görülmemiştir. Yazlık yağlarla (% 1.5 oranında) biri kışın, biri erken yaz aylarında yılda iki kez yapılan uygulama *A. aurantii* populasyonlarını tüm çalışma boyunca düşük düzeyde tutmaya yeterli olmuştur.

### Literature cited

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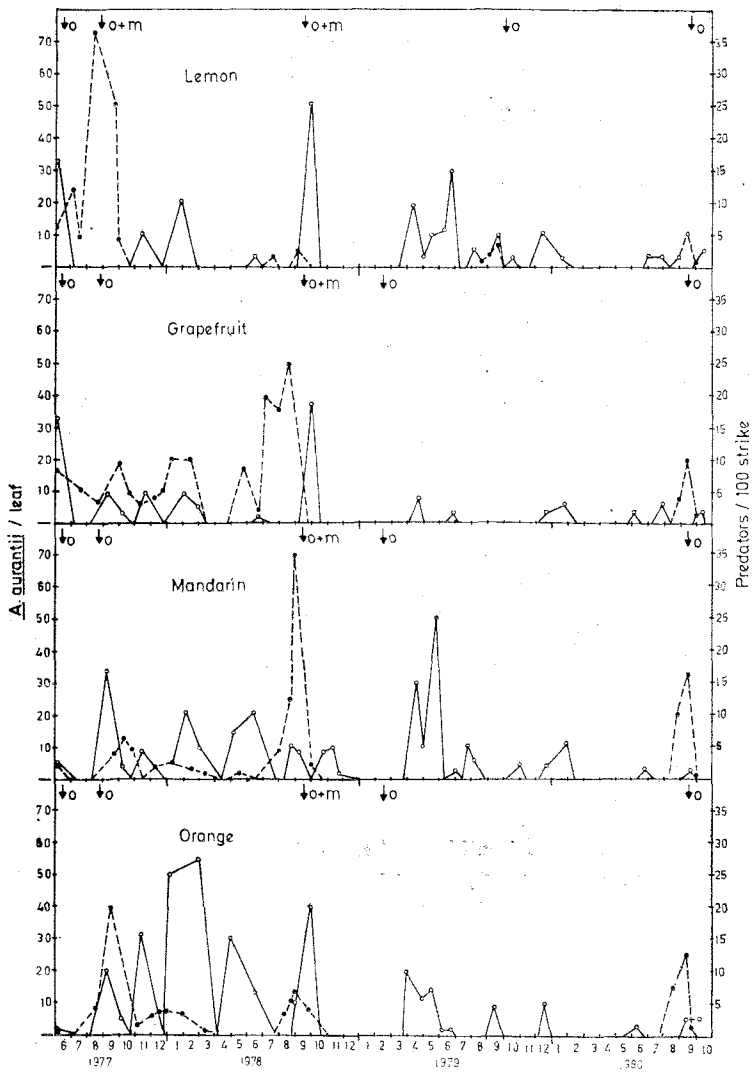


Figure 1. Population trends of California red scale (o-o), and natural enemies (● - - ●). (From Uygun and Şekeroğlu, 1981). Arrows indicate application time, o: mineral oil, m: methidathion.

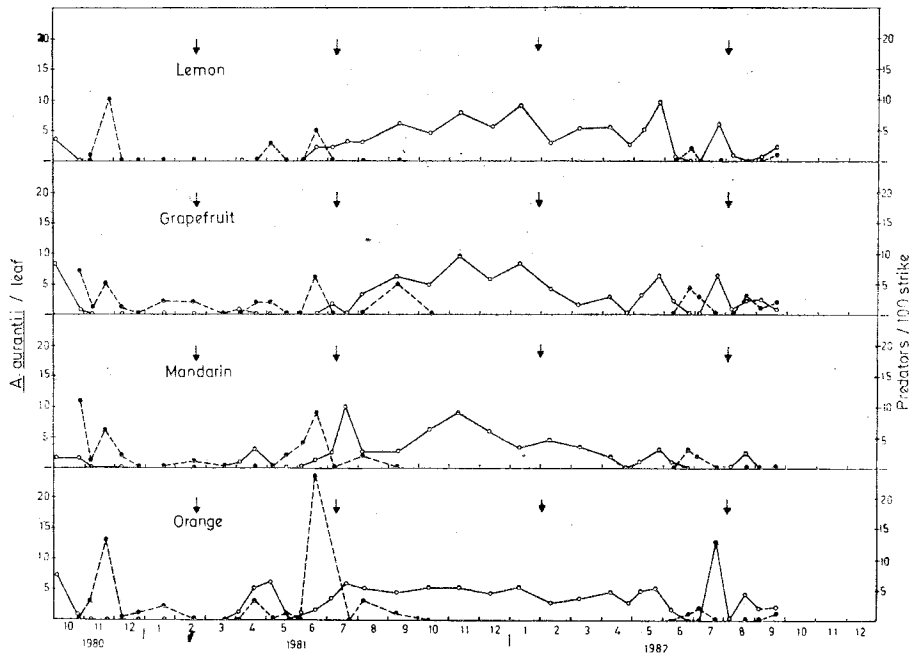


Figure 2. Population trends of California red scale (o-o), and natural enemies (●--●). Arrows indicate application time, of mineral oils.