Natural Habitats of *Lycopersicon* Species

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Broadening the limited genetic base of the domestic tomato, *Lycopersicon esculentum* Mill., has become an important research goal in recent years. Efforts have been expanded to transfer genetic characteristics from wild *Lycopersicon* spp. into the domestic tomato. New techniques and recognition of the broad range of valuable characteristics in wild species have fueled this work. Considerable collection work has been done and incidental comments have been made in the literature, but no critical evaluation of habitats has been made. Recent collectors, aside from locating collections, have provided an idea of the altitude (Cuartero et al., 1984, 1985; Delgado de la Flor, 1988; Hone et al., 1978, 1979), associated flora (Cuartero et al., 1984, 1985), and some general observations on habitats (Hone et al., 1978, 1979). Unfortunately, information relating taxa and intraspecific types to rainfall, temperatures, and edaphic conditions is lacking.

All eight wild species of tomatoes as well as the wild form of *L. esculentum* have natural habitats on the west coast of South America from southern Ecuador to northern Chile ($\approx 0^\circ$ to 23°S latitude) and in the Galapagos Islands (Fig. 1). The geography of this expanse is highly varied. Terrain on the mainland extends from sea level to >6500 m. Tosi (1960) listed 35 distinctive ecological formations for Peru alone, and Weberbauer (1936) mapped 25. Collections of wild *Lycopersicon* have been reported from sea level to as high as 3700 m (Hone et al., 1978). The eight wild *Lycopersicon* spp. plus the wild form of *L. esculentum* are highly variable, a reflection of the varied environment.

Rick (1976a) suggested knowledge of autecology to be valuable for determining genetic value. Knowledge of habitats of *Lycopersicon* collections elucidates the relationships of these species to their environment, and specific information on habitats provides insight into the value of collections as genetic sources for domestic tomato improvement. It is the purpose of this paper to review present habitat information, available rainfall and temperature data, and to highlight gaps in available information for the

various *Lycopersicon* spp. I would also like to convey an appreciation of the great diversity of the habitats and the concomitant diversity of the species.

Geographic characteristics

The west coast of South America is characterized by the Andes, a north-south cordillera. Elevations between 0° and 23°S latitude reach 6500 m, but the Andes are considerably lower than this in northern Peru east of Olmos. Major rivers of the eastern (Atlantic) drainage flow longitudinally south to north between the ranges and eventually turn east to the Atlantic. An exception is the Mantaro River, which initially flows south but subsequently turns north and then east. The west slope of the Andes is dissected by valleys formed by westwardly flowing rivers that have short steep courses and empty into the Pacific Ocean. Some 50 of these rivers occur on the west coast of Peru. Tosi (1960) designated 22 of these Peruvian rivers as

principal and permanent. The remainder are either permanent with low winter flow or intermittent. River valleys are separated by high ridges of the Andes that approach or reach the sea, and as a result they are isolated one from another.

The Peru Current borders the west coast of South America. It arises in the cold waters of the high southern latitudes of the Pacific Ocean and flows along the coast to $\approx 5^\circ\text{S}$ latitude, where it turns northwest, then west.

The Galapagos are a group of volcanic islands in the Pacific Ocean 1100 km west of the coast of South America on the equator. Elevations in the islands do not exceed 1700 m. These islands lie in the westward flow of the Peru Current.

General climatic characteristics

The climate of the area (Fig. 1) under consideration is basically tropical but strongly modified by topography and geophysical events. Moist tropical maritime and equa-

Fig. 1. Map of South America and the Galapagos Islands indicating the general area (shaded) of distribution of *Lycopersicon* spp. Seven of the eight wild species of *Lycopersicon* occur on the continent. An eighth wild species, *L. cheesmanii*, inhabits the Galapagos Islands.

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torial air masses yielding heavy rainfall are the principal sources of precipitation in the Andes (Barry and Chorley, 1987). Storms move westerly from the Atlantic Ocean. Rainfall from these air masses diminishes with increased elevation. Intermountain areas in the lee of storms maybe in rain shadows and quite arid. The Pacific slope receives precipitation from these storms, but rainfall diminishes beyond the vertex irrespective of elevation. Rainfall follows the same annual fluctuation throughout the area (Fig. 2). These storms seldom, if ever, result in precipitation on the coastal area. Rainfall seasonality is imposed on the intermountain area by encroachment in the winter, east of the Andes, of drier continental tropical air masses from the south that block storms of the tropical maritime and equatorial systems (Barry and Chorley, 1987). This blocking effect is less intense closer to the equator. In Ecuador, the Pacific slope is affected by the Intertropical Convergence in the Pacific Ocean and receives rain from Pacific marine air.

