of comfort and convenience of living, there are none of the seaside laboratories which are so fortunately situated as the one at Pacific Grove.

The views from the windows of the laboratory are singularly picturesque and attractive. On the east is seen the long curve of Monterey Bay, bordered by white sand-dunes covered with deep green chapparal, the dark pine trees of Pacific Grove, and the rocky promontory of Point Alones with its Chinese fishing camp in the foreground, and in the distance the mountains which separate the valley of Monterey from that of San Benito. On the west the irregular coast-line is visible as far as the point of pines, and on the north the broad sweep of the bay-shore is in sight as far as the lighthouse of Santa Cruz. The Bay of Monterey, with its surroundings of rock, forest, and mountain, is one of the most picturesque in the world, and to the eye of the naturalist it has no equal, at least short of the coral-lined harbors of the tropics.

THE ANTENNÆ AND STING OF YIKILCAB AS COMPONENTS IN THE MAYA DAY-SIGNS.

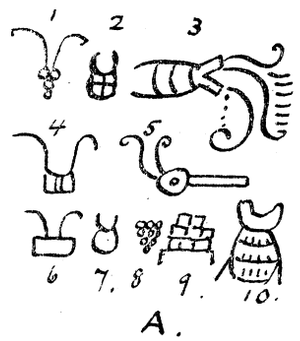
BY H. T. CRESSON, A M., M.D.

BEE-CULTURE among the ancient Mayas seems to have received considerable attention, and the apiarists, we are told, had patrons, — the *Bacabs*, — one of whom, called *Hobnil*, was in especial favor. It was in the month Tzoz that the bee-keepers began to prepare themselves for their celebration in Tzec, and the four Chacs were at that time presented with plates of incense, one for each Chac, the borders of which were painted around with designs representing the honey-comb.

The species of bee which prepared the celebrated honey of Estabentûm, from a white flower resembling our jessamine, is like the common bee of Europe in shape and size, and differs from it only in having no sting; it is in fact the bee of Yucatan and Chiapas, and the honey which was prepared, especially during the month when the Estabentûm bloomed, was much sought after in early times, and no doubt formed an important article of commerce between the inhabitants of *Maiam* and the island that is now called Cuba. Four or five other species of bee are said to exist in Yucatan, but, with a few exceptions, their productions are inferior to the bee common to that country and Chiapas.

That the honey-bee was highly esteemed by the ancient Mayas there is but little doubt; for we see this industrious insect represented in various portions of the "Bee-Keeper's Narrative" of the Codex Troano, while honey in the comb is represented by the Maya scribe as square cakes of that material (see Fig. 9, plate), carried in the hand of the "god with the old man's face,"— so named to distinguish him from other gods who were represented in the same narrative. Honey is represented by other hieroglyphs, one of which, shown in Fig. 8 of the drawing, has an especial connection with the antennæ sign, and we will presently refer to it. If our alphabet interprets with a reasonable degree of exactitude, we suppose the god with the old man's face to be Kukuitz, who appears in one of his various characters as the patron of the bee-keepers. The phonetic components of the hieroglyph which invariably accompanies this god, suggest this interpretation. In front of the glyph we have components of the day-signs Chuen and Akbal enclosed in the dotted aspirate circle, while below it are Landa's aspirates twice, and even in some cases thrice repeated. This gives us "chu-chu" or "khu-khu." Within the glyph, surrounding the eye, is the scroll which is always present in this god's glyph, and to us suggests the phonetic value of *ix* or *itz*. The c^{h}i glyph is generally placed underneath what we have assumed to be used as a determinative; the two round glyphs on either side of the tooth-like projections inside of the c^{h}i glyph suggest that in this case it is to be used as Chu. I find this c^{h}i glyph appearing as chá, chā, c^{h}i, cho, chu, a determinative being generally added to suggest which is to be used, whether it be á — ā — i — o — u. An example of one of these supposed determinatives will be given further on in this paper.

