might have built up these elevations, and what causes might have operated to depopulate them. For if mound-building ants now live both in Texas and in Montana, it is hardly necessary to call in climatic changes to account for the facts.

In California there are extensive tracts of similarly appearing mounds (*vulgo* 'hogwallows') in the San Joaquin valley; but here not only can their wind-drift origin be substantiated by ocular demonstration during any of the frequent sandstorms, when the sagebrush clumps are often left two feet above the general level because their roots resist the eroding action by holding the sand; but the wind-drift origin of the general soil surface can mostly be verified, even when, as frequently happens, the bushes thus left 'high and dry' die out in the course of time, and subsequent aqueous erosion increases the height, and a gradual consolidation of the material occurs.

'Hogwallows' of quite different origin occur in Washington, on the gravelly lands south of Tacoma city, *e. g.*, on Yelms prairie. Here, in the land of almost daily heavy rains during certain seasons, water erosion has removed the sand and smaller gravel from variously-shaped areas surrounding one or several larger blocks (erratics), the channels between adjacent mounds being lined with cobbles left behind by the water. Yet while the general aspect of the surface is similar to that of the 'hogwallows' of California and the mounds of the Calcasieu prairie, there is clearly no genetic relation between the three kinds of 'mounds,' however similar in their external conformation.

E. W. Hilgard.

Berkeley, Cal.,
March 10, 1905.

Progress in the Study of the Kelep.

The existence of an efficient insect enemy of the boll weevil having been ascertained, it became necessary to determine also the extent, if any, to which it could be utilized in the United States. Since the last published report on the subject* many additional data have accumulated, but there are three features worthy of special notice.

The Kelep in Western Guatemala.—Recent letters from Mr. W. R. Maxon report the existence of the kelep in the cotton fields of the Retalhuleu district of western Guatemala. Mr. Maxon has also sent to the Department of Agriculture seeds and dried bolls of an upland cotton of a variety evidently similar to that grown by the Kekchi Indians of Alta Vera Paz. The three nectaries inside the bracts appear to be even larger than in the Kekchi cotton. The pair of inner stipular bracts which subtend each of these nectaries are the largest yet known, and have their margins fringed with long hairs, as though to increase their efficiency in holding the nectar to attract the keleps inside the involucre.

This west Guatemalan or so-called *Pachon* cotton is also an annual crop and is said to ripen in five months, or in even less time than the Kekchi. Following the analogy of other plants, these varieties, if they can be acclimatized in the United States, may be expected to mature in a still shorter period, which gives them distinct agricultural interest. The effectiveness of the plan of mitigating the injuries of the boll weevil by cultural means depends upon the shortening, as far as possible, of the growing season of the cotton plant. Other things being equal, a short-season variety will also be an early variety, of course, but the simultaneous planting of quick-growing varieties is likely to prove a better measure of protection than uncertain and desultory early planting, because the weevils are much more likely to perish by starvation after the weather is warm enough to bring them to the condition of activity than while they are kept by the cold in a torpid, hibernating state. It is thus not impossible that these short-season varieties of cotton which are cultivated in Guatemala by the help of the kelep may prove to be of value in the United States, even without their insect guardians. It may be repeated, too, that both of the dwarf, kelep-protected varieties of Guatemala belong to the upland type and produce fiber of good length and quality.

* 'Report on the Habits of the Kelep,' Bull. 49, Bureau of Entomology, U. S. Department of Agriculture, 1904.

Breeding Habits of the Kelep.—The continued study of the kelep in Guatemala, as well as in the United States, makes it possible to outline the breeding habits of the insect, which are in many respects different from those of the true ants, and very much more suited to the purposes of domestication. Popular language affords only the one word 'ants' for all the wingless, social insects. Even the termites are everywhere called 'wood ants' or 'white ants,' though having no affinity or similarity with the true ants apart from their social habits and the winglessness of the worker castes.

The kelep furnishes another chapter of the same kind of history. It has, apparently, little or nothing to do with the true ants. Its social economy does not follow the monarchical system of the ants and termites, but represents an entirely different system, more like that of the honey-bees, in that new colonies are founded by the subdivision of the workers of older communities instead of by solitary queens. The keleps, indeed, have carried the principle of organization a step further than the bees, for they do not depend upon the queen to lead the swarm, but take her by the jaw and carry her over to the new burrow, in case she fails to go voluntarily. The new establishment is also equipped with eggs and larvæ brought over from the old, so that the founding of a new colony does not involve any interruption of the domestic activities. This mobile organization of the keleps suggests to a slight extent the social habits of the nomadic driver 'ants,' and as with these the queens are stationary, and probably never leave the nest except when carried by the workers in migrating to the new home. Males are to be found in the kelep nests throughout the year and cross-fertilization is probably accomplished by the wandering of these from one to another of the closely adjacent, not unfriendly communities. The kelep queens have wings at first, but probably never use them. In some of the related genera the queens are quite wingless, as among the drivers.

