teachers of science and employers of such teachers will use the columns of this weekly to make public their needs, that they may be the better filled. We appreciate that the commercial spirit is weak in the class to which we are appealing, but it is hard to believe that it is so weak as not to lead them to write us a postal the contents of which when published may lead to an improvement in their position.

COL. M. H. CRUMP of Bowling Green, Ky., is carrying on experiments to see whether the air from the so-called Grand Avenue Cave cannot be used for regulating the temperature of a proposed hotel at that point. We have already called attention to these experiments, and Col. Crump has advertised in *Science* constantly for some weeks for information on the use of cave air for such purposes, but none of the readers of *Science* have much to offer. The scheme is novel, and the prominent geologists of the country who have been consulted have expressed considerable interest in the outcome.

THE HORN-FLY.

THE knowledge of this pest now in the possession of the division of entomology of the United States Agricultural Department is sufficiently far advanced to enable it to present a preliminary article in the last number of *Insect Life*, giving the main facts ascertained. A more complete article will be published in the annual report.

Attention was first called to this pest in September, 1887, when Mr. I. W. Nicholson of Camden, N.J., wrote to the department, under date of Sept. 22, as follows: "Herewith I send some specimens of flies which appear to have made their first appearance about the middle of August. They are very annoying to cattle, but rarely settle upon the horses or mules. They gather in patches or clusters, particularly upon the legs, and are very active. I should like to know if they are common in other parts of the United States. They appear to be very numerous in all the counties near Philadelphia, yet I have seen no person who has observed them before this season."

Later letters the same season from Mr. Nicholson mentioned the common habit of clustering upon the horns, and the fact that after a severe frost in the middle of October the fly disappeared.

May 15, 1888, the same gentleman wrote that the flies had promptly made their appearance May 10, or a little before, in great numbers. A few days later the same insect was heard of in Harford County, Md., through Mr. George R. Stephenson, who reported its occurrence in that locality the previous summer.

By the summer of 1889 the pest had extended in numbers much farther to the southward, and the department was early informed of its occurrence in Harford and Howard Counties, Md., and Prince William, Fauquier, Stafford, Culpeper, Louisa, Augusta, Buckingham, and Bedford Counties, Va. The alarm became great. Considerable time has therefore been devoted to the study of the habits and life-history of the insect. This was done mainly by Mr. Howard, who made a number of short trips to The Plains, Warrenton, and Calverton during June and July. Later in the season Mr. Marlatt assisted in the work, which had been greatly facilitated by Mr. G. M. Bastable, Mr. David Whittaker, Mr. M. M. Green, and Mr. William Johnson, and particularly by Col. Robert Beverly. Aug. 20, Mr. Howard found the flies practically in Washington, — in Georgetown, — and the next day Mr. Marlatt found them in Rosslyn, at the Virginia end of the Aqueduct Bridge, so that further trips for material were not necessary.

The result of the summer's observations by these two gentlemen is that the life-history of the insect has been accurately made out from the egg to the fly through several consecutive generations, and that substances can be recommended which, from their experience, will keep the flies away for from five to six days; while from the life-history a suggestion as to preventives is made, which, under certain circumstances, will prove undoubtedly of great benefit.

Since this insect was first brought to notice, it has been felt that it was an imported pest. Its first appearance in the neighborhood of Philadelphia, and its gradual spread southward, have favored this idea. The fact that in this country it has spread with much greater rapidity towards the south than towards the north would seem to indicate that it is a south European species.

The exact time and place of the introduction, it is impossible to ascertain. Upon its first importation in small numbers, it was probably for some time unnoticed, and its first noticeable appearance may not have been at the point of importation.

All imported cattle from Europe pass through the quarantine stations of the Agricultural Department at either Littleton, Mass., Garfield, N.J., or Patapsco, Md., and an examination of the records develops one or two points of interest. Since 1884 only ten head of cattle have been imported into the country direct from France. All of these have passed through the New Jersey station, but their ultimate destinations have in no cases been within the regions now infested with the fly. The other importations have been from points like Antwerp, London, Amsterdam, Hamburg, Glasgow, Liverpool, Southampton, Hull, Rotterdam, and Bristol. The year 1886, immediately preceding the appearance of the fly, was marked by quite an extensive importation of Holsteins from Amsterdam and Rotterdam and London, through the Garfield station, mainly for parties in New York City. Over three hundred were imported, and an interesting point to investigate will therefore be the occurrence or non-occurrence of this fly in Holland.