The sting of the bee is used in the day-sign *yk* or *ik* (see Fig. 7 of drawing), and appears quite frequently in glyph form in the Troano, also in Landa's day-signs and those of the Chilan Balaam of Káua, and is attached to the body of the *ahaulil-cab*, who so frequently appears in the Troano with body erect as if ready to strike with her stinging apparatus (Fig. 10 of drawing). It can readily be seen that this sting is but a variant of that used in the day-sign *ik* (Fig. 7 of drawing). It can also be seen attached to the right-hand side of the head-dress of the goddess *Cab*, second division of plate 25, Codex Troano. The end of the bee's abdomen and the stinging apparatus (Fig. 3 of drawing) is somewhat square like those of the Codex Troano (Bee-Keeper's Narrative); but it is easily recognized as a variant of glyphs 7 and 10 of our drawing. The determinative ending is placed just beyond the stinging apparatus, and is composed of the *i* loop and *kil;* the dotted aspirate also appears, and the *há* glyph is the parallel line running out from the *il* curve — "ish-kil-há" is thus expressed, an admirable suggestion of "*Ikilca*" (*b* is understood).



The antennæ of the bee appear in the day-sign Cauac; in fact the signs *yk* (or ik), *Cauac*, and *Caban*, all have the sting and antennæ of the bee as components. This connection will be more apparent by reference to Dr. D. G. Brinton's study of the "Books of Chilan Balaam," pages 16 and 17. The day-sign 13 Caban, in the Chilan Balaam of Káua, has the antennæ of the bee for its components, and 2 *Cauac* and 5th *ik* have the antennæ and sting, one more component appearing in 2d Cauac than in 5th *yk*. These same signs in the Landa and Troano columns of Brinton's plates have the honey signs, and the antennæ and hive, all used as phonetic components of the glyph, that of Landa and the Codex Troano rendering the word *ikilcab* with great simplicity. It is expressed thus, "x-il-cab," the dotted *sh*, or *x* aspirate, being added to assist the reader in obtaining the correct interpretation. The *Cauac* glyph also appears in the bas-relief of Kukuitz, the left-hand slab alongside of the doorway, Casa No. 3, Palenque. By placing a lens on a good photograph of this masterpiece of the scribe sculptor's art, the antennæ of the bee can be seen attached to the honey-sign (Fig. 1 of the drawing shows this glyph), the antennæ being at-

tached to the honey-sign. In the more demotic *Cauac* glyphs, honey is represented as shown in Fig 8 Erosion has partially destroyed one of the components of the Casa No. 3 *Cauac* glyph of which we speak, but by comparing the photograph with Catherwood's drawing, it will be found to closely resemble this component in the demotic *Cauac* glyph. It is simply the aspirate circle (dotted), enclosing two small squares as in the Landa glyph of Cauac. In this connection it may be interesting to add that an attempt to interpret, by means of our alphabet, the inscription at the top of the left-hand slab, Casa No. 3, Palenque, gives as follows: "The gods — earth — sky — water — maize — Kukuitz and Kukulcan — Cauac — Muluc." The slab at the right-hand side of the doorway of Casa No. 3 we think represents *Kukulcan* with the wart-like excrescence and the antennæ sign attached to his forehead. The inscription, according to the rendering of our alphabet, reads "Kukulcan, u-ahkin imix, ah-Cimil, Chikin." The forefinger of the left hand of Kukuitz on the left-hand slab of Casa No. 3, Palenque, points to a glyph just above, which is probably the hieratic glyph of this god, bearing, we think, strong affinities to the demotic character, an attempt at the analysis of which has already been given in this paper. Just above the Kukuitz glyph, in the perpendicular column in front of the god's face, is *Chikin*, above Chikin is *Ahau*, the next two glyphs not yet determined, and then immediately below the horizontal line of glyphs in the right-hand corner of the slab is *Cimi*. Just above *Cimi* is *Kan*, and to the left *Ikilcab;* the third to the left on this parallel line of glyphs seems to be the long-nosed god — probably *Kukulcan* — next to it *Itzamna*, and the end glyph on the left seems to express "Itza." This interpretation is made subject to further alteration and improvement; to give detailed analyses of these glyphs in a short paper is impossible.

The small figure on Plate 25 of the Codex Troano (*b*), turned head downward, shown in drawing B, has some interesting relations with the antennæ glyph attached to the honey-sign (see Figs 1, 4–6, drawing A — 1 and 6 = hieratic script, 4 = demotic). The drawing B is but a portion of the original design of the scribe, the hand supporting the antennæ sign, enclosed in the circular glyph underneath the upturned foot, is that of the goddess *Cab*, or the earth. Just above the antennæ glyph (phonetic value = i-kil-cab) is the foot which = *uoc*. The hand of the goddess supporting this design is the $c^{h}i$ glyph, but in this place it has the phonetic value of *Chá*, the *há* determinative being quite conspicuous on the thumb, its end protruding well into the circle enclosing the antennæ glyph. This obtained, we have suggested "chá-uoc" or *Cauac*.

