during the summer. Being a warm-season grass, it was also dormant in the winter, irrespective of irrigation regimes. Nevertheless, its spring and fall growth allowed it to persist and compete with all invading spe-

Time of year

We collected data in May, July, and December to target plant responses at critical times. May readings reflected the response to the winter and early spring months; July readings, response under high temperatures; and December readings, response during the winter, which identified dormancy of warm-season species.

Figure 2 presents responses of four species, with quite different growth patterns, to the three irrigation regimes and three times of year. Santa Ana bermudagrass showed little difference in performance among the three irrigation regimes in May and July. In December, there was a downward trend in performance, reflecting the growth cessation and approaching winter dormancy of this warm-season turfgrass.

Conversely, the growth pattern of Sirosa phalaris showed its summer dormancy with higher cover and quality ratings before (May) and after (December) dormancy.

Buffalograss performed similarly at all irrigation regimes. It clearly showed the dormancy pattern that characterizes the species during summer and winter months, despite the irrigation regime.

Glaucus saltbush showed less of a seasonal response than an irrigation response. This species performed better as a turf cover when irrigated at the 20% regime than at the 40 and 60% regimes.

Conclusions

Of the 27 turfgrasses and ground covers tested in this study, bermudagrasses and seashore Paspalum were the best performing turfgrasses under very low irrigation regimes. Two species of saltbush, buffalograss, and two varieties of *Phalaris* also gave comparatively good cover and quality.

This work showed that there are existing turfgrasses, and other plant material maintained as turf, that are capable of surviving and giving cover under extremely low irrigation regimes. These materials apparently resist the stress of low water application by various mechanisms, including dormancy, deep roots, and low rates of water use.

Victor A. Gibeault is Extension Environmental Horticulturist, Department of Botany and Plant Sciences; Jewell L. Meyer is Extension Irrigation and Soils Specialist, Department of Soil and Environmental Sciences; and Richard Autio and Ralph Strohman are Staff Research Associates. All are with the University of California, Riverside.



Russian wheat aphid (green insect) and birdcherry oat aphid.

Suction trap reveals 60 wheat aphid species, including Russian wheat aphid

Keith S. Pike David Allison Leslie Boydston Calvin O. Qualset Herbert E. Vogt

Charles G. Summers

Effective aphid pest management strategies depend on a knowledge of the economically important species present in an area and their flight behavior. A suction trap at UC Davis collected 60 aphid species. most of which are economically important. The trap detected the first specimens of the Russian wheat aphid found in northern California.

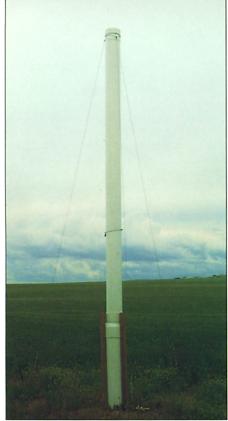
Aphids occur throughout the world on a wide variety of cultivated and wild plants. Many aphids cause economic damage through direct feeding, injection of toxins, transmission of plant pathogenic viruses, contamination with honeydew, or their presence on edible plant parts. They may attack any portion of the plant including leaves, stems, fruit, and roots.

Because aphids have adverse effects on many crops, are widely distributed, and reproduce rapidly, aphid control has been under investigation for many years. The introduction of biological control agents,

such as lady beetles and syrphids, has not been practical in large-scale crop production, but the natural occurrence of these insects and fungal diseases or parasites has reduced aphid populations in such crops as sugarbeets. Adjusting planting dates to avoid a damaging infestation can be effective in barley, wheat, sugarbeets, and some other crops. Control by insecticides is effective, but is costly when repeated applications are needed. Insecticides usually do not control diseases caused by aphid-transmitted viruses, because the viruses are transmitted from the aphid to the plant during a short feeding period before the insecticide kills the aphid.

Trapping aphids

Monitoring aphid populations is a first step in developing crop management practices to minimize losses. Methods of determining the aphid species and numbers present include ground-level collection of flying aphids in pan traps, vacuum or sweeping techniques to remove aphids directly from plants, and direct counts of insects on plants. Aphids can also be collected at various distances above the soil surface with suction traps. In the western United



Aphid suction trap is part of the network of traps established in the western states.

States and in Europe, suction traps 28 feet above the surface have been effective in assessing seasonal aphid flights and in determining aphid numbers, which can be related to potential crop losses. None of these methods alone is sufficient to establish management decisions.

A network of more than 75 aphid suction traps established through the Western Region Integrated Pest Management project and various state agricultural experiment stations is now being used in the western United States and Canada. The suction trap was developed at the Washington State University Irrigated Agriculture Research and Extension Center. It has proved useful in detecting which aphid species were prevalent as vectors of the barley yellow dwarf virus, a generally distributed pathogen of small grains.

