

The more important Insect Pests of Sugar Cane in Northern Venezuela

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Sugar cane plantations have been established in the settled northern part of Venezuela at different periods since early Spanish colonial times, at least 300 years ago, and today sugar products count among the more important agricultural industries of the country. The growing of sugar cane is not centered in any one district, however, but the numerous *centrales* (factories producing refined sugar), *haciendas* (private estates), or *fincas* (small estates and farms), are scattered through practically every one of the nineteen Venezuelan states north of the Rio Orinoco.¹ At least 95 per cent of the sugar cane grown in Venezuela is more or less confined to a curved belt, approximately 120 kilometers wide, which follows close to the northern mountainous and hilly regions, and extends for ten degrees of longitude, from 62° W. (Monagas State) to 72° W. (Táchira State). The altitudinal range of the crop extends from sea-level to 1,800 meters, but most of the sugar cane is grown at elevations of from 200 to 500 meters. Within the above-mentioned belt, the actual areas under cane cultivation vary from small *fincas* of 1 or 2 hectares and estates of 20-100 hectares, to large plantations of 2,000 hectares or groups of *haciendas* covering more than 3,500 hectares. The most important sugar producing states in Venezuela are Sucre, Miranda, Guárico, Aragua, Carabobo, Yaracuy, Lara, Trujillo, Mérida, Táchira and Zulia.

It will at once be recognized that these numerous sugar cane areas, established at different times, and separated from one another by varying distances, and by terrain which varies in nature from coastal marsh, swamp forest, sandy desert, or open savannah, to high mountain ranges, can best be considered as forming an archipelago of ecological islands, each with its own more or less distinct history and characteristics of soil, climate and plant ecology. Under such conditions, it is not surprising that different species of insects have developed into pests of varying degrees of economic importance in different localities, and that one which is quite serious in one place may be a minor pest or even quite absent in others. A full discussion of the distribution and status of the numerous sugar cane insects of Venezuela, and their natural enemies, must be left for the future, and in the present paper the writer proposes to give a brief account of those species which are at the present time of economic importance in one or more localities.

¹ The *haciendas* and *fincas* produce the solid blocks and cones of excellent quality brown sugar known respectively as *panelas* and *papelones*, and sometimes raw and rectified spirit (rum), which is also produced in some of the *centrales*.

These investigations were begun by the writer in December, 1946, and are the result of work carried out in the Section of Sugar Cane Insects, Division of Entomology, of the Venezuelan Ministry of Agriculture. They have covered practically all of the principal sugar cane areas of the country, as shown in the map.²

Two outstanding features concerning the sugar cane insects of Venezuela are worthy of note. In the first place, these insects, without exception, are all indigenous in the country or have spread naturally from adjacent territories, none of them having been introduced from abroad. Secondly, one is struck by the number of insects which are pests in Venezuela, but not known as such in other countries. Since no comprehensive list has yet been published, it is hoped that the following preliminary account may be of interest.

Lepidoptera

PYRALIDAE

Diatraea saccharalis (Fabr.), *D. impersonatella* (Walk.), *D. canella* Hamps., *D. busckella busckella* Dyar & Heinr., *D. busckella rosa* Heinr. The Moth Borers.³

The life history and general type of damage caused by the larvae do not differ in essentials from the published accounts concerning the well-known *D. saccharalis* in other countries. The actual amount of damage done to individual cane-stalks by the larvae of *b. busckella* and *b. rosa*, however, is considerably greater than that done by *saccharalis*. The tunnels are larger and much longer, generally passing through several successive internodes. In terms of *Intensity*, i.e., percentage of the internodes showing external borer tunnels, the average annual *Diatraea* damage in Venezuela varies from about 5.0 per cent in the eastern states (Monagas and Sucre) to 27.5 per cent in the Tocuyo valley (Lara); in the latter district, individual estates are known with an average *Intensity* of 35.0 per cent, indicating a loss of more than 50 per cent of the potential sugar. Other heavily infested areas (*Intensities* of 16.0 per cent or more) are the upper Tuy and Aragua Valleys (Aragua), and the Turbio Valley (Yaracuy and Lara). In general terms, it may be stated that the average *Intensity* for the whole country is in the vicinity of 15.0 per cent, corresponding to a loss in sugar products valued in Venezuela at approximately U.S. \$6,000,000 annually. The distribution and status of each of these moth borers has been studied in detail, and may be summarized as follows:

