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Seasonal Fluctuations of Alate Aphid Activity in California Citrus Groves

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ABSTRACT. Alate activity of *Aphis gossypii* Glover, *Aphis spiraecola* Patch, *Myzus persicae* (Sulzer), and *Toxoptera aurantii* (Boyer de Fonscolombe) was monitored by yellow water-pan traps during 1981-83 in citrus groves in the San Joaquin Valley, southern coastal, and southern intermediate valley areas of California. The most frequently trapped aphid was *A. spiraecola*, with peak catches exceeding a thousand per trap per week. Spring flights of *A. spiraecola* occurred earlier in southern California than in the San Joaquin Valley. Alate activity of *M. persicae* peaked later in spring than *A. spiraecola* but was similar during summer and fall. *Aphis gossypii* was seldom trapped in the two southern California areas and was less frequently trapped than either *A. spiraecola* or *M. persicae* in spring in the San Joaquin Valley. *Aphis gossypii* was the most frequently trapped species from July to December in the San Joaquin Valley in 1982 and 1983. *Toxoptera aurantii* was infrequently trapped in southern California and it was never trapped in the San Joaquin Valley. Population dynamics and colonizing habits indicate that *A. spiraecola* may play an important role in field spread of citrus tristeza virus, even though it is an inefficient vector.

Index words. Citrus tristeza virus, vectors, aphids, epidemiology, *Aphis gossypii, Aphis spiraecola, Myzus persicae, Toxoptera aurantii.*

Citrus tristeza virus (CTV) is transmitted semipersistently by aphids (4,5). The most efficient CTV vector is the oriental citrus aphid, *Toxoptera citricidus* (Kirkaldy) (2), which occurs worldwide in citrus-growing regions except in North America and the Mediterranean region. In these areas where *T. citricidus* is absent, the melon aphid, *Aphis gossypii* Glover is thought to be the most important vector because it transmits some CTV isolates efficiently (1,2,9,12). Several other reported vector species include *Aphis spiraecola* Patch (formerly *citricola* van der Goot (6)) (8,12) and *Toxoptera aurantii* (Boyer de Fonscolombe) (8), and *Myzus persicae* in India (11).

Recent studies have shown that some California isolates of citrus tristeza virus (CTV) are readily transmitted by indigenous populations of *A. gossypii* (9), and rapid natural spread of severe CTV isolates have been reported (3,10). However, the epidemiology of CTV and the phenology of citrus aphids in California are not adequately understood (5). To gain a better understanding of tristeza epidemiology, we trapped flying aphids throughout 1981-83 in the three major citrus-growing areas of the state where CTV is endemic or is a threat to become endemic. The purpose of this study was to determine the relative abundance of the aphid species which are reported as vectors of CTV and are commonly found in citrus environs in California. This is a report of seasonal variations in the alate activity of four aphid species as indicated by the numbers trapped throughout a 3-yr period.

MATERIALS AND METHODS

Yellow plastic water pans (25 cm diameter, 5 cm in depth), set in yellow wooden platforms (40 x 40 cm^2, 60 cm tall), filled with water and a small amount of detergent were used to trap flying aphids (7) (Fig. 1) at three locations. The locations were 1) six different citrus groves within an 8-km radius of the University of California Lindcove Field Station in the San Joaquin Valley (Tulare Co.); 2) four groves at the University of California South Coast Field Station (Orange Co.) which is approximately 15 km from the Pacific Ocean (hereafter called the coastal site); and 3) eight groves in the area between Riverside (Riverside Co.) and Redlands (San Bernardino Co.) (hereafter called in-

Fig. 1. Yellow water-pan trap used for trapping alate aphids in California citrus groves.

termediate valley site) approximately 100 km east of Los Angeles (Fig. 2). These areas were chosen because: 1) the San Joaquin Valley is the main citrus-growing area in the state and CTV is a major threat because a large proportion of plantings are on sour orange rootstock; and 2) the southern California locations constitute climatically diverse areas in the state where CTV is endemic. One trap was placed at the edge of each grove.