The *ca* glyph in the eye of the child figure and the foot also give us, *cauoc* a repetition of *cauac*. The antennæ of the bee with the slight *i* curve at the end give the phonetic value *ikil*, and the honey squares below give us *cab* = *ikil-cab*. There is evidently some close connection between *cauac* and *ikilcab*, for the head-dress of this child figure has the scribe's method of representing honey by squares and suggestions of *ikil*. The work of the scribe sculptor was necessarily different from that of his more demotic brethren, who drew the more cursive script, yet there seems to us to be a not improbable relationship of this figure on Plate 25 of the Troano to that upheld in the arms of the *ahkin* on the Casa No. 2 group — Palenque. The peculiar slit or deformed feet and variants of the head-dress suggest that future study may show some connection between these figures, and that *ikilcab* and *cauac* may have a dual meaning or personality. Mr. W. Thomson, who has been residing in Chiapas for many years, informs me that during a visit to Lorillard City his Maya servant, who had been a bee hunter in his youth, accompanied him, and while they were preparing a resting-place for the night the cry of a jaguar was heard; the old man shook his head, and laying his hand on a sculptured lintel near the door of the temple, said rapidly "The jaguar calls, the bee leaves the centre of the maize flower and seeks the hollow tree," then turning toward the bas-relief he indicated the head covering of the figures ejaculating "*cab*," then as if startled at what he had said, he relapsed into silence, and no amount of questioning could obtain anything further from him. I cannot recall where I have read it in one of Dr. Brinton's books, but he mentions that Dr. Berendt while travelling with a Maya guide overheard some remark which he made having an interesting meaning, but the man, recollecting that he was accompanied by one of the white race, stopped short in his words and nothing further could be elicited from him. The suggestion of *cab*, a hive, was an excellent one, for the head coverings of these

B.

figures, as represented by Charnay on page 391 of his "Villes du Nouveau Monde," seem to be representations of bee hives; and it was the antennæ sign to the right-hand side of the large figure on this slab, or lintel, that led my learned friend to make the suggestien that the antennæ, attached to the sign for honey, might possibly exist on other sculptured Maya reliefs. As I have stated, it exists in the manuscript Troano (see Plates 24 and 25), and a sculptured slab in the Smithsonian Institution has it represented by an incised square, to which the antennæ are attached (see *A*, Fig. 6). It is the most demotic form of the hieratic-scribe-sculptor's work that I have examined. The glyph in question is to be seen on a cast which is now hanging on the stairway-wall of the Smithsonian Institution at Washington, to the right-hand side of the long gallery in which Professor Thomas Wilson has arranged his interesting synoptical cases. No record is attached to the cast, but by its character and technique it seems to be a copy of one of Charnay's squeezes, probably from Lorillard City. The antennæ glyph frequently appears near representations of corn leaves, and as we have the day-signs *Ixim* and *ik*, the latter, there is but little doubt, being but an abbreviation of *ikil* = the sting

(the sign used for this day is the bee sting), there is evidently a connection between *ymix*, *ik*, *caban*, and *cauac*, whose components are all more or less associated with, or composed of, the bee and honey signs.

When I speak of the components of a glyph it may be that an example will make this more readily understood. Take the day-sign *manik*. We have in this glyph, as represented by Landa, four components; the first is the glyph not unlike a carpenter's T-square which has the phonetic value of *ma;* near it to the right are three short lines which = *n;* and below to the left is the *ich* or *ix* glyph, which gives us, together with the others, "Ma-n-ich" — an excellent suggestion of Manik. The day-sign, *chicchan*, was represented by a pot, the base of which was crossed by hatchings giving the phonetic value *x;* the white space at the end of this divides the hatching from a black line, to which tooth-like processes are attached, giving the phonetic value of "*há-ch.*" We now have *x* or *sh*, which, joined to *há*, = *xá;* placing *ch* before this we obtain "*ch*-xa" — the suggestion of "Chi-xa" or "chicchan." The hieroglyph of the day-sign *Ahau* contains as components the á glyph, from which perpendicular lines mount to the top of the circle enclosing them. The straight lines = *há*, and the two small round circles on either side of the há = oo, giving us "Ah-há-oo" or "Ahau." The phonetic components of Landa's B are simply expressed by conventionalized footmarks = *be* in Maya; and when Landa asked for *bay* (the way he pronounced it in Spanish), the Maya scribe jotted down representations of footprints which recalled to him the sound of the name of the thing represented — in other words *be* — pronounced bā in Maya.