Ability to Withstand Cold.—A cold storage experiment made in Washington last August showed that the keleps would be able to withstand low temperatures, and the colonies which have been left in the Texas cotton fields through the winter have lived long enough to show that cold weather is not likely to be the insurmountable obstacle which will prevent the establishment of this species in the United States.

Recent advices indicate, however, that none of the field colonies which have received no food or care of any kind since they were placed in the ground last July will survive to the cotton planting season. A sufficient cause for this mortality is doubtless to be found in starvation, though other contributing factors are apparent, now that the social organization of the insects is better understood. The season has been, as is well known, one of unusual severity, both in drought and cold. The colonies were planted in the fields so late in the season that it seemed necessary to look for the dampest places in order to give them a fair chance to dig, but this has exposed them to special danger from flooding, which appears to have been the immediate cause of death in several instances, and possibly in all. The fields in the vicinity of Victoria, where most of the colonies were located, were completely and repeatedly denuded of their foliage, flowers, buds and young bolls by the leaf worms. Although the keleps readily captured and made use of these when the successive broods were in the larval condition, and even broke into the pupæ, there were intervals when food was almost entirely lacking, and even boll weevils became extremely scarce.

There are also two important social causes of demoralization. The colonies were brought from Guatemala under the impression that the keleps were true ants, and would be able to replenish themselves if the queens were secured. Our artificial nests were mostly very small, no jars of suitable size being obtainable in that part of Guatemala. The complement of workers was, therefore, usually very much below the normal. It has since been learned by repeated observation that the keleps are like the honey-bees, in that the reduction of the colonies below the normal size induces discouragement, dejection and aberration of instincts. Neither did we take pains to include

with all the colonies eggs, larvæ and pupæ. The queens lay freely in captivity, but a break in the normal succession of forms may be disastrous, because nurse duty is performed by the young, light-colored workers, the predaceous, hunting instincts appearing with greater maturity. The neglect of the young in some colonies and a frequent tendency to cannibalism may be ascribed to this deficiency of keleps of proper age, though even in colonies otherwise normal some of the larvæ are occasionally killed and fed to the others, especially if there has been a deficiency of other animal food.

Detailed reports on the social organization and other features will be made, but in the meantime it is apparent that a fair experiment to determine whether the kelep can maintain itself in the United States will require the planting of full-sized colonies early in the season, and in sufficient numbers, if possible, to protect the field of cotton from the leaf-worms as well as from the boll weevils. That the kelep is not a true ant, and that its habits differ so greatly from those of any other insects previously known, are facts that show how impracticable it would have been to determine its possibilities in advance by the application of analogies drawn from insects of other families.

O. F. Cook.

New Orleans,
March 16, 1905.

QUOTATIONS.

THE SANITATION OF THE PANAMA CANAL ZONE.

Dr. Charles A. L. Reed, chairman of the legislative committee of the American Medical Association, and lately president of this the representative organization of the medical profession throughout the United States, a man capable in every way of forming just conclusions and with the courage and capacity vigorously to express his convictions, has, at the request of the Secretary of War, submitted a report of the sanitary, or unsanitary, conditions in the Panama Canal Zone and in the towns of Panama and Colon placed by treaty under the management of the United States commission.

If the report of this gentleman is correct, and it must be accepted as such until it is proved that he has made misstatements, the sanitary department of the Panama commission has been in great measure paralyzed by circumlocution and red tape and the misguided interference of those who have been placed in authority over the medical corps. In certain quarters Dr. Reed's report has been classified as 'frenzied' literature; but if one-tenth of the criticisms which he has made were justified sanitary affairs on the Isthmus are in such deplorable shape that the president should compel an immediate change in a disgraceful and dangerous situation.

There is but one commonsense solution of this problem, and sooner or later it will be applied; but the chief magistrate should not wait to take this matter in hand until the graveyards of Panama are filled with the victims of 'red tape.'

As an illustration of the absurd methods employed, Dr. Reed says in substance that if the surgeon in charge of the Ancon Hospital makes a requisition for supplies it must go to the chief sanitary officer for approval, then to the governor of the zone, then to the chief disbursing officer and thence to the commission at Washington. It must there wait for advertised bids, and when the award is made the requisition is filled under the supervision of a purchasing agent, often not properly qualified to select medical supplies. The material is then shipped to the Isthmus, the disbursing officer is notified, he notifies Col. Gorgas, and he in turn must notify the surgeon in charge of the hospital, who then applies to the quartermaster for transportation; and, finally, so much of the material as in the judgment of the governor and chief disbursing officer and the commission ought to be allowed to the superintendent arrives at the hospital.

There are cited numerous other instances of this ridiculous routine which in the light of a recent experience are a reflection upon the intelligence and conscience of the American people.

We refer to Cuba, where Major Reed and Col. Gorgas practically had *carte blanche* to do what in their judgment was best for the sanitation of Havana and Cuba.