even weeds were cut down, and the inner parts eaten out.

In the houses the struggle for existence of these long-tailed invaders was truly amazing. In many of the dwellings hundreds were killed in a single day. The cats could contribute but little aid, fighting such a plague; for not only were many of the rats so large that it would have been an unequal contest, but by their great number they drove the cats actually from the houses, not to return until the plague was passed. Nothing, except what was composed of iron, stone, or glass, was spared from their destructiveness: furniture, clothes, hats, boots, books, — every thing bore the traces of their teeth. They gnawed the hoofs of cows and horses in the stables, literally ate up fatted hogs, and often bit away the hair of persons during sleep. They penetrated all apartments, and gnawed their way through boards and walls of houses. Ditches that were dug about granaries did not suffice: the mice would climb over each other in some corner or other, and thus reach the top.

The foregoing account of one occurrence in Lourenço will suffice to show to what an extent the plague reaches. The same province had suffered similarly in 1843 and 1863, and in all probability will again in 1889. Our astonishment at the strange appearance and disappearance of such swarms of animal life is greatly increased when we perceive in what a close relation of cause and effect it stands with the presence or absence of food-supply; and probably nowhere among the vertebrate animals is the relation more apparent than here.

This food-supply is derived from the seeds of a large bamboo-grass (Taquary or Cresciuma) growing throughout Brazil. This grass grows in dense thickets to the height of thirty or forty feet, and bears a very large quantity of seed. Its natural history is remarkable. At regular intervals, varying in the different species from six to thirty years, it matures and blooms, and then disappears. Yet more remarkable is the uniformity with which it attains maturity throughout an entire province, if not the whole southern part of Brazil.

Similar plagues, though far less in extent, have occurred in Europe, in which the field-mice unaccountably appeared in greatly increased numbers. One may well think what would be the result were these little, almost insignificant creatures everywhere in such wise to take the ascendency. When one considers that on an average of every one or two months from five to eight young are born, and that these young become mature in a few months themselves, he will not be surprised to know that a single pair of the common field-mice, in the course of a single summer, would increase to twenty-three thousand individuals. Could all the conditions which now keep them in check be removed, every living thing upon the earth would be consumed in a half-dozen years.

BEE-HIVES AND BEE-HABITS.

ONE of the substantial improvements in bee-hives made in the last few years is the arrangement whereby the frames holding the combs can be quickly and easily turned up side down. The best arrangement of the several tried is where the rectangular frame holding the comb revolves on pivots fastened at the central point of the end-bars, within a half-frame just enough larger to permit the full frame to turn. The half-frame has the projecting top-bar of the usual Langstroth frame, and the half end-bars receive the pivots of the inner frame at their lower ends. Two years' experience shows me that these frames are a success.

But why this inversion of frames and combs in the hives? As is well known, bees only attach their combs firmly at top and upper portions of the lateral edges. It is probable that in past ages our honey-bees attached their combs to limbs of trees, as Apis dorsata does to-day, and as our honey-bees do in exceptional cases: hence the strong instinct to attach firmly above, slightly at the sides, and not at all below. By inverting the frames we take advantage of this habit, and secure firm attachment on all sides, thus making the combs secure for shipping, and less apt to break out when we are extracting or manipulating them for any purpose.

Another invariable habit with bees is to place their brood below the honey in the combs. Thus we always find honey at the top of the comb, and the brood at the bottom. Every bee-keeper is also aware that it is not always easy to induce the bees to leave the brood-chamber below, and pass to the sections above, when we desire to secure the comb-honey. But it is found, that if we invert our frames just as the honey harvest commences, thus throwing the honey below the brood, the bees at once, true to their instinct, pass into the sections, as they wish honey above their brood; and so we not only get the freshly gathered stores, but the honey previously stored in the brood-chamber carried into the sections above, just where we desire it, and all space below vacated for the brood, which is also desirable.

