

# Notes on food-habits and behavior in selected Orthopteroidea of Tenerife, Canary Islands, Spain<sup>1</sup>

BY

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The island of Tenerife presents certain unusual faunal, floral, and other features, and has a comparatively large and diversified orthopteroidean fauna. During the last half century many publications have appeared that deal, in part, with these insects. Among the more salient are reports by CHOPARD (1942, 1946, 1954), GANGWERE, MORALES, and MORALES (1972), GARDNER (1960), HOLZAPFEL (1970), WILLEMSE (1936, 1949, 1950), WILLEMSE and BRUIJNING (1949), and UVAROV (1948). They provide a faunal list and scattered notes on habits and distribution. However, surprisingly little is known about the biology of most species. Toward the partial elimination of that gap in our knowledge I undertook, during July and August, 1970, a pilot study of behavior in selected species, the results of which are presented below.

The Canarian Archipelago, a number of volcanic islands off the Atlantic coast of Africa, is situated approximately 195 kilometers from Cape Juby (Rio de Oro), 1,111 kilometers from Gibraltar, and near the Tropic of Cancer. The shores are washed by the Gulf Stream and blown by the northeasterly trade winds. Consequently, the climate is mild and uniform, with reduced daily and seasonal changes in temperature, humidity, and wind.

Tenerife, the largest island, is a triangular-shaped body of land with an area of approximately 2,000 square kilometers. It is characterized by great relief, having a central mountain range that divides it into climatic zones: a fertile, lushly vegetated northern zone of greater humidity and rainfall, and an arid southern zone, with reduced rainfall and supporting a xerophilic vegetation. Contact of the prevailing winds with the mountains, modified by elevation and exposure, results in the occurrence of several kinds of biotic communities including sublittoral scrub, laurel forest, pine forest, subalpine scrub, and alpine barrens, and is responsible for diverse microclimates.

The foregoing is with respect to natural sections of the island, but many parts are disturbed, being extensively cultivated with banana and other crops, and here and there urbanized. The resulting flora is an admixture of native and introduced species, and is comprised largely of Mediterranean, endemic, and cosmopolitan elements, mostly of a tropical or subtropical nature (Lems, 1960).

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## STUDY AREAS

I carried out field surveys in all sections of Tenerife to determine locations for detailed investigation. Among the biogeographic zones I examined were the *sublittoral scrub* at Santa Cruz, El Medano, Los Cristianos, Los Gigantes, Puerto de la Cruz, and Bajamar, the *laurel forest* in the Anaga Peninsula, the *pine forest* at La Esperanza, and the *subalpine scrub* at Las Cañadas del Teide. Certain of them proved too extensively cultivated or urbanized, were topographically unsuitable, or their orthopteroid fauna was seasonally reduced, so were eliminated from further study. Two sites proved especially suitable for detailed investigation. They were Los Cristianos, representative of the coast, and Las Cañadas, with elevations in excess of 2,000 meters above sea level assuring special subalpine conditions.

*Los Cristianos*, a village a few kilometers north of Punta de Rasca, at the southwestern corner of the island, is representative of the *sublittoral scrub zone* that occurs throughout the periphery of Tenerife but is best developed in the south. This is a hot, arid, rock-strewn zone of semidesert populated by a reduced number of xerophilic, irregularly distributed plants including prickly pear (*Opuntia*), century plant (*Agave*), aloe (*Aloe*), many spurge (*Euphorbia*), and ice plant (*Mesembryanthemum*). The station investigated in greatest detail is located along the old Los Cristianos - El Medano road, about 4 1/2 kilometers from Los Cristianos. I collected and determined the common plants that occur there, and found a number of species sufficiently available to serve, at that time of year (late summer), as orthopteroid foods. I prepared visual estimates of the latter, a listing of which follows (in order of decreasing availability):

