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Orijinal araştırma (Original article)

Composition, seasonal abundance and within-plant distribution of Thysanoptera species associated with seedless grapes (Sultana) in districts of Manisa, Turkey[1]

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Summary

This study investigated the species composition of Thysanoptera and the within-plant distribution, abundance and relation to plant phenology of major species on Round Seedless grapes (*Vitis vinifera L.* var. Sultana) in the Manisa Province, Turkey in 2003-2005. Monthly surveys were conducted in 41 vineyards in 11 districts of the province starting with bud burst (early April) and ending with complete defoliation (late November). Thrips were collected by beating plants in the field or by examining plant samples in the laboratory. A total of 35 Thysanoptera species was recorded. The most common and abundant species were (in descending order): *Rubiothrips vitis* (Priesner, 1933), *Thrips tabaci* (Lindeman, 1889), *Mycterothrips albidicornis (*Knechtel, 1923) + *M. tschirkunae* (Jachontov , 1961), *Frankliniella occidentalis* (Pergande, 1895) and *Drepanothrips reuteri* Uzel, 1895 (Thripidae). All major species were present in varying numbers from shoot growth to post-harvest. The highest thrips densities were attained during bud burst and early shoot growth, when *R. vitis* was the only species detected. Thereafter, *R. vitis* number declined sharply. Other major species, with the exception of *T. tabaci*, tended to increase before fruit ripening and/or afterwards. The most abundant species on different parts of the grapevines were as follows: *T. tabaci, D. reuteri* and *R. vitis* on leaves and shoots; *T. tabaci, D. reuteri* and *F. occidentalis* in flowers and *D. reuteri* in bunches. *R. vitis* has the highest potential to pose a threat to seedless grapes. The abundance of

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F. occidentalis is low; therefore, the incidence of scars or spots on berries attributed to it and quarantine problems stemming from its presence in exported table grapes are expected to be minimal.

Keywords: *Vitis vinifera* var. *sultana, Rubiothrips vitis*, *Frankliniella occidentalis, Drepanothrips reuteri, Thrips tabaci*

Anahtar Sözcükler: *Vitis vinifera* var. *sultana, Rubiothrips vitis*, *Frankliniella occidentalis, Drepanothrips reuteri, Thrips tabaci*

Introduction

Turkey is first among seedless grape-producing countries. Grown in the Aegean Region, especially in Manisa, and consumed fresh or dried, the Round Seedless grape (*Vitis vinifera* L. var. *sultana*) is one of the most important exports of Turkey (Altindisli, 2003).

Several reports have indicated that thrips are grape pests; such studies have attempted to describe the damage and estimate the yield loss which thrips might have caused in various regions of the world. Different species inflict damage by feeding on the buds, leaves, shoots, and fruits of grapevines. In terms of types of injuries caused on grapevines, thrips can be divided into two groups: 1) those that inhibit plant growth through feeding on buds, shoots and leaves; and 2) those that reduce the market value of the crop through scars or spots inflicted on the berries. Reports describing the type of damage produced by some species may not be consistent, even for the same country. For instance, *Drepanothrips reuteri* Uzel was reported to cause both types of injury in California (Bailey, 1942) and France (Bournier, 1976), while it was thought to affect only shoots and/or leaves in Turkey (Cengiz, 1974), California (Yokoyama, 1977a) and Switzerland (Baillod, 1974; Boller & Condolfi, 1990). A similar pattern was found for *Frankliniella occidentalis* (Pergande), albeit in different countries; it led to scars or spots on berries in southern Italy (Piemonte) (Ciampolini et al., 1990) and southern Greece (Tsitsipis et al., 2003), but stunted shoots in California (Mcnally et al., 1985). *Rubiothrips vitis* (Priesner), which causes damage to buds, shoots and leaves, is known as an important grape pest in several Balkan and Middle East countries, including Romania, Turkey, Bulgaria, Greece, Israel and Iran (Zinca, 1964; Cengiz, 1974; Bournier, 1976; zur Strassen, 2003). Thrips populations dominated by *Thrips tabaci* Lindeman led to stunted grapevines in southwest Germany (Rheinland-Pfalz) (Merk et al., 2004). It has been reported that grapevine leaves turn brown, wither and ultimately fall as a result of feeding by *Retithrips syriacus* (Mayet) in the Middle East, including Turkey, and in north Africa (Rivnay, 1939; Doğanlar & Yiğit, 2002; zur Strassen, 2003), and by *Rhipiphorothrips cruentatus* Hood in India (Ananthakrishnan, 1971). *Scirtothrips dorsalis* Hood presents another example of a species reducing the market value of grapes through brown scars on berries in Japan (Shibao et al., 2004).

