SCIENCE

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A BREATHING WELL IN LOGAN COUNTY, KANSAS.[1]

BY J. T. WILLARD, MANHATTAN, KANSAS.

FOR a number of years, Mr. R. L. Smith of Winona has noticed that two wells there blow out air at times and draw it in at other times. He has also noticed a close connection between their action and the weather. One well he has noticed more especially, and became so satisfied that the movement of air was connected with the state of the atmosphere that he called it a natural barometer. He was very anxious that the well should be observed by some scientific man with the necessary instruments. An aneroid barometer was sent him to make observations with, at the same time recording the state of the well. His observations indicated quite clearly that the movement of air in and out of the well was dependent on the pressure of the atmosphere. As the case seemed interesting, the writer visited the well, taking with him an excellent mercurial barometer and such other apparatus as seemed likely to be useful.

The well was found to be a bored one, cased with lumber. It was about eight inches in diameter. Water is reached in this region at about 130 feet, but this particular well has been drilled much deeper. This fact has no influence on the blowing of air, however, as other wells in the vicinity not over 135 feet deep show the same phenomenon. The well is abandoned now, on account of machinery having been lost in it, which interferes with its use.

On reaching the well, the writer first sealed the top, by means of mortar and plaster of Paris, air-tight, inserting a one-fourth-inch brass tube to connect the well with a gauge. The gauge consisted of a simple U-tube of glass, bent so that the two limbs were side by side. The bend of the tube and for several inches up was filled with water, and a scale behind the glass tubes measured any difference in height between the two columns of water. On connecting this gauge with the well, if air had been blowing out, its tension was measured by the height to which the water in the outer limb rose above that in the inner. If, on the contrary, air was being drawn into the well, on attaching the gauge, the water would stand higher in the inner limb. The following abstract from the observations made during four days will serve to show the connection between the movement of air to and from the well, and the fluctuations of the barometer: —

Date.	Time.	Barometer in millimeters.	Gauge in millimeters.[2]
Aug. 27	4.30 P.M.	674.15	29
" "	5.30 "	673 75	28
" "	6.30 "	673.65	23
" "	7.55 "	673 60	21
" "	9.00 "	673.70	16
" 28	6.15 A.M.	674.30	0
" "	7.45 "	674.35	1
" "	8.45 "	674.15	2
" "	9.35 "	674.45	0
" "	8.45 P.M.	678.50	— 31
" 29	7.25 A.M.	681.15	— 33
" "	8.30 "	681.55	— 31
" "	10.00 "	681.90	— 30
" "	11.30 "	681.90	— 24
" "	1.00 P.M.	681.65	— 17
" "	3.40 "	681.40	— 10

[1] Read before the Kansas Academy of Science, Oct. 13, 1892.

[2] The minus sign indicates a drawing-in of air, the water standing higher in the inner limb of the gauge.

The observations made showed conclusively that, the air of the well being stationary, if the barometer fell, the air of the well at once exerted a pressure outward, as shown by the water-gauge. Should the barometer then remain stationary, the tension of the air of the well became gradually less until equilibrium was again established. As this well was closed by the gauge, the evidence was conclusive that the tension was relieved by the escape of air from other openings, probably neighboring wells. Equilibrium being established, should the barometer rise, the gauge showed that the tension of the air of the well was less than that of the atmosphere, and this inequality was corrected by an inflow of air. If, after a fall of the barometer, a rise should ensue before equilibrium was established, the gauge would still show a greater internal tension. The well was therefore less delicate than the barometer, because of the interval of time required for the necessary movement of the air. After a sudden and considerable change of the barometer a strong movemont of air to or from the well would be caused, and this movement would continue for some hours, even though the barometer might be returning to its original height.

These wells doubtless tap a subterranean reservoir of air, probably filling the interstices of sand or gravel beds. When the pressure of the external air is diminished, some of this imprisoned air escapes, and the greater the fall of the barometer, the greater the force with which the air is expelled. My friend Mr. Smith utilized this air-current to blow a whistle which could be heard all over the town, warning the inhabitants of a possible storm. With a rising barometer, caused by an increase in the pressure of the air, air would be forced back into the subterranean reservoir. Mr. Smith tells me that when the air is going into the well, the water recedes a certain amount, and that when the air is blowing out, it can be heard bubbling through the water.

