

Brown lacewing

Micromus substanticus (Walker)
(Neuroptera: Hemerobiidae)

Members of the Hemerobiidae are commonly referred to as brown lacewings. The *M. substanticus* adult is brown and averages 7.1 mm in length from the front of the head to the tips of the wings, which are folded rooflike over the body when at rest. Both body and wings are covered with brown hair. The oblong-ovoid eggs, laid singly and horizontally on the undersides of leaflets, average 0.9 by 0.38 mm. They are opaque white when first laid, becoming pinkish orange near hatching, and have faint spiral markings on the surface. The slender larvae are rust-red dorsally with pinkish red markings laterally on the body, becoming less distinct toward the rear on the abdominal segments. Pupation occurs in a thin, loosely woven silk cocoon spun primarily on the undersides of leaflets. Brown lacewing larvae feed voraciously on all stages of the spider mite.

Although brown and green lacewing larvae are superficially similar, the mouthparts (mandibles) of brown lacewing larvae are shorter and stouter. Additionally, the rings (annulae) on the basal half of the antennae of brown lacewing larvae are closer together than those (wider rings) of green lacewing larvae. Larvae of brown lacewing are more common than those of green lacewing on strawberry early in the growing season.

Green lacewings

Chrysopa spp.
(Neuroptera: Chrysopidae)

The adults, averaging 13.9 mm in length to the wing tips, are distinctly green with golden compound eyes and delicate, greenish, iridescent wings that typically are held rooflike over the body when at rest. Each egg is laid on the end of a long, thin stalk attached primarily to the undersides of leaflets. The oblong-ovoid eggs, averaging 0.91 by 0.39 mm, are creamy white to light green and darken just before hatching. The larvae, about 6.25 mm in length, range from pinkish white to rust-red with whitish areas on the back and sides of the body, becoming less distinct toward the rear. Pupation occurs in an oval, whitish cocoon of closely woven silk, which is formed primarily on the undersides of leaflets. Green lacewing larvae feed on all stages of the spider mite as well as on soft-bodied insects, eggs, and small larvae. Adults of some species are carnivorous; others feed on nectar or honeydew.

Dusty wing

Conwentzia californica Meinert
(Neuroptera: Coniopterygidae)

Members of the Coniopterygidae commonly are referred to as dusty wings. The greyish white adult of *C. californica* is about 3 to 4 mm long. The wings are covered with a greyish powder and, like those of the lacewings, are folded rooflike over the body when at rest. The oval, pinkish yellow eggs are about 0.5 by 0.23 mm, with faint hexagonal surface markings, and are laid singly, usually on the

undersides of leaflets. The larvae are pinkish white with reddish orange, variable patterns dorsally on the body, which is broad in the middle, tapering at both ends. This color pattern separates *C. californica* larvae from other predaceous larvae on strawberry. Pupation occurs in a cocoon consisting of a double layer of silk, an inner compact layer more or less oval in shape, and an outer flat, loosely woven web. The outer covering extends beyond the inner cocoon, making it appear flat on the leaf. Both larvae and adults feed on all stages of the spider mite, but the larvae are more voracious.

Western predatory mite

Typhlodromus occidentalis (Nesbitt)
(Acari: Phytoseiidae)

Gravid (egg-laying) females are light amber, pear-shaped, slightly flattened on top, and about 0.37 mm long by 0.24 mm wide. The eggs are oval and almost colorless. The larvae are whitish and slow moving. The nymphal stages (protonymph and deutonymph) resemble the adults, but are smaller. All stages feed on the spider mite.

Typhlodromus occidentalis is the most common of nine predaceous phytoseiids associated with the two-spotted spider mite on strawberry in southern California. *Typhlodromus arboreus* Chant, *Amblyseius californicus* (McGregor), *A. brevispinus* (Kennett) and *A. hibisci* (Chant) are the next most common native species, in that order.

Phytoseiulus persimilis Athias-Henriot
(Acari: Phytoseiidae)

Gravid females of this introduced (exotic), predaceous, phytoseiid mite are orange, globose, and about 0.43 mm long by 0.31 mm wide. The oval eggs are a light pinkish orange. Larvae are greyish white and slow moving as compared with the females, which move very rapidly and disperse considerable distances in search of prey. The two nymphal stages closely resemble the adult female, and all three feed on all stages of the spider mite. The larvae do not feed.

