

STRAWBERRIES IN MEXICO, CENTRAL AMERICA, COLOMBIA, AND ECUADOR

George M. Darrow¹

FROM JANUARY 19 TO MARCH 19, 1952, while making a survey of temperate fruits in the highlands from Mexico to Ecuador, I observed strawberries in most of these countries. Though a minor fruit in Costa Rica, El Salvador, Honduras and Colombia, they were seen in most of the larger city markets in each country. In Mexico and Ecuador, however, strawberries are an important fruit even though bananas, avocados, pineapples, and citrus are abundant and relatively cheap. They are used in many ways in Mexico, possibly in even more ways than in the United States — fresh and in preserves, fruit salads, shortcakes, sauce, fruit drinks, and so forth. In Ecuador, besides being used fresh, they were served as preserves and probably in many other ways. In the other countries there seems to be no reason for their not becoming an equally successful and important crop. At elevations of 2,500 to 3,000 feet the flavor was only fair, but at elevations of 5,000 to 9,500 feet the quality was excellent. In all sections the plants produced the year through and the yields compared well with those in the United States. At no time, so far as could be determined, were the plants without buds, flowers, or fruit.

In the Irapuato area of Mexico, about 200 miles northwest of Mexico City, some 1,000 to 1,500 acres of strawberries are grown on a high, level irrigated plateau. The industry there probably started over 100 years ago to supply Mexico City with strawberries. Now modern freezing and storage plants freeze several million pounds annually for export. Planting is done in the fall and the fields are kept for 3 to 4 years. The plants are set in double rows about 12 inches apart, about 30,000 per acre.

In the semiarid Ambato section of Ecuador the strawberries (*frutillas*) are grown in a few immense fields on a

¹ Principal horticulturist, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture, Beltsville, Maryland,

plateau and on hillsides, without irrigation. So far as could be learned, the original fields have not been replanted in the 200 to 400 years since they were first started. There are no rows; the plants are about one per square foot of ground and they cover the entire acreage. The berries are picked about once a week throughout the year (1), carried by man or burros in boxes holding up to a bushel each from Guachi to Ambato, about 6 miles, and then shipped to Quito and other markets. Because of the dry climate and their slow development, they are firm enough to arrive in Quito in excellent condition. They are commonly sold retail by the hundred berries, not by the pound. Short days and cool temperatures make strawberries everbearing.

In all this area from Mexico to Ecuador ordinary varieties of strawberries are everbearing, for the daylight periods the year through are short enough and the temperature low enough to initiate fruit-bud formation. At the equator the day length (sunrise to sunset) is relatively constant the year through; at 20° North latitude it increases gradually from approximately 11 in December to 13-1/3 in June; and at 30° North latitude from 10-1/4 to approximately 14 hours. The daily effective light period for plant growth is slightly longer, however. At 5,000 feet, or above, the temperatures are never high, rarely above 80° F., while the nights are always cool. Frosts occur where strawberries are grown at 5,200 feet at Irapuato in Mexico, at 7,000 feet in Guatemala, and at about 9,000 feet in Colombia and Ecuador. The humidity and intensity of light vary with the local conditions. Rainfall is, of course, extremely variable, ranging from that of a desert to that of a rainforest, even within short distances.

Though all varieties seen at 5,000 feet, or over, produce throughout the year, the time of the heaviest production varies with local conditions. Thus, at Irapuato, Mexico, at about 5,200 feet elevation and 21° North latitude, the heaviest production usually is from February to May, cropping being affected by heavier fruit-bud formation under (1) the somewhat short days of October to December, (2) the lower temperatures of November to January, and (3) the rainy season, June to September. In Guatemala at 14° to 15° North latitude the seasonal change in day length is somewhat less than in the

Irapuato section, but where fields were observed at about 5,600 feet the temperatures are nearly as low. There the peak of the harvest season is December, the period when production is least in the United States. The reason for this production peak was not evident but may be the reaction of a locally grown variety. At about 9,500 feet, near Ambato, Ecuador, at 1° South latitude, cropping was also the year through, but the crops were somewhat larger at recurring periods in February, August, and December (1). At Turrialba, Costa Rica, at an elevation of just over 2,000 feet, in a tropical climate, only one of three identified varieties seemed to be everbearing. At all elevations and in all countries the strawberries seen were making runners and runner plants. Near Cali, Colombia, runners were being produced freely in March.

VARIETIES GROWN

In the Irapuato, Mexico section the chief varieties being grown (Blakemore, Klondike, and Klommore) were introduced from the United States. They are replacing the "Criollo", a selection of apparently pure *Fragaria chiloensis*, long grown in this area. In Guatemala, though the Missionary variety was seen growing well at 6,000 feet, a variety grown at Parramos and here referred to as the "Parramos" berry, with more *F. chiloensis* in its parentage than Missionary, was producing very well and was perhaps better than the latter. In Honduras, Missionary was growing well at 2,600 and 6,000 feet but was more vigorous and better flavored at the higher elevation. In the section around Cali, Colombia, at 3,000 feet the Missionary, grown for preserving, produced very well. At the lower elevations, 2,600 to 3,000 feet, the fruit of the Missionary was more like that of the same variety in North Carolina or Maryland; but at the higher elevations, 5,000 to 6,000 feet, where climate is cooler it was nearer that grown in Florida in midwinter though better flavored. In Ecuador most of the strawberries were grown on the loose, fine, sandy soil near Ambato. All of the several hundred acres there are planted with an ancient perfect-flowered selection of pure *Fragaria chiloensis* which, according to Popenoe (1) was introduced