Alate aphids were collected from each trap once a week when the traps were serviced. The aphids were identified under magnification in the laboratory. The aphids counted included *A. gossypii*, *A. spiraecola*, *M. persicae*, and *T. aurantii*, all reported vectors of CTV. At the two southern California locations, weekly observations were made of shoot growth in the groves throughout the 3-yr trapping period.

RESULTS

New growth of citrus, which began late winter-early spring each year, was generally accompanied by a rapid increase in the numbers of trapped alate aphids at each site. As new foliage matured in late spring, the number of trapped aphids of each species decreased rapidly. In general, spring aphid flight activity in southern California citrus peaked from February to early April; whereas it peaked in May in the San Joaquin Valley during our 3-yr survey (Fig. 3).

At the intermediate valley site, *A. spiraecola* was the most abundant aphid trapped with peaks of 1120, 1300, and 140 aphids/trap in April 1981, March 1982, and January 1983, respectively (Fig. 3A). *Myzus persicae* was second in abundance in this location with peaks of 150, 800, and 300 aphids/trap in April 1981, March 1982, and April 1983, respectively. Some alates of these two species were trapped in late summer and fall, but in comparison with the spring flights, numbers were low. Virtually no flight activity of *A. gossypii* or *T. aurantii* occurred at this location.

Aphis spiraecola was the most commonly trapped species at the coastal site, reaching a spring peak of 750 aphids/trap in April 1981. *Myzus persicae* was much less abundant in 1981, reaching a peak of 70 aphids/trap (Fig. 3B); however, in March 1982 and February 1983, flight activity of *M. persicae* peaked at levels similar to *A. spiraecola* (approximately 180 and 50 aphids/trap). As in the intermediate valley site, there was a comparatively low level of alate activity of these two species in summer and fall. There was virtually no activity of *A. gossypii* or *T. aurantii* during the entire survey period in either southern California location.

In early March 1982, heavy rains occurred in southern California and lasted throughout the month. Relatively high counts of *A. spiraecola* per trap were present on the abundant foliar growth at the beginning of the month at both southern California sites; however, collections dropped to near zero in several weeks, well before the young succulent foliage ma-