The traps have also been used to track the advance and the spring, summer, and fall migrations of the Russian wheat aphid, Diuraphis noxia, a new pest first found in the United States in 1986. Because of the need for information on economically important aphids, the system of traps has been expanded annually, most recently in California, where seven new traps were installed in late 1988. California's first trap was placed at the Agronomy Farm on the University of California Davis campus in 1987.

The results of the first year of monitoring aphid species from the Davis trap presented here demonstrate the variety of aphid species detected and their seasonal flight distributions. A sample was taken from the trap each week from February through November 1988 and assayed at the aphid laboratory at Prosser, Washington. The trap has already been useful in detecting the Russian wheat aphid for the first time in northern California.

Aphid species found in 1988

More than 60 species representing 37 genera were trapped, of which about 80% are economically important. The 10 most abundant species were birdcherry oat aphid (with 43.4% of total catch), pea aphid, green peach aphid, turnip aphid, potato aphid, greenbug, rice root aphid, mealy plum aphid, rose grass aphid, and green citrus aphid (fig. 1, table 1).

In the United States, 27 aphid species are capable of colonizing and feeding on small grains; at Davis, 12 cereal aphid species were detected. The predominant one was

Aphis armoraciae Metopolophium dirhodum Ro Rhopalosiphum insertum Aphicalosiphum padi Ri, rufiabdominalis Rii, rufiabdominalis Riibabominalis Riibabominalis Riibaboni armoraciae Erratraneura ulmi Eli Su DTHER ECONOMIC APHIDS Acyrthosiphum kondoi Blidacyrthosiphum kondoi Blidacyrthosiphum pisum Aphis circola Acyrthosiphum pisum Aphis circola Aphis gossypii Caphis gossypii Caphis gossypii Cavariella asparagi Brachycardus helichrysi Brachycardus helichrysi Brachycorynella asparagi Brevicoryne brassicae Cavariella aegopodii William Sulani Dysaphis plantaginea Hyadaphis foeniculi Hyalopterus pruni Hyperomyzus lactucae Lipaphis erysimi Tu Macrosiphum euphorbiae Myzus persicae Gar	Common name Western aster root aphid Dogwood aphid [root feeding aphid] Russian wheat aphid Rose grass aphid Apple grain aphid Corn leaf aphid Birdcherry oat aphid Rice root aphid Greenbug English grain aphid Elm grass root aphid Subtotal Blue alfalfa aphid [vector/lettuce mosaic]	Feb 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0	Mar 0 0 0 0 0 0 1981 78 117 1 0	Apr 1 0 0 0 34 0 4 835 52 55 5 0 986	1 0 0 2 39 1 2 42 2 5 5 0 99	No. of a Jun 0 0 0 2 2 0 0 1 1 0 8	9	Aug 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Sep 0 0 0 0 0 1 2 4 0 0 45 0 2	Oct 1 1 1 0 0 0 1 5 7 19 7 0 0	Nov 0 0 0 0 0 12 19 25 2 0	Total 3 1 1 9 75 5 25 3300 178 235	Total aphid catch <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <2.0 43.4 2.3	0.1 <0.1 <0.1 <0.1 0.2 1.9 0.1 0.6 85.6
