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Waianae Co.	***	Fred Meyer	Waianae
Waialua Agricultural Co.	*	W. W. Goodale	Waialua
Kahuku Plantation Co.	x°	Andrew Adams	Kahuku
Waimanalo Sugar Co.	°°	G. Chalmers.	Waimanalo
Oahu Sugar Co.	x	E. K Bull	Waipahu
Honolulu Plantation Co.	°°	J. A. Low	Alea
Laie Plantation	x°	S. E. Wooley	Laie
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HAWAII.			
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KEY.

HONOLULU AGENTS.

	Castle & Cooke ( )
°°	W. G. Irwin & Co. (8)
°°°	J. M. Dowsett (1)
x	H. Hackfeld & Co. (9)
°x	T. H. Davies & Co. (8)
°°x	C. Brewer & Co. (6)
x°	Alexander & Baldwin (6)
x°°	F. A. Schaefer & Co. (2)
x°x	H. Waterhouse Trust Co. (2)
tt	Hind, Rolph & Co. (2)
xx	Bishop & Co. (1)

THE HAWAIIAN PLANTERS' MONTHLY

PUBLISHED FOR THE

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SUGAR PRICES FOR MONTH ENDING AUGUST 16, 1907.

	Centrifugals.	Beets.
July 12	3.835¢	9s 5¼d
July 19	3.875¢	9s 6¾d
July 26	3.9375¢	9s 9d
August 2	3.9375¢	9s 9¾d
August 9	3.9375¢	9s 9d
August 16	3.9375¢	9s 9¾d

Czarnikow, Macdougall & Co. report under date of August 2 as follows:

After the activity that prevailed last week, when probably 40,000 tons sugar were placed with refiners, the local market became quiet and refiners showed very little disposition to increase their supplies, notwithstanding the better tone of the European market. As a result, the small offerings of Cubas at 2 9-16c. c. & f., basis 95°, and Porto Ricos at 3 15-16c. c. i. f., were not taken.

This attitude of refiners can hardly be explained, excepting that it is an evidence of their unwillingness to follow the market and thus bring an advance upon themselves, and that they prefer to withdraw and give time for sellers to lower their high views somewhat.

Total stocks in United States were 441,878 tons on June 26th, the maximum for the year. Today's stocks are 296,057 tons, showing a reduction of 145,821 tons. During the same period, the combined stocks of Cuba and United States have decreased 228,821 tons and now stand at 449,057 tons against 455,000 tons at the same date last year.

With these figures before us, it is not unreasonable to suppose that foreign beet sugars may again be required by our refiners at the end of the season unless further large purchases of Javas for September-October shipment are soon made, which is necessary in order to enable sellers to secure sufficient tonnage, which is rather scarce.

The European market, after slight fluctuations, became much stronger, partly due, perhaps, to the covering of shorts for August delivery and to reports of very unfavorable weather in Germany, although as regards the latter, the statements of the newspapers estimating the damage to be 25 per cent. are not confirmed by authorities better able to judge. The market, however, has shown considerable firmness at an advance of 2¼d. for this month and 2½d. for New Crops, from the lowest point touched during the week, and closes steady at the following quotations: 9s. 9¾d. August, 9s. 10½d. September, 9s. 8d. New Crop—October-December, 9s. 9d. January-March and 9s. 11d. May.

As reported in our last issue, there is a possibility that the Brussels Convention may continue even without the United Kingdom. Russia, which heretofore was not a party to the Convention, may join. However, nothing definite may be settled as to the continuance of the Convention until March of the coming year.

There are very few offerings from Cuba, and these are at 2 5/8c. c. f., basis 95°, which price is more than likely to be obtained unless refiners can purchase sugars elsewhere at lower prices. There cannot be more than 100,000 tons of Cuban sugar unsold, or say 80,000 tons for export, thus making the Cuban situation a very strong one.

Spot sugars have been offered in small quantities at 4c., although this price has not been paid, the probabilities are that it will be before long.

Consumption in Europe has been more favorable than anticipated, and the reports of the fruit crop on the Continent, and even in United Kingdom, are good, notwithstanding the cool weather.

The world's visible supplies are now 2,260,000 tons, against 2,300,000 last week and 2,570,000 tons at the same time last year.

Willett & Gray in their Weekly Statistical of August 8, say:

Present Indicated Yields of Growing Crops.—It is much too early to estimate the outturn of the growing crops, as the weather and other conditions during the next few months, may cause great changes in their prospects. Operators, however, wish to know what yields may reasonably be expected, based on reports received to date. We therefore give the following as the present indications only and not as close estimates:

Beet.—In Europe there is an increased acreage of 2½ per cent. The season has been backward, with two months of wet and cold weather. Fields show small roots, but luxuriant growth of leaves. Conditions now are improving and weather more favorable. The probability is for a late harvest. The outturn last season was 6,700,000 tons. Present indications

point to a crop of 6,600,000 tons, provided conditions continue favorable.

In the United States generally the beet crop is two to three weeks late, but with the exception of California, all important sections report improving conditions and much depends upon the length of the growing season. Acreage shows an increase of 3.06 per cent., but last season's exceptionally favorable yield can hardly be expected to be repeated. The present outlook points to a crop of 415,000 tons if favored with a late autumn, against the last crop of 433,010 tons.

Cane.—In Louisiana the cane crop has done well generally since the beginning of the season and is now making rapid progress. If the crop escapes damage, an outturn of 350,000 tons will not be surprising. Last year the yield was exceptionally poor, amounting to only 230,000 tons.

In Cuba few canes were left in the fields at the end of the grinding season. Plantings were small. The young canes were stunted by the drought. The weather since grinding ceased, except for a few weeks, has been and is now generally favorable for the growing cane, which is recovering to some extent from the damage done earlier in the year. It is expected that the harvest will be late. From present indications a possible outturn, with a normal grinding season, would be 1,200,000 tons against the last crop of 1,425,000 tons.

Brussels Convention.—The action of Great Britain in practically withdrawing from membership in the Brussels Convention is causing a great deal of enquiry and speculation as to its effect long in advance of the time when actual conditions will be changed, which cannot be until after September, 1908. But suggestions of what these changed conditions will consist are wanted. First and foremost is the beet crop of Russia, which is increased some 300,000 to 400,000 tons over former times and this amount of extra sugar must find a market outside of Russia. Now the markets of the U. K. are closed to Russian sugars. After September, 1908, they will be open.

Whatever sugar goes from Russia to the U. K. will exclude an equal amount of beet sugar now supplied by other countries.

Germany will suffer the most from being supplanted in the U. K. markets and must find a market elsewhere for her surplus production. The U. S. is the natural outlet for Germany.

But Germany with out new legislation cannot compete with Cuba unless an offset is found against the Cuban reciprocity of 20 per cent. advantage in duties.

The only offset that Germany can make to this is the increase of import duties to exclude all foreign sugars and the re-establishment of the cartel and possibly the bounty systems by which the sugars exported can be sold at enough less than the home consumption value to offset the 20 per cent. Cuban reciprocity.

Germany to compete with Cuba in the U. S. must legislate to give her sugar producers the same benefit that the U. S. gives Cuba.

This seems to be the new complications opened up for the future by the action of Great Britain in withdrawing from the convention.

The Brussels Convention has worked to such good advantage to all the world, the U. K. included, that it seems extraordinary, to say the least, that Great Britain should wish to return to the old and highly unsatisfactory conditions which existed under the bounties and cartels.—[Willett & Gray, July 18.]

The action of Great Britain in withdrawing from the Brussels Convention is uppermost in the minds of all Europe and bids fair to completely rupture the entire convention.

The German Ministers of Agriculture will petition the Lord Chancellor for the German Empire to resign from the Brussels Convention whenever Great Britain withdraws. The 25th July is the time suggested for the Brussels Convention to act upon the British withdrawal.

It is not likely that this convention will grant Great Britain the exceptional position in the convention of being permitted to import sugar from bounty-paying countries free of countervailing duty.

According to today's cables the French Government announces its willingness to adhere to the Convention.—[Willett & Gray, Aug. 1, 1907.]

NATIONAL IRRIGATION CONGRESS.—The fifteenth National Irrigation Congress will be held in Sacramento, California, in the early part of September, the purpose of the Congress being to discuss irrigation and forestry with especial reference to Governmental policies of forest preservation, water conservation and irrigation construction.

The annual sessions of this body have been a large factor in bringing about the enactment of the present National Irrigation and Forestry Law, under which approximately forty million dollars is being expended in reclaiming from the desert vast areas of western lands and in reserving forested public lands and administerting them in the interests of public welfare.

The official call of this Congress states that the purposes thereof are to "Save the forests, store the floods, reclaim the deserts and make homes on the land" and all who are interested in these objects are invited to participate.

The personnel of the Congress, as stated in the Call, includes the President and Vice-President of the United States, Members of the Cabinet, Senators and Representatives, Governors of States

and Territories, Members of State and Territorial Legislatures and State Irrigation, Forestry and other Commissions. Delegates may be appointed by Governors of States and Territories, Mayors of cities, county governing boards, official and unofficial public bodies, and organizations of every kind including agricultural, horticultural and commercial, as well as Boards of Trade, Chambers of Commerce and Development Associations.

GOVERNOR FREAR'S INAUGURAL ADDRESS.

In our opinion Governor Frear's inaugural address is one of the ablest state documents produced during the existence of Hawaiian government and in its analysis of the existing situation with regard to the most vital matters of land settlement, the sugar industry, diversified industries and immigration, is very reassuring.

The Governor has a complete understanding of all the conditions simple and complex in this regard. His discussion of them, revealing his intended policy, is both inspiring of confidence that established industries will be conserved and encouraging of hope that the newer sources of wealth will be stimulated by all legitimate means the administration can bring into play.