² The two maps accompanying this paper are the work of the writer's colleague, Signor Pietro Guagliumi.

³ Full accounts of these moth borers in Venezuela have been given by the present writer in (i) "Informe Preliminar sobre los Taladradores de la Caña de Azúcar (*Diatraea* spp.) en Venezuela," Boletín Técnico (No. 1), Sección de la Caña de Azúcar, Departamento de Entomología, Min. Agric., Caracas, December 1947, pp. 1-117, pls. i-xix; and (ii) "Investigaciones sobre los Taladradores de la Caña de Azúcar (*Diatraea* spp.) en Venezuela. Informe del Progreso durante 1948-1949," Bol. Tec. No. 2, idem., pp. 1-60, 1 graph and 1 map in text, with folding map. (In course of publication.)

Diatraea saccharalis (Fabr.)

One of the most important species, occurring throughout the country, and in the majority of the cane-growing areas. It is, however, relatively scarce in the eastern states (Monagas and Sucre), and has not been found in sugar cane (though it occurs in corn and wild grasses) in the extensive plantations of Central Tacarigua (alt. 430 meters) and Central Lucinda, Urama (near sea-level), both in Carabobo State. In both of these areas *D. b. rosa* is the dominant cane borer. Our records show *saccharalis* to be absent from the numerous scattered cane areas in Trujillo State, in the eastern Andean region (300-1650 meters), where the dominant borer is *D. b. busckella*. The areas where *saccharalis* is most abundant and destructive are the following: Altigracia del Orituco (Guárico, 350-400 meters); Guatire-Guarenas (Miranda, 320-380 meters); the middle and upper Rio Tuy valleys (Miranda and Aragua, 180-550 meters); the Aragua valley and tributaries (Aragua, 450-500 meters); Central Matilde, Chivacoa (Yaracuy, 225 meters); the Rio Turbio and Rio Tocuyo valleys (Lara, 350-450 meters and 600-750 meters, respectively). In the Andean region, *saccharalis* occurs sparsely in sugar cane around Mérida (1300-1650 meters) and Egido (1100-1250 meters), and also in the vicinity of San Cristóbal and Rubio (800 meters) in Táchira State.

Diatraea impersonatella (Walk.)

The distribution of this borer in Venezuela is rather curious. The species is actually known to occur from Sucre State to as far west as Trujillo, and also on the llanos (Apure and Portuguesa), and the larvae are not uncommon locally in certain wild species of *Paspalum*, principally *P. virgatum* and *P. fasciculatum*. In sugar cane, however, *impersonatella* has been found only at Cumanacoa (230 meters) and Cumaná (sea-level) in Sucre State, and at El Tocuyo (600-750 meters) in Lara. At El Tocuyo, this borer, in company with *canella*, *saccharalis* and *b. busckella*, is quite a serious pest, attacking canes of all ages from the youngest shoots to stalks ready for harvest. When it is remembered that *impersonatella* is the most important cane borer in the neighboring island of Trinidad, it will be realized that it requires careful watching, because it may be in process of gradually adapting itself to sugar cane in new localities in Venezuela.