CEREAL APHIDS Aphis armoraciae Anoecia corni Do Colopha ulmicola [ro Colopha ulmicola Ru Metopolophium dirhodum Ro Rhopalosiphum insertum Aph Rhopalosiphum maidis Co Rhopalosiphum padi Bii Rhitilabdominalis Rii Schizaphis graminum Gr Sitobion avenae Er Tetraneura ulmi Eli Su COTHER ECONOMIC APHIDS Acyrthosiphum kondoi Bii Acyrthosiphum kondoi Bii Acyrthosiphum pisum Pe Aphis craccivora Co Aphis circola Gr Aphis gossypii Co Aulacorthum solani Fo Brachycaudus helichrysi Pi Brachycorynella asparagi As Brevicoryne brassicae Ca Cavariella aegopodii Wi Dysaphis plantaginea Ro Hyadaphis (beniculi Helyalopteus pruni Mi Hyperomyzus lactucae Bi Lipaphis erysimi Tu Macrosiphum euphorbiae Myzus persicae Gr	Western aster root aphid Dogwood aphid root feeding aphid] Russian wheat aphid Rose grass aphid Apple grain aphid Corn leaf aphid Birdcherry oat aphid Rice root aphid Greenbug English grain aphid Elm grass root aphid Subtotal Blue alfalfa aphid	0 0 0 0 0 0 1 1 0 408 1 2 1 0	0 0 0 0 0 0 0 1981 78 117 1 0	1 0 0 0 34 0 4 835 52 55 5	1 0 0 2 39 1 2 42 2 5 5	0 0 0 2 2 0 0 2 0 1 1	0 0 0 5 0 0 0	0 0 0 0 0 0 1 0 2 0	0 0 0 0 0 1 2 4 0 45 0	1 1 0 0 1 5 7 19 7	0 0 0 0 0 0 12 19 25 2	3 1 1 9 75 5 25 3300 178	<pre><1.0 <1.0 <1.0 <1.0 <1.0 <1.0 <1.0 41.0 43.4</pre>	0.1 <0.1 <0.1 <0.1 0.2 1.9 0.1 0.6 85.6
Aphis armoraciae Aphis armoraciae Anoecia corni Doc Colopha ulmicola Diuraphis noxia Metopolophium dirhodum Ro Rhopalosiphum insertum Rhopalosiphum padi R. rufiabdominalis R. rufiabdominalis Ristobion avenae Tetraneura ulmi CO THER ECONOMIC APHIDS Acyrthosiphum kondoi Blid Acyrthosiphum lactucae Acyrthosiphum lactucae Acyrthosiphum pisum Aphis ciracivora Aphis craccivora Aphis craccivora Co Cavariella asparagi Brachycarynella asparagi Brevicorynella asparagi	Dogwood aphid root feeding aphid] Russian wheat aphid Rose grass aphid Apple grain aphid Corn leaf aphid Birdcherry oat aphid Rice root aphid Greenbug English grain aphid Elm grass root aphid Subtotal	0 0 0 0 1 0 408 1 2 1 0	0 0 0 0 0 0 1981 78 117 1 0	0 0 0 34 0 4 835 52 55 5	0 0 2 39 1 2 42 2 5 5	0 0 2 2 0 0 2 0 1 1	0 0 5 0 0 0 0	0 0 0 0 1 0 2 0 1	0 0 0 0 1 2 4 0 45	1 1 0 0 1 5 7 19 7	0 0 0 0 0 0 12 19 25 2	1 1 9 75 5 25 3300 178	<1.0 <1.0 <1.0 1.0 <1.0 <1.0 43.4	<0.1 <0.1 0.2 1.9 0.1 0.6 85.6
Anoecia corni Colopha ulmicola Colopha ulmicola Colopha ulmicola Colopha ulmicola Colopha ulmicola Coloraphis noxia Re Metopolophium dirhodum Ro Rhopalosiphum insertum Aphopalosipum maidis Ri Robalosiphum padi Robalosiphum padi Robalosiphum padi Robalosiphum padi Robalosiphis graminum Gr Sothizaphis graminum Gr Sothizaphis graminum Eli DTHER ECONOMIC APHIDS Acyrthosiphum kondoi Roythosiphum lactucae Acyrthosiphum pisum Robalosiphum Robalo	Dogwood aphid root feeding aphid] Russian wheat aphid Rose grass aphid Apple grain aphid Corn leaf aphid Birdcherry oat aphid Rice root aphid Greenbug English grain aphid Elm grass root aphid Subtotal	0 0 0 0 1 0 408 1 2 1 0	0 0 0 0 0 0 1981 78 117 1 0	0 0 0 34 0 4 835 52 55 5	0 0 2 39 1 2 42 2 5 5	0 0 2 2 0 0 2 0 1 1	0 0 5 0 0 0 0	0 0 0 0 1 0 2 0 1	0 0 0 0 1 2 4 0 45	1 1 0 0 1 5 7 19 7	0 0 0 0 0 0 12 19 25 2	1 1 9 75 5 25 3300 178	<1.0 <1.0 <1.0 1.0 <1.0 <1.0 43.4	<0.1 <0.1 0.2 1.9 0.1 0.6 85.6