The coastal areas of Chile and Peru are strongly influenced by the Peru Current, producing a coastal climate in a narrow band 30 to 100 km wide. A warm anomaly in the Peru Current occurs in the bight near Arica, in northern Chile (Bakun and Parrish, 1982). This phenomenon is intensified in the winter and tends to abate in the summer. The anomaly induces an onshore flow of warm air, with the result that Arica has a mean annual temperature higher than Lima. Some effect of the coastal climate may move inland and spill into the intermountain valleys, particularly in northern Peru and southern Ecuador (Barry and Chorley, 1987). The coastal area of the northern portion of this region is also affected by El Nino-Southern Oscillation. This oscillation, a weak southerly flow of warm water to $\approx 6^{\circ}\text{S}$, develops annually along the coast of Ecuador and Peru, usually in December (Barry and Chorley, 1987). This event becomes more extensive and intense at highly irregular intervals, resulting in marked changes in the weather of southern Ecuador and northern Peru. Less-severe events are interspersed with more-severe ones, resulting in an average occurrence interval for noteworthy ones of ≈ 3 years. This Southern Oscillation allows the Intertropical Conver-

gence and its associated rainfall to extend southward into Peru. Older local inhabitants affirm that this event extended as far south as Trujillo (8°S) in 1925-26.

Temperatures

The most accurate and readily available temperature data for the area are the 10-year averages published by the U.S. Commerce Dept. Temperature data used in this manuscript are the 1961-70 averages (U.S. Dept. of Commerce, 1982), except as noted. Tosi (1960) gives rainfall and temperature data for various locations in Peru. He notes that records mostly were taken over short periods and that the data contained some very obvious inaccuracies.

Annual temperature fluctuation tends to be least at the equator. Quito, Ecuador, has a mean monthly variation of $\approx 1^{\circ}\text{C}$ throughout the year, while at La Paz, Bolivia, at $16^{\circ} 25'\text{S}$ there is an annual fluctuation in monthly means of 3.4°C .

There is a markedly seasonality induced by the Peru Current in the coastal area, and a lag in seasonality for winter and summer occurs as the current progresses north. From 1961 to 1970 (U.S. Dept. Comm., 1982), the coolest month of the year at Antofagasta, Chile, was July (Table 1). Lima was coolest

in July and August, and at Trujillo (on partial records) the lowest temperature occurred in August. The coolest month at Talara was September. The highest temperatures for each location were in January from 53° to 18°S , but were skewed toward autumn (February, March) at lower latitudes (Table 1). There is a greater fluctuation in temperature from summer to winter in the coastal area than in the intermountain area, the coastal fluctuation being $\approx 6^{\circ}\text{C}$.

Temperature decreases with increased altitude in the inland areas, the decrease averaging 1°C for each 200 m of elevation. The lapse rate of temperature fluctuates from summer to winter, tending to be less in winter months (Barry and Chorley, 1987). The lapse rate can be used to estimate temperatures for the eastern Andes and the higher elevations of the western Andes. However, the lapse rate is not pertinent for west coast locations at lower elevations because of an inversion caused by the Peru Current. This inversion occurs at 600 to 1500 m, the normal lapse rate being reestablished above this inversion (Barry and Chorley, 1987; Flohn, 1969).

Using seven low elevation and seven high elevation stations in Ecuador, Peru, and Bolivia east of the Andes, I determined the lapse rate of temperature from annual means. This

Fig. 2. Mean monthly rainfall at Tingo Maria and Huancayo (elevation 641 and 3350 m, respectively), Peru, for 1951-60 (U.S. Dept. of Comm., 1966).

Table 1. Mean monthly temperatures for 1961 through 1970 for various locations on the west coast of South America (U.S. Dept. of Comm., 1982)¹. The highest and lowest monthly temperatures for each location have been underlined.