Diatraea canella Hampson

This species is almost as widely distributed as *saccharalis*, but rather more scattered. It is abundant at Altigracia del Orituco (Guárico, 300-400 meters), Guatire-Guarenas (Miranda, 320-380 meters), the upper Tuy Valley (Aragua, 500 meters), the Aragua valleys (Aragua, 450-500 meters), Central Tacarigua (Carabobo, 430 meters), the Rio Turbio and Rio Tocuyo valleys (Lara, 350-400 and 600-750 meters), and San Cristobal-Rubio (Táchira, 800 meters). The discovery of this species in the far west of Venezuela is of special interest, since previously it was believed to be limited to the eastern and east-central states. Although the larva is much larger than that of *saccharalis*, it is not generally reck-

oned so destructive, owing to its preference for young unjointed shoots (especially ratoons) rather than mature stalks. Occasionally, however, it damages the latter, causing them to die, and in such cases the damage may be serious where the insect is abundant.

Diatraea busckella busckella Dyar & Heinr., and
Diatraea busckella rosa Heinr.⁴

D. busckella may be counted among the most destructive sugar cane insects of Venezuela, and one or the other of the two subspecies is now known to occur in practically every cane-growing area of the country. Owing to the large size of the larvae (which average from 1.5 to 2.0 times those of *saccharalis*), and their abundance, the damage caused by this species can be particularly severe in certain localities.

Of considerable zoological interest is the geographical distribution of the two subspecies. The species itself (as here recognized, but see foot-note 4) ranges through northern South America for a distance of more than 2000 kilometers from eastern Venezuela (it is not known in Trinidad or British Guiana) to the Isthmus of Panamá, i.e., from long. 62° W. to long. 80° W. *D. b. rosa* occupies the eastern part of this range, and *D. b. busckella* the western part, and the ranges of the two subspecies approach each other, without overlapping, and almost meet in Yaracuy State. The most easterly points in the range of *b. busckella* are Chivacoa and San Pablo, situated less than 20 kilometers from farms in the upper Rio Nirgua valley, where *b. rosa* reaches its most westerly limit in this region. As stated above, there appears to be no overlapping in the respective zones of distribution of these two subspecies, and nowhere have they both been found together, in spite of very thorough search in the critical ecotone. Of special practical importance, therefore, are measures to prevent the accidental introduction of one or the other of these destructive borers into an area where at present it does not exist.

A glance at the two maps accompanying this paper will suggest that the zones of distribution of *b. busckella* and *b. rosa* are more or less coincident with the two main systems of mountain ranges. Nevertheless, our surveys indicate no ecological barriers of sufficient importance to explain the abundance of one of the subspecies at Chivacoa and the other less than 20 kilometers away. This investigation is proceeding, and will form the subject of a special paper to be published at a later date.

Parasites⁵

The above species of *Diatraea*, whose larvae are normally sugar cane borers, are attacked by a considerable number of parasites, the majority of which have not previously been reported from Venezuela. The most

⁴ *D. b. rosa* Heinr. was originally described as *D. busckella* var. *rosa* Heinr. 1931 (Proc. U. S. Nat. Mus. 79, no. 2879:4); recently it was made a subspecies by the present writer (Bol. Entom. Venez., 7:39, Caracas, 1948). Further work is leading us to regard *busckella* and *rosa* as separate species, but until this is complete it is preferred to retain their present status as subspecies.

⁵ For the determination of the dipterous parasites the writer is greatly indebted to Dr. F. I. van Emden, and of the Hymenoptera to Messrs. G. E. Nixon and G. J. Kerrich; the identity of the signiphorid hyperparasite was confirmed by Dr. A. B. Gahan.