Anoecia corni Colopha ulmicola [to Diuraphis noxia Metopolophium dirhodum Rhopalosiphum insertum AphRopalosiphum maidis Rinopalosiphum maidis Rinopalosiphum maidis Rischizaphis graminum Grischizaphis graminum Gristobion avenae Erraneura ulmi Eli St. OTHER ECONOMIC APHIDS Acyrthosiphum lactucae Acyrthosiphum lactucae [vi Acyrthosiphum pisum Aphis craccivora Aphis craccivora Aphis craccivora Aphis gossypii Co Aulacorthum solani Brachycaudus helichrysi Brachycorynella asparagi Brevicoryne brassicae Cavariella aegopodii Wysaphis plantaginea Hyadaphis foeniculi Hyalopterus pruni Myperomyzus lactucae Lipaphis erysimi Tu Macrosiphum euphorbiae Myzus persicae Gri	Dogwood aphid root feeding aphid] Russian wheat aphid Rose grass aphid Apple grain aphid Corn leaf aphid Birdcherry oat aphid Rice root aphid Greenbug English grain aphid Elm grass root aphid Subtotal	0 0 0 1 0 408 1 2 1 0	0 0 0 0 0 1981 78 117 1 0	0 0 34 0 4 835 52 55 5	0 2 39 1 2 42 2 5 5	0 0 2 2 0 0 2 0 1 1	0 0 5 0 0 0 0	0 0 0 0 1 0 2 0 1	0 0 0 0 1 2 4 0 45	1 0 0 1 5 7 19 7	0 0 0 0 12 19 25 2	1 1 9 75 5 25 3300 178	<1.0 <1.0 <1.0 1.0 <1.0 <1.0 43.4	<0.1 <0.1 0.2 1.9 0.1 0.6 85.6
Colopha ulmicola [ro Diuraphis noxia Ru Metopolophium dirhodum Ro Rhopalosiphum insertum Ap Rhopalosiphum insertum Ap Rhopalosiphum maidis Co Rhopalosiphum padi Bil R. ruliabdominalis Ri Rochizaphis graminum Gir Silobion avenae Er Tetraneura ulmi Eli DTHER ECONOMIC APHIDS Acyrthosiphum kondoi Bil Acyrthosiphum lactucae [vi Acyrthosiphum pisum Pe Acyrthosiphum pisum Pe Aphis craccivora Co Aphis craccivora Co Aphis gossypii Co Aulacorthum solani Fo Birachycorynella asparagi Ri Birachycorynella asparagi As Brevicoryne brassicae Co Cavariella aegopodii Wi Dysaphis plantaginea Ro Hyadaphis (beniculi Hyalopterus pruni Mr Hypleromyzus lactucae Bil Lipaphis erysimi Tu Macrosiphum euphorbiae Myzus persicae Gi	iroot feeding aphid] Russian wheat aphid Russian wheat aphid Rose grass aphid Apple grain aphid Corn leaf aphid Birdcherry oat aphid Rice root aphid Greenbug English grain aphid Elm grass root aphid Subtotal Blue alfalfa aphid	0 0 1 0 408 1 2 1 0	0 0 0 0 1981 78 117 1 0	0 34 0 4 835 52 55 5	2 39 1 2 42 2 5 5	2 2 0 0 2 0 1 1	5 0 0 0 0 1 0	0 0 1 0 2 0 1	0 0 1 2 4 0 45	0 0 1 5 7 19 7	0 0 0 12 19 25 2	9 75 5 25 3300 178	<1.0 <1.0 1.0 <1.0 <1.0 43.4	<0.1 0.2 1.9 0.1 0.6 85.6
Diuraphis noxia Metopolophium dirhodum Rhopalosiphum insertum Rhopalosiphum insertum Rhopalosiphum padi Rhopalosiphum padi Rivliabdominalis Reliviable Graminum Rivliabdominalis Reliviable Graminum	Russian wheat aphid Rose grass aphid Apple grain aphid Corn leaf aphid Birdcherry oat aphid Rice root aphid Greenbug English grain aphid Elm grass root aphid Subtotal	0 1 0 408 1 2 1 0	0 0 0 1981 78 117 1 0	34 0 4 835 52 55 5	39 1 2 42 2 5 5	2 2 0 0 2 0 1 1	5 0 0 0 0 1 0	0 1 0 2 0 1	0 1 2 4 0 45	0 1 5 7 19 7 0	0 0 12 19 25 2	75 5 25 3300 178	<1.0 1.0 <1.0 <1.0 43.4	0.2 1.9 0.1 0.6 85.6
Rhopalosiphum insertum Aphopalosipum maidis Chizaphis graminum Graphiobinum padi Britaphis graminum Graphiobinum padi Britaphis graminum Graphiobinum kondoi Acyrthosiphum kondoi Acyrthosiphum kondoi Bultosiphum kondoi Bultosiphum lactucae Cyrthosiphum losum Aphis craccivora Aphis craccivora Aphis craccivora Graphis gossypii Coalaphis gossypii Coalaphis gossypii Coalaphis gossypii Brachycorynella asparagi Brachycorynella asparagi Brevicoryne brassicae Cavariella aegopodii Wyosaphis plantaginea Hyadaphis foeniculi Hyalopterus pruni Hyperomyzus lactucae Bultaphis erysimi Macrosiphum euphorbiae Myzus persicae Graypusicae Grayp	Apple grain aphid Corn leaf aphid Birdcherry oat aphid Rice root aphid Greenbug English grain aphid Elm grass root aphid Subtotal Blue alfalfa aphid	1 0 408 1 2 1 0	0 0 1981 78 117 1 0	0 4 835 52 55 5 0	1 2 42 2 5 5	0 0 2 0 1 1	0 0 0 1 0	1 0 2 0 1	1 2 4 0 45 0	1 5 7 19 7	0 12 19 25 2	5 25 3300 178	<1.0 <1.0 43.4	0.1 0.6 85.6