I believe the standard of phoneticism in these old Maya glyphs to be about the same as the more advanced system of writing used by the Nahuatalacs, and described by M. Aubin. The phonetics of some of the Maya day signs are quite obscure, others quite clear and easily interpreted.

The scientific world is already coznizant of the painstaking labors of Professor Cyrus W. Thomas of the Bureau of Ethnology, and his researches upon the Codex Troano are of inestimable value. I have recently had the pleasure of working in conjunction with Dr. Thomas as a member of the staff of the above-named institution, and I am convinced that his alphabet is based upon a solid foundation. Although we are both working by independent methods of research, like results have been obtained in several cases by repeated tests. His recent publication in *Science* adds other similarities of interpretation; surely this correspondence of results cannot be the result of accident. Dr. D. G. Brinton, Professor of American linguistics and archæology in the University of Pennsylvania, in a recent letter, says, "The correspondence between your interpretations and that of Professor Thomas in certain cases is strong *prima facie* evidence that both methods are based on correct principles." I have but to repeat Dr. Thomas's words "that this agreement in our conclusions . . . serves to strengthen both in the conviction that we are making genuine progress in the solution of this difficult problem."

"THE Optics of Photography and Photographic Lenses," by J. Traill Taylor, editor of the *British Journal of Photography*, is a useful little volume for those who desire to master the optical principles involved in the construction of photographic lenses. The work is also of value to the practical photographer, as it gives directions for the proper use of diaphragms, for the testing of lenses, etc.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

The English Sparrow and Other Birds.

I HAVE often read accounts of the English sparrow driving out our native birds, and for several years have been watching closely to see what the truth is; and from my observations I must conclude that many persons write facts from imagination.

That matters may be better understood, I may state that for twenty-three years I have lived on Ohio Street, the principal business street of the city, between 9th and 10th streets; this being near the centre of the city, the business buildings extending on Ohio Street half-way between 7th and 8th streets, and the residences having considerable ground around them, with many shade trees from fifteen to twenty-five years old.

The English sparrow came to Sedalia about twelve years ago, and for a long time did not get away from the vicinity of the business centre. Some five or six years ago, during a severe winter, I saw them one time only as far out on Ohio Street as Broadway or 8th Street, to which point they had come hunting something to eat on the street. The following summer they were frequently seen on the block between Broadway and 9th Street, but came into my yard only a few times. The following summer they were frequently in the yard, but made no nests. Since that time they have built their nests in the yard, and have fed in large numbers in the chicken-yard.

The trees are now large enough and dense enough to furnish protection for birds, and of late years more kinds are found in the city than formerly. The blue jay stays the year round, and during the winter as well as summer the red bird and some other kinds are frequently seen. In summer the tree black bird, the robin, the cat bird, the rain crow, or cuckoo, and the wren are abundant, and make their nests. In addition to these, the brown thrush, the mocking bird, the red-head woodpecker, the red-head flicker, the sap-sucker, and other kinds are often seen, some of them daily.

Now, which of all these birds has been affected by the sparrow? Not a single one of them. They are all as abundant as they were five years ago, or at any time in the past, and much more so than they were ten to twenty years ago, before there were as many trees as there are now.

In addition to the birds mentioned, I might name three others. The town martin has always been in the city in great numbers, making their nests in all kinds of cavities around the houses in the business part of the city. These same places were taken possession of by the sparrows; and they being here the year round, and making nests even in the winter time, the places belonging to the martins were appropriated before their arrival, and when they came they had to fight to recover them. I was much interested in watching one of these fights. Across the roof of a one-story building next to my office, and in the top of the adjoining building, a martin had found a hole, and had appropriated a place within for a nest. A sparrow had also afterwards done the same, and was found in possession when the martin arrived from its winter pilgrimage. The latter at once gave fight, and time and again during their fight they would fall to the roof below, and were so intently engaged that more than once I had my hand almost upon them before they would let go of each other. The martin won the fight, and the sparrow gave up the nest it had taken.

As I now sit in my yard the martins are circling overhead by the hundred, they staying during the day in the business part of the city. It is very evident that the sparrows have not run the martins out, although they are direct competitors for the same nesting places.

Years ago the chippee always made its nests in my yard, but has not done so for six years, except in one case, and that nest was abandoned without being completed. I do not know the reason; I imagine the English sparrow domineers over the little