In nine experimental studies from 1964 through 1975, we successfully controlled the two-spotted spider mite on strawberry in southern California, using mass releases of *Phytoseiulus persimilis* early in the growing season. Surveys in 1975 and 1976 showed that *P. persimilis* was well established in the Oxnard area of Ventura County, where it was released in commercial strawberry fields from 1971 through 1977, and where it is considered an important factor in suppression of the two-spotted spider mite.

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Labor trends

John W. Mamer □ Philip L. Martin

California's 82,000 farms employ 600,000 hired workers at some time during the year to tend livestock and to plant and harvest crops. Many of these hired workers are employed in agriculture only a few days or weeks. California farmers have come to depend on a large work force that accommodates itself to their seasonal labor needs. The United States labor force is now growing at a decreasing rate and is projected to do so until 1995. In this article we discuss the changing labor force, adjustments that farm employers can make, changes in the California farm labor market that have emerged in the past two decades, and issues that arise with the increasing employment of foreign workers.

Changing labor force

For California agriculture, the most significant labor force changes are the slowing down in the rate of growth, the increasing average age, and the increasing relative importance of females (U.S. Department of Labor middle growth projections to 1995).

The U.S. labor force (individuals 16 years and older who are employed or unemployed but looking for work) grew by 5.7 million during the 1950s, 12.1 million in the 1960s, 20.1 million in the 1970s. An increase of 18 million is projected for the 1980s. During the next decade, growth will be concentrated in the 25 to 54 age group, reflecting its increasing average age. Fully two-thirds of the labor force growth will be a result of adult women deciding to work (by 1995, 79 percent of all women 25 to 54 years of age are expected to be in the labor force, as compared with 33 percent in 1950).

These trends will affect California agriculture. Agriculture usually hires young men for arduous harvest jobs, adult men and women for easier hoeing and pruning jobs, and adult men for irrigation and equipment operator jobs. Many young men begin to harvest crops when they are 18 to 24, continue to do

affecting agriculture

Farm wage rates in California have increased slightly more than nonfarm rates, and benefits have expanded

seasonal harvest work for 5 to 15 years, and then find an easier (and often more skilled) farm job, such as irrigator or equipment operator, find a nonfarm job, or return to Mexico.

Since the number of American teenagers and young adults is shrinking, and rural service establishments such as fast-food restaurants offer alternative employment to farmworker children, farmers are becoming more dependent on immigrant workers. Immigrant workers usually begin to come to the United States to do harvest work when they are 18 to 30 and return each year for 5 to 10 years. However, immigrants drift out of harvest jobs in their thirties and forties.

California's fruit and vegetable farms hire about 350,000 workers annually. If the average worker has a 10-year harvest "career," then fruit and vegetable growers must recruit about 35,000 new harvest workers each year. Possibly one-fourth of the 350,000 workers are illegal, or undocumented, and the illegal component is 30 to 40 percent among the new recruits. As the number of American teenagers shrinks, this illegal component could rise further.

Employer options

Farmers can adjust to the demographic change in several ways. They could intensively mechanize hand-harvest jobs, or switch to less labor-intensive crops. Farmers could try to make farmwork easier with mechanical aids to attract more American workers. Modern personnel systems improving the terms of employment may encourage some workers to lengthen their harvest careers. Finally, farmers can request temporary foreign workers to fill the labor vacuum.

Agriculture's responses to slower labor force growth depend on economic, technological, and political factors. Low returns and labor problems encouraged many producers of soft fruits to switch to mechanically harvested fruits (prunes) and nuts. Processing tomato acreage in