Rhopalosiphum insertum Aphopalosipum maidis Chizaphis graminum Graphiobinum padi Britaphis graminum Graphiobinum padi Britaphis graminum Graphiobinum kondoi Acyrthosiphum kondoi Acyrthosiphum kondoi Bultosiphum kondoi Bultosiphum lactucae Cyrthosiphum losum Aphis craccivora Aphis craccivora Aphis craccivora Graphis gossypii Coalaphis gossypii Coalaphis gossypii Coalaphis gossypii Brachycorynella asparagi Brachycorynella asparagi Brevicoryne brassicae Cavariella aegopodii Wyosaphis plantaginea Hyadaphis foeniculi Hyalopterus pruni Hyperomyzus lactucae Bultaphis erysimi Macrosiphum euphorbiae Myzus persicae Graypusicae Grayp	Apple grain aphid Corn leaf aphid Birdcherry oat aphid Rice root aphid Greenbug English grain aphid Elm grass root aphid Subtotal Blue alfalfa aphid	0 408 1 2 1 0 413	0 1981 78 117 1 0	4 835 52 55 5 0	1 2 42 2 5 5	0 0 2 0 1 1	0 0 1 0	0 2 0 1	2 4 0 45 0	5 7 19 7 0	12 19 25 2	5 25 3300 178	<1.0 <1.0 43.4	0.1 0.6 85.6
Rhopalosipum maidis Rhopalosipum maidis Rhopalosiphum padi Billosiphum padi Billosiphum padi Reliabilis Rii Schizaphis graminum Gritobion avenae Fetraneura ulmi Su DTHER ECONOMIC APHIDS Acyrthosiphum kondoi Billosiphum kondoi Billosiphum pisum Petrosiphum pisum	Corn leaf aphid Birdcherry oat aphid Rice root aphid Greenbug English grain aphid Elm grass root aphid Subtotal Blue alfalfa aphid	408 1 2 1 0 413	1981 78 117 1 0	4 835 52 55 5 0	2 42 2 5 5	0 2 0 1 1	0 0 1 0	2 0 1 0	4 0 45 0	5 7 19 7 0	12 19 25 2	25 3300 178	<1.0 43.4	0.6 85.6
Ithopalosiphum padi Bit Ithufabdominalis Rit Ithufabdominalis Ele Ithufabdominalis Bit Ithufabdominalis Rit Ithufabdominalis Ri	Birdcherry oat aphid Rice root aphid Greenbug English grain aphid Elm grass root aphid Subtotal	408 1 2 1 0 413	1981 78 117 1 0	835 52 55 5 0	42 2 5 5	2 0 1 1 0	0 1 0 0	2 0 1 0	4 0 45 0	7 19 7 0	19 25 2	3300 178	43.4	85.6
Rufliabdominalis Rifichizaphis graminum Gritiobion avenae Erietraneura ulmi Eli DTHER ECONOMIC APHIDS Leyrthosiphum kondoi Acyrthosiphum lactucae Leyrthosiphum pisum Peter Conomic Graminum Aphis craccivora Corticola Gracificola Gracif	Rice root aphid Greenbug English grain aphid Elm grass root aphid Subtotal Blue alfalfa aphid	1 2 1 0 413	78 117 1 0 2177	52 55 5 0	2 5 5 0	0 1 1 0	1 0 0	0 1 0	45 0	19 7 0	25 2	178		
chizaphis graminum ilitobion avenae eteraneura ulmi Eli SU THER ECONOMIC APHIDS tcyrthosiphum kondoi tcyrthosiphum lactucae tcyrthosiphum pisum pelis cracicvora Aphis citricola Griphis criscivora Grachycaudus helichrysi Brachycorynella asparagi Grachycorynella asparagi Gravicoryne brassicae Cavariella aegopodii Wysaphis plantaginea Hyadaphis foeniculi Hyalopterus pruni Hyperomyzus lactucae Lipaphis erysimi Macrosiphum euphorbiae Myzus persicae Gri	Greenbug English grain aphid Elm grass root aphid Subtotal Blue alfalfa aphid	1 0 413	117 1 0 2177	55 5 0	5 5 0	1 1 0	0	1	45 0	7	2			4.6
intobion avenae Er etraneura ulmi Eli Eli St. DIHER ECONOMIC APHIDS Acyrthosiphum kondoi Blin cyrthosiphum lactucae [vi Aphis craccivora Grachychis citricola Grachycaudus helichrysi Brachycorynella asparagi As Brachycorynella asparagi Brachycorynella Brachycor	English grain aphid Elm grass root aphid Subtotal Blue alfalfa aphid	1 0 413	1 0 2177	5 0	5 0	1 0	0	0	0	0			3.1	6.1