The popular name which is here adopted — the "horn-fly" — has the sanction of popular use. It is sufficiently distinctive. The names of "Texas fly" and "Buffalo fly" and "Buffalo gnat" are also in use in some sections, and indicate an impression that the insect came from the West. Dr. Lintner uses the term "cow-horn fly."

The most prominent of the popular errors is the belief that the fly damages the horn, eats into its substance, causes it to rot, and even lays eggs in it, which hatch into maggots and may penetrate to the brain. There is no foundation for these beliefs. As will be shown later, the flies congregate on the bases of the horns only to rest where they are not liable to be disturbed. While they are there, they are always found in the characteristic resting position. Where they have been clustering thickly on the horns, the latter become fly-specked, and appear at a little distance as though they might be damaged; and it is doubtless this fact which has given rise to the erroneous opinions cited.

Mr. Howard's first impression upon entering the field, that the eggs would be found to be laid in freshly dropped dung, proved to be correct. He brought to Washington with him from Calverton dung dropped on the night of July 28, and exposed in the field during the 29th; and from this dung the first adult flies, five in number, issued Aug. 7, only ten days from the laying of the eggs. This settled the point of place of oviposition and breeding. It seemed probable that this was the only substance in which the species breeds, as indeed it is the only likely substance which exists in sufficient quantity through the pastures to harbor the multitudes of flies which are constantly issuing through the summer. However, many living females were captured, and placed in breeding-cages with horse-dung and decaying animal and vegetable material of different kinds, each isolated; and it resulted that a few ovipositied in the horse-dung, and four flies were reared from this substance. There is no evidence, however, that in a state of nature the flies will lay their eggs in any thing but cow-dung.

The time and manner of oviposition were puzzling at first. After hours of close watching of fresh dung in pastures close to grazing cattle, not a single *Hæmatobia* was seen to visit the dung, much less to lay an egg. This close observation was made at all times of the day from dawn till dusk without result, while breeding-cage experiments were all the time proving that nearly all fresh droppings contained many eggs. With some hesitation, therefore, the inference was made that the eggs were presumably laid at night.

The question was, however, considered by no means settled; and, on the discovery of the fly at Rosslyn, Mr. Marlatt was directed to make especial observations upon this point. The first result was, that careful examination of dung dropped in the early

morning (prior to 7 A.M.) showed very few eggs, not more than eight or ten to a single dropping, while that dropped between 4 P.M. and later in the night contained still fewer. On a dung dropped between 10 and 11.30 A.M. in the hot sunshine, however, examination a few minutes after showed a large number of eggs, estimated at three hundred and fifty. Other very fresh droppings were examined, and the eggs were found to range from none at all to over three hundred. One animal was then fortunately observed, from close quarters, in the act of passing her dung. As the operation commenced, forty or fifty of the flies moved from the flank to the back of the thigh, near the "milk mirror;" and at the close of the operation they were seen to dart instantly to the dung, and to move quickly over its surface, stopping but an instant to deposit an egg. The abdomen and ovipositor were fully extended, and the wings were held in a resting position. Most of them had left the dung at the expiration of thirty seconds, while a few still remained at the expiration of a minute. Every individual had returned to the cow, however, in little more than a minute. This explains the previous non-success in observing the act of oviposition; for the Virginia cattle on the large stock-farms are comparatively wild, and, although the dung was examined as speedily as possible after dropping, the flies had already left.

The results, therefore, indicate that the eggs are deposited during daylight, chiefly during the warmer time of the day, between 9 and 4, and mainly between 9 in the morning and noon. They are laid singly, and never in clusters, and usually on their sides on the surface of the wet dung, seldom inserted in cracks.