from Chile to Peru in 1557 and probably taken to Ecuador about the same time. This selection growing near Ambato may well be the original one selected by the Indians in prehistoric times. It is referred to as the "Ambato" strawberry and in this paper the variety is called by that name. The fruit is long blunt-conic, with the calyx covering the stem end of the berry as it does in the wild *F. chiloensis*. The berries average medium in size but vary from large to small, are pale red on the surface, with white flesh. The flavor is good, but not equal to the flavors of the "Parramos" and Missionary varieties at elevations of 6,000 to 8,000 feet. The Ambato variety has less color and flavor than Missionary and other United States varieties and, like most *F. chiloensis* when put under cultivation, is very subject to leaf scorch.

No native strawberry was found in any of the countries visited. However, *Fragaria vesca*, the wood strawberry of Europe, had been introduced and naturalized on mountains at about 10,000 feet in Ecuador and Colombia. At San Rafael (6,800 feet) near Guatemala City a strawberry suggesting *F. moschata* in appearance has become naturalized.

VARIETIES RECOMMENDED

The varieties grown in each area are probably the best available for the conditions under which they are grown. Thus, for all countries from Guatemala to Ecuador the Missionary is probably the best variety for elevations of 2,500 to 6,000 feet. It is the most vigorous variety under most conditions. From 6,000 to 9,500 feet the "Parramos" variety may be the best where it can be irrigated, but it may be too subject to leaf scorch and leaf spot to grow in humid areas unless these diseases are controlled. In the Ambato, Ecuador, section probably no variety other than the Ambato, the *Fragaria chiloensis* selection, can be grown unless irrigation is used, for the annual rainfall is said to average less than 25 inches, possibly less than 20 (1).

B R E E D I N G

It would seem fairly easy to obtain selections much better adapted than the present varieties. Suggested crosses are *Missionary* × *Parramos* (for Central America); and *Missionary* × *Ambato* (for Ecuador). At first lots of perhaps 1,000 seedlings of each cross should be grown in each location for selecting the best for local use. If crosses were made in the winter of 1952-3, seeds could be available by April 1, 1953. Seedlings could be large enough for field planting 2 to 3 months later. Seedling populations of the crosses recommended may suggest other crosses that might be tried.

D I S E A S E S

The *Missionary* variety was entirely free of leaf diseases wherever seen. In Mexico the *Blakemore*, *Klondike*, and *Klondike* were remarkably free from leaf diseases, only three single spots on leaves being noted in all fields seen. In contrast, the "Parramos" variety was very heavily infected with both leaf spot and leaf scorch in Guatemala and both were damaging the plants. In Ecuador also, the *Ambato* strawberry was severely infected with leaf scorch: perhaps 80 percent of the leaves were destroyed by this disease. It was also badly infected with leaf spot along the living fences of *Furcraea cabuya*, an agave relative and along an irrigation ditch that ran through one field, but it was infected in the main part of the fields. It would seem as though the "Parramos" and *Ambato* varieties could be rapidly cleaned up. Because there are no native strawberries in these areas, the varieties could be propagated in an isolated place; all leaves showing any disease could be destroyed and all new planting could be isolated from old infected fields.

I N S E C T S

Aphids were common on the strawberries in Guatemala, Honduras, and Ecuador. Those in the first two countries were species of *Capitophora*, which could transmit viruses if they

were present in the fields. The aphids in the Ambato, Ecuador, fields were of other genera, and it is not known whether they could transmit viruses. Every plant examined there was infested with aphids.

In the Cartago area of Costa Rica, at about 4,000 feet elevation, white grubs were reported to have destroyed the strawberry fields. These rarely cause serious losses in the United States where they are usually controlled by planting strawberries after cultivated crops have been grown. Chlordane mixed with the soil at a rate of ten pounds of dust per acre should control the grubs. No root lice and no bud weevil (clipper) were seen or reported. Slugs were occasionally seen and reported in the more humid regions.

SOIL FERTILITY

In Mexico there seemed to be little use of fertilizers, even though strawberries had been grown in the area for perhaps 100 years. Tests for the need of fertilizers, especially of nitrogen, seemed to be indicated.

In the fields at Parramos, Guatemala, heavy applications of complete fertilizers were said to be used and the plants were vigorous and very productive. In the Ambato fields apparently no fertilizer was used; nor had any ever been used, so far as we could learn. Tests for the need of fertilizer could well be made.

SUMMARY AND RECOMMENDATIONS

The Missionary variety is suggested as the only variety for testing for all locations at 2,500 to 6,000 feet. It is probably at its best at 4,500 to 6,000 feet. It should probably be tested in comparison with the "Parramos" in Central America at 6,000 to 9,500 feet. Both "Parramos" and Missionary should be tested at 6,000 to 9,500 feet in Colombia and Ecuador under irrigation except where the rainfall is adequate. Though the Ambato strawberry as grown in Ecuador is remarkably firm and drought-resistant, it is very subject to leaf scorch, is