SOME ENTOMOLOGICAL FACTORS IN THE PROBLEM OF COUNTRY FENCES.[1]

BY F. M. WEBSTER, OHIO AGRICULTURAL EXPERIMENT STATION, WOOSTER, O.

THE subject of country fences has been frequently considered, both as to matters of device and material, by bodies both scientific and otherwise, and from almost every conceivable standpoint, except from that of an entomologist. As a rule, man will utilize for the purpose of constructing fences whatever available material may be the most abundant in his locality. In New England, where rocks are nearly everywhere over-abundant, the stone-wall will probably predominate in future. On the prairies of the west, where rock is a valuable material and timber equally so, a fence of living trees or shrubs, which can be planted, or one composed largely of iron, will occupy a position similar to the stone-wall of the eastern States. In the south, where timber is abundant, we may still look for its extravagant use, in the old Virginia worm fence composed of rails. To this, however, there are some exceptions. In Louisiana and portions of the south, barbed wire is largely used, for the reason given me by a Louisiana planter, viz., that the improvident negro cannot carry it away for fuel.

There is no denying the fact, that some of these forms of fences are harborers of a vast number of insects. In this respect the old worm-rail fence, with its wide margin of neglected ground on each side, stands probably at the head, followed closely by the stone-wall and hedge. A fence that has been very popular over a large portion of the country lying between the Alleghenies and longitude 97° west, is composed of posts and boards, the former set at distances of from six to eight feet apart, the latter, from

[1] Read before the Biological Society of Washington, Nov. 19.

one to five in number, being nailed horizontally to them. In this case, the uncultivated or ungrazed margin is greatly reduced, but even this form of fence offers some protection to various species of insects. Any one who will observe the number of cocoons and eggs that are ensconced between the boards and posts, where these come in contact, will be astonished at their number, especially if his examinations be made during late autumn or winter.

The minimum protection is probably afforded by a fence constructed of posts and wire. The vegetation can be grazed off or otherwise removed, reducing the protection thus afforded to the least possible amount, and the wires offer no hiding-place where they are attached to the posts. It is this form of fence that is, to a very large extent, displacing all others except the stone-wall, especially throughout the area above mentioned, and this change materially reduces the protection before offered a considerable number of injurious insects. Of the species thus more or less fostered may be cited the chinch bug, *Blissus leucopterus* Say, which passes the winter protected by the thick covering of leaves and matted grass. The army worm, *Leucania unipuncta* Haw., often originates in such places in abundance. A large portion of the larvæ of the Stalk Borer, *Hydrœcia nitela* Cauen, pass the early part of their larval stage in the stems of grass growing in such localities. Grasshoppers breed there in abundance. The Fall Web-worm, *Hypantria cunea* Drury, delights to pass its adolescent stage in the crevices about rail and board fences and stone-walls. If, as is often the case, the border of fields along the line of and in the corners of such fences, is allowed to grow up in a wilderness of blackberry and raspberry bushes, these will harbor the Root-borer, *Bembecia marginata* Harris, the Raspberry Saw-fly, *Selandria rubi* Harr., and the author of the Gouty gall of the raspberry, *Agrilus ruficollis* Fab. The Tarnished Plant-bug, *Lygus pratensis* Linn., will pass its winters in comfort among the leaves of mullein which adorn such places, and which constitute a veritable nursery for these and other injurious insects, from which they readily spread to adjoining gardens, orchards, and fields.

Soon after the adoption of barbed wire as a fence material, it was discovered that domestic animals were more or less liable to injury from the barbs. This led to a modification, to the extent of placing one board horizontally above the wires, and, while done especially for the protection of animals, it has an entomological and botanical signification which was wholly unlooked for, even by the entomologist or botanist.