important of them is the dextine, *Paratheresia claripalpis* (Wulp), which occurs throughout the country parasitizing the various species of *Diatraea* in degrees which vary according to the locality and food-plant; it appears to be most effective, however, as a parasite of *Diatraea lineolata* (Walk.), the widely distributed corn borer. Among the cane borers its preferred hosts are *saccharalis*, *b. rosa*, and *b. busckella*, and in some localities the first-named seems to be kept well under control by it. It is attacked by four distinct hymenopterous hyperparasites, among which the signiphorid, *Thysanus dipterophaga* (Gir.) is the most frequently met with. Other Diptera attacking cane borers in Venezuela are *Leskiopalpus diadema* (Wied.), *Sarcodexia sternodontis* (Townes.), *Zenillia palpalis* Aldr. (extremely rare), and a tachinid, which Dr. van Emden provisionally considers to be close to *Zenillia ochracea* Wulp, which is very local and rare. Among the Hymenoptera, the egg-parasite, *Trichogramma evanescens* Westw. (*T. minutum* Riley) is ubiquitous; other egg-parasites are *Prophanurus alecto* Crawford and *Telenomus* sp., both extremely local. Hymenopterous parasites of the larvae include five species of *Ipobracon* and four species of *Microdus* (Bassus), among which *I. grenadensis* Ashm., *M. (B.) stigmaterus* Cress., *M. (B.) sacchari* Myers, and *M. (B.)* sp., are the most frequent. The pupal parasite, *Spilochalcis dux* (Walk.), is rare as a parasite of *Diatraea* in sugar cane, but occasionally common in corn and certain wild grasses. Four distinct species of fungi attack the cane borers, but only one of them, *Cordyceps barberi* (Giard), is at all common.

CASTNIIDAE

Castnia licoides Boisd. (*C. licus* Dru.). Giant Moth Borer.
This is a serious pest of sugar cane in British Guiana and Trinidad, but is extremely localized in Venezuela. Its history, however, suggests that *C. licoides* may only be beginning its attacks, and therefore the insect is to be regarded as being of considerable potential importance.

At present, we have found the larvae abundant only at two localities in Carabobo State, viz., Central Tacarigua and Bejuma, 30 kilometers farther west, but in neither place can their importance be compared with the attacks commonly met with in Trinidad and British Guiana. Larvae of a *Castnia* sp., at present unidentified, but perhaps *C. licoides*, have been found in sugar cane and bananas around San Cristobal (Táchira), and information has been received concerning an attack of *Castnia* in sugar cane at Upata, south of the Rio Orinoco and 120 kilometers east of Ciudad Bolívar.

No natural enemies of *Castnia* have so far been discovered in Venezuela, but it is worth mentioning that the tachinid, *Zenillia palpalis* Aldr., recorded above as a parasite of *Diatraea*, was originally described from specimens reared from *C. licoides* larvae in *Heliconia Bihai* L. (Musa-ceae), in the Northwest District of British Guiana, by the late Dr. J. G. Myers (Aldrich 1932, Proc. U. S. Nat. Mus. 81, 9:19).

Coleoptera

SCARABAEIDAE

Unlike the Antillean region, Venezuela is singularly free from the attacks of white grubs, e.g. *Lachnosterna* (*Phyllophaga*), *Ligyris*, etc., in the cane fields. Adults of several species of *Lachnosterna* are sometimes very abundant around the sugar estates, but the larvae of none of them can be considered as pests. The only scarabaeid which comes into this category is the following:

Podischnus agenor (Oliv.). Rhinoceros Beetle.

This dynastid has been very thoroughly investigated and its biology studied by Signor Pietro Guagliumi, whose results are shortly to be published by the Venezuelan Ministry of Agriculture. The general nature of the insect and its damage were described and illustrated by F. A. Bianchi in 1935 (Hawaiian Planters' Rec. 39:191-197), who studied it in Guatemala.

P. agenor has been found at numerous localities scattered throughout northern Venezuela from Sucre State in the east to Táchira in the west. A related species, *P. horni* Sternb. (determined by Dr. E. A. Chapin) has been collected on a sugar estate at San Cristobal (Táchira), but its exact status is not yet known.

The maximum destructiveness of *P. agenor* has been observed in certain fields at Central Tacarigua (Carabobo), where the damage is sometimes quite spectacular. The insect appears recently to have become established in the important cane zones of the Turbio and Tocuyo valleys (Lara).