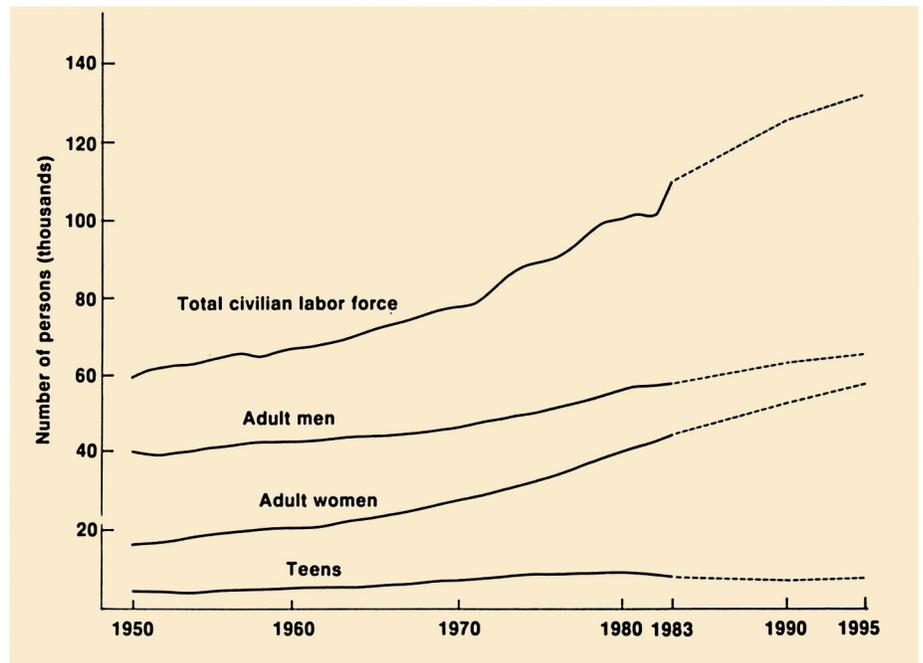
California doubled in the decade after the mechanical tomato harvester was adopted in the mid-1960s.

Some commodities can be harvested with mechanical aids and nontraditional work forces. Lettuce-wrap machines carrying workers who put plastic film over each head of lettuce harvested have increased the proportion of women in the lettuce work force. The field-packing of other vegetables such as broccoli, cauliflower, and melons has decreased the proportion of young men employed in harvesting these commodities. Field-packing is likely to spread for several reasons: field workers' wages are often half those of packingshed workers; the cost of harvesting and packing with hourly wage field-pack workers is often lower than the cost using piece-rate hand-workers; and product quality often improves with the reduced handling in field packing.

Not all labor-intensive commodities have harvests that can be mechanized or made easier with mechanical aids. Strawberry, celery, and citrus growers may be able to double the harvest careers of workers with personnel systems that stress seniority recall, fringe benefits, and training and promotion opportunities. A personnel system can quickly screen out noncommitted farmworkers, increasing productivity and reducing worker turnover. However, a corps of professional harvest workers who maintain a continuing relationship with the producers is not likely to evolve under a casual system of recruiting and managing labor.

The Simpson-Mazzoli Immigration Reform and Control Act contained at least three temporary-worker programs for farmers. Some farmers and farm leaders hope that Congress will enact a temporary-worker program that legalizes the status quo. However, most political observers believe that California agriculture will obtain temporary workers only after it makes major investments in housing and other job-related amenities.

Given demographic trends, a temporary-worker program that legitimized the status quo would make agriculture dependent on government decisions for its work force. Such dependence can impose severe adjustment costs on farmers when political winds change, as in 1965 when many farmers were not prepared for the termination of the Bracero Program, which had brought Mexicans to the United States as temporary farmworkers. There are alternatives to in-



Civilian labor force by age group, 1950-1995. California agriculture will be most affected by the slowing rate of labor force growth. (Source: U.S. Dept. of Labor)

creased dependence on government for farmworkers.

At this time it is difficult to anticipate the alternatives that will prove successful and the extent of their applicability. The structure of the farm labor market has changed over the past two decades, and a new context for adjustment has evolved.

The adjustment context

The California farm labor market, particularly the harvest, has become more complex in the past two decades. In addition to the demographic changes in the labor force and the prospect of immigration reform legislation, highly divergent patterns of compensation and labor management affect the ability of farms to compete in the labor market.

Although many workers who harvest fruits and vegetables are paid \$3.50 to \$6 hourly, some workers, such as those in lettuce harvest, earn up to \$18 to \$25 per hour and receive nonwage benefits such as off-the-job medical insurance, paid holidays, paid vacations, retirement plan, and job rights in successive years that are protected by seniority. Those earning near the minimum wage of \$3.35 tend to be covered only by the legally mandated protective legislation such as worker compensation benefits, unemployment insurance, and disability insurance, and are often recruited and supervised by labor contractors on a casual basis. A significant proportion of the lettuce workers are employed under collective bargaining contracts but the wage and benefit package is similar for union

or nonunion workers. The lettuce industry is able to staff its harvest crews from the more than adequate numbers of domestic workers who apply for lettuce harvest jobs.