Location ²	Lat.S	Long.W	Elev. (m)	Mean temperature ($^{\circ}\text{C}$)												Annual mean
				Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Punta Arenas/Chabunco	$53^{\circ}00'$	$70^{\circ}50'$	30	<u>10.4</u>	10.0	8.4	5.8	3.7	1.7	<u>1.3</u>	2.2	4.0	6.2	8.4	9.7	6.0
Santiago	$33^{\circ}27'$	$70^{\circ}42'$	520	<u>21.2</u>	20.0	17.7	14.4	11.3	8.2	<u>8.1</u>	9.4	11.4	14.3	17.2	19.8	14.4
Valparaiso/Punta Angeles	$33^{\circ}01'$	$71^{\circ}38'$	40	<u>17.6</u>	17.2	15.9	14.3	13.3	11.8	<u>11.3</u>	11.5	11.8	13.3	15.2	16.6	14.2
Antofagasta	$23^{\circ}28'$	$70^{\circ}26'$	130	<u>19.8</u>	19.7	18.5	16.8	15.2	13.8	<u>13.2</u>	13.5	14.1	15.2	16.7	18.4	16.2
Arica	$18^{\circ}29'$	$70^{\circ}19'$	40	<u>21.6</u>	21.9	21.3	19.4	17.4	16.0	<u>15.2</u>	15.3	16.0	17.2	18.8	20.3	18.4
Lima/Campo del Marte	$12^{\circ}04'$	$77^{\circ}55'$	130	21.3	<u>22.0</u>	21.8	20.2	17.9	16.0	<u>14.9</u>	<u>14.9</u>	15.0	16.0	17.4	19.3	18.1
Trujillo	$8^{\circ}06'$	$79^{\circ}05'$	30	21.5	<u>21.8</u>	20.8	20.1	18.3	17.5	<u>17.3</u>	<u>16.7</u>	16.9	17.0	18.1	19.2	19.3
Talara/Corpac	$4^{\circ}34'$	$81^{\circ}15'$	80	23.9	24.8	<u>24.9</u>	24.0	22.1	20.0	18.5	<u>18.5</u>	18.3	18.8	19.7	21.5	21.3

¹Means for Trujillo are for the period 1 July 1961 to 31 Dec. 1964 (recorded by the author).

²Latitudes above 18°S are in Chile and those below in Peru.

Table 2. Monthly and annual mean isothermal temperatures for various altitudes in inter-Andean South America from latitude 0° to 23°S.

Elevation (m)	Mean temperature (°C)												
	January	February	March	April	May	June	July	August	September	October	November	December	Mean
500	25.4	25.9	25.0	24.8	23.9	22.0	22.4	24.2	25.8	26.3	26.5	26.3	24.9
1000	22.9	23.3	22.5	22.4	21.6	19.9	20.2	21.8	23.2	23.7	23.9	23.7	22.4
1500	20.4	20.7	20.0	20.0	19.3	17.8	18.0	19.4	20.6	21.1	21.3	21.1	19.9
2000	17.9	18.1	17.5	17.6	17.0	15.7	15.8	17.0	18.0	18.5	18.7	18.5	17.4
2500	15.4	15.5	15.0	15.2	14.7	13.6	13.6	14.6	15.4	15.9	16.1	15.9	14.9
3000	12.9	12.9	12.5	12.8	12.4	11.5	11.4	12.2	12.8	13.3	13.5	13.3	12.4
3500	10.4	10.3	10.0	10.4	10.1	9.4	9.2	9.8	10.2	10.7	10.9	10.7	9.9
4000	7.9	7.7	7.5	8.0	7.8	7.3	7.0	7.4	7.6	8.1	8.3	8.1	7.4
Lapse rate ^a	0.99	1.04	0.99	0.96	0.92	0.82	0.87	0.97	1.05	1.04	1.05	1.06	0.99

^aPer 200 m.

lapse rate was 0.99C per 200 m, a value essentially identical to the standard 1C for 200 m. Subsequently, I calculated the lapse rate for the mean monthly temperatures. These followed expectations also, with winter months having lower lapse rates than summer months. Using these lapse rates and the mean temperatures for the lower elevation stations, I calculated isothermal temperatures for 500-m intervals (Table 2). These isothermal temperatures, coupled with elevation reports for tomato collections, provide information on temperature conditions in areas of collection outside the coastal area.

Diurnal temperatures are less well-documented than monthly and annual means. Barry and Chorley (1987) suggest variations of ≈ 10 to 14C in the tropics. My experience at Trujillo suggested about the same, 10 to 15C. Slightly higher or lower variations may occur in isolated places and times.