Signor Guagliumi has shown that the larvae normally live only in soils over-rich in decomposed or semi-decomposed vegetable matter, and that they feed on the soil humus, rarely if ever eating living plant tissues. The damage is done by the adult beetles, which appear in large numbers at the commencement of the rainy season (April-May), and eat their way into the cane stalks, excavating large tunnels and causing their death.

The only parasite so far discovered is the larva of a large black scoliid wasp, which has been determined by Dr. J. Chester Bradley as *Campsomoris servillei* (Guer.) (syn. *C. hyalina* Sauss.). This is a widely distributed species known, according to Bradley (Bol. Ent. Venez., 4:33, Caracas, 1945), from Guatemala, Costa Rica, Panama, Venezuela, Trinidad, Dutch and French Guiana, Brazil, Argentina (Misiones), Paraguay, Peru, Bolivia west to the coast, and Chile (Arica). In Venezuela it is recorded from Monagas State in the east to Merida in the west.

CURCULIONIDAE

Metamasius hemipterus (L.). Weevil Borer.

The common neotropical weevil borer, *M. hemipterus*, has been found in nearly every sugar cane area, its attacks nearly always following on those of *Diatraea*. Occasionally, however, its damage may be quite serious, for which reason it is included here.

Hemiptera-Homoptera

This group of insects includes a large number of species directly associated with the sugar cane in Venezuela, but comparatively few of them can be ranked as major pests.

COCCIDAE

Trionymus sacchari (Ckll.). Pink Mealybug.

One of the most widely distributed pests of sugar cane in Venezuela which may occasionally be very severe, especially during the dry season in small isolated farms where the fields have been generally neglected. The writer has seen in Venezuela extremely severe attacks of sugar cane mealybugs in some districts, but always on a small localized scale; such outbreaks are always accompanied by vast numbers of ants. On the large estates and plantations this pest appears to be adequately controlled by native predators, among which the coccinellid, *Hyperaspis trilineata* Muls. (det. Dr. E. A. Chapin), appears to be the most important.

APHIDAE

Sipha flava Forbes. Yellow Sugar Cane Aphis.

Another insect which is widely distributed but only occasionally severe. The worst attacks are in fields of young plant canes, the development of which may sometimes be seriously impeded. These outbreaks appear to be associated with generally poor agricultural conditions, and heavily attacked fields also show the symptoms of various root-diseases, especially *Sclerotium Rolfsii* Sacc.

Common predators are coccinellid larvae, notably *Cycloneda sanguinea* (L.) and *Coleomegilla maculata* (Dej.), and the larvae of lacewing flies (*Chrysopa*).

Aphis maidis Fitch. Corn Aphis.

Because of the widespread abundance of the mosaic disease in Venezuelan cane fields, its well-known vector, *Aphis maidis*, should be included in any list of the sugar cane insects of the country. It is to be admitted, however, that the insect appears to be very rarely seen on sugar cane, and has been observed by the writer on very few occasions.

JASSIDAE

Rhopalogonia scita (Walk.). Spotted Leafhopper. (Det. by J. W. Evans)

This insect appears to be unknown as a pest except in Venezuela whence it was originally described. It has been found at numerous localities in Miranda, Guárico and Aragua States, and also in the Andean region. Severe outbreaks seem to occur only in the more elevated regions (approximately 1000 meters and upwards), and in such cases the insects literally swarm in the cane fields, their numerous feeding punctures causing the foliage to turn brown and wither. Such outbreaks were observed in the dry season (January-March) of 1947, in the R

Guaire valley (Miranda, 960 meters), a few miles west of Caracas, and at La Puerta, in the eastern Andes (Trujillo, 1500-1650 meters).

All stages are passed on the leaves of sugar cane, corn and certain wild grasses. The biology has been studied and our observations will shortly be published.