*Vulpia myurus* > *Centaurea melitensis* > *Mesembryanthemum crystallinum* & *Plantago psyllium* > *Schizogyne sericea* > *Euphorbia regis-jubae* & *Micromeria panata* > *Plocama pendula* > *Launaea spinosa* & *Opuntia ficus-indica* & *Nicotiana glauca*

*Las Cañadas del Teide* is a giant crater near the center of the island. It exceeds 2,000 meters above sea level, and supports a *subalpine scrub community*, chiefly of *Spartocytisus nubigenus*, a legume shrub, interspersed with a few other broadleaved plants. This vegetation occurs in widely separated patches that take root in volcanic ash covered by sand and pumice. The station examined in greatest detail is adjacent to the Parador Nacional de Turismo, where, at that time of year, the potential orthopteroid foods are as follows (in order of decreasing availability):

*Spartocytisus nubigenus* > *Sisymbrium bourgaeum* > *Pinus insignis* & *Pterocephalus lasiospermus* > *Adenocarpus viscosus* > *Echium bourgaeum*

## METHODS

I undertook the following activities:

1) *Field observation*, both day and night, to provide first-hand information on the insects' food selection, general behavior, and habitat occupancy.

2) *Analysis of mouthpart adaptation*, to reveal the insects' gross food-habit. I collected, determined, and preserved in alcohol individuals of the several common species, and later, in the laboratory, spread their mouthparts and examined the dentes *in situ*.

3) *Analysis of crop contents*, to disclose identifiable plant and animal remains. I dissected free and slit open the crops of the above insect specimens, emptied the contents onto microscope slides, and made them into permanent preparations for analysis.

4) *Analysis of feculae*, to disclose identifiable contents. I collected feculae defecated by newly taken animals, and prepared therefrom permanent microscope slides for analysis. As with the crop materials, above, I then analyzed the content using standard procedures.

5) *Habitat study*, essential because orthopteroid feeding tends to be as much a function of food availability as it is of feeder preference. Thus, I determined the composition and relative availability of the flora at Los Cristianos and Las Cañadas (see above). Involved therewith was the collection of voucher plant specimens, and this activity was useful in another way. It yielded determined plants, parts of which I later placed in a microblendor assembly, ground into fragments, and used to prepare slides of known materials simulating crop contents found naturally. I photomicrographed these simulated contents, and compared them with natural crop contents.

6) *Differential feeding tests*, to reveal the insects' food preferences irrespective of variations in plant availability. I conducted tests on confined *Calliptamus plebeius* and *Sphingonotus willemsei*, a dozen of each given access to plants common in their habitat and left to feed for a day, whereupon the result was noted.

## RESULTS

The results of the feeding investigation are summarized in Tables I (List of Feeding Records Amassed) and II (Synopsis of Overall Feeding Data); the general behavioral data are included below (Discussion); while the plant availability data have already been presented (Study Areas).

## DISCUSSION

*Arbiblatta bivittata* (Brullé) (Blattoidea: Ectobiinae). This delicate-bodied cockroach, endemic to the Canaries, occurs wild in forests, especially laurel and pine, throughout northern Tenerife. Adults, wingless in the female sex, are common throughout the year, except in the high Las Cañadas del Teide during the harsh winter months. It was in the latter area where I briefly studied the insect. It proved to be inactive during the day, taking refuge under stones and in crevices, plant debris, and pine, needles, and active at night, moving about over ground and vegetation. I was unsuccessful in obtaining feeding records, and took comparatively few specimens. The several I examined in the laboratory had mandibles characterized by the omnivorous-type adaptation and crops with a content of about 97 % plant debris (including fragments identifiable as *Spartocytisus nubigenus*, *Pterocephalus lasiospermus*, and *Adenocarpus viscosus*) and 3 % insect sclerites. On that incomplete basis, and in light of

behavior in related ectobiines, I presume for the species an omnivorous habit.