After the eggs hatch, the larvæ descend into the dung, remaining, however, rather near the surface. When ready to transform, the larvæ evidently descend from the dung into the ground below from a half to three-quarters of an inch. Actual observations were made on larvæ in dung in breeding-cages where the soil was fine sand, affording ready entrance to the larvæ. Where the dung has been dropped upon hard ground, the probabilities are that they will not enter so deeply, and may indeed transform upon the surface of the ground at the bottom of the dung.

From the records it appears that from ten to seventeen days, say two weeks, is about the average time from the laying of the egg to the appearance of the flies; and with four active breeding months, from May 15 to Sept. 15, there will be eight generations. The flies will undoubtedly breed later than Sept. 15, but this time may be allowed to make up for the time occupied in the development of the eggs in the abdomen of the female. With seven or eight annual generations, the numbers of the flies are not surprising.

The flies were observed in the greatest abundance during July. They make their first noticeable appearance in Virginia early in May, and, from hearsay evidence, remain until "late in the fall" or until "right cold weather." Sept. 28, they were still as abundant as ever around Washington. The characteristic habit of clustering about the base of the horn seems to exist only when the flies are quite abundant. When they average only a hundred or so to a single animal, comparatively few will be found on the horns. Moreover, as a general thing, the horn-clustering habit seems to be more predominant earlier in the season than later, although the flies may seem to be nearly as numerous. The clustering upon the horns, although it has excited considerable alarm, is not productive of the slightest harm to the animal. Careful study of the insects in the field show that they assume two characteristic positions, — one while feeding, and the other while resting. It is the resting position in which they are always found when upon the horns. In this position the wings are held nearly flat down the back, overlapping at the base, and diverging only moderately at the tip. The beak is held in a nearly horizontal position, and the legs are not widely spread. In the active sucking position, however, the wings are slightly elevated, and are held out from the body, not at right angles, but approaching it, — approximately an angle of sixty degrees from the abdomen. The legs are spread out widely; and the beak, inserted beneath the skin of the animal, is held in nearly a perpendicular position. The fly, before inserting its beak, has worked its way through the hairs close to the skin. While feeding, however, the hairs which can be seen over its body do not seem to interfere with its speedy flight when alarmed; for at a fling of the tail, or an impatient turn of the head, the flies rise instantly in a cloud for a foot or two, returning again as quickly, and resuming their former positions.

The horns are not the only resting-places; for, with the horns black for two inches above their base, we have seen the flies towards nightfall settle in vast numbers upon the back between the head and fore-shoulders, where they can be reached by neither tail nor head. When feeding, they are found over the back and flanks, and on the legs. During a rain-storm they flock beneath the belly. When the animal is lying down, a favorite place of attack seems to be under the thigh and back belly, around the bag. With certain animals the dewlap seems to be badly attacked, while with others this portion of the body is about exempt. Certain cattle, again, will be covered with flies, and will lose condition rapidly, while others are but slightly troubled.

On the horns the flies settle thickly near the base, often forming a complete band for a distance of two inches or more. They seem to prefer the concave side to the convex side of the curve of the horn, probably for the reason that the cow cannot scrape them off so readily; and one cow was noticed in which they reached nearly to the tip of the horn on the concave side of the curve only.

The amount of damage done by the fly has been exaggerated by some, and underestimated by others. Many rumors have been heard of the death of animals from its attacks, but not a single case as yet has been substantiated. It is believed that the flies alone will never cause the death of an animal. They reduce the condition of stock to a considerable extent, and in the case of milch cows the yield of milk is reduced from one-fourth to one-half. Their bites seldom even produce sores by themselves, although a number of cases have been seen where large sores had been made by the cattle rubbing themselves against trees and fences in an endeavor to allay the irritation caused by the bites; or, in spots where they could not rub, by licking constantly with the tongue, as about the bag and on the inside of the hind-thighs. A sore once started in this way will increase with the continued irritation by the flies, and will be difficult to heal. Those who underestimate the damage believe that the flies do not suck blood; but such persons have doubtless watched the flies only upon the horns or elsewhere in their resting position, when the beak is not inserted, or have caught them and crushed them when their bodies contained little blood. In reality, the flies suck a considerable amount of blood, however, and it is their only nourishment. If captured and crushed at the right time, the most sceptical individual will be convinced.