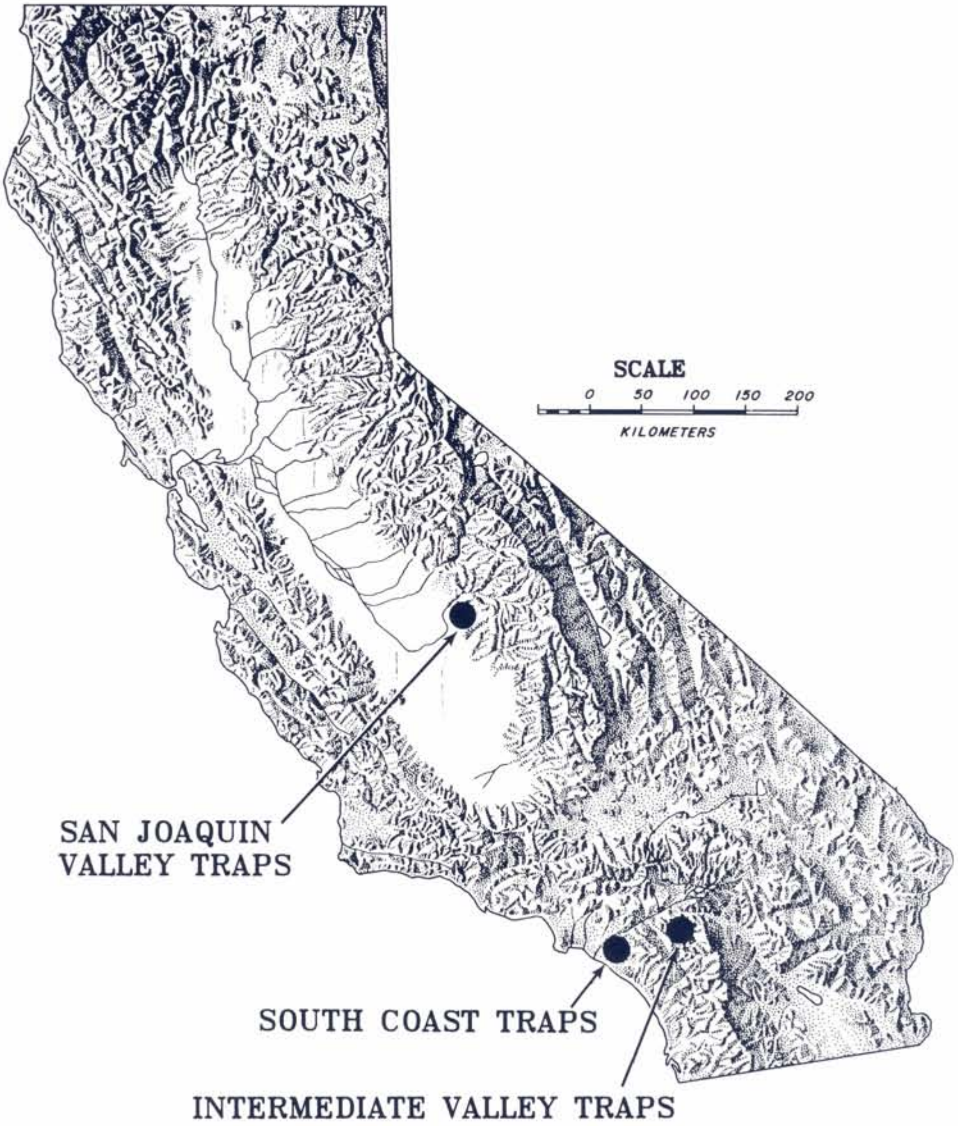

Fig. 2. Map of California showing areas where traps were located to collect alate citrus aphids.

tured in late April. This population collapse, during a period of continued shoot growth favorable for aphids, was not reversed and populations of *A. spiraecola* remained extremely low throughout the rest of the year. *Myzus persicae*, also common in traps in early March, similarly decreased to near zero with the onset of the heavy rains and remained low throughout the rest of the year at the southern California sites.

Aphid flight activity occurred approximately 1 month later in the San Joaquin Valley than in the two southern California sites (Fig. 3C). *Myzus persicae* was the most abundant species trapped reaching peaks in May of 135, 178, and 455 aphids/trap in 1981, 1982, and 1983, respectively. *Aphis spiraecola* was numerous only in April and May in 1981, with approximately 85 aphids/trap/month. In 1982 and 1983, *A. spiraecola* flight ac-