*Blattella germanica* (Linné) (Blattoidea: Pseudomopinae). This domiciliary cockroach is cosmopolitan in world distribution, and in Tenerife occurs all year long in the coastal districts, especially near port cities. I analyzed the feculae defecated by a newly taken animal. The content was 100 % plant debris. This suggests omnivorous habits, and is consistent with the insect's known feeding in other parts of the world.

*Periplaneta americana* (Linné) (Blattoidea: Blattinae). This domiciliary cockroach, like *B. germanica*, above, is cosmopolitan in world distribution. It has a coastal distribution in the north and south of Tenerife, where the fully winged adults may be taken throughout the year in urban areas both out-of-doors and in homes, stores, restaurants, and hotels. All life stages are nocturnally active. I observed but a single individual feeding. It ate dog dung along the lush, palm-lined Avenida General Franco, a boulevard where the inhabitants walk their pets. This record correlates with the species' mouthparts, which are of omnivorous-type adaptation. Though valid conclusions can hardly be drawn from such limited experiences, there is sufficient evidence based on the species' feeding behavior in other parts of the world to suggest that Tenerifean individuals probably scavenge on dead plant and animal materials in nature, and in man's dwellings presumably attack foodstuffs and wastes.

*Pseudoyersinia subaptera* Chopard and *P. teydeana* Chopard (Mantoidea: Amelinae). I made limited observations on *P. subaptera* and *P. teydeana*, two endemic Canarian mantises of somewhat similar appearance and habits but different distribution. The former is comparatively widespread throughout southern coastal Tenerife, while the latter is restricted to the central heights of Las Cañadas del Teide. These small, nocturnally active, meiopterous mantises are phytophilous on herbs and shrubs, and deposit their eggs on the underside of rocks. I analyzed a few individuals of each for mouthpart adaptation, which is carnivorous-type, and for crop content, composed entirely of insect remains, including scales of Lepidoptera. These scant observations suggest that the two species, like related mantises studied elsewhere, are obligatory predators on small insects.

*Phaneroptera nana sparsa* Stal (Tettigonoidea: Phaneropterinae). This small, fully winged Mediterranean katydid is ubiquitous throughout Tenerife. It frequents coarse vegetation in cultivated and wild places, and is in the adult stage all year long. I obtained but one feeding record. One night at Los Cristianos, hearing the species' feeble stridulation, my attention was drawn to an adult male eating the scruffy flowers of the decumbent forb *Mesembryanthemum crystallinum*. I analyzed the feculae of a newly taken male, and found a content of 100 % dicot material, including floral parts and pollen grains, some of which seemed referable to *M. crystallinum*. These records are generally consistent with the species' food selection in eastern Spain; there it is forbivorous-florivorous (Gangwere, unpublished), and one would assume for it the same behavior in Tenerife.

*Decticus albifrons* (Fabricius) (Tettigonoidea: Decticinae). This large, phytophilous katydid occurs in cultivated fields and other open places in the eastern and central parts of Tenerife. I analyzed the feculae defecated by a newly taken female. The content was approximately 60 % plant parts and 40 % insect remains. This result is consistent with the

insect's food-habits in the Mediterranean region; in France, for example, it is a voracious predator on insects, but also damages grains and legumes (Chopard, 1951).

*Calliptamus plebeius* (Walker) (Acridoidea: Calliptaminae). This diurnally active insect, striking both for its marked sexual dimorphism and for its color polymorphism, is a stout-bodied grasshopper endemic to the Canaries and ubiquitous in Tenerife. Throughout its Tenerifean range it is phytophilous on coarse herbs and shrubs in arid locales, and at Las Cañadas del Teide, where I studied it, it perches on the legume shrub *Spartocytisus nubigenus*.

At austere, subdesertic Las Cañadas, *C. plebeius* is occasionally found at the bases of plants or walking along the bare ground to another clump of vegetation, but in most cases perches, head upward, on *S. nubigenus*, usually near the stem apices. It seldom perches on other plants. When disturbed, a given individual sidles around the stem away from the observer and remains motionless. When flushed, it leaps onto an adjacent branch and remains motionless for a time before leaping onto still another branch farther away and/or sidling out of view. Then after prolonged inactivity it resumes grooming its antennae and moving about slowly, only occasionally feeding.