Harvest crews employed on lettuce-wrap machines are paid by the hour. Such workers do not get the high piece-rate wages that hand-cutters and packers earn, but hourly earnings of slightly more than twice the minimum wage have attracted women into lettuce harvest work. The reality is that the lettuce-wrap machine, an innovation introduced in an effort to produce a superior product, makes it possible to offer jobs and wages that attract a labor supply not previously employed in the industry.

Innovative labor management in the citrus industry is another illustration of the new context in the California farm labor market. Many producers have developed systems that bring citrus harvest work into the mainstream of modern labor management. In the most fully developed cases, citrus harvest workers are encouraged to establish a continuing relationship with the employer.

Among the practices are rehiring rights protected by seniority, paid vacations, a retirement plan, internal recruitment in filling positions of increased responsibility and authority, a personnel system that enables workers to accumulate a good performance record. To minimize waiting time, employees are told in advance when to return to work. Supplementary unemployment benefits are paid to supervisory employees during layoff periods. The result: stable, proficient crews who return every year with few or no undocumented workers.

Some cases of innovative approaches to labor management have been the subject of research reports (University of California, Division of Agriculture and Natural Resources Leaflet 21147, *The Management of Seasonal Farm Workers Under Collective Bargaining*, 1980), but systematic surveys have not been made. Yet it is clear that, among California farm employers, interest in improved labor management practices is quite broad. The lettuce-industry, in addition to the wage and mechanization innovations mentioned, has supported in-depth research in personnel management.

In 1981, several hundred leading farm employers and members of their professional personnel management staff formed the California Agricultural Personnel Management Association to improve the quality of personnel management. The association, whose members are identified with all of the major commodities produced throughout the state, has continued to prosper; more than 250 members meet annually to discuss mod-

ern labor management principles and practices.

However, there can be little question that the bulk of seasonal farmworkers are employed annually on California farms on a casual basis, often recruited by a labor contractor who is also likely to supervise them. Recent research (*Industrial Relations*, Winter 1984, R. Mines and P. L. Martin) indicates that the increasing employment of undocumented workers in citrus, at substantial savings in harvest costs, has undercut the progress made in developing labor management systems and resulted in some erosion in established hourly earnings and employment standards. Pickers employed under farm labor contractors receive no housing subsidy, vacation benefits, or free transportation to work, nor are they paid for down time when the orchards are too wet to pick.

The effect of undocumented workers on the terms of employment in the citrus industry raises important questions about the possible impact of a foreign worker program. Foreign workers employed under contract may not cause an immediate reduction in prevailing wage levels. But in the long run, their availability could tend to slow the rate of improvement in wages and other terms of harvest worker employment, decreasing the relative attractiveness of such jobs, thereby increasing the dependence on foreign labor.

Over the past two decades, farm wage rates in California appear to have increased slightly more than nonfarm rates, and nonwage benefits commonly accorded nonfarm workers have been increasingly extended to farmworkers in this state. These trends have not been strong or uniformly pervasive. They could be reversed.

Conclusion

The farm labor situation in California is complex. Substantial progress has been made in upgrading harvest jobs in a number of important farm commodities. This progress is being undercut somewhat by the inflow of undocumented workers.

The long-term problem is (1) to find ways to meet the emerging demand-supply situation without undercutting progress that has been made and (2) to avoid slowing the rate of improvement in wages and employment standards in seasonal farm work.

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Farm wage rates as a percentage of manufacturing

Year	Calif.	U.S.
	%	%
1960	46.9	42.9
1961	46.7	42.7
1962	46.2	42.3
1963	45.8	42.7
1964	45.6	36.5
1965	46.6	43.7
1966	48.7	45.2
1967	49.2	47.0
1968	48.9	47.8
1969	50.0	43.7
1970	48.4	48.8
1971	49.0	48.5
1972	48.8	48.3
1973	50.5	49.0
1974	54.6	47.3
1975	51.7	46.8
1976	53.7	47.3
1977	54.3	46.7
1978	52.9	46.0
1979	54.1	47.1
1980	55.3	47.5
1981	53.4	46.7
1982	50.8	44.9

Sources: *Employment and Earnings*, U.S. Bureau of Labor Statistics. *Farm Labor*, U.S. Department of Agriculture Economics, Statistics and Cooperatives Service, February issues.