Not only is it desirable to invert the brood-frames, but the sections as well. This secures more firm attachment of the combs in the sec-

tions, and hastens the filling and capping, which is always more quickly and speedily done at the top than at the bottom. It is more than likely that the future hive will be so constructed that the entire hive, as well as the crate holding the sections, can be inverted at pleasure. This will give all the advantages named above with the least possible expense of time. The changing of the comb does no injury in any way, and is thought, by those who have tried it most, to prevent swarming. Turning the combs over causes the bees to tear down the queen-cells.

The late Mr. Samuel Wagoner suggested that the laying of fecundated eggs (those which develop into females) or unfecundated (those which produce drones) was automatic, and not an act of volition. The small worker-cells, he said, would compress the queen's abdomen, and thus force the sperm-cells from the spermatheca, and the eggs would be impregnated. The larger drone-cells would fail to exert this necessary compression, and so the eggs would pass unfecundated.

Bee-keepers now generally think that the queen is no such machine. Why the muscular apparatus connected with the spermatheca, except that it is to be used voluntarily to extrude the spermatozoa as the queen may desire? Sometimes worker-cells just started receive eggs which always develop into worker or female bees. Here the cells could not compress the queen's abdomen. The queen also lays fecundated eggs in the queen-cells, which are larger even than the cells which receive the unfecundated eggs, — the so-called drone-cells. That this act of adding or withholding the sperm-cells from the eggs is an act of volition on the part of the queen, is further proved in the fact that young queens, just beginning to lay, often scatter drone-eggs here and there in worker or the small cells. These, of course, produce drones, which only vary from the usual drones in their smaller size, which is necessitated by the smaller cells. This is obviously a mistake, and seldom occurs after the first two or three days of the queen's life. Now, may we not consider this the result of inexperience, the mistake of a novice? The queen has never yet used the complex muscular apparatus of the spermatheca, and at first fails in her attempt to work it satisfactorily. Soon she gains by experience, and makes no more failures. To assert this is no more irrational than to say that a colt will stumble and fall when it first begins to walk.

The observations of Sir John Lubbock and others as to wasps bear directly on this question. He finds that the mother-wasp invariably stocks the cell where the unimpregnated egg — the one that is to produce the male, which is considerably smaller than the female — is deposited with a less number of insects than the one where the impregnated egg which is to develop into a female is placed. Here we see that the mother-wasp not only knows the kind of an egg she is to lay, but she provisions the cells with exact reference to the necessities of the case. As the wasp puts just so many insects in each cell, it is evident that she has learned to count. Who shall be so prejudiced as to say that her waspship does not consider her act in laying the special egg, and does not think and plan her maternal acts looking to the larders of her yet unborn? We all know how close the relationship between wasps and bees is. Now, if a wasp realizes what she is doing as she adds or withholds the sperm-cells, to such an extent that it influences her daily acts, and modifies her performance of daily duties, who shall say that the queen-bee, of higher development and structure, does not think upon her acts as she places the eggs in worker or drone cells? Here, then, is another proof that egg-laying with the queen is a matter of intelligent volition; and far be it from me to say that the queen does not consider the size of her home, the size of her family, and the condition of her larder, as she passes in stately mein over the combs, stocking the worker or drone cells as circumstances dictate. If such volition and discretion are exercised, it makes plain many peculiarities noticed in studying bees. It makes it easy to understand why there is so much variation as to the swarming-habit, drone-production, etc., of different colonies of bees. Each queen has her own notions. A. J. COOK.

LEGIBILITY OF LETTERS OF THE ALPHABET.

MR. JAMES CATTELL has recently published in *Mind* the results of studies upon brain and eye inertia, of which the following will be found of interest. Some alphabets are harder to see than others, and the different letters of the same alphabet are not equally legible. Reading is one of the largest factors in our modern life, but at the same time a thoroughly artificial act. Here, as everywhere in nature, the organism shows its power of accommodating itself to its environment; but the large percentage of children who become shortsighted and weak-eyed, and suffer from headaches, gives us sharp warning, and puts us on our guard, lest these diseases become hereditary. Considering the immense tension put, of necessity, upon eye and brain, it is of the most vital