I amassed a total of seven feeding records for *C. plebeius*, all on *S. nubigenus*, usually its foliage, and in light of that fact, together with the insect's propensity to perch on that plant, was prepared to regard the Las Cañadas individuals as monophagous on it. However, the results of a later differential feeding test and analyses of crop materials and feculae dispelled that notion. The differential feeding test disclosed that, though leaves and stems of *S. nubigenus* are preferred, the green leaves, stems, and flowers of the forb *Pterocephalus lasiospermus* may be eaten, and dried stems of the forb *Sisymbrium bourgaeaeum* may be nibbled, while needles and stems of the tree *Pinus insignis* are rejected. The analyses of crop contents were conducted on 18 specimens, with the following result: about 98 % dicot material (mostly composed of *S. nubigenus* fragments but with significant amounts of *P. lasiospermus* and traces of *P. insignis*), 1 % grass, and 1 % apparent insect fragments. A few feculae from newly taken animals were composed mostly of *S. nubigenus*, though there was also some *P. lasiospermus*. The species' mouthparts have the forbivorous-type adaptation, a type well suited for incision and mastication of the above foods. I conclude that, at Las Cañadas, the insect usually eats *S. nubigenus*, the shrub on which it perches, but when near the ground may occasionally turn to the forb *P. lasiospermus*.

*Sphingonotus Willemsei* Mistshenko (Acridoidea: Oedipodinae). This grasshopper, adult in summer, is a geophile endemic to Las Cañadas del Teide, where I spent some days studying its behavior. Its individuals are disruptively colored «bare ground Orthoptera» common on bare terrain and roads, though seldom many meters removed from patches of living vegetation. They are inactive under cloudy conditions and at night, but move about more or less constantly on bright days. Their typical behavior under sunshine consists of sporadic, fairly rapid walking; occasional short flights during which they flash their blue wings, crepitate loudly, and then fall brusquely; and brief intervening periods of inactivity.

I spent many hours watching these wary insects. Despite that effort I obtained no feeding records, and the differential feeding test I attempted

was inconclusive, presumably owing to the shaded hotel window ledge on which the cage had to be housed. Fortunately, I collected a fair number of specimens, thirteen of which I analyzed for crop contents, with the following result: about 97 % dicot material (mostly fragments of *Pteroccephalus lasiospermus*, *Sisymbrium bourgacianum*, *Spartocytisus nubigenus*, and *Adenocarpus viscosus*), 2 % insect remains, and 1 % grass. The mouthpart adaptation paralleled this content, being herbivorous toward forbivorous in type. In view of the species' habitat occupancy, as well as the desiccated nature of most potential foods during the harsh, dry summer months, it seems likely that, at that time of year, *S. willemsei* takes as much dead plant debris as it does living plants. This scavenging tendency is borne out by the overall gut contents.

*Wernerella picteti* (Krauss) (Acridoidea: Oedipodinae). This small grasshopper is a Canarian endemic that, in Tenerife, is found along the southern and western coasts. It is adult throughout the year. I noted it at a number of localities, and studied it at Los Cristianos.

I found *W. picteti* to be geophilous and diurnally active in scrub near Los Cristianos. The males spend periods of time motionless, except for occasional stridulating with the hind legs. They break these inactive periods with occasional abrupt, fairly rapid walking, but only rarely fly spontaneously and then for distances of but a meter or so. When they reach a rock they tend to climb it, or to hop onto it, and then jump back onto the ground. When they perceive another individual they move over to it, sometimes from a distance of a meter or more. They quickly determine its sex, apparently through stridulation and overall behavior, and then move away if it is another male. If a female they face the same direction and attempt to couple with it. If no response is elicited they move away; if the response is positive it leads to copulation lasting at least half an hour, during which the larger females unceremoniously drag the males about, legs kicking in a vain attempt to keep balance. The males seldom feed, and when they do apparently eat little. The females tend to be more lethargic in their movements than are males but are more inclined to eat. Hungry females are readily identified. They move about more or less constantly, and from time to time touch vegetation or ground with the mouthparts. Occasionally they test a plant, and upon finding it satisfactory eat for a period of several minutes or more.