DELPHACIDAE

Saccharosydne saccharivora (Westw.). Green Leafhopper. (Det. by R. G. Fennah.)

This leafhopper, which in the old days in the West Indies earned itself the name of the "Blast," because of its destructiveness, has not received the attention that it merits in Venezuela, where occasionally it may be extremely abundant. Although heavy outbreaks appear annually at Central Tacarigua (Carabobo, 430 meters) and a few other localities, our observations suggest that the material damage is not serious, since the pest rapidly disappears and the plants soon recover from the attack. It must be conceded, however, that such outbreaks are at least spectacular, because practically every leaf of every cane plant harbors colonies of the insects, whose secretions fall to the leaves below, engendering a thick growth of sooty mould. The contrast in the appearance of the white waxy secretions of the insects and the black fungus, is very striking.

We have not been able to make a detailed study of this pest as yet, but we have observed and been impressed by the large number of its predators, notably coccinellid and chrysopid larvae, which appear very effective in reducing the numbers in succeeding generations. A high percentage of the nymphs and adults is stylotized.

CERCOPIDAE

This family includes the sugar cane froghoppers, among which the most well-known are those of Trinidad and British Guiana, hitherto known as *Tomaspis saccharina* Dist. and *T. flavilata* Urich, respectively. In Venezuela, it would appear that certain related species have quite recently (since 1942) developed as major pests, and in truth, today the sugar cane froghoppers are considered second only to *Diatraea* in order of economic importance in this country. In certain districts, the insects appear in the form of annual outbreaks, causing damage at least as serious as that caused by the froghopper in Trinidad. The fields so attacked have the appearance of having been burned, for which reason the attacks are described in the vernacular under the name of "candelilla" (i.e., little fire). The outbreaks are now, however, regularly controlled by the application of insecticides. This work is in charge of Dr. H. C. James, Entomologist in the Sugar Cane Division, Ministry of Agriculture.

During 1946, 1947 and 1948 the present writer and his colleagues made large collections of froghoppers from sugar cane, corn and numerous wild grass hosts, wherever they could be found, this survey covering nearly all of the main sugar cane areas of the country. The resulting collection was submitted to the Commonwealth Institute of Entomology

in London, in July 1948, and we are fortunate that R. G. Fennah, the recognized authority on neotropical Homoptera, happened to be in England at the time. As a result of his examination of this material, together with the fine collection in the British Museum (which includes many types), Mr. Fennah published (Ann. Mag. Nat. Hist. [12] 1:605-620, 1948) a revision of part of the genus previously known comprehensively as *Tomaspis* A. & S., creating seven new genera, and restricting the majority of the economic froghoppers of Trinidad, British Guiana and Venezuela to *Aeneolamia* Fenn. Within this new genus, he recognizes six *Rassenkreise*, among which two, viz. *Ae. varia* (Fabr.) and *Ae. flavilata* (Urich), include most of the economic froghoppers of Venezuela. The others are included in *Delassor* Fenn. Before the present paper appears in print, Mr. Fennah will have published his second report, in which he defines the various subspecies listed below.

Aeneolamia varia semifascia (Walk.), *Ae. v. campestris* Fenn., *Ae. v. costata* Fenn., *Ae. v. fallax* Fenn., *Ae. v. pallidior* Fenn., *Ae. v. paspali* Fenn., *Ae. v. tomentosa* Fenn., *Ae. v. sontica* Fenn., *Ae. flavilata* ssp., and *Delassor tristis monagasi* Fenn. Sugar Cane Froghoppers.

The regional and local distribution of each of the above, together with several others taken from outbreaks on corn, or on wild grasses (and therefore to be regarded potentially as cane pests) are given by Mr. Fennah in his second report. For the purposes of the present paper, therefore, it is sufficient to state that the most widely distributed and economically serious form in Venezuela, at the present time, is *Ae. v. sontica* Fenn., which causes severe annual outbreaks of the "candelilla" in certain fields at Central Tacarigua (Carabobo), and especially on several estates in the Rio Turbio Valley (Yaracuy and Lara) centered around Yaritagua and Barquisimeto. This is the form which has generally been known as *Tomaspis bodkini* Williams, in Venezuela.