Thrips seem to have attracted more attention in recent years as a result of increasing awareness of their potential to cause problems in vineyards. In today's viticulture, thrips create problems not only due to the damage they cause, but also through restrictions imposed on international trade because of quarantined species being intercepted in exported table grapes. Losses incurred due to the rejection of crops destined for export on the grounds of contamination with thrips cannot be ignored (Mitcham, 1997). Turkish fresh vegetable, fruit and cut-flower exports suffered from such losses after the quarantine pest *F. occidentalis* was reported for the first time in Turkey in 1993 (Tunç & Göçmen, 1994).

In order to prevent revenue losses in table grape production stemming from thrips damage and international trade restrictions, gathering information on the species composition of Thysanoptera fauna and relation to plant phenology in major species in vineyards is a necessary first step. Such studies are rather scarce, however. Species composition of vineyard thrips fauna has been investigated in southwest Germany (Merk et al., 2004, 2006) and northern Italy (Rigamonti, 2000). Seasonal population fluctuations and their relation to plant phenology have been investigated in California (Yokoyama, 1977 a, b; McNally et al., 1985), Japan (Shibao et al., 2004) New Zealand (Schimidt et al., 2006). The first faunistic study on vineyard thrips in Turkey was carried out by Cengiz (1974) in the major grape-producing provinces, İzmir and Manisa; however, this study lacks data on the seasonal and within-plant distributions and abundance of the species involved. For this reason, it is not possible to identify those species that have the potential to cause damage, the type of damage those species might cause, and which species might be present in the produce after harvest. *F. occidentalis* which was recorded for the first time on grapevines in Aegean region in 2000 (Altındişli et al., 2002) is known as a grape pest in the Mediterranean countries indicated above. This study investigated the species composition of Thysanoptera and the within-plant distribution, abundance and relation to plant phenology of major species on Round Seedless grapes (*Vitis vinifera L.* var. Sultana) with an emphasis on the status of *F. occidentalis* in the Manisa Province.

Material and Methods

Geographical position of Manisa and crop pattern in districts

The Manisa province is situated in the Aegean Region of Turkey and lies between 38°04'and 59°58' north latitudes and 27°08' and 29°05' east longitudes (Figure 1).

In addition to Round Seedless grapes, cereals, olives, tobacco and cotton are commonly grown in the major viticulture districts of Manisa. Other major crops include fruits in the central, Alaşehir, Salihli and Sarıgöl districts; vegetables in Ahmetli and fruits, vegetables and sesame in Saruhanlı and Turgutlu.

Figure 1. Districts of the Manisa province; the location of the province within Turkey is shown in the frame at the top right.

Thrips sampling and laboratory processing

Surveys were conducted in 41 round seedless grape (*Vitis vinifera L.* var. Sultana) vineyards in 11 districts of Manisa in 2003 and only in Alaşehir in 2004 and 2005. The numbers of vineyards according to districts were as follows: Central 5, Ahmetli 3, Akhisar 1, Alaşehir 11, Demirci 1, Gölmarmara 1, Kırkağaç 1, Salihli 6, Sarıgöl 4, Saruhanlı 3 and Turgutlu 5 (Figure 1). The indicated number of vineyards per district was sampled once a month. These vineyards were selected with priority given to organic vineyards. Sampling started with bud burst (early April) and ended with complete defoliation (late November). Thrips were collected by beating plants in the field or examining plant samples in the laboratory. Randomly selected grapevines were beaten on a 40 x 40 cm cloth frame. Thrips present in buds, flowers and bunches were collected separately. Two shoots from each of 10 grapevines per vineyard during the bud burst stage (early April) but thereafter until harvest (August/September), 10 flowers or 10 fruit bunches per vineyard were beaten. A separate series of samples was constituted by beating 10 randomly selected full-grown whole grapevines per vineyard between May and late November. Leaf and shoot samples were taken from randomly selected plants. Five leaves (the fourth or fifth leaves of shoot tips) were collected from each of six grapevines, for a total of 30 leaves; in addition, 20 shoots that were 30 cm in length were collected per vineyard. Leaf and shoot samples were first wrapped in paper bags, then into clear plastic bags. Plant samples were transported in ice-boxes to the laboratory and maintained at 4°C until processed. Thrips were extracted by tapping plant samples over a white cardboard and examining them under a stereomicroscope. With all collection methods, adult thrips were transferred into small vials containing preservation fluid (9 parts ethyl alcohol + 1 part glacial acetic acid) using a fine paintbrush. Larval thrips were separated and kept alive for rearing until adulthood. The larvae collected in the field were transferred into ventilated jars, supplied with a piece of shoot and placed into an icebox. Living larvae were maintained over grapevine leaf discs (20 mm in diameter) and confined in cylindrical transparent plastic cages. The top and removable bottom of the cages had holes that were covered with serigraphic cloth, which provided ventilation at the top and let the leaf disc come into contact with moisture provided by a wet sponge laid over a tray at the bottom of the cage. Culture cages were maintained in a walk-in chamber under 25 ± 1^{o}C, 60 ± 10 % R. H., 16 h L: 8 h D and 4000 lux. Only 20.5% of the larvae collected reached the adult stage. Counting and identification was carried out under a stereomicroscope, and representative adult specimens were prepared for slide mounting by clearing in lactophenol and mounting in Hoyer's medium. Due to problems distinguishing between females, *Mycterothrips albidicornis* (Knechtel) was pooled with *M. tschirkunae* (Jachontov) and *Aeolothrips collaris* Priesner was pooled with *A. intermedius* Bagnall. Specimens were identified by İrfan Tunç.