I amassed twelve feeding records for *W. picteti*. Most were on dried, dead vegetation of undetermined nature scavenged from the ground, but two were on leaves of the aromatic forb *Schizogyne sericea* and one, each, on dried leaves of the grass *Vulpia myurus* and the forb *Plantago psyllium*. The crop contents of 17 specimens were composed of about 95 % dicot material (including *Centaurea melitensis* and somewhat lesser amounts of *Chrysanthemum gracile* and *S. sericea*), 4 % grass, and 1 % insect sclerites. The mouthparts are characterized by the herbivorous toward forbivorous-type adaptation. On the above basis I conclude that the insect eats a number of forbs and low shrubs, especially *S. sericea* and *C. melitensis*, but on occasion turns to grasses. Much of this food may be taken in a dried, brown condition, for during the dry season few plants retain their succulence and green coloration. Not surprisingly, the parched insects turn, on those rare occasions of availability, to the dead of their own species.

*Stenohippus epacromioides* Krauss (Acridoidea: Gomphocerinae). This slantfaced grasshopper, found both on the African mainland and in the

Canaries, occurs along the southern and western coastal regions of Tenerife, always in association with lush grasses. It is adult all year long. I studied it at Los Gigantes, on the west coast. There a rough terrain makes the few uncultivated sections difficult to study, except for certain mesic areas adjacent to the hotel. Two species of grass predominate there: *Cynodon dactylon*, a crab grass composing much of the lawn, and *Stenotaphrum secundatum*, a coarse grass growing about a meter high in the unclipped lawn edges.

The overall behavior of the grasshopper differs from that of *Wernervella picteti*, as described earlier, in that the *S. epacromioides* individuals are phytophilous on the grass plants, remain inactive for shorter periods of time, and frequently move both by flying and by walking and hopping. Moreover, both males and females stridulate with the hind legs, though the sound proved inaudible to my ears.

I amassed a total of nine feeding records, seven of which were on leaves of *S. secundatum* and two on those of *C. dactylon*. This disparity could be as much a result of the foods' growth pattern and clipped or unclipped condition as it is the feeders' preferences, but unfortunately no opportunity was presented to conduct the tests necessary to establish comparative preference value. A total of four specimens of *S. epacromioides* analyzed for crop contents disclosed 100% grass materials (including fragments both of *S. secundatum* and *C. dactylon*), and had mandibles of graminivorous-type adaptation. These incomplete data suggest that the insect is probably an obligatory graminivore, and, in the restricted areas of Los Gigantes where I worked, it presumably selects greater quantities of *S. secundatum* than of other grass species.

*Acheta meridionalis* (Uvarov) (= *A. canariensis* Chopard) (Grylloidea: Gryllinae). This moderate-sized cricket inhabits eastern Tenerife. It hides beneath stones and debris near the banks of ponds, pools, and dry river beds. I analyzed feculae defecated by a female taken at Bajamar. The content proved to be approximately 90% plant debris and 10% insect remains. This result is consistent with the scavenging food-habits of related crickets elsewhere.

## CONCLUSIONS

The Orthopteroidea of continental Michigan and peninsular Spain (both of which I studied earlier) and those of insular Tenerife retain the traditional feeding pattern of their taxonomic group, be it omnivory, carnivory, forbivory, graminivory, or combinations thereof, notwithstanding exposure to vastly different faunal, floral, edaphic, geomorphologic, and climatic factors. Though the general nature of their food-habit is consistent with the group pattern, the details of their feeding vary from species to species. This is not surprising, for the three faunae share no species other than a few domestic cosmopolites, and no two places on the face of the earth—and certainly none as divergent as these—are ever identical in terms of foods, and thus cannot be so in terms of feeding.