Almost any greasy substance will keep the flies away for several days. A number of experiments were tried in the field, with the result that train-oil alone, and train-oil with a little sulphur or carbolic acid added, will keep the flies away for from five to six days, while with a small proportion of carbolic acid it will have a healing effect upon sores which may have formed. Train-oil should not cost more than from fifty to seventy-five cents per gallon, and a gallon will anoint a number of animals. Common axle-grease, costing ten cents per box, will answer nearly as well; and this substance has been extensively and successfully used by Mr. William Johnson, a large stock-dealer at Warrenton, Va. Tallow has also been used to good advantage. The practice of smearing the horns with pine or coal-tar simply repels them from these parts. Train-oil or fish-oil seems to be more lasting in its effects than any other of the substances used.

A great deal has been said during the summer concerning the merits of a proprietary substance, consisting mainly of tobacco-dust and creosote, known as "X. O. dust," and manufactured by a Baltimore firm, as an application to cattle: and it has received an indorsement from Professor J. B. Smith, entomologist to the New Jersey Experiment Station. This substance has considerable merit as an insecticide, and will kill many of the flies when it touches them, although they die slowly, and a few may recover. The substance costs twenty-five cents per pound, and is not lasting in its effects. Where it is dusted through the hair, the flies, on alighting, will not remain long enough to bite; but two days later they are again present in as great numbers as before. A spray of kerosene emulsion directed upon a cow would kill the flies quite as surely, and would be cheaper; but it is not advisable to attempt to reduce the numbers of the pest by actually killing the flies.

Throwing a spadeful of lime upon a cow-dung will destroy the larvæ which are living in it; and, as in almost every pasture there are some one or two spots where the cattle preferably congregate during the heat of the day, the dung which contains most of the larvæ will consequently be more or less together, and easy to treat at once. If the evil should increase, therefore, it will well pay a stock-raiser to start a load of lime through his field occasionally, particularly in May or June, as every larva killed then represents the death of very many flies during August. Dr. C. V. Riley feels certain that this course will be found in many cases practical and of great avail, and will often be an advantage to the pasture besides.

THE KANSAS ACADEMY OF SCIENCE.

THE annual meeting of this society was held at Wichita. Among the papers read was the following: "On Monstrosities in Flowering Plants," by W. A. Kellerman. The author illustrated what may be called extreme variations in the development of certain parts of plants. These are looked upon as interesting phenomena in botany, and deserve greater attention.

E. A. Papenoe discussed oviposition in *Tragidion*, and showed that this beetle places its egg within an elliptical case on the surface or bark of the chestnut, oak, and other trees. The egg is oblong, smooth, and dull white. The bark is not punctured, as is commonly the case with this class of beetles. Robert Hay read a paper on artesian wells, in which he showed by diagrams how such wells are possible, and what progress had been made in the West with these wells. The relation of artesian wells to irrigation in arid regions was discussed. J. T. Willard gave a brief description of devices and methods used in the analysis of agricultural products. He described a desiccating apparatus, a method of purifying ether, and a method to prevent foaming in boiling liquids. G. H. Failyer communicated the results of his work on nitric acid and ammonia in rain-water. These observations have extended through more than three years. The per cent is usually greater in smaller rains. About three pounds and a half of nitrogen are annually added to an acre of soil by the rains. But little continuous work has been done in this line in this country. F. H. Snow gave the results of his attempts at artificial spreading of contagious disease among chinch-bugs. It has been observed that a certain fungus is present where the bugs are dying in large numbers. The attempt was made to propagate this disease by sending the infected bugs to different parts of the State and to several other States. The result has been thus far successful, and the war will be pushed next season with the help of a lot of infected material which is being kept over. The same author showed the curve of mean daily temperature for twenty-one years at Lawrence, Kan. Among the interesting facts brought out, it may be noted that the average coldest day is Jan. 6; and the hottest day, July 15. There seems to be a remarkable rise in temperature during the first ten days of April, and a corresponding fall of temperature in November, thus showing a more sudden change of seasons than has been observed in some other States. Professor Snow has also made a discovery on the method of respiration of the salamander. In its final or air-breathing stage, a stream of water was observed passing into the mouth through each nostril, the mouth being opened eight or nine times a minute to allow the water to escape. Folds of mucous membrane in the posterior part of the mouth appear to perform the function of removing the oxygen from the inspired water. E. C. Murphy gave some tests of cements manufactured in Kansas. From these tests it was shown that the native cements are inferior in tensile strength, compressive strength, and transverse strength, to Portland cement. L. I. Blake gave the result of tests made in the physical laboratory on the insulation resistance of electric wires exposed to moisture. The wires were immersed in water, and daily tests were made for three months. The results were shown by a series of curves, and a remarkable difference in quality was observed. The underwriter's wire was especially condemned. The same author gave the results of experiments in telephonic communication between vessels at sea. W. S. Franklin presented a paper on classification of the sense of smell. D. B. Jennings gave the result of his observations on hot winds. Though the paper is too long to be successfully abstracted, many interesting points were brought out. This is simply a preliminary paper on the subject.