Data analysis

Due to the large variation the total numbers of individuals of the major species are shown logarithmically in Figs. 2 and 3. Data on seasonal abundance and distribution in districts were analyzed by one-way ANOVA and by Duncan's test. The statistical analysis was accomplished using SPSS software (SPSS, 1999). A probability level of $P \leq 0.05$ was considered statistically significant.

Results

Species composition

A total of 35 Thysanoptera species were recorded in round seedless vineyards in Manisa; the majority of these, 26 species, belong to Thripidae (Table 1). The most common and abundant species and their rank in descending order and percentage (in parentheses) in terms of total number of thrips collected were as follows: *R. vitis* (34.4), *T. tabaci* (16.8), *M. albidicornis* + *M. tschirkunae* (13.2), *F. occidentalis* (9.7) and *D. reuteri* (7.8).

Table 1. Thrips species collected from 41 Round Seedless grape vineyards in Manisa province between 2003 and 2005, and their frequency (number of vineyards in which the species was found) and abundance (total number of individuals of the species collected)

List no.	Family and species	Frequency	Abundance	Percentage of total individuals
	AEOLOTHRIPIDAE			
1	*Aeolothrips collaris**Priesner + *Aeolothrips intermedius** Bagnall	20	75	1.6
2	*Aeolothrips gloriosus* Bagnall	2	4	<0.1
	THRIPIDAE			
3	*Anaphothrips obscurus* (Muller)	1	1	<0.1
4	*Anaphothrips sudanensis* Trybom	8	41	0.9
5	*Chirothrips aculeatus* Bagnall	4	24	0.5
6	*Chirothrips manicatus* Haliday	4	12	0.2
7	*Collembolothrips mediterraneus* Priesner	1	1	<0.1
8	*Dendrothrips phyllireae* (Bagnall)	8	20	0.4
9	*Drepanothrips reuteri* Uzel	35	347	7.8
10	*Frankliniella intonsa* (Trybom)	1	1	<0.1
11	*Frankliniella occidentalis* (Pergande)	32	434	9.7
12	*Frankliniella tenuicornis* (Uzel)	6	13	0.2
13	*Limothrips denticornis* Haliday	2	3	<0.1
14	*Limothrips angulicornis* Jablonowski	1	1	<0.1
15	*Mycterothrips albidicornis* (Knechtel) + *M. tschirkunae (*Jachontov)	32	586	13.2
16	*Mycterothrips salicis* (Reuter)	2	2	<0.1
17	*Neohydatothrips gracilicornis* (Williams)	1	6	0.1
18	*Oxythrips ajugae* Uzel	3	17	0.3
19	*Rubiothrips vitis* (Priesner)	41	1526	34.4
20	*Scolothrips longicornis* Priesner*	26	244	5.5
21	*Tenothrips anatolicus* (Priesner)	2	6	0.1
22	*Tenothrips discolor* (Karny)	4	22	0.4
23	*Tenothrips frici* (Uzel)	4	95	2.1
24	*Thrips angusticeps* Uzel	4	10	0.2
25	*Thrips major* Uzel	8	30	0.6
26	*Thrips meridionalis* (Priesner)	6	13	0.2
27	*Thrips tabaci* Lindeman	41	747	16.8
	PHLAEOTHRIPIDAE			
28	*Haplothrips aculeatus* Fabricius	23	62	1.3
29	*Haplothrips andresi* Priesner	3	7	0.1
30	*Haplothrips distinguendus* Uzel	2	3	<0.1
31	*Haplothrips globiceps* (Bagnall)	15	45	1.0
32	*Haplothrips reuteri* Uzel	11	30	0.6
33	*Haplothrips tritici* Kurdjumov	3	8	0.1
	Total		4436	100.0

*__Predacious species__

The species found include 11 grass and cereal thrips (list no 3-7, 12-14, 24, 28, 33), 5 species that inhabit deciduous trees and shrubs (list no 2, 8, 18, 25, 29) and 8 species that inhabit the flowers of herbaceous plants (list no 10, 17, 21-23, 26, 30, 32). With regard to predacious species, *A. collaris*, *A. intermedius* and *Scolothrips longicornis* Priesner were detected.