That part of the Governor's address relating to these subjects should be of interest to our readers and we therefore give it as follows:

"The question both of paramount importance and of superlative difficulty concerns the character of the future citizenship of the Territory as dependent mainly upon the immigration, labor, industrial, school and land policies. Shall the Territory be dependent upon a single industry, and that be conducted on the present plan, or shall the policies of homesteading, small farming and diversified industries, both manufacturing and agricultural, be pressed?

"It will be conceded that the Territory should not, if it can be avoided, keep all her eggs in one basket—especially when that basket's upsetting is threatened by probable tariff revision. Doubtless, also, no unprejudiced person would deny that the highest interests of these islands require them to be peopled as far as may be by small landed proprietors.

"The disputed ground lies in the possibilities of attaining these ends.

"The difficulties must not be underrated; the process by which they may be overcome will be slow; but true Americanism, as related to problems of this nature, consists not in waiting for something to turn up, nor in sound of trumpets,

nor even in energetic action by traditional methods, but in vigorous action, it may be for traditional ends, by methods found through careful investigation to be adapted to the specific conditions.

"Faith in what may be accomplished by such methods is justified by the history of our present chief industry. For forty years before the reciprocity treaty that industry was a tottering infant with scarcely better prospects than have other industries at present, and even long after the advantages of the treaty began to be enjoyed one venturing to predict that that industry could eventually attain more than a small fraction of its present proportions would have been branded as visionary. If the success of that industry during the last quarter of a century has been due to anything outside of the free admission of sugar into the United States it has been due to the application of scientific methods to every phase of the industry except—it is to be regretted—its most constant and troublesome phase—that of labor. In the light of experience in that industry, and of the progress that obviously to any careful observer has already been made in the direction of homesteading and diversified industries, and the plain probabilities of favoring conditions in the future, it would be reckless to assert impossibility of overcoming the obstacles. Under these circumstances the supreme importance of the end calls for heroic effort toward its accomplishment even at the risk of failure.

"The aim must be for the highest class of citizenship possible.

"Japanese and Chinese citizens by birth under the constitution are growing to manhood and womanhood in constantly increasing numbers; it is no longer a matter of doubt that under proper training they will prove themselves worthy of their citizenship. Hawaiians and Portuguese form the bulk of our present citizen population; it cannot be questioned that they may become successful landed proprietors in far larger numbers than at present.

"To what extent Anglo-Saxons may become such, whether tilling their lands exclusively themselves or employing others to assist, is not so clear.

"The statutes should be amended if necessary to enable us to obtain in adequate numbers immigrants of desirable races; the highest types available and adaptable to local conditions should be secured; those reared here should be trained with reference to existing conditions.

"The difficulties, apart from questions of immigration, are mainly those of suitability of crops, methods of cultivation and manufacture, irrigation, transportation and market. The limitations of the occasion forbid detailed consideration f these, whether as to progress already made towards the solution of each or to favorable considerations for the future. The

solution will constantly grow easier. The rapid filling of the great West will drive increasing numbers to these islands as settlers and tourists, and at the same time furnish a growing demand for our products. The expanding commerce of the Pacific, arising largely out of that growth of the West and the awakening of the East, aided by the construction of the Isthmian canal, will enlarge the market for the products of this pivotal point as well as increase its facilities of transportation out of all proportion to its separate importance. The development of harbors already begun will enable us to take advantage of these favoring circumstances and at the same time will encourage the building of belt lines of railroad about the principal islands. Such lines will remove one of the main obstacles now confronting the would-be settler, not alone by facilitating transportation to and from the seaboard and reducing its cost, but by affording means of conveying crops to central factories and furnishing the advantages of competing factory owners. Development of internal means of transportation will make possible the production for local consumption of much that is now imported in such enormous quantities.

"The Territory is underpopulated; it needs development along many lines in proper relation to each other in order to reach the highest point of efficiency through division and combination of labor and capital. Changes that may at first seem inimical to this enterprise or that will in the end prove advantageous through the general upbuilding. Many of our lands do not require irrigation; as to those that do, failure to devise feasible methods of irrigation for small proprietors would mean stultification in view of the recent reclamation projects of the west, the ancient complicated systems of Hawaiian water rights, and reputed American ingenuity and enterprise. The Planters' Experiment Station, the Federal Experiment Station, the Bureau of Agriculture and Forestry, the College of Agriculture and Mechanic Arts, the special employment of experts and scientists in many lines indicate a disposition to pursue appropriate methods for discovery of suitable crops and methods of cultivation and manufacture. The public schools must be directed by the same spirit of inventiveness and adaptability in order to meet requirements by instilling into rising generations respect for manual labor and interest as well as instruction in agricultural and mechanical pursuits.

"The factors are many; all must be made to contribute.

"The more detailed the consideration the more feasible appears the object, but in general it would seem strange if the spirit that is converting what was once called the "Great American Desert" into what is coming to be called the "Bread Basket of the World" cannot insure success in a land of such salubrity of climate, fertility of soil, favorableness of location and natural attractiveness as these islands possess.

"The policies of small landed proprietorships and diversified industries are not necessarily antagonistic to the prosperity of the sugar industry. There is no inherent reason for opposition to that industry; every reason for aiding it. Probably nowhere are business enterprises, large and small, conducted more generally under corporate forms, but probably nowhere are they conducted more honorably or with less abuse of capitalistic power. The sugar industry is the proverbial goose that lays the golden egg—from which directly or indirectly the Territory and her people derive their main support. To destroy or seriously cripple it would deprive us of what we have and render us impotent to get what we want. If it were still in its infancy it would call for most strenuous efforts to bring it to its present extent and state of efficiency.

"Our policy should be constructive, not destructive, nor even substitutional except as to methods.

"Indeed, far from being in opposition, the campaigns for small landed proprietorships and the sugar interests should be, for best results to each, in closest conjunction. It is not too much to expect this. Those in control of the sugar plantations are among the most public spirited of our people or of any people; more than that, they need the small settler as much as he needs them.

"The land laws must, of course, be applied liberally for the promotion of settlement and strictly for the prevention of speculation or of absorption into large estates, but these very objects demand that the laws should be applied with due regard to facts.

"It would be fatal to those objects to divide among small settlers, as leases to plantations expire, sugar lands which would inevitably soon pass to the plantations in fee,—whether because purchased for speculation or because impossible of successful cultivation on a small scale under specific conditions of irrigation, transportation, capital or other difficulties.

"Until such conditions change, such lands should be leased to the highest bidders, thus securing revenue to the Territory, aid to the plantations, and above all, the retention of the lands for purposes of settlement when conditions warrant.

"The lands most suitable for homesteading should be the first to be utilized for that purpose.

"When circumstances permit or require, the utilization of other lands for the same purpose will doubtless be found consistent with the prosperity of the sugar industry. Meanwhile those in control of the sugar plantations are in duty bound from considerations both of the public welfare and of self-interest to offer every aid possible towards the homesteading of suitable neighboring lands. Thus will be guaranteed both success to the small proprietor by providing him a sure source of income through the sale of products or labor to the planta-

tion, and the advantage to the plantation of a change from an evanescent supply of labor requiring constant expensive replenishment to a permanent, efficient and economical, because a self-propagating and attached, supply. Even before annexation the contract labor system had largely disappeared; long since, the purchase system, in one form or another, possessing in some degree the principle of profit sharing, has come into general practice, with increased returns to both planter and laborer; more recently the planters have begun extensively to provide laborers with homes of sufficient size for resident and garden purposes; already a beginning has been made towards coöperation in various ways by the planters with the government in the establishment of homesteads of sufficient size to support families independently—in one noteworthy instance by the erection and operation of a central factory for canning pineapples raised by the homesteaders—the advantage to the plantation consisting in the certainty that a large proportion of the stronger members of the families will desire work on the plantation much of the time; it may yet, in the natural course of events, prove to be to the advantage of the sugar planters to have their operations confined to central factories, and their lands, whether now held under lease or in fee, subdivided and sold to settlers.

"The conclusion of the whole matter" is that setting aside all meanness of spirit we should one and all proceed, with faith in the possibilities of high purposes, right methods and persistent and united effort, to the grand task of building up our fair Territory to the utmost in every possible way. Then will her political, social and industrial life be in harmony with the purity, beauty and grandeur of her azure skies, opal seas and richly variegated mountains and valleys."

THE SUGAR PRODUCING CAPACITY OF THE HAWAIIAN ISLANDS.

In 1882 or 1883 there was published here a pamphlet entitled "The Sugar Producing Capacity of the Hawaiian Islands," showing the sugar production of the Islands and the possible extention of the sugar industry; the author of the article is unknown. The treaty of Reciprocity with the United States went into effect in 1876 and was to continue in force for seven years, and for so long a period thereafter as should be agreeable to both the United States and Hawaiian Governments, and terminable at the pleasure of either upon giving notice one year previously of its desire to terminate it. In 1883 a reso-

lution was introduced by the Committee on Foreign Relations of the United States Senate that notice be given of the termination of the Treaty. It is therefore very probable that this pamphlet was prepared for the purpose of showing how small a concession was really granted by the Treaty, and how no fear should be entertained that such concession would so stimulate the growth of sugar cane in the Hawaiian Islands as to menace the American sugar interests.

A reading of the pamphlet at this time brings very forcibly to mind one phase of the argument made for the reduction of the duty on sugars raised in the Philippines, and especially the statements made with all earnestness and sincerity by Secretary Taft to the Committee on Philippines of the United States Senate that, "It is a mere dream to believe that ever in the "Philippine Islands we shall go beyond four or five hundred "thousand tons, and that in the course of a great many years." "I do not hope that we are going to improve the sugar industry "of those islands (with the benefit of the reduction in tariff "asked for) in ten years beyond the highest total which they "have raised and imported in the past years of 280,000 tons." Also the statements of Mr. W. C. Welborn, "I think we would "probably grow some five hundred thousand tons of sugar in "fifteen years, possibly in twelve years, maybe in twenty "years."

The pamphlet referred to is in part as follows:

"THE SUGAR PRODUCING CAPACITY OF THE HAWAIIAN ISLANDS.