Climatic data from the Galapagos are not readily available. The island is washed by the Peru Current, which undoubtedly moderates the climate. Rick (1956) describes the climate as mild and cloudy. J.T. Landivar (personal communication) described the climate as cool-temperate throughout the year, with limited rainfall, but with slightly more rainfall from November to May than during the other half of the year. He was unable to provide specific weather data. A mean annual temperature for the Galapagos (at sea level) probably lies between the mean annual temperature of Talara, Peru (21.3 C), and that of Guayaquil, Ecuador (25.5 C).

Rainfall

Rainfall data for Peru were not reported for the 1960-1971 decade; hence, rainfall data I used are the 1951-1960 averages (U.S. Dept. Comm., 1966), except as noted. Rainfall varies markedly from north to south and east to west (Table 3). Condensate from fog is the principal source of precipitation in the coastal area. Rainfall from orographic enhancement of Pacific marine air may occur inland, but is difficult to distinguish from rain from eastern storms cresting the Andes (Tosi, 1960). Precipitation from fog generally is very light in unexposed areas, but it can be particularly heavy in elevated areas or exposed outcrops. Records (Tosi, 1960) for the Lomas de Lachay (380 m) (lying between Chancay and Huacho, Peru) for 1931-1954 indicate annual average precipitation of

210 mm, with 87% occurring in the colder period from June to November. In contrast, average precipitation at Paramonga (15 m elevation) to the north and at La Punta (15 m elevation) to the south was 24 and 10 mm, respectively. In the north coastal area, rainfall can be highly variable because of the influence of El Niño. Annual rainfall at Zorritos, Peru, has varied from 0 to 1500 mm·year⁻¹ (Tosi, 1960).

Precipitation increases inland. Annual amounts average 125 mm (Tosi, 1960) in the elevated area immediately adjacent to the coastal belt, and amounts increase at the higher elevations. Tosi (1960) listed inter-Andean locations with a range of 236 to 1388 mm. Because of moderate temperatures and frequent cloudy weather, evaporation is undoubtedly low.

Edaphic variation

Indications are that valleys of westerly flowing rivers may have unique edaphic characteristics. One clue is dedication of arable land in valleys to specific crops. For example, the Jequetepeque tends to be dedicated to rice, the Chicama, Santa Catalina, and Fortaleza to sugarcane, the Viru to corn, and the Santa and Canete to cotton. Obviously, other factors influence this dedication, but it appears edaphic conditions have played a role in the empirical selection of a

dominant crop. The average soil pH of the delta area of each valley tends to be related to the amount of water that flows in the valley. The greater the flow, the lower the pH. Furthermore, the pH steadily increases from the upper delta area to the ocean (unpublished data). Nutrient deficiencies, particularly phosphorus deficiency, occur in some valleys. Ground water emanating from copper-bearing rock is low in pH. Rick has mentioned edaphic differences, but has not provided specifics. Edaphic information is conspicuously lacking for locations of collections, probably because many of the collections are not made on arable land.

Specific habitats

Many distinct environments exist in the area because of the intermingled and variable characteristics of the soil, temperature, precipitation, and elevation. In this highly variable milieu, the *Lycopersicon* spp. have evolved. While they may be sympatric in many instances, each species has a distinctly defined range different from each of the other species (Fig. 3). The species are not coextensive with the territory throughout their ranges, but tend to occur individually or in enclaves where certain environmental requirements are met.

The true natural habitat of *L. esculentum* var. *cerasiforme* (Dun.) Gray is difficult to

Table 3. Average annual rainfall for 1951 through 1960 at various locations in South America (U.S. Dept. of Comm., 1966).

Location	Lat. S	Long. W	Elevation (m)	Rainfall (mm)
Ecuador				
Banos ^a	01°23'	78°25'	1830	1368
Quito	00°13'	78°30'	2818	1240
Guayaquil	02°12'	79°53'	6	1023
Peru				
Tingo Maria	09°08'	75°57'	641	3193
Huancayo	12°02'	75°20'	3350	776
Lima/Campo del Marte	12°04'	77°02'	137	22
Bolivia and Chile				
Santa Cruz (Bolivia)	17°47'	63°10'	437	1237
La Paz/El Alto (Bolivia)	16°30'	68°10'	4103	556
Antofagasta (Chile)	23°28'	70°26'	122	Trace

^aData for Banos are for 1961-1970 (U.S. Dept. of Comm., 1982). Quito averaged 109 mm less rainfall in the decade 1961-1970 than in the reported decade.