Seasonal abundance

Seasonal abundance and its relation to plant phenology in the most widespread and abundant species, namely, *R. vitis*, *T. tabaci*, *M. albidicornis* + *M. tschirkunae, F. occidentalis* and *D. reuteri* in the vineyards of Manisa, are shown in Figure 2. All of the major species were detected, albeit at varying levels, throughout the growing season, from bud burst to post-harvest. *R. vitis* was the first and only species detected in early season, specifically in April, when the buds began to burst. The count was significantly higher ($P < 0.05$) in April than in other months (Table 2). The individuals of *R. vitis* decreased after April and became very scarce after May. The other species tended to increase significantly ($P < 0.05$) as the season progressed. The population of *D. reuteri* reached the highest level at the onset of fruit maturing, during harvest and post-harvest which include July, August and September; *F. occidentalis* in September and October; *M. albidicornis* +*M. tschirkunae* in October (Figure 2).

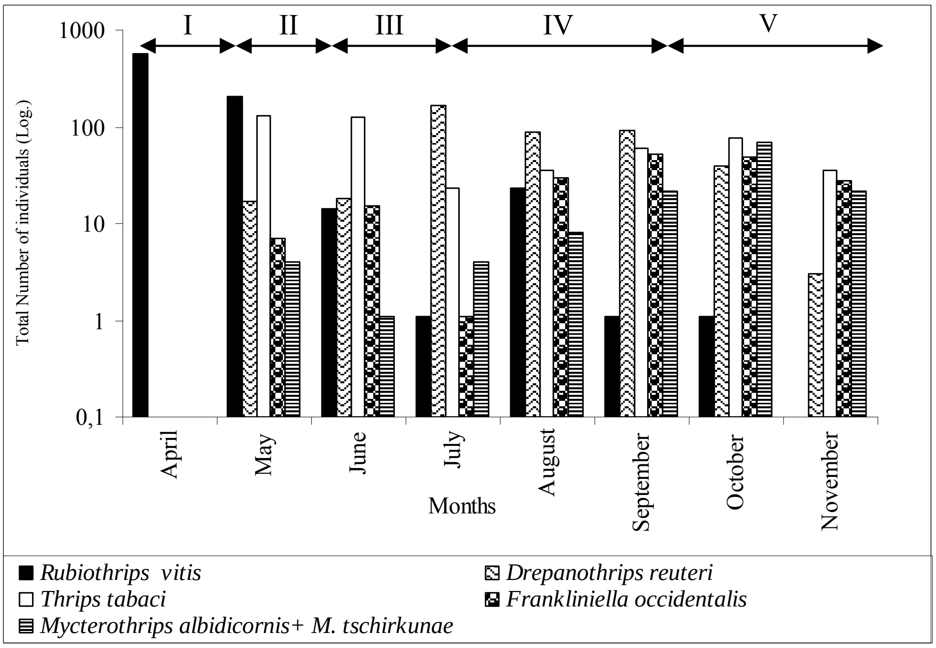

Figure 2. Seasonal abundance presented as total number per month and its relation to plant phenology in major thrips species of Round Seedless grapes in districts of Manisa in 2003 (phenological stages: I: bud and shoot; II: flower; III: unripe fruit; IV: ripe fruit and harvest; V: post-harvest).

Table 2. Monthly mean number of major thrips species per 10 grapevines in 41 vineyards in Manisa in 2003

Month	Mean number ± S.D				
	R. vitis	*T. tabaci*	*D. reuteri*	*F. occidentalis*	*M. albidicornis* + *M. tschirkunae*
April	12.85 ± 1.64^{b}	0.00	0.00	0.00	0.00
May	3.78 ± 1.64^{a}	3.29 ± 1.25^{b}	0.43 ± 0.21^{a}	0.24 ± 0.32^{ab}	0.14 ± 0.32^{a}
June	0.41 ± 1.64^{a}	2.97 ± 1.25^{b}	0.46 ± 0.14^{a}	0.43 ± 0.32^{ab}	0.02 ± 0.32^{a}
July	0.02 ± 1.64^{a}	0.48 ± 1.25^{ab}	4.04 ± 2.11^{c}	0.02 ± 0.32^{a}	0.14 ± 0.32^{a}
August	0.34 ± 1.64^{a}	0.80 ± 1.25^{ab}	2.14 ± 0.09^{b}	0.80 ± 0.32^{bc}	0.24 ± 0.32^{a}
September	0.02 ± 1.64^{a}	1.41 ± 1.25^{ab}	2.26 ± 0.73^{b}	1.36 ± 0.32^{c}	0.58 ± 0.32^{a}
October	0.02 ± 1.64^{a}	1.78 ± 1.25^{ab}	0.95 ± 0.46^{ab}	1.26 ± 0.32^{c}	1.73 ± 0.32^{b}
November	0.00	0.82 ± 1.25^{ab}	0.07 ± 0.00^{a}	0.75 ± 0.32^{bc}	0.58 ± 0.32^{a}

$^{a\text{-}c:}$ Within columns, values with different superscripts differ significantly ($P < 0.05$).