* * * "These islands are all of volcanic origin. But the only active volcanoes are situated upon the great island of Hawaii, where there are two, Mauna Loa and Kilauea, which are the most active in the world.

"The greater part of the Island of Maui is occupied by a large volcano, Haleakala, which has become extinct probably within a very few centuries, though no tradition of any eruption from it is preserved among the natives. The remaining portions of the islands consist of volcanoes which have probably been extinct for many thousands of years, and which are very much battered, eroded, and degraded by weathering. The more ancient volcanic piles are cut up into crags and precipices, and are scored by immense ravines and canyons, while those which are active or recently extinct are either smooth, rounded domes of fresh lava without gorges, or are just beginning to show the ravages which time and decay produce in all mountains.

"All of these islands are very lofty. Hawaii has two summits nearly 14,000 feet high, and a third summit 8,500 feet high. The altitude of Haleakala, on Maui, is 10,400 feet, while the western mountains of the same island attain 5,800 feet.

The eastern part of Oahu rises 3,000 feet and the western 4,200 feet. The summit of Kauai is about 6,200 feet above the sea.

"The islands are situated within the trade-wind belt, and the winds blow from the northeast with great force and incessantly for nine months of the year, and also with some interruptions during the remaining three months. These winds determine chiefly the characteristics of the climate. The temperature is remarkably uniform throughout the year, varying at sea level from 67° to 87°, never falling below 57° and never going above 90°. With increasing altitude, of course, the temperature rapidly falls, and during the winter months the upper domes of Mauna Loa and Mauna Kea are heavily clad with snow. The windward sides of the islands are usually very wet and rainy, the rainfall indeed being excessive. Along the northeastern coast of Hawaii the annual precipitation varies from 150 to 240 inches. In the lofty interiors even this enormous rainfall is probably much exceeded. But the leeward sides of the islands are, with some exceptions, extremely arid. When the mountain barriers are high enough to completely deflect the trade wind, the lee becomes subject to the daily alteration of land and sea breeze, and the lee is very moist. But if the barrier is low enough to permit the trade wind to blow over it, the lee is extremely dry. As we pass from place to place in the islands we find many sharp contrasts with respect to wetness or dryness, and so great and rapid are these contrasts that it may be said that there are almost as many climates as there are square leagues.

"Only a very small proportion of the total area of the islands is suited to agriculture. The causes and conditions which render most of the area fruitless are many, but among them the following may be mentioned:

"1. The lofty interiors are wholly unfit for any industry, except occasionally, pasturage. The old volcanoes are too rocky, craggy, and precipitous, and are scored by immense ravines, separated from each other only by mere "knife-edges." The younger volcanoes are vast expanses of recent lavas and fields of clinkers and scoria, which are in part as fresh as when they were first erupted, and in part decomposed, but not enough to furnish deep arable soils. And moreover the climate above 2,000 feet altitude is too cold for the culture of staple crops.

"Wherever the lavas of the interior are sufficiently decayed to form soil, however, grasses grow luxuriantly, and give abundant sustenance to cattle, sheep and goats. The interiors of the islands in some parts therefore form excellent pasturage grounds, and thousand of wild cattle and goats are found there. They are hunted for their hides. Wild hogs literally swarm in the mountains, and wild turkeys are also common.

"The lands which are suitable for the cultivation of such

staple crops as sugar cane, coffee, rice, fruits, etc., are limited to a rather narrow marginal ring bordering upon the sea and surrounding the mountainous interior of each larger island. But only a very small proportion of this marginal ring is cultivable and for the following reasons:

"2. On the leeward sides of the islands the climate is (near the sea) too dry and arid, and if there is any soil at all, it must be irrigated in order to produce a crop. But as in all other countries the very dryness which renders irrigation necessary also makes the streams few and small, and very little water available for irrigation exists in the places where it is most necessary.

"3. Again many portions of the marginal rings are occupied with fields of young lavas which are not yet broken down or decayed into soil, and some of which have been erupted within the last one hundred years. This is more or less true of all the islands, least so, perhaps, of Kauai where the percentage of arable land is greatest, and most so of Hawaii, where this percentage is least. In the southeastern part of this island, in the district of Puna, which has an area of nearly six hundred square miles, there is not a single tract of ten acres which has a soil deep enough to plow, though the climate is otherwise perfect for any practical crop.

"4. There is another condition which still further restricts the area of arable land. On the windward sides of the islands the shore is generally an abrupt cliff, plunging at once into deep water. Against this cliff the long heavy swell of the Pacific, driven for thousands of miles before the trade winds, is forever beating powerfully. The platform above is gently sloped, and would form good land were it not for the fact that at short intervals it is cut by deep gorges or canyons heading far up in the mountains and opening to the sea in the faces of the cliffs. These gorges are very numerous on the windward sides of Hawaii and Maui, and are most serious obstacles to the cultivation of the land. The only good land occupies the flats between gorges, but these upland flats are generally so narrow that one compact unbroken piece of land, large enough for a plantation, seldom occurs. It is a matter of extreme inconvenience to a planter to have his farm cut up into three or four pieces by gorges 300 to 500 feet deep, which are very difficult to cross, and if the component tracts are too small, his farm will not pay. There is also great difficulty and expense in getting in his supplies and getting out his crop. It can only be done by water, and the loading and unloading of a vessel lying off a windward coast in the heavy swell of the Pacific, where anchorage is impossible, is a difficult, expensive, and sometimes dangerous matter.

"A few limited tracts, however, are found, in which the conditions are favorable for highly cultivated crops, especially the

sugar cane. In these the soil is deep, and of great richness. A large proportion of them, probably about one-half, require to be irrigated. The sugar cane is always an exceedingly bulky crop, and requires a great amount of moisture to sustain the life of so much vegetable matter, and of such rapid growth. Even in localities where the rainfall exceeds 100 inches per annum, irrigation is still necessary in many cases, because droughts are very prone to occur. Even in plantations where irrigation is not resorted to, it would be advantageous as a resource in such times. Irrigation, however, has some great advantages, especially since irrigated lands preserve their fertility undiminished for years without feeling the drain upon the soil made by such heavy crops, as no other fertilizers need to be added than that brought by the irrigating waters.* The amount of water available for irrigation, however, is limited, and indeed very small. Moreover, the perennial streams are mostly situated on the windward sides of the island where they are not needed, among canons of great depth and ruggedness. To bring their waters around the islands to the leeward and dry sides, or to carry them laterally from their channels to any considerable distance, is impracticable. In a single instance, however, viz., that of the Hawaiian Commercial Company, on the island of Maui, a large ditch has been constructed which carries water a distance of about 24 miles along the base of Haleakala, and across many profound chasms, and the amount of water is equal to the irrigation of about 2,600 acres. The work, however, was very expensive, costing, it is understood, more than a million dollars, and is regarded as a triumph of hydraulic engineering, much surpassing any similar achievements in California. The land thus redeemed was previously a complete desert.

"SUGAR LANDS ON THE ISLAND OF HAWAII.

"On the island of Hawaii there are four out of six districts which contain sugar lands. In the southern, or Kau district, there are three plantations occupying localities near each other. About one-fourth of the area is available for sugar cane, the remainder being covered with extensive lava streams which cross it in an irregular way, and by steep, stony hillsides, and large knobs or buttes, which are cultivable only in a few spots.

* [Note: We believe a somewhat similar assertion was made for the lands in the Philippines by one of the witnesses advocating the reduction of duty on Philippine sugar. All plantations in Hawaii, irrigated and unirrigated, for many years past have used large quantities of fertilizer, the average quantity being about 900 pounds per acre.—Ed.]

Such lands as occur are of excellent quality, and whenever there are no droughts the climate is the best in the islands. Droughts, however, are sometimes long and severe. The total cultivable area in this district is about 4,700 acres. Irrigation is impossible. The entire area is under cultivation, excepting some inconsiderable nooks and corners.

"The northern, or Kohala district, is similar in character to Kau. Within the limits in which arable lands occur the proportion of good to waste lands is larger, and the whole of it is now occupied by sugar plantations. Droughts are not so frequent though they sometimes occur. The amount of cultivable land for sugar cane in this district is about 7,500 acres.

"The third sugar cane area of Hawaii occupies a long narrow marginal belt in the northeastern quarter of the island in the Hilo and Hamakua district. This belt is characterized by many profound gorges and ravines. Its length is about 35 miles and its width varies from one to three miles. Nearly seventy deep canons cross it, or on an average one in every half mile. About three-fourths of this area, as projected on the map, would be occupied by ravines. Between the gorges are some strips of good land, but in many cases the ravines are so close together and the strips of soil are so narrow that they are too restricted in area to be available for plantations. In other cases intervals of one to two miles separate the chasms, leaving between them very good tracts of soil, which are desirable.

"The best of these are now occupied. But there still remain a few tracts, which, under favorable auspices, could be converted into plantations of smaller dimensions. It would, however, require a very heavy outlay of capital to make them available. The only feasible plan yet suggested is to build a narrow gauge railroad, which would be mostly bridges and high trestles, partly for the purpose of hauling cane to the mills and partly to afford ingress for supplies and egress for products. An ordinary wagon road would be quite impossible, owing to the great depth and abruptness of the ravines. The total area under cultivation in this belt is about 17,000 acres. The amount of land which under the strongest inducements might be brought from the virgin state under production is extremely difficult to estimate, but in an extreme case might be 10,000 to 12,000 acres. The climate being excessively rainy irrigation is not resorted to.

"SUGAR LANDS ON THE ISLAND OF MAUI.

"The sugar lands of this island are nearly all on the windward side. With one exception they require irrigation. The water available for irrigation appears to be utilized at present to its full capacity. A single plantation at the eastern ex-

tremity of the island is perhaps capable of some expansion, and it has not hitherto been found necessary to irrigate. Beyond this any further extension of the sugar area, except by adding nooks and corners and forcing the capacity of the irrigating water, seems impracticable. The total acreage now cultivated for sugar is about 12,000 acres.

"SUGAR LANDS ON OAHU.