Tetraneura ulmi Subtraneura ulmi DTHER ECONOMIC APHIDS kcyrthosiphum kondoi kcyrthosiphum lactucae kcyrthosiphum pisum Pe kcyrthosiphum pisum Re kcyrthosiphum Re kcyrthosiphum pisum Re	Elm grass root aphid Subtotal Blue alfalfa aphid	0 413	0 2177	Ō	0	ò						13	<1.0	0.3
State Conomic Aphids cyrthosiphum kondoi Blicyrthosiphum lactucae [vicyrthosiphum lactucae] cyrthosiphum pisum Pechiphis cracivora Graphis critricola Graphis gossypii Craphis critricola Grachycaudus helichrysi Plicarchycaudus helichrysi Plicarchycorynella asparagi Asgrachycorynella asparagi Asgravicoryne brassicae Cravariella aegopodii Williagophis foeniculi Hyalopterus pruni Milyperomyzus lactucae Blicipaphis erysimi Tukacrosiphum euphorbiae Myzus persicae Gravariselpam euphorbiae euph	Subtotal Blue alfalfa aphid	413	2177				•	-	-	4	2	8	<1.0	0.2
Acyrthosiphum kondoi Bliocyrthosiphum kondoi Qurthosiphum lactucae Queythosiphum lactucae Queythosiphum lactucae Queythosiphum pisum Prophis craccivora Graphis gossypii Qualacorthum solani Prophis crachycaudus helichrysi Pliocycorynella asparagi Asgrachycorynella asparagi Asgravicoryne brassicae Queythyadaphis foeniculi Hydadaphis foeniculi Hydalphis teniculi Hydalphis erysimi Tumacrosiphum euphorbiae Queytsieae Graydysus persicae Graydysus persi	Blue alfalfa aphid			986	99		•		- 4					0.2
cyrthosiphum kondoi cyrthosiphum lactucae cyrthosiphum lactucae cyrthosiphum pisum Pe phis craccivora Co phis citricola ghis gossypii Co ulacorthum solani trachycaudus helichrysi trachycorynella asparagi Astevicoryne brassicae Cavariella aegopodii Wysaphis plantaginea dyydaphis foeniculi dyglopterus pruni Myeromyzus lactucae pipaphis erysimi Ascrosiphum euphorbiae Myzus persicae Gi		0				8	6	4	54	46	60	3853	50.7	
cyrthosiphum lactucae cyrthosiphum pisum Pe pibis cractivora phis citricola ghis gossypii ulacorthum solani trachycaudus helichrysi trachycorynella asparagi As arvericus asparagi As arvericus asparagi As arvericus asparagi As arvericus asparagi W Dysaphis plantaginea Hyadaphis foeniculi Hyalopterus pruni Myeromyzus lactucae pipaphis erysimi Ascrosiphum euphorbiae Myzus persicae Gi		0				-	_	_	_	_	_			
cyrthosiphum pisum Peophis craccivora Cophis craccivora Graphis gossypii Cophis gossypii Cophis gossypii Cophis gorachycaudus helichrysi Placachycorynella asparagi Astrevicoryne brassicae Caravariella aegopodii Wipsaphis plantaginea Rolyadaphis foeniculi Hyalopterus pruni Mityalopterus pruni Tudacrosiphum euphorbiae Graccivorae	[vector/lettuce mosaic]		0	36	9	0	0	0	0	0	0	45	<1.0	_
ophis craccivora Co ophis craccivora Grophis citricola Grophis gossypii Co Aulacorthum solani Fo Brachycaudus helichrysi Pli Brachycorynella asparagi As Brevicoryne brassicae Co Cavariella aegopodii W Oysaphis plantaginea Ro Hyadaphis foeniculi Ho offen of the bracking Bl Hyalopterus pruni M Hyperomyzus lactucae Bl Lipaphis erysimi Tu Macrosiphum euphorbiae Go Myzus persicae Gi		0	16	14	0	0	0	0	0	0	2	32	<1.0	_
phis citricola Gr Aphis gossypii Cr Aphis gossypii Cr Brachycaudus helichrysi Pl Brachycorynella asparagi As Brevicoryne brassicae Cr Bravariella aegopodii W Dysaphis plantaginea Ro Hyadaphis foeniculi Helyalopterus pruni M Hyperomyzus lactucae BI Aparosiphum euphorbiae Gr Myzus persicae Gi	Pea aphid	1	33	224	23	1	0	0	39	215	231	767	10.1	_