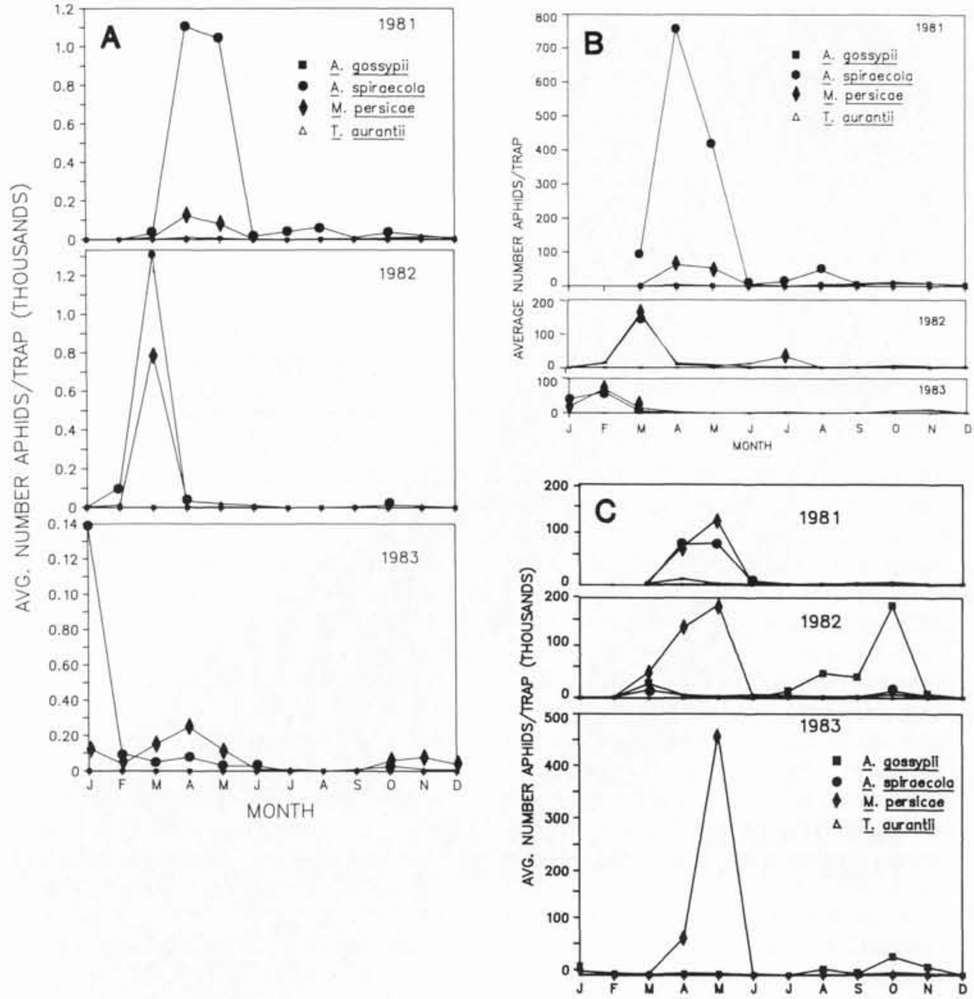

Fig. 3. Seasonal fluctuation in numbers of alate aphids trapped in yellow water-pan traps in citrus groves in three different regions of California. A. Southern California intermediate valley. B. Southern California coastal region. C. San Joaquin Valley. Note the different scales for number aphids/trap. Figures are averages for six trap sites, four trap sites, and six trap sites, respectively.

tivity was sparse throughout the sampling period. *Aphis gossypii* was trapped in March and April in small but consistent levels in 1981 and 1982 with peaks of 15-20 aphids/trap. There was a significant summer and fall flight peak of *A. gossypii* in 1982 and 1983 with peaks of 170 and 50 aphids/trap, respectively, while *A. spiraecola* and *M. persicae* activity remained low. No *T. aurantii* were ever trapped in the San Joaquin Valley.

DISCUSSION

Our findings indicate that *A. spiraecola* is the most common alate aphid species in California citrus groves and corroborate that obtained by Dickson *et al.* (5). Although *A. spiraecola* transmits CTV, it is, at best, an inefficient vector under laboratory conditions (8,12). Many varieties of citrus are excellent hosts of *A. spiraecola* (13) and its populations on citrus are frequently large. With abundant populations and much alate activity in citrus groves, it is highly probable that tree-to-tree spread of CTV by this species occurs. Indeed, in areas where *T. citricidus* does not occur, it may be quite important as a vector of CTV. Although *A. gossypii* is an excellent vector of CTV under experimental conditions (1,2,9,12), populations of *A. gossypii* in citrus are generally much smaller than *A. spiraecola*. Our trap data indicated that there were relatively few alate *A. gossypii* in the southern California groves surveyed, in general agreement with the earlier study (5). Substantial flight activity of this aphid was detected only in late summer and fall in the San Joaquin Valley. Such activity may reflect dispersal of *A. gossypii* into citrus groves from hosts such as senescing melons or cotton. Since these hosts of *A. gossypii* are not CTV reservoirs, immigrating populations can only become viruliferous by feeding in phloem of CTV-infected citrus. Should the field incidence of CTV be low, the opportunities for this are limited. These migrating populations of *A. gossypii* from other crops may pass through citrus groves in search of suitable annual host plants and only occasionally colonize citrus, a less preferred host. In contrast, *Aphis spiraecola* develops primarily on citrus and alatae which develop on a CTV-infected tree and become inoculative will constitute agents of virus spread.