"This island contains but a very small amount of land upon which cane can be raised. Three plantations of very moderate size and two very small ones comprise the whole of it. In the center of the island is a very extensive tract where the soil seems good and sufficient, but it is under the lee of the eastern mountain range, and would have to be heavily irrigated, and there is no water except such as is already employed by existing cane fields. The total acreage at present cultivated is about 3,000 acres. The three existing large plantations may be capable of some slight enlargement.

"SUGAR LANDS ON KAUAI.

"This is often called the Garden Island. There is probably a larger percentage of arable land upon it than upon the others, and most of this is already utilized. Irrigation is in all cases necessary, and there are several large streams only partially utilized. But owing to the fact that these streams are located in immense gorges of great abruptness the practicability of diverting them upon the land seems doubtful. In any case the expense would be enormous, and even if it were successfully accomplished it is further doubtful whether the lands so irrigated would be extensive enough to insure under any circumstances a fair return upon so large an outlay. Such waters as are at present available are already employed to their full capacity, and the sugar lands are apparently incapable of further enlargement, except by incurring the excessive outlay first referred to.

"The sugar cane is a plant which requires for its full maturity more than a year's growth, and the same field yields a crop not oftener than once in two years, and is frequently allowed to fallow. Thus the land which appertains to any plantation must always be more than double the area actually cropped each year, and is sometimes three or four times as great. The conditions, however, vary so much with the circumstances and climate, that no universal rule can be laid down.

"The following table will show, as nearly as can at present be estimated, the total acreage of the islands, the extent of the lands available for cane, and the amount which can be cropped annually, and the yield of sugar.

TABLE SHOWING THE AREAS OF SUGAR LAND AND PRODUCTIONS, PRESENT AND POSSIBLE, IN THE HAWAIIAN ISLANDS.

Name of Island.	Acres of Cane Land.		Acres Cropped Annually.		Annual Yield of Sugar in Tons.	
	Present	Possible	Present	Possible	Present	Possible
Hawaii.....	30,000	40,000	12,000	18,000	29,000	40,000
Maui	12,000	14,000	6,000	7,500	15,500	25,000
Oahu,.....	3,000	3,500	1,500	2,000	3,000	4,000
Kauai	10,000	15,000	4,000	6,500	9,500	15,000
Total	55,000	72,500	23,500	34,000	57,000	84,000

"ISLAND OF HAWAII.

"Total area, 3,900 square miles. Total acreage at present cultivated for sugar cane, 30,000 acres. Total acreage at present annually cropped, 12,000 acres. Maximum possible acreage which can be cropped, 40,000 acres. Maximum acreage which can be cropped annually, 18,000 acres. Present annual yield of sugar, 29,000 tons. Maximum possible yield of sugar, 40,000 tons.

"ISLAND OF MAUI.

"Total area, 680 square miles. Total acreage at present cultivated for sugar cane, 12,000 acres. Total acreage at present annually cropped, 6,000 acres. Maximum possible acreage which can be cropped, 14,000 acres. Maximum possible acreage which can be cropped annually, 7,500 acres. Present annual yield of sugar, 15,500 tons. Maximum possible yield of sugar, 25,000 tons.

"ISLAND OF OAHU.

"Total area, 600 square miles. Total acreage at present cultivated for sugar cane, 3,000 acres. Maximum possible acreage for cane, 3,500 acres. Total acreage at present annually cropped, 1,500 acres. Maximum possible acreage which can be annually cropped, 2,000 acres. Present annual yield of sugar, 3,000 tons. Maximum possible yield of sugar, 4,000 tons.

"ISLAND OF KAUAI.

"Total area, 640 square miles. Total acreage at present cultivated for sugar cane, 10,000 acres. Maximum possible acreage for cane, 15,000 acres. Total acreage at present cropped

annually, 4,000 acres. Maximum possible acreage which can be cropped annually, 6,500 acres. Present annual crop of sugar, 9,500 tons. Maximum possible crop of sugar, 15,000 tons."

The foregoing report very well shows the general understanding of well informed people of that time. Referring particularly to the Island of Oahu one of Hawaii's most successful and capable sugar men, after a careful investigation reported on or about the time of the publication of the foregoing, that Ewa plantation (for many years last past the premier sugar plantation of the world with a present output of thirty thousand tons) could possibly be developed into a five thousand ton plantation.

The analogy between the Hawaiian situation at that time, and the Philippine situation now is therefore complete, and let us look for a moment at the Hawaiian development and results. We should explain that we are not attempting an argument for or against a reduction of the duty on Philippine sugars, nor to furnish war material for the advocates or opponents of the measure; our object being merely to establish the fallacy of attempting to show by a statement of present results what the future production in any country may be of a product naturally adapted to the climatic and soil conditions of that country, and where all that is necessary to increase such production is, as was the case in Hawaii, an application of capital and brains, backed by the American spirit of "get there."

To resume: The report of Engineers Schuyler and Allardt on the water supply for irrigation on the Honouliuli and Kahuku ranches, Island of Oahu, came in 1889, the purpose of asking for the report being to obtain the opinion of qualified engineers as to the water supply available for irrigation in certain portions of the Island of Oahu, and the probability of establishing extensive plantations of sugar cane, therein, to be supplied with water for irrigation from pumps or storage reservoirs.

These engineers investigated particularly the artesian well supply, it having been theretofore demonstrated that such a supply existed, and reached the conclusion that the supply of water from this source was practically unlimited.

This marked the beginning of the establishment of the large plantations bordering Pearl Harbor, and in 1902, 20 years after the report on the sugar producing capacity of the Hawaiian Islands was issued and 12 years after the investigations of Schuyler and Allardt the area of land devoted to cane on the Island of Oahu was possibly 40,000 acres, with an annual output of about 108,000 tons, and those plantations represent an investment in irrigation enterprises alone of four and one-half millions of dollars.

The increase in production has taken place in the same ratio on the other Islands. On Maui the maximum of yield established by the report above quoted, has been exceeded for some years past by one plantation alone.

On Hawaii the Hamakua district so disparagingly spoken of long ago exceeded the maximum placed for the entire island.

New lands have been opened, great irrigation works have been constructed, improvements have been made in manufacture, nine and twelve roller mills have taken the place of three roller mills, an extraction of 93-95 per cent. has taken the place of an extraction of 72-76 per cent.; great advances have been made in cultivation and fertilization until we find in 1906 a crop of 429,213 tons, divided as follows:

Hawaii	137,750	tons
Maui	102,960	"
Oahu	113,750	"
Kauai	74,753	"

BOILER WATERS AND THEIR TREATMENT.

By William Miller Booth, B. S.

In localities where manufacturers are able only to obtain hard water, it has been the custom to add various compounds to the feed water just prior to entering the boiler or to the boiler itself. In this way dense, hard scale is avoided. As ordinarily used, boiler compounds are expensive, and engineers insist that soda ash causes foaming.

Feed water heaters act as purifiers, removing carbonates of lime and magnesium. Sulphates are sometimes removed in open tray heaters by the use of soda ash. Whatever the form of heater, the accumulated scale must be removed often. If of the closed type with brass tubes and a cast iron case, diluted muriatic acid can be used successfully. It is very necessary that a feed water heater should be as free from scale as possible. Engineers are sometimes surprised to find that their feed water does not register more than 140 degrees F., when it should be delivered to the boilers at very nearly the boiling point. Carbonates can be handled within the boiler if the blow-off valve is used once every three or four hours. It is very difficult to get the ordinary engineer to do this on account of the supposed enormous heat loss. Carbonates accumulate both at the lower and upper surfaces of the water, and circulate at all points between. They may be largely removed as sludge with formation of little scale. Caustic lime is sometimes added to feed water. Sedimentation is then sufficient

if large areas are provided. For small areas upward filtration is necessary. None of the added lime must, however, enter the boiler. If sulphates are found in boiler waters, soda ash is the most convenient and reasonable softening agent. This should be 58 per cent. anhydrous sodium carbonate. Hard waters usually contain both carbonates and sulphates, and the simplest apparatus for their removal consists of two tanks holding about twelve hours' supply each. Raw water is added to a certain mark representing a certain number of gallons, the pre-determined amount of lime and soda ash are then added, the whole is stirred if possible and allowed to clarify. At the conclusion of this process the water is drawn from the top by a float valve. All hard water surrounds particles of lime and soda ash with a relatively insoluable skin or scale, which tends to prevent further action. Hence the use of larger quantities of lime than described by the chemist. Soda ash is more soluable, but similar disadvantages result unless the salt is first dissolved in softened water. The intermittent process is capable of producing excellent results, but cannot be used advantageously in plants above 500 H. P. The more recent method is to install a continuous process for often the floor space is limited, and from two to forty thousand H. P. boilers must be cared for in a single plant. Whatever the process, a given quantity of water must be treated with a fixed amount of chemicals provided the water remains of the same analysis. This is not often the quantity prescribed by the analyst, but is determined by practical experience after the analysis. At first this seems a simple problem, but it is not. Were the load to remain constant, valves could be set once and for all with a constant delivery of water and each chemical solution. But the load at power plants is constantly changing and boilers are filled as the water is needed, resulting in very large variations in the demand. The successful water softening plant must then be as flexible as the steam plant. To avoid poor filtration and a milky sediment the filter ought to be capable of carrying 50% more water than is required at the peak load with from three to five hours' supply constantly undergoing the process of filtration. Where a filter bed has proved insufficient to carry the necessary amount of water during the peak load of a large railway system, lime salts have passed over to the cylinder valves forming lime balls with the cylinder oil and cutting these at least one-sixteenth of an inch.