At times, any one of the other forms named above may be sufficiently abundant to rank as an important cane pest locally, for which reason the list includes all the froghoppers at present known to attack sugar cane in Venezuela.

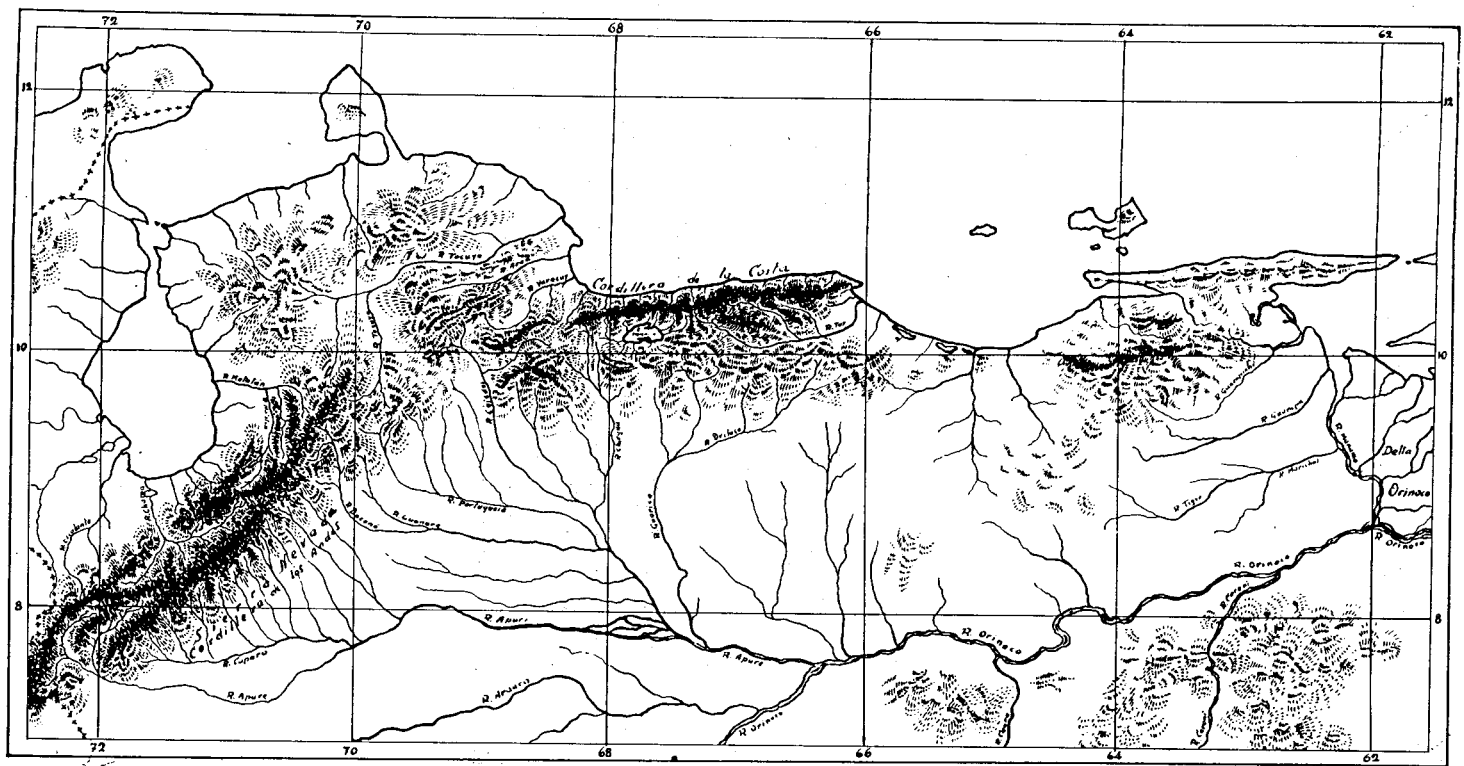


Figure 1.—Map of Northern Venezuela, showing principal physical features.