The period of abundant shoot development in early spring was not always accompanied by heavy populations of alate aphids as evidenced by the collapse of *A. spiraecola* populations in the presence of continued shoot growth during the prolonged period of heavy rains in southern California in 1982. The decimation of early-season populations of CTV vectors in conjunction with the onset of a prolonged period of heavy rains would contribute to decreasing the spread of CTV during such periods.

The abundant alate populations of *M. persicae* may be of no consequence in CTV epidemiology in California because it has not been confirmed as a CTV vector in the U.S. (5,8,12). In addition, it only colonizes citrus occasionally and its consistent collection in traps probably indicates that they are either migrating populations in search of new host plants or are residents on weed hosts in the grove (5). The low level of *T. aurantii* trapped in our survey indicates that this species plays an insignificant role in CTV spread in California.

Aphids not included in this survey which colonize citrus occasionally are *Aphis craccivora* Koch, *Aphis fabae* Scopoli, *Aphis helianthi* Monell, *Macrosiphum euphorbiae* (Thomas), and *Aulacorthum solani* (Kaltenbach).

LITERATURE CITED

1. Bar-Joseph, M., and G. Loebenstein
   1973. Effects of strain, source plant, and temperature on the transmissibility of citrus tristeza virus by the melon aphid. Phytopathology 63: 716-720.
2. Bar-Joseph, M., B. Raccah, and G. Loebenstein
   1977. Evaluation of the main variables that affect citrus tristeza virus transmission by aphids. Proc. Int. Soc. Citriculture 3: 958-961.
3. Calavan, E. C., M. K. Harjung, R. L. Blue, C. N. Roistacher, D. J. Gumpf, and P. W. Moore.
   1980. Natural spread of seedlings yellows and sweet orange and grapefruit stem pitting tristeza virus at the University of California, Riverside, p. 67-75. *In* Proc. 8th Conf. IOCV. IOCV, Riverside.
4. Costa, A. S. and T. J. Grant
   1951. Studies on transmission of the tristeza virus by the vector, *Aphis citricidus*. Phytopathology 41: 105-113.
5. Dickson, R. C., M. McD. Johnson, F. A. Flock, and E. F. Laird
   1956. Flying aphid populations in southern California citrus groves and their relation to the transmission of the tristeza virus. Phytopathology 44: 172-176.

6. Eastop, V. F., and R. L. Blackman
1988. The identity of *Aphis citricola* van der Goot. Systematic Entomol. 13: 157-160.
7. McCalley, N. F., and W. H. Lange
1969. A practical aphid trap for field studies. Calif. Agric. 23(10): 18.
8. Norman, P. A., and T. J. Grant
1956. Transmission of tristeza virus by aphids in Florida. Proc. Fla. State Hort. Soc. 69: 38-42.
9. Roistacher, C. N., M. Bar-Joseph, and D. J. Gumpf
1984. Transmission of tristeza and seedling yellow tristeza virus by small populations of *Aphis gossypii*. Plant Disease 68: 494-496.
10. Roistacher, C. N., E. M. Nauer, A. Kishaba, and E. C. Calavan
1980. Transmission of citrus tristeza virus by *Aphis gossypii* reflecting changes in virus transmissibility in California, p. 76-82. *In* Proc. 8th Conf. IOCV. IOCV, Riverside.
11. Varma, P. M., D. G. Rao, and R. S. Vasudeva
1960. Additional vectors of tristeza disease of citrus in India. Curr. Sci. 29: 359.
12. Yokomi, R. K., and S. M. Garnsey
1984. Transmission of citrus tristeza virus by *Aphis gossypii* and *Aphis citricola* in Florida. Phytophylactica 19: 169-172.
13. Yokomi, R. K., and S. M. Garnsey
1988. Host effects on natural spread of citrus tristeza virus in Florida, p. 77-81. *In* Proc. 10th Conf. IOCV. IOCV, Riverside.