Aphis gossypii Co Aphis gossypii Co Aulacorthum solani Fc Brachycorynella asparagi As Brevicoryne brassicae Ca Cavariella aegopodii W Dysaphis plantaginea Re Hyadaphis foeniculi Helyalopterus pruni M Hyperomyzus lactucae BI nacrosiphum euphorbiae G Myzus persicae G G	Cowpea aphid	4	17	18	5	3	3	1	0	0	0	51	<1.0	-
Aulacorthum solani Fc Brachycaudus helichrysi Pl Brachycorynella asparagi As Brevicoryne brassicae Ca Cavariella aegopodii W Dysaphis plantaginea Rc Hyadaphis loeniculi Hyalopterus pruni Mi Hyperomyzus lactucae Bl Macrosiphum euphorbiae Pc Myzus persicae Gi	Green citrus aphid	2	48	0	0	0	0	0	2	0	0	52	<1.0	_
Brachycaudus helichrysi Brachycorynella asparagi Brachycorynella asparagi Brevicoryne brassicae Cavariella aegopodii Wy Dysaphis plantaginea Hyadaphis foeniculi Hyadopterus pruni My Hyperomyzus lactucae Bi Lipaphis erysimi Macrosiphum euphorbiae Myzus persicae Gi	Cotton aphid	0	32	0	0	0	0	0	0	0	0	32	<1.0	_
Brachycorynella asparagi As Brevicoryne brassicae Ca Cavariella aegopodii W Dysaphis plantaginea Re Hyadaphis loeniculi Hryalopterus pruni M Hyperomyzus lactucae BI Lipaphis erysimi Tu Macrosiphum euphorbiae Gi	Foxglove aphid	0	1	9	8	0	0	0	0	0	0	18	<1.0	_
Brevicoryne brassicae Ca Cavariella aegopodii W Dysaphis plantaginea Re Hyadaphis foeniculi He Hyalopterus pruni M Hyperomyzus lactucae Bi Lipaphis erysimi Tu Macrosiphum euphorbiae Pe Myzus persicae Gi	Plum leafcurl aphid	0	2	27	15	0	0	0	0	0	0	44	<1.0	_
Cavariella aegopodii W Dysaphis plantaginea R Hyadaphis loeniculi H Hyalopterus pruni M Hyperomyzus lactucae BI Lipaphis erysimi Tu Macrosiphum euphorbiae G Myzus persicae G	Asparagus aphid	0	0	0	0	0	0	0	4	13	3	20	<1.0	_
Dysaphis plantaginea Ro Hyadaphis (beniculi Hu Hyalopterus pruni M Hyperomyzus lactucae BI Lipaphis erysimi Tu Macrosiphum euphorbiae Gi Myzus persicae Gi	Cabbage aphid	0	0	0	1	0	0	0	0	0	0	1	<1.0	_
Hyadaphis foeniculi Ho Hyalopterus pruni M Hyperomyzus lactucae Bl Lipaphis erysimi Tu Macrosiphum euphorbiae P Myzus persicae Gi	Willow carrot aphid	0	0	8	2	1	0	0	0	0	0	11	<1.0	_
Hyalopterus pruni Mr. Hyperomyzus lactucae Bl. Lipaphis erysimi Tu. Macrosiphum euphorbiae Pr. Myzus persicae Gi	Rosy apple aphid	0	0	16	0	0	0	0	0	0	0	16	<1.0	_
Hyperomyzus lactucae BI Lipaphis erysimi Tu Macrosiphum euphorbiae Po Myzus persicae Gi	Honeysuckle aphid	0	0	0	0	1	0	0	1	1	0	3	<1.0	_
Lipaphis erysimi Tu Macrosiphum euphorbiae Po Myzus persicae Gi	Mealy plum aphid	0	0	20	56	1	0	0	0	3	3	83	1.1	1.
Macrosiphum euphorbiae Po Myzus persicae Gi	Black currant thistle aphid	0	0	2	4	1	0	0	0	0	0	7	<1.0	_
Myzus persicae Gi	Turnip aphid	1	105	103	9	2	1	3	4	18	6	252	3.3	_
	Potato aphid	0	16	5	0	157	25	38	0	1	0	242	3.2	-
Nearactanhis hakeri St	Green peach aphid	5	283	237	14	0	0	0	5	34	29	607	8.0	
	Short-beaked clover aphid	1	0	0	1	0	0	0	0	0	1	3	<1.0	· —
Therioaphis maculata	Spotted alfalfa aphid	0	0	0	0	0	0	0	2	1	2	5	<1.0	· —
Si	Subtotal	14	553	719	147	167	29	42	57	286	277	2291	30.1	· —
ALL ECONOMIC APHIDS SI	Subtotal	427	2730	1705	246	175	35	46	109	330	337	6140	80.8	_
NONECONOMIC APHIDS S		4	307	469	237	128	116	11	72	47	68	1459	19.2	_
ALL APHIDS TO	Subtotal	431	3037	2174	483	303	151	57	181	377	405	7599		