The present study emphasized indigenous species, for it is of interest to determine whether or not in the unique Tenerifean environment they depart from the feeding pattern of their group. I found that they, like more widespread species, both here and elsewhere, do not depart in the

broad sense, though they do adjust their feeding to the particular conditions that confront them. Moreover, they offer no evidence that suggests feeding plays a controlling role in orthopteroid adaptive radiation.

Both areas of Tenerife investigated in detail lie within arid scrub zones, one of them, Los Cristianos, being sublittoral and the other, Las Cañadas del Teide, being subalpine. These are harsh, generally desiccated environments, exposed to full sun and wind, and with a rough terrain and a rocky, thin soil that supports sparse patches of a few xerophilic plant species. The orthopteroids that dwell here—at least the few species I studied—are neither monophages nor oligophages; they are polyphages that actually extend their array of hosts with season. They are forced into virtual scavenging in late summer, when the vegetation is brown, dry, and reduced in preference value.

I conclude that there is a positive correlation between absolute and seasonal food availability and food selection, and believe the availability factor to be as important as is preference in determining food selection in Tenerifean orthopteroids.

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#### RÉSUMÉ

This investigation, conducted during the summer of 1970, dealt with feeding and the general behavior of the orthopteroid insects of Tenerife, Canary Islands, Spain. It emphasized certain species common near Los Cristianos and Las Cañadas del Teide, areas of sublittoral and of subalpine scrub, respectively, but also treated a few orthopteroids representative of the island's other biotic communities. It subjected these insects to one or another of several techniques of study, including field observation, analyses of crop contents and of fecal materials, study of mouthpart adaptation, and differential feeding tests.

Based on this study it is suggested that the geophilous grylloid *Acheta meridionalis* and blattoid *Arbiblatta bivittatus*, as well as the domestic blattoids *Blattella germanica* and *Periplaneta americana*, are scavengers on dead plant and animal materials; the phytophilous mantids *Pseudoyersinia subaptera* and *P. teydeana* obligatory predators on small insects; the phytophilous tettigonoids *Phaneroptera nana sparsa* and *Decticus albifrons* a forbivore-florivore and a forbivore-insect predator, respectively; the geophilous acridoids *Wernerella picteti* and *Sphingonotus willemsei* herbivores-forbivores that, during the dry summer months, also scavenge on dead plant and insect debris; the thamnophilous *Calliptamus plebeius* mostly a dendrophage on the legume shrub *Spartocytisus nubigenus*; while the graminicolous acridoid *Stenohippus epacromioides* is a graminivore.

The two scrub areas investigated, Los Cristianos and Las Cañadas del Teide, are harsh environments with rough terrain and a rocky, thin soil supporting but a few clumped, xerophilic plants on which the acridoids feed. These insects normally have wide food latitude, yet with season, when their plant foods become dry and unattractive, are forced beyond phytophagy into virtual scavenging.

There is a positive correlation between absolute and seasonal food availability and food selection, and availability appears as important as preference in determining feeding.

#### RESUMEN

Esta investigación, llevada a cabo durante el verano de 1970, trató del comportamiento general y alimenticio de los ortopteroideos de Tenerife, Canarias, España. Se prestó especial atención a ciertas especies comunes cerca de Los Cristianos y Las Cañadas del Teide, áreas de matorral sublitoral y subalpino, respectivamente, pero se estudiaron también unos pocos ortopteroideos representativos de otras comunidades bióticas de la isla. Se sometió a estos insectos a una u otra de las siguientes técnicas de estudio: observación en el campo, análisis de contenidos estomacales y materias fecales, estudio de adaptación de las piezas bucales y ensayos diferenciales de alimentación.