To provide an abundance of clear scale-free water is the purpose of any softening plant. The load being variable a float valve must be provided to permanently regulate the flow of raw water. To each gallon of raw water the requisite lime and soda ash must be added. There are many contrivances for accomplishing this result. One well-known system makes use of a water wheel which dips up the required solutions and

delivers water and chemicals automatically. If the plant is running at overload and the filter bed can carry the water, the plant still maintains itself with mechanical precision. The power from the wheel may stir the milk of lime solution. Other types of softening apparatus depend upon plungers of sizes proportional to the solution required. If the solutions are kept uniform and at a constant level this system also becomes automatic and flexible. Still another system weighs the raw water and admits the chemicals in proportion when the whole is spilled out and flows through the filters. Another mechanism is so arranged that raw water displaces both lime and soda solutions. Each gallon of water is divided into three fractions,—one going to the bottom of the lime tank, one to the top of the soda tank and the remainder and the largest portion following directly into the mixing tank. Such a system also becomes automatic.

Having accomplished a thorough mixing of the raw water and chemicals the question of sedimentation arises. The writer finds eight feet of quiet water a sufficient depth to accomplish good results. Special sand, coke, shavings and excelsior are used as materials for filter beds. The latter is the most accessible and is easily managed. Better results are accomplished in any apparatus if the filter bed is cleaned often. This is done by reversing the flow of water, by hose washing, or with a steam jet.

If the apparatus is correctly designed water is delivered to the supply tanks free from any form of sediment and is soft. The supply of soft water ought to be sufficient to last the entire plant at peak load for at least two hours. If this tank is furnished with a sludge valve the sediment resulting from any secondary reaction is readily drawn off.

It seems to be generally supposed by power plant managers that *all* of the lime and magnesium salts must be removed by this process. This is not necessary. If the chemist reports a cost of twenty-five cents per day for soda ash and ten cents per day for lime, it is entirely possible and probable that the cost of soda ash will not be more than eighteen or twenty cents and that the expense of lime will be half as much again. A plant is now in successful operation the water of which calls for a daily expenditure for lime and soda of $2.28. The actual cost for chemicals at this plant is a dollar and ten cents, and 60 per cent. of the scale is being removed. Old scale in the boilers, which were in very bad condition, is gradually disappearing. The idea that boilers using treated water will foam or prime excessively is erroneous. The probability is that the boiler has not been properly blown down, if difficulty is experienced in this direction. Concentration of sodium salts is common on this account. In some cases oil is the offender. It is not unusual to find an alkali concentration from 8 to 12

times as great as that originally contained in the water. Ordinarily alkali is harmless, but in such quantity becomes corrosive. As sulphate of soda results from the softening process it must be removed. A hydrometer in the hands of a competent engineer obviates any difficulty in this direction. A well designed water softening plant does not require a resident chemist. Every manufacturing concern can obtain the services of a young man who is willing to look after such apparatus. He usually combines such duties with others of a similar nature about the plant. A high school graduate who has taken one year's work in chemistry will often make a very good attendant if he likes the work. The consulting chemist can give directions and prepare solutions, and should teach the attendant the important facts relative to water softening. Under ordinary circumstances the solutions last from three to four months. A large plant is now being operated by a man absolutely unfamiliar with chemistry. He has solutions prepared occasionally and operates the plant successfully. The changes that occur in water during an entire year ought to be followed by an expert chemist and tabulated for the use of a concern. April, August and November are suggested as months during which the greatest changes will be observed. With an intelligent attendant the plant will require little expert attention.

The loss due to idle boilers, the expense of new tubes, expense of compounds and of scale-removing machinery have cost many manufacturers more money annually than an entire softening system with the attendant expense of operation during that period. The field is broad and the results sure if the plant fulfills the fundamental conditions mentioned in this article.—*Chemical Engineer.*

EXPLANATION OF PLATES.

Except where otherwise given the magnification of each figure is given with its number on the Plate; thus: 1x2.

PLATE I.

All figures are of the Sugar Cane Leaf-Roller (*Omiodes accepta*).

1. Adult moth.
2. Caterpiller, side view.
3. " dorsal view.
4. " 4 anterior segments.
5. " front view of head.
   e, eye cluster.
   c, cervical shield.
   s, spiracles.
   d, dorsal row of tubercles. (In fig. 4=posterior trapezoidal).
   sp, supra-spiracular row of tubercles.
   sb, sub-spiracular row of tubercles.
6. Pupa, side view.
   e, eye.
   a, antenna-case.
   l, leg case.
   w, wing-case.
   s, spiracles.
   c, cremaster.
7. Apex of cremaster, showing the curled spines by which the pupa is fastened to the cocoon.
8. Cluster of 4 eggs in groove on surface of leaf.
9. Eggs more highly enlarged.
10. Leaf spun together for "retreat" or hiding place of carterpillar; shows where carterpillar has eaten, (Nat. size.)
11. Leaf, showing spots where a very young carterpillar has eaten, leaving one epidermis intact, instead of eating holes through the leaf, (Nat. size.)

PLATE II.

1. *Omiodes localis.*
2. *O. continuatalis.*
3. *O. demaratalis.*
4. *O. epicentra.*
5. *O. asaphombra.*
6. *O. iridias.*
7. *O. anastrepta.*
8. *O. antidoxa.*
9. *O. monogramma.*
10. *O. blackburni.*
11. *O. monogona.*
12. *Hymenia recurvalis.*

PLATE V.

1. *Macrodyctium Omiodivorum.*
2. " eggs on surface of caterpillar of *Omiodes accepta.*
3. " 5 larvae feeding on outside of caterpillar of *Omiodes accepta.*
4. " 9 cocoons on cane leaf near the dried remains of a caterpillar upon which the larvae fed. The holes in cocoons are where the adult parasites gnawed out. All were inside a "retreat" of *Omiodes accepta*, which has been opened, (Nat. size).
5. *Pimpla hawaiiensis.*
6. *Echthromorpha maculipennis.*

THE SUGAR CANE LEAF-ROLLER.

The Experiment Station of the Hawaiian Sugar Planters' Association has recently issued a Bulletin by Otto H. Swezey under the above title, containing also an account of allied species and natural enemies.

The Bulletin is well illustrated and contains much that is of interest even to those who are not scientific entomologists.

The cane leaf-roller and all the other moths of the genus *Omiodes* herein mentioned, are native to the Hawaiian Islands and occur nowhere else. It is a tropical and subtropical genus, other species occurring in South America, Central America, West Indies, Tonga Is., Fiji, Solomon Is., Malay Is., Upper Burmah, and even to E. Siberia, the latter being the farthest north that

any species occurs. There are 15 Hawaiian species, and about an equal number in the other localities mentioned.

Hampson places *Omiodes* under *Phryganodes* as a synonym; but our species do not agree with his characterization of that genus in respect to palpi and vein 7 of forewing. Our species more nearly correspond with his characterization of the genus *Nacoleia,* another tropical and subtropical genus.

The only species of Hawaiian *Omiodes* whose caterpillars have been previously described are *O. accepta* and *O. blackburni.* The caterpillars of all species are very similar in general, but vary in size respective to the size of the species, and in markings on head, cervical shield, and the tubercles, as is well shown in the figures. The pupae of the different species vary little except in size and degree of coloration—some being lighter in color, others darker. They all have similar habits of feeding, and of rolling leaves or otherwise fastening leaves together for a "retreat," to protect them from their enemies. The life-history of the different species varies somewhat, but in general is much the same as given for *O. accepta* and *O. blackburni.* The caterpillars obtain their growth in about 3 to 4 weeks, and the pupal period is about 1 to 2 weeks, which gives 4 to 6 weeks from egg to maturity. As they breed more or less the year round, there is time enough for several broods per year—about 6 to 8, though there are seasons when they breed less prolifically and grow less rapidly than at others; so that perhaps there may be really a less number of broods per year.

As regards food-plants, the caterpillars of the different species are more or less restricted to particular food-plants. Four are grass-feeders: *accepta, continuatalis, localis, demaratalis;* two feed on sedge: *anastrepta, antidoxa;* two feed on *Astelia* (a Liliaceous plant): *iridias, asaphombra;* one feeds on *Dianella* (another Liliaceous plant): *monograma;* one feeds on leaves of various species of beans: *monogona;* one species on palms: *blackburni;* two species on banana: *meyricki* and *blackburni.* With the exception of one species *(monogona)* it is seen they are confined to the Monocotyledonous group of plants. Of those feeding upon grass, *accepta* is the only species which also attacks sugar cane to such an extent as to be considered a pest; in fact, there are only occasional instances of any other species feeding upon cane.

Of the sugar cane leaf-roller Mr. Swezey says:

This is a native moth, and its caterpillars were probably originally grass-feeders, but at the present time they feed largely upon sugar cane. It is found especially in sugar plantations, or the portions of plantations, which are quite high, or are near to the native forests; for example the upper parts of plantations of the Kohala, Hamakua, Hilo and Kau districts of Hawaii, but it is generally distributed however,—a few found in nearly all, if not all, of the plantations of these islands, but scarce in the irrigated plantations of the dry districts. Besides feeding upon sugar cane, it is also found along with other species of Omiodes, feeding upon

Hilo grass *(Paspalum conjugatum), Paspalum orbiculare, Panicum pruriens,* and other grasses. I have also found the caterpillars feeding upon Pampas grass, and on a native sedge, *Baumea meyani.*

It is present in some fields of cane sometimes in such large numbers as to do considerable damage, in fact cases have been reported where the young cane has been entirely stripped of leaves. Such instances are not numerous, however, and even in the worst cases would not result in entire destruction of the crop of cane as it would grow again after the caterpillars had obtained their growth, or their parasites had got them checked. It is not usually to be considered a serious pest. Possibly it is not so abundant now as it was a few years ago when reports were made of cane fields having been entirely stripped by them.

At present there are a number of parasites preying upon this species and this keeps them well in check.

LIFE HISTORY.

The eggs are deposited on the surface of a grass or cane-leaf, usually on the upper surface, in the groove of the mid-rib of the leaf. They are in clusters of from 2 or 3 to as many as 30, and quite regularly arranged in rows, (when but a small number they are in one row) and a little overlapping like shingles. They are flat, nearly circular, about 2-3 mm. in diameter, very finely reticulated on both surfaces, slightly yellowish with a slight iridescent hue which shows more distinctly after hatching. Just previous to hatching, the young larvae may be seen coiled around inside the egg. They are conspicuous by their black heads.