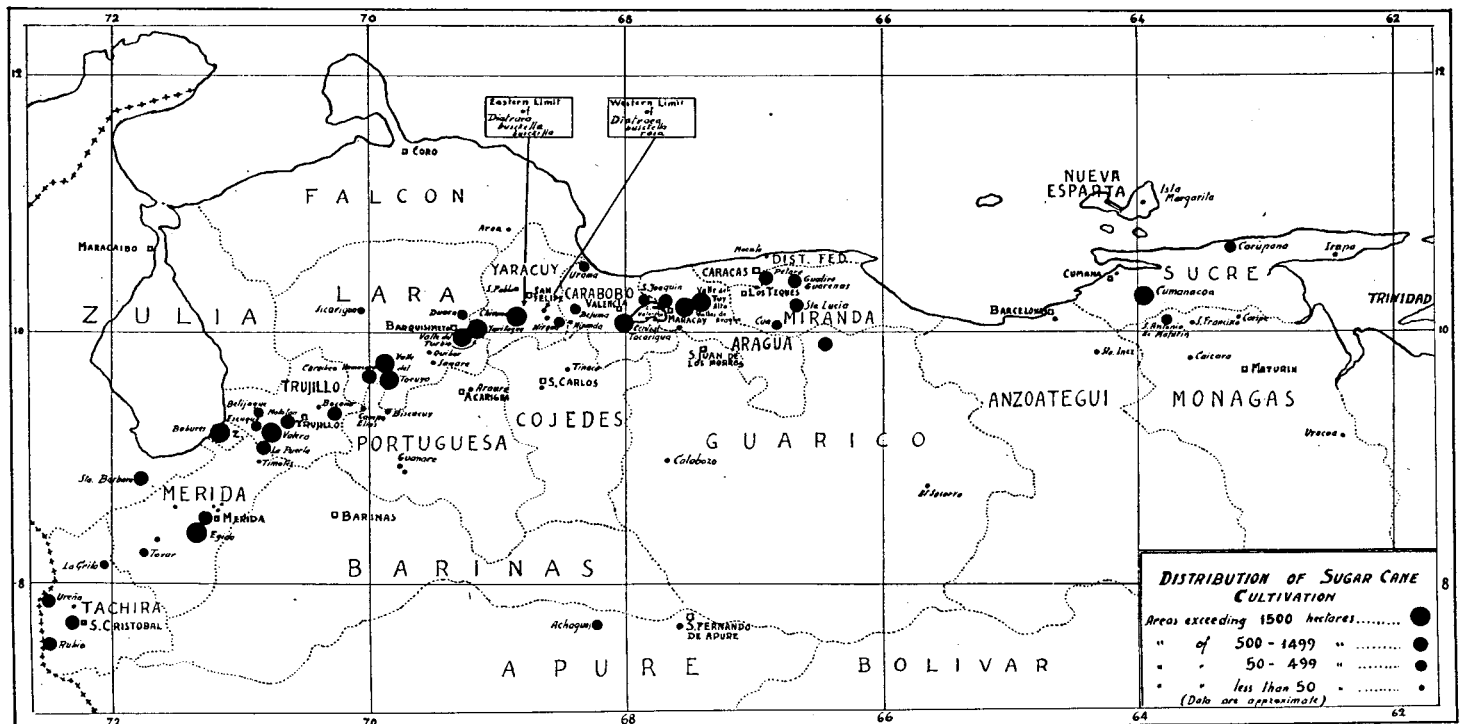


Figure 2.—Map of Northern Venezuela, showing the sugar cane areas.