Distribution in districts

All major species were detected in all districts in which more than one vineyard was sampled (Figure 3). Statistical analyses (not presented here) indicated insignificant differences in the distribution of major species among districts in terms of the number of individuals per vineyard with the exception of the significantly higher numbers ($P < 0.05$) of *D. reuteri* found in central district of Manisa and Ahmetli and the higher level of *F. occidentalis* in Sarıgöl District.

As expected, the number of thrips species recorded in any given district depended on the number of vineyards surveyed. In Alaşehir, where the highest number of vineyards (11) was sampled, the highest number of species (20), was found; in districts where only one vineyard was sampled, only 5 to 10 species were detected (Ozsemerci et al., 2006).

Within-plant distribution

Counts of thrips collected from different parts of grapevines revealed that the within-plant distribution of major species based on the most abundant species was as follows: *T. tabaci, D. reuteri* and *R. vitis* on leaves and shoots (Figure 4A,B); *T. tabaci, D. reuteri* and *F. occidentalis* (Figure 4C) on flowers, and *D. reuteri* (Figure 4D) in bunches. When the thrips collected from whole plants were taken into account, the most abundant species was *R. vitis*, followed by *T. tabaci* and *D. reuteri* (Figure 4E). The total numbers of thrips of all species found on the whole grapevine, shoots, bunches and leaves were 4436, 1025, 361 and 100, respectively.

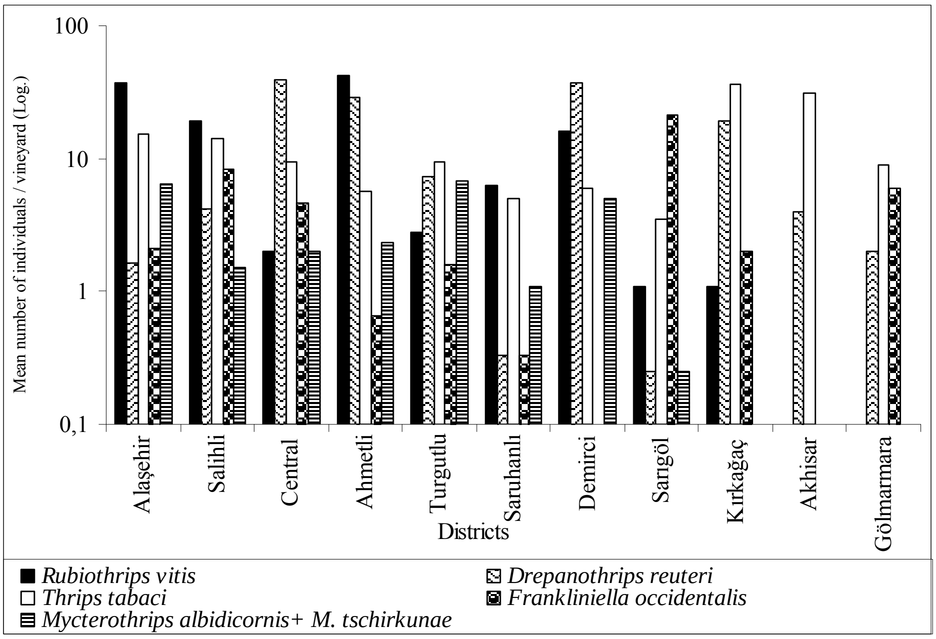

Figure 3. Distribution of major thrips species in districts of Manisa in 2003, shown as mean number per vineyard (Ozsemerci et al., 2006).

Discussion

Of the major thrips species on Round Seedless grapes in Manisa, *R. vitis, D. reuteri* and *H. globiceps* are known to be specialized to the grapevine, while *T. tabaci* and *F. occidentalis* are known to be polyphagous. *M. albidicornis* and *M. tschirkunea* are known as species that live on deciduous trees (oak, apple, peach, plum, apricot, almond) and shrubs in addition to grapevines (Tunç, 1992b; zur Strassen, 2003).