Freshly hatched larvae are 1.5 mm. long. They are pale greenish; head black; no markings on the other segments; tubercles and hairs are conspicuous.

2nd Stage.—About 4 mm.; pale green; head with black spot at cluster of ocelli, a black dot in middle of each lobe in front; a black dot at postero-ventral angle, a black line on margin above it.

3rd Stage.—About 7 mm.; pale green; head as before; a black spot in each lateral lobe of cervical shield; a black dot behind each spot; on segment 3 tubercles ii are heavily black-margined below and in front.

4th Stage.—About 12 mm.; all marks are more conspicuous; the dot and spot in each lobe of cervical shield are united; a faint oblique dash on each side above paraclypeus.

5th Stage.—About 20 mm.; the markings are the same as in previous stage, and a faint black lateral margin to the cervical shield.

6th Stage.—Full-grown, 27 mm. Head rounded, slightly bilobed, pale luteous, upper part checkered with angular slightly darker spots; a rounded black spot about the middle of each half of face, two little oblique dashes a little above these and near

median line, the black dot at postero-ventral angle in earlier stages is no longer present; ocelli black, except the lower posterior one; tips of mandibles black; tips of antennae brown. Body slender, cylindrical, uniform green, the dorsal vessel edged by a more or less distinct, opaque, white fat-body, the tracheae along sides show very distinctly through the integument. Tubercles broad, flat, somewhat convex, same color as body, each bearing a seta (certain ones 2 setae), arranged in several longitudinal rows; one tubercle per segment on each side of body. They are to be designated as follows: those on the dorsum are anterior trapezoidal (i) and posterior trapezoidal (ii), near the anterior and posterior margins respectively of segments 5-12*, the former are nearer the median line, on segments 3 and 4 each of these tubercles is double, i. e., has two setae, and ii is situated ventrally from i, instead of posterior to it; supra-spiracular (iii), a tubercle situated just above each spiracle, also one in a nearly corresponding position on segments 3 and 4; sub-spiracular (iv + v), a double tubercle just below each spiracle, it is composed of two united and bears two setae, on segments 3 and 4 it is in front of iii, on segment 2 it is in front of the spiracle (pre-spiracular); lateral (vi), a tubercle a little below iv + v and situated a little farther back; marginal (vii), situated on outer side of each proleg, and on inner side of each true leg, and on legless segments a little ventral from vi, each has three setae; ventral (viii) a small tubercle near median ventral line of each segment. Cervical shield same color as body, has two black spots near each lateral margin, the anterior spot the larger, sometimes the lateral margin is faintly black. On segment 3, tubercle ii is more or less black-margined on its lower and anterior sides, making a conspicuous black spot in line with those on cervical shield. Feet same color as body; spiracles yellowish-brown, those of segments 2 and 12 larger than the others.

The recently hatched larva feeds in the folded together tip of a grass leaf which it has fastened with silk. It eats the surface of the leaf in spots, leaving the under epidermis, which gives the appearance of dead spots on the leaf; as it becomes larger it folds the leaf together lower down, doing this from time to time as it needs to enlarge its retreat, or have access to a fresh portion of leaf for feeding. In about two weeks the larva has grown to a length of 15 mm., and now eats the whole substance of the leaf, not leaving the epidermis as before. Having used up one leaf, the larva migrates to another, by spinning, rolls a portion of it into a tube, within which it hides, protruding its head at the ends of the tube to feed upon the leaf; eventually its "retreat" becomes reduced by being eaten at the ends, and another leaf has to be taken, and so on, till the larva reaches its growth. Often a larva

* In numbering segments, the head is 1, prothorax 2, and the others in succession.

fastens several leaves together confusedly for a retreat, instead of rolling up just one.

On sugar cane the very young larvae feed in the crown of the plant where the young leaves have not yet unrolled. They are thus protected between the natural rolls of the leaf; later on they roll over the margin of a leaf forming a tube for their "retreat." When nearly full grown, they are usually found in tubes towards the tip of the upper leaves. These tubes are easily observed if the ragged leaves where the larvae have fed, are examined. The work of the smaller larvae shows as oval or elongate dead spots on leaves which have unrolled in the growing of the cane after the young larvae have fed upon them.

When disturbed in its retreat, as by its being torn open, or violently shaken, or jarred, the larva wriggles very lively and drops to the ground for escape. This habit is probably to escape from parasites, many of which prey upon them. The retreat which it constructs, is undoubtedly for the same purpose, as well as for protection from wasps and birds which prey upon.

The caterpillars are full-grown in about 3 weeks from hatching. They molt 5 times at intervals of about 3 to 5 days, and 5 to 7 days between the 5th molt and the spinning of the cocoon and pupation. Pupation takes place within a slight cocoon of white silk in the "retreat" where the caterpillar has lived; however, the cocoon is sometimes made beneath the leaf-sheaths of cane, and in other favorable places.

Pupa.—Length 12-14 mm., width about 2.5 mm.; light brown, head darker; delicate hairs distributed as in the larva; cremaster somewhat flattened, blunt-pointed, with a cluster of 8 hooked spines fastened into the cocoon; spiracles slightly raised; wing cases extending to the middle of the fourth abdominal segment, antenna- and leg-cases extending to about the middle of the sixth segment, free beyond the fourth segment.

The pupal period is 8 to 13 days, usually about 10 days.

The Bulletin describes other species of leaf-rollers none of which however are a pest on sugar cane.

REMEDIES.

Arsenical sprays such as Paris Green and Arsenate of Lead should be more or less effective against leaf-rollers when they become destructive. There would be great difficulty in applying these in cane fields, however, except in young fields where the cane has but a few months' growth, and small enough not to be broken down by a spraying cart. Of course it is in the younger cane the destruction by leaf-rollers will be greatest, as the amount of eating they would do on small shoots has greater effect in crippling it for further growth. Larger cane is better able to withstand some loss of leaves without any particular injury.

So far as I know, no trials have been made to determine how

expensive, or how effective, the use of poisons may be in the control of this pest. At present, the natural enemies have made the damage by leaf-rollers less severe than in former years, as indicated by occasional reports of very serious injury by them in the past. But even with this usually efficient control by parasites, there may be times when certain fields of young cane appear to be becoming too seriously attacked by leaf-rollers, and spraying could be profitably resorted to. In case this is attempted, a cart should be devised to be drawn by a team, and straddling one row, spray it and another row on either side. This might be readily done in unirrigated fields, but probably too difficult to accomplish in irrigated fields, on account of the crookedness of the rows of cane in conforming to the natural contour lines of the land.

Arsenate of lead would be the better poison to use, as it is easier retained in suspension in the water of the spraying cart; and it also adheres to the leaves permanently, even in rainy times; whereas Paris Green would wash off with the first shower. About 4 pounds of the Asenate to 100 gallons of water would be a good proportion to use. This should be effective against the Army worm and cut worms as well. They sometimes infest the fields of young cane at the same time the leaf-rollers do, though usually they are apt to be injurious to young cane at an earlier stage than it is attacked by the leaf-rollers.

A method which has been used at times is to go over the field row by row, and by hand, pinching all the "retreats" of the leaf-rollers that can be seen, thus destroying the caterpillar within. This could be accomplished without much additional labor at the time of hoeing, the laborers being properly instructed to look for the "retreats" which are usually conspicuous, when one knows what to look for, i. e., the portion of margin or tip of leaf rolled up into a tube on a portion of the leaf which has been more or less eaten away by the caterpillars.

Young palm trees may be easily relieved of the leaf-roller pest by frequent examination, and destroying the young caterpillars soon after they hatch, when they are feeding gregariously on the surface of the leaf. The colony may be recognized by the web by which they are covered; and a stiff brush, or something similar, may be used to kill them at one stroke. After they have grown to a larger size and fastened together leaflets or folds of the leaf for hiding places, they may be killed by pinching together the folds with the fingers, continuing the pressure along the whole length of the fold of the leaf or leaflet. This is applicable to small trees only; after they have grown larger, beyond convenient access, nothing can be done to advantage. Spraying with poison is not feasible, as the caterpillars do so much of their feeding inside of folded leaves that the poison is not likely to be placed where much of it will be eaten by them. Under these circumstances dependence has to be made upon the natural enemies, of which there are many. Of course it will be readily understood,

that any method given above for the destruction of leaf-rollers, will also result in the destruction of whatever parasites may be infesting them at the time.

NATURAL ENEMIES.

Omiodes caterpillars are attacked by a large number of species of parasites, some of which are native, and several which are the most valuable have been introduced. The most of the species are kept in check by their natural enemies, so that they do not become very numerous; in fact, several of them are very rare. Two species feed so numerously on cultivated plants that they become serious pests: *accepta* on sugar cane, and *blackburni* on palms. These two species are preyed upon very extensively by the parasites and checked considerably, but not sufficiently to keep them from doing considerable injury in certain localities and at certain seasons. Apparently the moths are more prolific in the winter months (about December to March), and the parasites are scarcer owing to their having had fewer caterpillars for them to keep breeding on during the preceding summer. Hence, when the winter broods of caterpillars appear, there may be two or three generations of them before the parasites breed up to sufficient numbers so that they produce any noticeable check on the number of the caterpillars; then in another generation or two the caterpillars may be much reduced in numbers and a large percentage of them found to be parasitized; for example: on one occasion 75% of the cane leaf-rollers in a field at Hutchinson plantation, Hawaii, were found to be destroyed by one species of parasite; at Olaa plantation, Hawaii, in a certain field, on one occasion a much higher percentage of them than that were killed; in Honolulu, of a large number of the palm leaf-roller caterpillars collected, 90% were parasitized.