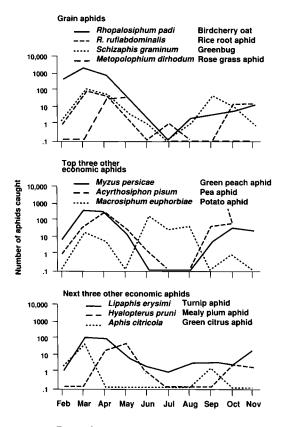


Fig. 1. Seasonal distribution of 10 aphid species caught most frequently in a suction trap at Davis, California, 1988.

The cream-colored stripes on wheat leaves are the most characteristic symptom of damage by Russian wheat aphid. Leaves later curl in a corkscrew fashion and resemble onion leaves.

birdcherry oat aphid, a common aphid pest and virus vector of worldwide distribution. In Washington state, this species is abundant during the fall, sometimes constituting up to 95% of the flying aphids, but in the warmer climate of California, its peak flights occurred between February and April. Six of the 12 species of cereal aphids trapped at Davis form colonies on the roots of wheat and other plants: western aster root aphid, dogwood aphid, Colopha ulmicola, apple grain aphid, rice root aphid, and elm grass root aphid). These are probably minor pests in California, except possibly rice root aphid. The remaining six species are potentially major pests, depending on their abundance and the percentage transmitting virus. Previous work by V. Burton and others in California has shown that birdcherry oat aphid, English grain aphid, rose grass aphid, and greenbug are the most important species, in that order.

The pattern or peak flight period of most economic aphid species at Davis occurred during the first half of the year in contrast to regions further north. Three exceptions were potato aphid, which peaked in June, July, and August; and pea aphid and green peach aphid, which peaked in April and also in October and November.

Green peach aphid

The presence of green peach aphid in suction trap catches in the spring or summer is important, even in low numbers, because of its potential to transmit virus to crops. Host crops include almond, cabbage, carnation, peach, pepper, potato, spinach. strawberry, sugarbeet, tomato, turnip, and wheat. Sugarbeet yellows and potato leafroll viruses are among important viruses transmitted by this aphid.

Russian wheat aphid

The Russian wheat aphid was first sighted in Mexico in 1980 and in Texas in 1986. By 1988 it was found in 15 western and midwestern states. Crop losses were estimated at about \$80 million in 1988.

In California, the Russian wheat aphid was first found in Imperial County in March 1988. Its discovery in Davis by suction trap in May 1988 was significant, since the species was not previously known north of Imperial County. In addition to Imperial and Yolo counties infested in 1988, the Russian wheat aphid has been reported in 1989 in Alameda, Contra Costa, Fresno, Kern, Los Angeles, Riverside, Sacramento, San Benito, San Bernardino, San Joaquin, Santa Clara, and Solano counties. Because of this aphid's prolific nature and its high potential to damage wheat and barley, early detection and timely controls will be important

during the winter and spring growing seasons.

The suction trap results indicated a very low frequency of winged Russian wheat aphids during May-July. It was not known how or if these aphids would survive through the summer in California. None were collected during the fall. However, in September-planted wheat, barley, and oats at Davis, typical symptoms of Russian wheat aphid feeding were observed in November. Specimens were positively identified later as Russian wheat aphid. This was a mixed planting of Atlas 57 barley, Tanori 71 wheat, and California Red oat varieties. In January 1989, counts were made of healthy and affected plants from three replicates of this planting. Barley was the most severely affected (71 of 134 plants, or 53%), followed by wheat with 13 of 50 plants (26%) showing symptoms induced by Russian wheat aphid. Oat was practically free of damage (2 of 182 plants, 1%).

The appearance of Russian wheat aphid in the suction trap earlier in the year was taken as a warning that this pest might appear in the next crop cycle. This was the case, since a low level of Russian wheat aphid infestation was documented at the UC Davis Agronomy Farm in November 1988. No winged individuals were found at that time on either the grain or in the trap. This result emphasizes the need for regular field scouting as well as monitoring suction traps to develop crop management information needed to reduce losses from aphids. These observations and the rapid spread of Russian wheat aphid across the western United States as well as a similarly rapid dispersion in South Africa, point to the importance of monitoring aphid distribution throughout California to develop appropriate control strategies.

Conclusions

In the first year of use in California, the suction trap provided an additional method of monitoring aphid species and their flights. The results of the first year illustrate the value of noting low frequencies of previously undetected species, such as Russian wheat aphid. Because so many California crops are affected by aphids, the expanded network of suction traps and increased ground-level scouting are highly recommended.

Keith S. Pike is Entomologist, and David Allison and Leslie Boydston are Research Technicians, Irrigated Agriculture Research and Extension Center, Washington State University, Prosser; Calvin O. Qualset is Professor, and Herbert E. Vogt is Staff Research Associate, Department of Agronomy and Range Science, University of California, Davis; Charles G. Summers is Associate Entomologist, Department of Entomological Sciences, UC Berkeley (stationed at UC Kearney Agricultural Center, Parlier).