In a survey carried out in Izmir and Manisa between 1969 and 1972, 25 thrips species were detected in vineyards. Regarding the samples collected in Manisa, *R. vitis, H. globiceps* and *D. reuteri* represent 61, 29 and 0.1%, respectively, of the total number of thrips specimens collected (Cengiz, 1974). It is difficult to make a sound comparison between the current research and the previous one due to the fact that data obtained from the prior research were based on samples collected only at a single phenological stage (bud and early shoot growth) and without selecting the grape variety. Nevertheless, there was an apparent decrease in the abundance of *H. globiceps* and an increase in *T. tabaci*, *M. albidicornis* and *M. tschirkunae* in 2003 compared to 1969-1972. Based on the material collected by various investigators in different localities of the country the composition of major thrips species in vineyards of other regions of Turkey is not expected to differ from that of Manisa. For instance in 1988-1989, when *F. occidentalis* was not recorded yet, *D. reuteri, M. albidicornis* and

T. tabaci were the most common and abundant species in vineyards in Antalya (Tunç, 1992c).

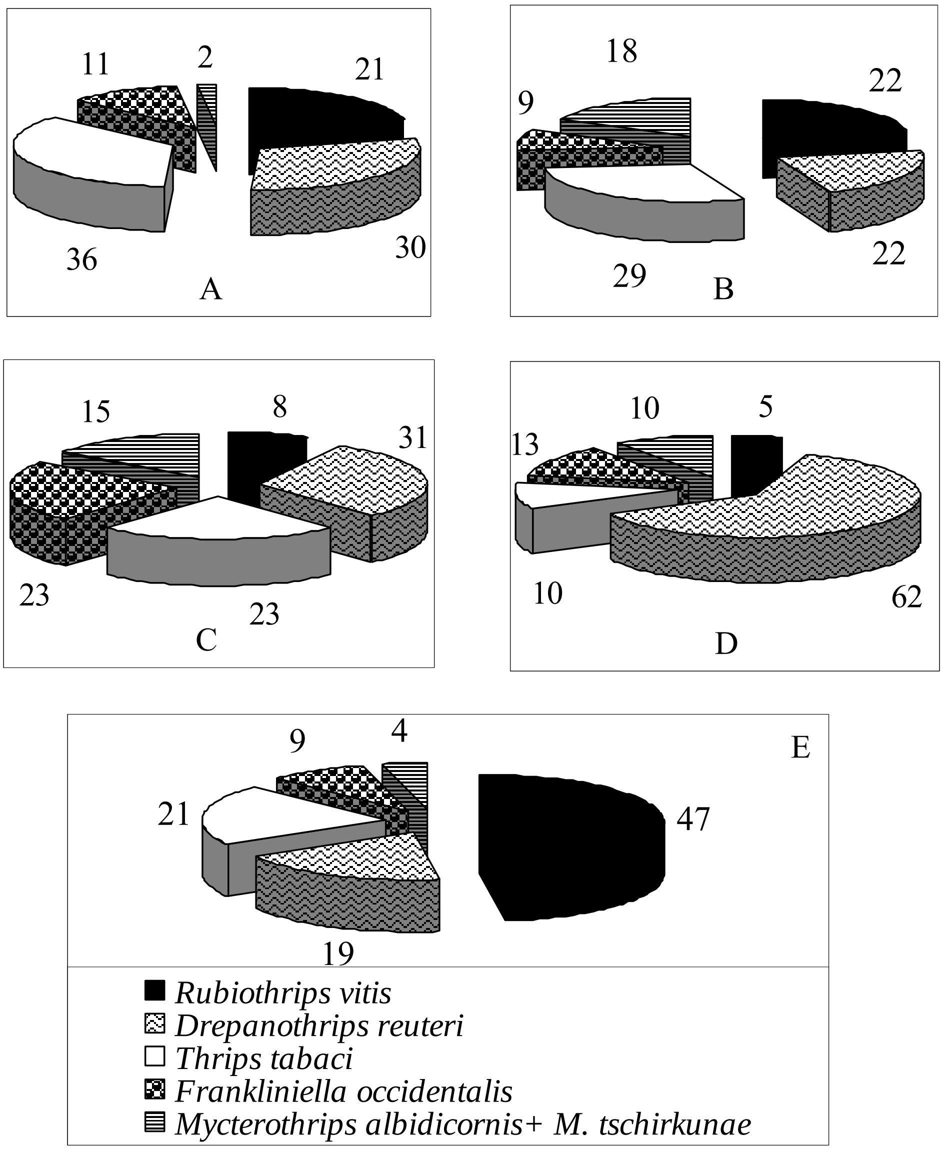

Figure 4. Percentage of thrips species obtained from different parts and whole of grapevines in vineyards in Manisa in 2003. A: leaf, B: shoot + leaf, C: flower, D: bunch, E: whole grapevine.