Since there are so many species of parasites preying on the leaf-rollers which are pests, it might be asked "Why do they not become exterminated, or at least cease to be pests?" Apparently, with all of the parasites, they are still not numerous enough to over-balance the prolificness of the pest, even though they do kill such high percentages of them at times. Since so many are killed by parasites, and yet there are enough left to do considerable injury at times, one can not help but wonder to what extent these pests might increase were there no parasites preying on them, and how many times more serious would be the damage done by them. The extreme difficulty and impracticability of treating sugar cane fields, or large palm trees, artificially, for the destruction of these pests, makes it all the more important that there are so many valuable parasites preying upon them; and shows the value of introducing natural enemies to control a pest, for the four best parasites of these leaf-rollers are introduced species, viz., *Macro-*

dyctium omiodivorum, Chalcis obscurata, Frontina archippivora and *Trichogramma pretiosa.*

The most valuable of these parasites is the *Macrodyctium omiodivorum* (Omiodes Braconid), which is thus described:

This valuable Braconid is an introduced species. There is no definite record of it, but it was probably introduced by Mr. Koebele from Japan, in 1895, at the same time that he introduced *Chalcis obscurata.* It is now thoroughly established and very widely distributed in these islands. It is the most valuable of all the parasites on the cane leaf-roller *(Omiodes accepta),* and is found wherever the latter is abundant in the cane-fields.

In one field of Hutchinson Sugar Plantation, Kau, Hawaii, where there were a good many *O. accepta* caterpillars feeding on the cane leaves, a large number of the caterpillars were examined and by actual count 75% were dead, having been killed by this parasite. Many of the caterpillars had the larvae of the parasite feeding upon them; others were entirely dried up, the parasites having obtained their growth and spun cocoons in a cluster on the leaf close by. In a cane-field at Olaa, Hawaii, I found the leaf-rollers, though abundant, nearly all killed by this parasite. Similar conditions I have found in many other sugar plantations. The larvae are entirely external feeders, and grow very rapidly, becoming full-grown before the caterpillar gets too much decomposed. I have found this parasite feeding very abundantly on a leaf-roller *(Cacoecia,* sp.) on Guava, at Kipahulu, Maui, and on the palm leaf-roller *(Omiodes blackburni)* in Honolulu. It probably will eventually parasitize many other species of leaf-rollers, attacking particularly whichever is most abundant in the particular locality.

LIFE HISTORY.

The female parasite most likely attacks the *Omiodes* larva within its "retreat," made of a piece of leaf rolled over. From the size of her ovipositor, one would expect that she would insert her eggs within the host; but so far as I have observed they are placed on the outside. The number of eggs varies. I have seen five on one caterpillar; and the number of larvae which I have seen feeding upon one caterpillar varies from 1 to 23—probably all laid by the same female.

The adult parasite must sting the host caterpillar before laying its eggs, for the caterpillars have the habit of squirming very actively when disturbed, and falling to the ground.

The caterpillars always appear to be dead whenever found with parasites or their eggs, but probably they are only paralyzed by the sting of the parasite, as is done by certain wasps which store up caterpillars and spiders for food for their larvae. Often on examination of these apparently dead caterpillars which have parasite eggs or small larvae present, pulsations can be seen in the dorsal vessel.

The eggs are white, or slightly yellowish, 5/8 mm. long. They hatch in a day or two, and the young larvae have a very rapid development. They are footless grubs, and feed externally, biting into the caterpillar and consuming its juices. In one instance under observation, they had become full-grown (4 mm.) in three days, and begun spinning cocoons; cocoons were finished the next day; three days after, the pupae were formed; and after five more days the adults appeared. This gives the life cycle as 13 to 14 days. From this same lot another generation was bred to maturity in exactly 14 days.

The cocoons are made in a cluster on the surface of the cane leaf close by the dried up remains of the dead caterpillar. The pupa is whitish at first, but becomes black in a few days, before the adult is formed. The adults emerge by eating a round hole near one end of the cocoon.

A species of black wasp is also active in keeping the leaf-roller in check, and the following description of their operations is interesting:

There are more than 100 species of wasps of the genus *Odynerus* which are peculiar to the Hawaiian Islands. This black species is one of the largest ones. It is distributed to all the islands from Oahu to Hawaii, and occurs from the coast up as high as 4,000 feet in the mountains. Like the other members of the genus, they store up caterpillars of medium sized Lepidoptera as food for their young. Their nests are made in hollow twigs or holes in trees, in holes in rocks, in burrows in earth banks, etc., according to what is convenient in the particular locality. A favorite place is the nests of the mud wasp *(Pelopaeus caementarius)*. I once found them occupying a deserted paper wasp nest *(Polistes)* attached to underside of leaf of fan palm. They take possession of the empty cells of mud wasp nest, which are somewhat too large for them, however, so they divide them into two by a transverse partition of mud. They first put the desired number of caterpillars in the bottom of the cell, having paralyzed them by stinging them in ventral side, deposit an egg, then put in the mud partition, and fill up the outer part of the cell similarly, and seal up the opening with mud. When they use holes in rocks they are apt to use a hole about the proper size to hold caterpillars sufficient for one wasp larvae to feed upon, and seal the opening with mud. In burrows in earth, or in hollow sticks, they may have several cells end to end.

The caterpillars which this species gathers are usually about an inch long, and they usually gather all one species for one cell, though sometimes I have found them mixed. The number of caterpillars stored in one cell varies from 6 to 12. There is great variation in the size of the adult wasps, which is evidently due to the amount of food it had when a larva, i. e., the number of caterpillars which had been stored for it to feed on.

In many nests examined, the following species of caterpillars (all leaf-rollers) were found: *Omiodes accepta* (Cane Leaf-roller), *O. localis, O. monogona, O. blackburni, Hymenia recurvalis, Cacoecia,* sp., *Mecyna aurora.* These observations were taken at various places on Oahu, Maui and Hawaii. The species of caterpillar found in each case, was in accordance with the proximity to a place where there was an abundance of this particular species of caterpillar. When in the vicinity of sugar cane-fields where cane leaf-rollers are abundant, they capture a good many of these. Among the other caterpillars, those of the genus *Cacoecia* are collected in largest numbers. There are two species of these and they are leaf-rollers on almost every kind of tree, shrub and plant, planted or growing wild in the lower parts of the islands. The next most abundant caterpillar collected was *Hymenia recurvalis,* which is abundant on weeds of the Amarantaceae, on Purslane, and often on Beets.

LIFE HISTORY.

The egg is white, elongate, 2.5 mm. long, and suspended from the upper side of the cell by a filament of about the same length. One egg is placed in each cell of stored up caterpillars. The egg hatches in but a few days, and the whitish larva at once begins eating its food-supply of caterpillars. It grows rapidly, finishing its food-supply and becoming full grown in 5 to 7 days. It is then a fat, footless grub about 15 to 17 mm. long and 5 mm. thick, curved ventrally. In a day or two it spins a layer of whitish silk over the inner surface of the cell, not making a regular, close-fitting cocoon.

Pupation soon takes place. The pupa is white for several days; finally it gradually turns black a few days before it becomes adult. The pupal period is about 15 days. At times they may pass long periods of time as full-grown larvae in their cells before pupation, probably a provision to enable them to survive long periods of drought in some of the drier regions. I found such a larva in a mud wasp's nest, June 5th, 1906. It remained in this condition in a tube in the laboratory of the experiment station till Dec. 9th, 1906, when it pupated. This was a period of a little over 6 months as a full-grown larva, and there is no knowing how long it had been in this condition when discovered. Pupation took place after a period of about 2 weeks of rainy weather with "Kona" storms. It remained in pupal stage 18 days, when the adult was fully developed.

PARASITE (*Ageniaspis* sp?)

Unfortunately the good work of *Odynerus nigripennis* is much checked by reason of its being parasitized by a very small Chalcid Fly. This parasite I have found widely distributed on Hawaii,

Maui and Oahu. In a number of instances I have bred them from *O. nigripennis* larvae; and much oftener have found in *nigripennis* nests the empty larval skin from which the parasites emerged. The *nigripennis* larvae are allowed to become full-grown; the numerous tiny larvae of the parasite feeding inside, and pupate shortly after the host larva is full-grown. They completely fill the latter and can be seen through the transparent skin, packed so close that the skin has bulges where it conforms to the pupae inside. I have bred 105 parasites from one wasp larva. They escape from the mud cell of the wasp by gnawing a tiny hole through the plug of mud which sealed it.

THE EFFECT ON THE HUMAN SYSTEM OF FEEDING SYRUPS AND MOLASSES CONTAINING SULPHUR AS SULPHITES.

The Agricultural Experiment Station of the Louisiana State University has recently issued a bulletin giving the results of experiments to determine the effects on the human system of syrups and molasses containing sulphur as sulphites when fed in normal quantities in connection with normal diet.

The work was carried on under the auspices of the Louisiana Sugar Experiment Station, and the subjects selected for the tests were twelve negro prisoners, whose well known fondness for sweets made them particularly desirable for such a test.

The conclusions deduced were as follows:

"From the foregoing tabulated data and from the observations of the subjects and from their own statements as to their condition of health, etc., while considering the effects of regular hours, sanitary and hygienic surroundings, and general contentment, it is believed that the following conclusions from Dr. Archinald's report to the Board of Health are thoroughly justified:

"'1. From a practical standpoint the experiments on molasses feeding were carried on for a sufficient length of time and on a scale large enough to test the effects of these foods on the human subject in ordinary health.

"'2. We believe that our mode of examination is the fairest way to test the effects of substances on the human subject under natural conditions, for here we had a large number of docile and ignorant men who did not know what was expected of them, were neither frightened nor awed, and put in the same condition as persons who partake of molasses as a food, eating of the same according to their taste and liking, and the effects on them carefully and faithfully noted from day to day and week to week.

"'3. As in none of our cases were the body functions interfered with, in each one the body weight increased, and as the

blood steadily increased in number of red blood cells, in the percentage of hæmoglobin, etc., it must be admitted that these subjects were gaining in health and neither doing nor taking anything prejudicial to their physical well being.