Fig. 3. Schematic representation of the habitat of seven of the eight wild species of the genus *Lycopersicon*. The wild habitats of these seven species are all on the west coast mainland of South America.

define because of its aggressive colonizing tendencies and wide distribution into other parts of the world (Rick, 1976b). It is native to western South America, but as a weedy form migrated into Central America and Mexico, where it supposedly gave rise to the domestic tomato. It is now found in other parts of South America and most tropical regions of the world. Biotypes from the arid regions of Peru as well as types that survive the wet humid conditions of the eastern Andes have been collected. This latter type is an exception to the preference of tomato species for dry climates (Rick, 1978). *L. esculentum* var. *cerasiforme* has been collected from sea level to as high as 2400 m in South America (Cuartero et al., 1985).

The native habitat of *L. cheesmanii* Riley is confined to the Galapagos Islands. This species tends to colonize the lower arid elevations of the island, but also has been found at the middle forested elevations (Rick, 1963). Rick (1971) reported that this species occurs on tumefaceous soils and on cinder slopes in the lower and middle altitudes. Skies are overcast and temperatures mild during the time the species flourishes (Rick, 1956). The species grows in a climate of generally low rainfall and moderate to medium high temperatures (Table 4). *L. cheesmanii* f. *minor* (Hook. f.) Mull. is particularly adapted to the low elevations of the Galapagos and its range extends into the littoral zone (Rick, 1978). Rush and Epstein (1976) concluded that an ecotype from the littoral zone had a high degree of salt tolerance.

L. pimpinellifolium (Jusl.) Mill., *L. hirsutum* Humb. & Bonpl., *L. parviflorum* (Rick, Kes., Fob. & Hone) and *L. chmielewskii* (Rick, Kes., Fob. & Hone) all tend to be mesic. *L. pimpinellifolium* and *L. hirsutum* are found at similar latitudes. However, *L. hirsutum* inhabits higher elevations, while *L. pimpinellifolium* is found at the low elevations in coastal Ecuador and Peru (Rick et al., 1979). *L. hirsutum* has been collected from 200 m in coastal Ecuador to 3700 m (the highest reported elevation for any *Lycopersicon* spp.) in Peru (Hone et al., 1978). Rick (1978) suggests its usual occurrence is between 500 and 3300 m elevation. Average annual temperatures in the domain of *L. hirsutum* range from 21°C for those collections below the inversion to 10°C at the highest elevations (Tables 1, 2, and 4). This species extends farther into Ecuador than any others and also occurs in the inter-Andean area east of Olmos (5°59'S, 79°46'W), suggesting a tolerance of more humid conditions.

Precipitation at the low elevations of the habitat for *L. hirsutum* ranges from 125 to 200 mm (Tosi, 1960) and at the high elevations and low latitudes from 700 to 1200 mm annually (Table 3). Night temperatures at the high elevations are low enough, 3 to 5°C, that night chilling-resistant ecotypes of *L. hirsutum* have developed (Patterson, 1988; Patterson and Payne, 1983).

L. pimpinellifolium is found in uncultivated areas in the deltas of the coastal rivers and sporadically in cultivated fields. It is fre-

Table 4. Range of elevations of *Lycopersicon* spp. in their native habitats and associated mean annual temperatures.

Species	Elevation (m)	Temperature (°C)
<i>L. pimpinellifolium</i>	0-1450	18-21
<i>L. cheesmanii</i>	0-1000*	22-23'
<i>L. hirsutum</i>	200-3700	10-21
<i>L. pennellii</i>	0-2300	18-20
<i>L. chmielewskii</i>	1900-3100	12-18
<i>L. parviflorum</i>	1700-2800	13-19
<i>L. peruvianum</i>	0-3300	11-21
<i>L. chilense</i>	0-2900	12-20

*Estimated.

quently found along permanent canals. Rainfall is nonexistent in much of the *L. pimpinellifolium* range, and the species occurs where condensate, flooding, or seepage provide sufficient water. Heavy rains, up to 1500 mm annually, occur sporadically in the northern portion of its range (Tosi, 1960). *L. pimpinellifolium* is found from near sea level to 1450 m, the upper limit of its range being near the inversion level. Temperatures are moderate throughout its range (Table 4).