The species composition of vineyard thrips fauna and the relative abundance of the species involved in a given locality may depend on many factors, including biogeography, flora, crop patterns, established agricultural practices, etc. (Rigamonti, 2000; Merk et al., 2006). Nearly 40% of the species constituting the grapevine fauna and the major species (though the order of abundance differed) were similar across Manisa, southwest Germany and northern Italy. Surveys carried out in vineyards in southwest Germany revealed 30 thrips species. The most common species was *T. tabaci*, which was present in 66-85% of the leaf samples, followed at some distance by *D. reuteri* (Merk et al., 2004, 2006). In northern Italy, 26 thrips species were found in one vineyard; the most abundant species were *D. reuteri, Thrips major* Uzel and *T. tabaci* (Rigamonti, 2000). *F. occidentalis* was the dominant species in vineyards in southern Italy (Ciampolini et al., 1990) and southern Greece (Tsitsipis et al., 2003), while *T. tabaci* and *D. reuteri* were less abundant.

None of the other species attained the high abundance achieved by *R. vitis* in the vineyards of Manisa. However, the decline in numbers as blooming progressed indicated that such abundance was restricted only to the bud burst and shoot development stages of grapevines. Although *R. vitis* was able to maintain a level of abundance higher than other species at blooming, levels declined to negligible numbers with the fruit formation. Shoots and leaves are affected by *R. vitis*, as it feeds on not-yet-opened leaves inside the buds, leading to wrinkles and deformations, then to necroses that turn into holes in leaves. This is the most serious damage caused by any thrips species in Round Seedless grapes in Manisa. Zinca (1964) reported similar injuries attributed to *R. vitis* in grapevines in Romania.

T. tabaci was the most or the second-most common and abundant species depending on the phenology of the grapevines and was able to maintain a more or less stable population level from blooming to post-harvest, with insignificant increases at the shoot development and blooming stages. *T. tabaci* led to stunted plants as a result of its feeding in the early phenological stages of grapevines in newly set up vineyards and nurseries in Germany (Merk et al., 2004). Further research is required to determine whether such damage occur in Manisa. There are no reports showing the presence of *M. albidicornis* and *M. tschirkunae* in the vineyards of any country at a frequency and abundance as high as those observed in Turkey, nor is any information available that suggests that these species were pests of any crop, including grapes. These leaf-inhabiting species were present in negligible amounts throughout the season until full defoliation and showed a tendency to increase their numbers in harvest and thereafter.

The relative abundance of *F. occidentalis* was higher on flowers than on leaves, shoots and bunches in Manisa, but its seasonal abundance tended to be higher during harvest and afterwards, not at blooming. This contradicts the situation observed in other countries, in which the highest levels of abundance of the species were observed during the blooming of grapevines. It was announced that *F. occidentalis* peaked during blooming in grapevines in California and southern Italy and also migrated to other flowering plants inside or around the vineyards at the mature period of berries (Yokoyama, 1977b; Moleas & Addante, 1995). The lack of alternative hosts may have forced *F. occidentalis* to remain on grapevines during harvest and afterward in the present study. It is also interesting to note that unlike in other countries (California, Yokoyama, 1977b and McNally et al., 1985; Italy, Ciampolini et al., 1990; Greece, Tsitsipis et al., 2003 and Roditakis & Roditakis, 2007), *F. occidentalis* has never been a predominant species in any phenological stage of grapevines in Manisa. Furthermore, *F. occidentalis* in Manisa has never reached the levels of abundance recorded in California, i.e., 50-60 individuals per flower cluster (Yokoyama, 1977b). Such differences may stem from the crop patterns of districts of Manisa, which apparently lack alternative crops. An increase in the abundance of *F. occidentalis* may be observed in a given crop when alternative crops, like cotton or greenhouse plants are widely available in the vicinity (Tekşam & Tunç, 2009).

The most serious crop loss attributed to *F. occidentalis* is a reduction in market value as a result of scars and spots on berries in Italy and Greece where it is the predominating thrips species (Ciampolini et al.,1990; Tsitsipis et al., 2003; Roditakis & Roditakis, 2007). However, in contrast with this, *F. occidentalis* in California scarred the rachis, laterals, and berry pedicels, but not the surface of the grapes (Yokoyama, 1977b); *F. occidentalis* was also responsible for stunted growth in grape shoots (McNally et al., 1985). None of such symptoms that can be attributed to any major thrips species (including *F. occidentalis*) were observed in Round Seedless grapes in Manisa at a scale that deserves attention.

The seasonal population trends of *D. reuteri* on grapevines are similar in Manisa and California. In the spring, the first individuals of *D. reuteri* appear in early May and the population attains the highest level before harvest (July). During the harvest and post-harvest period (August, September), its abundance continues (Bailey, 1942; Yokoyama, 1977a; McNally et al., 1985).