"'4. A careful survey of Table XX, on weights, and of Tables VII to XVII, on blood examination, will satisfy any one that the subjects gradually improved in weight, body functions and blood conditions, notwithstanding the fact that during Periods II, III and IV they daily took a considerable quantity of syrup or molasses containing appreciable quantities of sulphur as sulphites.

"References to the tables will demonstrate that the amount of molasses consumed, although in some instances very large, does not seem to have had any deleterious effects on the functions, weight and blood condition of the subjects, but rather to the contrary.

"We are, therefore, free to conclude that molasses feeding even when said molasses contains as high as over 900 milligrams per kilo of sulphur as sulphites, can be carried on under ordinary circumstances without prejudicial effect to health."

MEXICO'S CRUDE SUGAR.

Vice Consul-General Albert de Baer, of Mexico City, sends the following information in relation to the extensive Mexican production of crude brown sugar from the cane:

Panocha, panela, and piloncillo are forms of crude unrefined sugar made by primitive methods, somewhat similar to those used by the maple-sugar makers of the United States—that is, by boiling the cane juice until it reaches a sirupy consistency and evaporating this residue over a fire and pouring it into molds and forming into a cake. No clarifying or refining process is made use of in any way.

The name given to the resulting crude brown sugar is usually determined by its form, size, and weight; it is known as panocha when molded into cakes weighing approximately 10 kilos (kilo=2 1-5 pounds); panela when it has the shape of a plate, each cake weighing about 1 kilo, and piloncillo when it has a cylindrical and conical form and a weight varying from 5 grams to 1 kilo. The latter form of the crude sugar is the one of most importance commercially. Piloncillo is made in the States of Neuvo Leon, Michoacan, Veracruz, and Puebla, the light-colored product of certain parts of Michoacan enjoying the best reputation. The ordinary product is a dark honey color.

The producers of this form of sugar are, in general, small farmers who can not afford a modern sugar-refining plant. The maximum production of piloncillo for each planter other

than in Puebla is said to be 1,000 arrobas (25,000 pounds) annually, although that State is said to supply some 500,000 arrobas (12,500,000 pounds) per annum.

The average price of piloncillo laid down at a railroad station varies from 50 to 62½ cents United States currency per arroba, or 25 pounds. The mode of packing employed is to wrap up the cakes of sugar in pairs in the dry leaf of the sugar-cane and then pack them in a jute sack or other container. This crude sugar is largely used for the manufacture of aguardiente (spirits), but its importance as a commercial factor rests principally upon its sale at retail in the innumerable tiendas de abarrotes (small grocery shops) throughout the Republic. The poorer class of Mexicans use the piloncillo in place of the more expensive refined sugar.

There has also been a quantity of this crude sugar exported to the United States. The shippers have been unable to give me exact information relative to the uses to which it is applied there, but believe that it is employed in the confectionary manufacturing trade. An average invoice value is 65½ cents per 25 pounds, while the value of the jute sacks in which it is usually packed is about 22½ cents apiece.

THE ELECTION IN THE PHILIPPINES.

The result of the assembly election of July 30 in the Philippines would seem to contradict the statement of Secretary of War Taft and others who have been contending that American rule has proven so beneficial that all desire for independence has ceased.

But two per cent. of the so-called "Civilized People" of the Philippines registered, but one per cent. of them voted, and the preliminary returns indicate that out of the fifty assembly members elected, but ten are of the progressive, or pro-American, party, which stands for a continuance of American control with gradually increasing powers of self-government. Of the remaining forty members, one is announced simply as a Catholic, eight as Independents and thirty-one as Nationalists, or radicals, who in their platform denounced the present American regime and declared for the immediate independence of the islands. And all of this in the face of the fact that through the aid of the Americans in the islands, the "Progressists" had a complete political organization and but one candidate in the field in each province, or electoral district, while the Nationalists, having no political organization, no primaries or electoral conventions, had several self-appointed candidates in each of most of the provinces. The Progressives declared for the reduction of the American tariff on Philippine sugar and tobacco, while the Nationalists declared for the reduction of the alleged excessive salaries of American offi-

cials in the islands. Had the Nationalists been as well organized as were the Progressives, it looks as though not a Progressive would have been elected.

In the city of Manila, the center of wealth and education and the place where our rule of "benevolent assimilation" is best known, the returns show that despite the split vote of the Nationalists, the Progressives were overwhelmingly defeated. This is all the more suggestive, from the fact that while our secretary of war professes to be deeply in love with all the eight million Filipino people, practically all the money we are expending in the islands for public improvements is being spent in the city of Manila, where resides our American governor and the other American officials, while the rest of the archipelago is left largely in the dilapidated condition in which we found it.

Our amiable and rotund secretary of war invariably speaks of the Filipino people either as "Our Little Brown Brothers" or as "My people," but it is evident that the beneficence of his rule has not led them to reciprocate the feeling.

In the advocacy of the introduction of contract coolie Chinese labor in order to still further reduce their already pitiful plantation wage rate of $4.29 per month, and the raising of the present 2,500-acre limit of sugar estates to 25,000 acres in order that vast American sugar and tobacco corporations might exploit the islands and drive out the smaller native planters as has been done in Porto Rico, the Filipino planter observes a menace, rather than the alleged blessing.

Nor has the Filipino planter ever enthusiastically endorsed the secretary of war's hobby of eliminating the American tariff on Philippine sugar and tobacco. This is not because he is such a fool that he would not save this duty if he could and still preserve other industrial conditions, but he is wise enough to see that the three propositions would ultimately go together, that free trade with the United States would be but a stepping-stone to 25,000-acre American sugar estates to be operated by the cheapest labor in the world and the ultimate elimination from the industrial field of all small planters.

Secretary Taft has coaxed and petted and cajoled the Filipinos in his efforts to make them join in with him in singing their "Swan Song" by helping him induce Congress to turn the islands over to American exploiters; but the lack of interest they have shown in his free trade propaganda and the result of the election just held, both indicate that the Filipinos are no more anxious to be wiped off the face of the earth and supplanted by gigantic American corporations than are we to have them. The secretary of war has done much traveling at government expense during the last few years, and the economic fallacies into which his alleged altruism would lead both the present American and Philippine planters seem to be about as well known on the other side of the world as they are on this.—*Beet Sugar Gazette.*

OUR TRADE WITH THE MAINLAND.

The volume of trade transacted between Hawaii and the Mainland of the United States in the last fiscal year was larger by $4,600,000 than in the previous year, the increase being about equally divided between imports and exports, the former showing a gain of $2,200,000, while the exports increased by $2,400,000. The total for last year was the largest in a period of five years, excepting 1905 when the higher price of sugar made a difference of more than $10,000,000 in our exports.

In regard to imports, the figures for the year ending June 30, 1907, show an increase in value of $3,300,000 over 1903, of $2,500,000 over both 1904 and 1905, and of $2,200,000 over 1906. Making due allowance for the higher level of prices that has been ranging in many commodities recently, it is evident that there has been a larger quantity of goods imported into Hawaii during the 1906-07 period, and that the increase has been gradual and steady for the last five years.

There is no indication of a smaller volume of business between Hawaii and the Mainland, nor is there anything to indicate that a depression in business has existed. Quite the contrary. The importers know that they have handled more goods, that their turnovers have been larger, and if a different experience has been found among retail distributors of goods, it must be because of more competition and the business passing into other hands. The figures certainly indicate a satisfactory condition of business for Hawaii. They are as follows:

Year Ending June 30	Imports from U. S.	Exports to U. S.	Total
1903	$10,943,061	$26,275,438	$37,218,499
1904	11,683,393	25,204,875	36,888,268
1905	11,753,180	36,171,576	47,924,756
1906	12,036,675	26,938,512	38,975,187
1907	14,225,000	29,364,000	43,589,000

TEN YEARS OF SUGAR EXPORTS.

By special cable from Washington Trans-Pacific Trade has received the figures of the quantity and value of both raw and refined sugar exported from Hawaii during the fiscal year ending June 30 last, which enables the presentation of the latest statistics of our sugar export movement for a period of ten years. The figures show that the exports of raw and refined sugar, during the last fiscal period, aggregated 822,000,000 pounds worth $27,700,000, being larger both in quantity

and value than in any preceding year in the decade with the exception of 1905, when the sugar exports were only 10,000,000 pounds larger in quantity though $7,300,000 greater in value. Last year there was a considerable falling off in the quantity of refined sugar exported, which was but little more than one-half the quantity of the refined exported in the 1906 fiscal year. The ten year comparisons stand thus:

Hawaiian Sugar Exports for Ten Years.

Year ending June 30	Pounds.	Value.	Price per Pound.
1898	499,766,798	$16,660,109	3.33
1899	462,299,880	17,287,683	3.72
1900	504,713,105	20,392,150	4.05
1901	690,877,934	27,093,863	3.92
1902	720,553,357	24,147,884	3.35
1903	774,825,420	25,665,733	3.31
1904	736,491,992	24,359,385	3.30
1905 (raw)	811,603,329	33,946,040	4.19
1905 (refined)	21,118,308	1,166,108	5.52
1906 (raw)	712,560,997	23,840,803	3.35
1906 (refined)	34,041,640	1,654,624	4.86
1907 (raw)	803,250,000	26,860,000	3.34
1907 (refined)	18,765,000	833,000	4.44

Average for ten years, 3.586 cents.

It is noteworthy that, since the two years immediately preceding the annexation of these Islands by the United States, our exports of sugar have increased by 60 per cent. in quantity. But the average value of the sugar exported has remained practically unchanged, being 3.33 cents a pound in 1898 for the raw product, as compared with 3.34 cents, which was the average export value for the year ending June 30, 1907.

When it is considered that the cost of plantation labor has increased exactly fifty per cent. within the same period, it is very evident that plantation interests in the Hawaii of today cannot be in as prosperous a condition as they were in the Hawaiian Islands of 1898, for no person will venture to assert that any new inventions and new economics practised will come anywhere near offsetting the increase of fifty per cent. in the cost of labor.