Basándose en este estudio se sugiere que el grilloideo *Acheta meridionalis* y el blattoideo *Arriblatta bivittatus*, ambos geófilos, así como las domésticas *Blattella germanica* y *Periplaneta americana*, son carroñeros alimentándose de materia muerta vegetal y animal; los mantoideos fitófilos *Pseudoyersinia subaptera* y *P. teydeana* son predadores obligatorios sobre insectos pequeños; los tettigonoideos fitófilos *Phaneroptera nana sparsa* y *Decticus albifrons* son el primero forbívoro-floricola y el segundo forbívoro y predador de insectos; los acridoideos geófilos *Wernerella picteti* y *Sphingonotus willemsei* herbívoros-forbívoros que, durante los meses secos del verano, se alimentan también de plantas muertas y restos de insectos; el tanófilo *Calliptamus plebeius* es principalmente dendrófago en el arbusto leguminoso *Spartocytisus nubigenus*, mientras que el acridoideo graminícola *Stenohippus epacromioides* es un graminívoro.

Las dos áreas de matorral investigadas, Los Cristianos y Las Cañadas del Teide son medios ambientes ásperos de terreno accidentado, con un suelo rocoso, somero que mantiene sólo unas pocas plantas xerofíticas de las que se alimentan los acridoideos. Estos insectos tienen normalmente gran amplitud en su alimentación, pero, de acuerdo con la estación, cuando sus plantas alimenticias se secan y dejan de ser atractivas, abandonan su fitofagia y se convierten en virtuales carroñeros.

Existe una correlación positiva entre disponibilidad de alimento absoluta y estacional y selección de alimento, y la disponibilidad parece tan importante como la preferencia en determinar la alimentación.

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TABLE I

List of Feeding Records Amassed, Tenerife, Canary Islands, 1970.

Feeder	Sex & No. Individuals	Locality	Date	Food	Food Part/s
<i>Periplaneta americana</i>	?	Santa Cruz	6/30 <sup>nr</sup>	Dog dung	—
<i>Wernerella picteti</i>	♀	Los Cristianos	7/09	Grass <sup>a</sup>	Leaves
<i>Wernerella picteti</i>	♀ <sup>s</sup>	Los Cristianos	7/09	<i>Vulpia myurus</i>	Florets
<i>Phaneroptera nana sparsa</i>	♂	Los Cristianos	7/09 <sup>nr</sup>	<i>Mesembryanthemum crystallinum</i>	Flowers
<i>Wernerella picteti</i>	♀	Los Cristianos	7/10	<i>Plantago psyllium</i>	Leaves
<i>Wernerella picteti</i>	♀	Los Cristianos	7/10	<i>Schizogyne sericea</i>	Leaves
<i>Wernerella picteti</i>	♀	Los Cristianos	7/10	Debris, herbaceous	Apparently floral
<i>Wernerella picteti</i>	♀	Los Cristianos	7/11	Herb, undetermined	Flowers
<i>Wernerella picteti</i>	♀	Los Cristianos	7/11	<i>Schizogyne sericea</i> <sup>a</sup>	Leaves
<i>Wernerella picteti</i>	♀	Los Cristianos	7/12	Debris, herbaceous <sup>a</sup>	—
<i>Wernerella picteti</i>	♀ <sup>s</sup>	Los Cristianos	7/12	Debris, herbaceous <sup>a</sup>	—
<i>Wernerella picteti</i>	♀ <sup>s</sup>	Los Cristianos	7/12	Debris, herbaceous <sup>a</sup>	—
<i>Wernerella picteti</i>	♀ <sup>s</sup>	Los Cristianos	7/12	Grass, probably <i>Vulpia myurus</i>	Leaves
<i>Wernerella picteti</i>	♀	Los Cristianos	7/12	Debris, herbaceous	—
<i>Wernerella picteti</i>	♀	Los Cristianos	7/12	Forb, undetermined	Fruit
<i>Stenohippus epacromioides</i>	♂	Los Gigantes	7/14	<i>Cynodon dactylon</i>	Leaves
<i>Stenohippus epacromioides</i>	♀	Los Gigantes	7/14	<i>Cynodon dactylon</i>	Leaves
<i>Stenohippus epacromioides</i>	2♂♂	Los Gigantes	7/14	<i>Stenotaphrum secundatum</i>	Leaves
<i>Stenohippus epacromioides</i>	5♂♂	Los Gigantes	7/14	<i>Stenotaphrum secundatum</i>	Leaves
<i>Calliptamus plebeius</i>	♀	Las Cañadas del Teide	7/27	<i>Spartocytisus nubigenus</i>	Leaves & stem debris