In California, *D. reuteri* caused crinkling and curling of grapevine leaves but was not associated with scars on grape fruits (Yokoyama, 1977a), as had previously attributed to this thrips species (Bailey, 1942). Control was not considered necessary for leaf distortion inflicted at a population level of a maximum of three *D. reuteri* per leaf (Yokoyama, 1977a). In Switzerland, where *D. reuteri* was reported to be a pest that damaged the shoots and leaves of grapevines, it was found that a population level of 50 thrips day/leaf could be tolerated without yield loss (Boller & Candolfi, 1990). *D. reuteri* did not reach this population level (approximately >1 thrips/leaf) in Manisa in the present survey or in a previous study carried out in 2000-2001 in which the total number of thrips per leaf was 0.5 (Altındişli et al., 2002). The abundance of *D. reuteri* in vineyards may depend on availability of alternative hosts in vicinity (McNally et al., 1985). The alternative hosts *Betula* spp., *Corylus* spp., *Quercus* spp., fruit trees and blackberry (zur Strassen, 2003; Tunç, 1992a) may not be widespread or abundant enough in and around vineyards in Manisa to support *D. reuteri* at the higher population levels recorded in other countries

In conclusion, *R. vitis* has the highest potential among the major thrips species to pose a threat to Round Seedless grapes in Manisa given its abundance and association with the most sensitive phenological stages of the plant,bud burst and shoot growth, in spring. In the subsequent phenological stages, none of the major species were predominant in the thrips population; three species were represented in higher but roughly equal levels of abundance on shoots, leaves and flowers, but not bunches, which were dominated by *D. reuteri*. This should work in the grapevines' favor since none of the species are able to increase to damaging levels as a result of possible interspecies competition and/or other unknown causes.

The abundance of *F. occidentalis* is low in Round Seedless grapes in Manisa compared to countries where it is considered a grape pest; consequently, the incidence of scars and spots on berries attributed to its feeding and oviposition may also be expected to be low in Manisa (if these issues exist at all). Low levels of thrips infestation (particularly infestation with *F. occidentalis*) during harvest may lead to a low incidence of quarantine problems during export of table grapes. Post-harvest control (Mitcham et al., 1997; Yokoyama et al., 2001) rather than field control should be sought for eradication of thrips present in table grapes destined for export.

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Özet

Manisa (Türkiye) ilinde çekirdeksiz üzüm bağlarında (Sultaniye) görülen Thysanoptera türleri, mevsimsel ve bitki üzerindeki dağılımları

Manisa (Türkiye) ilinin ilçelerinde, 2003-2005 yılları arasında Yuvarlak çekirdeksiz üzüm (*Vitis vinifera* L. var. *Sultana*) çeşidinde görülen Thysanoptera türleri belirlenerek önemli türlerin bitki fenolojisiyle ilişkileri, bitki üzerinde bulundukları yerlere göre dağılışları ve yoğunlukları incelenmiştir. Aylık sürveyler Manisa ilinin 11 ilçesinde gözlerin uyanmasıyla başlamış (nisan başı) ve hasattan sonra asmalar yapraklarını dökünceye kadar (kasım sonu) devam etmiştir. Thripsler, asmalardan darbe yöntemiyle veya laboratuvara getirilen bitki örneklerinin incelenmesiyle elde edilmiştir.

Sürvey sonucunda toplam 35 tür elde edilmiştir. En yaygın ve yoğun tür *Rubiothrips vitis* (Priesner, 1933) olup, onu sırasıyla *Thrips tabaci* Lindeman, 1889, *Mycterothrips albidicornis (*Knechtel, 1923) + *M. tschirkunae* (Jachontov, 1961) *Frankliniella occidentalis* (Pergande, 1895) ve *Drepanothrips reuteri* Uzel, 1895, (Thripidae) izlemiştir. Asmalar üzerinde Thripsler ilkbaharda gözlerin uyanışından, hasat sonrasına kadar değişen sayılarda bulunmuştur. Asmada en yüksek thrips yoğunluğuna gözlerin uyanmaya başladığı dönemde, *R. vitis* ile ulaşılmış, sonraki dönemlerde sayısı hızla azalmıştır. *T. tabaci* dışındaki diğer önemli türler olgun meyve dönemi öncesi ve/veya sonrasında artış göstermiştir. Önemli türlerden *T. tabaci, D. reuteri* ve *R. vitis* yaprak ve sürgünlerde; *T. tabaci, D. reuteri* ve *F. occidentalis* çiçeklerde; *D. reuteri* salkımlarda daha bol bulunmuştur. *R. vitis* çekirdeksiz üzümlerde en yüksek potansiyele sahip tür olarak saptanmıştır. *F. occidentalis* 'in yoğunluğu düşük bulunmuştur. *F. occidentalis* üzüm tanelerinin kabuğunda yara ve lekelere neden olduğu için ihracatta önemli sorunlara yol açtığından istenmemektedir.

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