L. parviflorum and *L. chmielewskii* are found at the 1700 to 3100 m elevations of inter-Andean valleys (Rick et al., 1976). Both species occur under mesic conditions on well-drained soils, generally on slopes. *L. chmielewskii* tends to occupy the higher, better-drained portion of the sites where the two species are sympatric. Conversely, in experimental culture, *L. parviflorum* is less tolerant of excessive watering (Rick et al., 1976). *L. chmielewskii* tends to be confined to a small area in south-central Peru, while *L. parviflorum* extends over several degrees of latitude (Fig. 3). Annual mean temperatures in the habitat are between ≈ 12 and 19°C (Table 4).

L. pennellii (Corr.) D'Arty and *L. chilense* Dun. exist in the very dry habitats of the south-central coast and western slope of South America. *L. pennellii* inhabits the central portion of this dry western slope (Rick, 1978), and occasionally is found on the lower, wetter valley floors (Hone et al., 1978; Rick and Tanksley, 1981). It tolerates drought, and such tolerance prompted Yu (1972) to investigate it as a source of drought tolerance for the domesticated tomato. Temperatures are moderate in the range (Table 4). *L. chilense* is found at the southern end of the range of the *Lycopersicon* spp. and inhabits the very dry area of southern Peru and northern Chile. It is generally found on the slopes and bottoms of river channels that are occasionally flooded (Rick, 1978). It has been collected from sea level to 3000 m. Temperatures are relatively low to moderate in the area (Table 4). *L. chilense* tends to grow in an area parallel to the warm anomaly in the Peru Current found in the bight near Arica. Whether this is coincidental or a case of related incidence is not known.

L. peruvianum (L.) Mill. is more widespread than the other *Lycopersicon* spp., suggesting somewhat greater adaptation and less temperature and rainfall dependency. It extends from 4°S to 20°S and, like *L. hir-*

sutum, extends inland into the intermountain area of northern Peru east of Olmos. *L. peruvianum* is extant in the southern dry area but does not occur as far south as *L. chilense*. It inhabits the northern area sympatric with *L. hirsutum* but does not extend as far north into the humid equatorial region as does *L. hirsutum*. *L. peruvianum* has been collected from sea level to >3000 m. Races have developed in the western river watersheds and these may be related to edaphic differences in watersheds (Rick, 1986). Mountain races developed where there is relatively good seasonal rainfall. Generally, the mountain races are confined to areas near streams but may spread over slopes at the higher elevations (Rick, 1962). Coastal types of the species have been found where moisture seeps from permanent or irregular streams and where fog-supported vegetation grows in the coastal area (Rick, 1962). C.M. Rick (personal communication) indicated a propensity for this species to grow in the area of copper mines, which might suggest ecotypes with a tolerance of low pH soils. The temperature range of its habitat is from low to moderate (Table 4).

DISCUSSION AND CONCLUSIONS

Because of the highly varied topography, *Lycopersicon* spp. do not occur in a contiguous manner throughout their range, but rather are in isolated enclaves in locations where their adaptive needs are met. Intraspecific types occur as a reflection of their specific habitat. Collections of cold-tolerant, salt-tolerant, and drought-tolerant types are examples. Rick (1962) indicated that in *L. peruvianum* there is a strong tendency for mountain races to be confined to the catchment area in which they are collected, with variation from watershed to watershed. He considered this variation related to edaphic conditions (Rick, 1986). The nature of these edaphic differences is not well-defined but may be related to pH and availability of nutrients.

Estimation of the elevation of collections is valuable as it provides the opportunity to evaluate rainfall and temperature conditions. Utility of collections could be improved by additional data. Portable pH and conductance meters are available and could be used to provide pH and soil solution conductance information. Both sets of data might provide insight into genetically useful types. Soil

samples for chemical analyses would also be valuable. Assignment of Peruvian collections to the vegetative zones of Tosi (1960), using his ecological maps, would help correlate collections with rainfall data and temperatures. Assignment of location by approximate latitude and longitude would also be possible with these maps. Use of local place names can result in difficulty in locating specific sites for those unfamiliar with the area.

The wide range of variation in the tomato species habitats results in genetic material rich in diversity. Additional information on habitats of this material would provide the opportunity for greater discretion in selection of accessions for screening for suspected genetic characteristics.

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