The fall brood of the larvæ of *Spilosoma virginica* Fabr., familiarly known as the Common Yellow Bear, reaches maturity in September and early October, and appears to then acquire a somewhat nomadic habit of life, possibly being in search of a suitable place for cocooning. In their travels they seem to take advantage of fences and convert them into highways, over which they travel in great numbers. Now, with a fence of rails or boards, the travel is distributed over all of these, though the uppermost seems to be preferred. A barbed-wire fence is well-nigh impassable for these caterpillars, on account of the difficulty of crawling along the wires and over an occasional barb which stands in the way. The addition of the top board to a fence of barbed wire settles the transportation problem with these larvæ, and they crawl along these, upon the upper edge, in great numbers; but, as with mankind, disaster overtakes them in the midst of prosperity. This fall brood of larvæ seems especially liable to attack from a fungous disease, *Empusa aulicœ* Reich, as determined for me by Dr. Thaxter, of Harvard University. A caterpillar when affected by this Empusa becomes first paralyzed and limp, but later it is rigid and attached so tenaciously to the board that it only disappears by becoming disintegrated and washed off by rains. Now, when a caterpillar dies from this cause it usually becomes firmly affixed, right in the way of the migrating larvæ, so that one of these can scarce pass in either direction without rubbing against the corpse, as the way is only an inch in width. In thus coming in contact with the dead body of its fellow, in all probability some of the spores of Empusa become attached to its body and soon do their work, the dead as before lying in the narrow path and adding to the danger for other travellers. You can readily see that in a short time the narrow way will become so filled with dead that to travel for any distance along this highway without contracting this fungoid disease is almost an impossibility. In proof of this, the upper edge of this board, where it is used, becomes literally strewn with corpses. In a distance of forty-eight feet I recently counted seventeen dead caterpillars, and clustered on the surface of the upper end of a post, comprising an area of two by six inches, six bodies were observed. As these caterpillars are not gregarious, and being general feeders, their chances of being reached by the spores of Empusa is comparatively small unless they rub against a diseased larva, or come within a certain radius of such a one when the spores are thrown off or "shot," as it is termed. Hence, as now appears, this mortality is largely due to the cause indicated, and which seems to be a powerful agent in holding the species in check.

It may be suggested that these larvæ might have been attacked before they made their way to the fences, as it is, I believe, a characteristic of Empusa that its hosts seek high objects, and crawl up as far as possible before dying. In my own observation, while this has proved true in the majority of cases, affected insects have been observed to travel about but little after reaching such elevation. Furthermore, these caterpillars have been observed in abundance crawling along fences when Empusa did not appear to be present.

WATCHING A SNAKE FOR AN HOUR.

BY WALDO DENNIS.

ONE bright morning in July I was walking in the woods, when a snake crossed my path only a few feet in front of me. It was about two feet long, and its dark blotches made it resemble a water snake. It had not been disturbed by my presence, as it moved very slowly, and this slow movement led me to watch it.

It scarcely crossed the path before it began to ascend a medium-sized dogwood tree (*Cornus Florida*). This to me was a coveted opportunity. The story of an eye-witness as to how a blacksnake had climbed the naked corner of a house to a height of ten feet had left me curious to see something of the kind myself.

The dogwood tree, near the ground, was about seven inches in diameter, and was a rather smooth-barked one. The tree leaned but slightly for about ten feet of its height, but then it curved sharply to a horizontal, making the highest part of the body about fifteen feet from the ground. The snake started up on the under side of the slant, and apparently found no more trouble going up the tree than it had in going over the ground. It made no effort to wind itself around the tree nor to hug the tree by winding back and forth, as the blacksnake had been reported to do on the corner of the house. It went straight up without crook or turn.

After ascending about three feet, it seemed to feel its hold weaken, and threw its body into folds. But this was only for a few inches of its course, and it found no occasion to repeat even this expedient. The very acute angles of two or three of the folds, however, showed how well this could be done when necessary. When such a protuberance as a knot came in its way, it seemed to care very little for its advantage, and left it to one side.

After getting up four or five feet, it stopped; being anxious that it should go on up, and fearing it would come down, I touched it with a stick, whereupon it moved faster, gliding quickly out of my reach, showing thus that it had been going so slowly from choice, and not from any difficulty in going faster. When it was about eight feet high it stopped again, which made me have recourse to a larger stick. When it had reached the highest point from the ground, I shook the tree, as well as one could a tree of such size, to see if it could keep its hold. This it did, only lifting up its head and poking it out from the tree, where it lay, four or five inches, as if to see what was the matter. It occurred to me to wonder how it would manage its descent, so I left off experimenting in this line and retired to watch.

I had to wait but a few minutes before the snake began to turn round by doubling on itself. But after crawling along toward