Calliptamus plebeius	2♀♀	Las Cañadas del Teide	7/29	Spartocytisus nubigenus	Leaves
Calliptamus plebeius	♀	Las Cañadas del Teide	7/29	Spartocytisus nubigenus	Leaves & young stem
Calliptamus plebeius	♀	Las Cañadas del Teide	7/29	Spartocytisus nubigenus	Leaves & flowers
Calliptamus plebeius	♀	Las Cañadas del Teide	7/30	Spartocytisus nubigenus	Fruit
Calliptamus plebeius	♀	Las Cañadas del Teide	7/30	Spartocytisus nubigenus	Flowers

<sup>s</sup>Same individual as listed for preceding record.

<sup>nr</sup>Nocturnal feeding record.

<sup>n</sup>Nibbled only; though not eaten, this is a valid food record, for it involves more than mere testing.

TABLE II

Synopsis of Overall Feeding Data, Tenerife, Canary Islands, 1970.

Feeder	Locality	Mouthpart Type	Crop & /or Fecal Content	Feeding Record/s
<i>Arbiblatta bivittata</i>	Las Cañadas del Teide	Omnivorous	97 % plant debris ( <i>S. nubigenus</i> , <i>P. lasiospermus</i> , & <i>A. viscosus</i> ), 3 % insect	—
<i>Blattella germanica</i>	Santa Cruz	Omnivorous	100 % plant debris	—
<i>Periplaneta americana</i>	Santa Cruz	Omnivorous	—	Dog dung
<i>Pseudoyersinia subaptera</i> & <i>P. teydeana</i>	Los Cristianos & Las Cañadas, respectively	Carnivorous	100 % insect (including lepidopterous scales)	—
<i>Phaneroptera nana sparsa</i>	Los Cristianos	—	100 % dicot leaves & flowers (possibly including <i>M. crystallinum</i> )	<i>M. crystallinum</i>
<i>Decticus albifrons</i>	Monte de Aguire (Anaga Peninsula)	—	60 % plant debris, 40 % insect remains	—
<i>Calliptamus plebeius</i>	Las Cañadas	Forbivorous	98 % dicot ( <i>S. nubigenus</i> > <i>P. lasiospermus</i> > <i>P. insignis</i> ), 1 % grass, 1 % insect	<i>S. nubigenus</i>
<i>Sphingonotus willemsei</i>	Las Cañadas	Herbivorous-forbivorous	97 % dicot ( <i>P. lasiospermus</i> > <i>S. bourgaeum</i> & <i>S. nubigenus</i> & <i>A. viscosus</i> ), 2 % insect, 1 % grass	—
<i>Wernerella picteti</i>	Los Cristianos	Herbivorous-forbivorous	95 % dicot ( <i>C. melitensis</i> > <i>C. gracile</i> & <i>S. sericea</i> ), 4 % grass, 1 % insect	Herb debris > <i>S. sericea</i> > <i>V. myurus</i> & <i>P. psyllium</i>
<i>Stenohippus epacromioides</i>	Los Gigantes	Graminivorous	100 % grass ( <i>S. secundatum</i> & <i>C. dactylon</i> )	<i>S. secundatum</i> > <i>C. dactylon</i>
<i>Acheta meridionalis</i>	Bajamar	—	90 % dicot, 10 % insect	—

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