F. O. Marvin exhibited an isogonic chart of the State of Kansas. There is shown to be an irregularity in the action of the needle in several contiguous counties. E. H. S. Bailey and E. E. Slosson presented a paper on the occurrence of celestite and associated minerals in concretionary formations in eastern Kansas. Complete analyses of the minerals will be published. E. H. S. Bailey also called the attention of the academy to the analyses of some Kansas mineral waters. Their occurrence and constituents were discussed. J. R. Mead gave a *résumé* of his observations on the occurrence of gold in Montana. L. E. Sayre gave the history and process of manufacturing binding-twine. In the discussion which followed, W. A. Kellerman suggested that perhaps some common weeds, like the velvet-leaf or the dogbane, might be used as a substitute for the more expensive fibres now in use. F. O. Marvin gave the result of a series of experiments on the second setting of cements. L. E. Sayre gave some notes on albuminoids, and also exhibited a novel and ingenious microscope attachment to be used to facilitate field-work in botany.

At the close of the meetings an excursion was made to the salt-fields of Kingman, where an opportunity was afforded to examine the practical work of salt-manufacture and salt-mining.

BOOK-REVIEWS.

Studies in Pedagogy. By THOMAS J. MORGAN. Boston, Silver, Burdett, & Co. 12°. $1.75.

THE author of this work, who is the principal of the Rhode Island State Normal School, here gives the public a statement of the views on education to which his experience and reflection have led him. We cannot say, however, that there is much that is new or valuable in them; on the contrary, they are mostly of a commonplace order. Mr. Morgan rightly lays stress on training, or discipline, as of more importance than mere instruction; but there is nothing new in this idea, and we cannot see that he has any thing striking to offer in regard to methods of training. He lays great stress on the education of the senses and the imagination, and even proposes to have a special series of exercises for training the nose, which he characterizes as an organ of "neglected merit and overlooked modesty." He points out the importance to the teacher of a thorough knowledge of psychology, and also of a preliminary training in methods of teaching. He has a high conception of the function of the teacher, and of the qualifications necessary for their perfect performance. Mr. Morgan's views appear to us in the main sound and true; but they are so familiar that there seems to be no good reason for writing a whole volume for the purpose of setting them forth.

Seven Thousand Words often Mispronounced. By WILLIAM HENRY P. PHYFE. New York and London, Putnam. 12°. $1.25.

THE editor of this book has produced already two books on pronunciation, — one "The School Pronouncer," and the other "How Should I Pronounce?"

That every one cares to pronounce correctly goes without saying. That every one, even if he may be reckoned among the well educated, does not necessarily know the accepted or most acceptable pronunciation of our mysteriously spelled English words, is equally true. But it is not always true that one seeking the recognized pronunciation of a word in dispute is willing to handle his big dictionary, even if he is so fortunate as to possess such; and, again, it not infrequently happens that the word may be a proper name, and proper names are sparingly treated in even the big quartos.

"Seven Thousand Words often Mispronounced" includes fully that number of words which, through inherent difficulty or carelessness on the part of the speaker, are liable to be mispronounced, with twenty-five hundred proper names.

There are the necessary introductory chapters on the sounds of the English language, — sounds both native and adopted or imported, as it were, from foreign tongues; it being the editor's idea that the adoption of so considerable a number of foreign words into