bacterial cells suspended in 12% saline, following essentially the method of Huddelson and Abell (*2*). The S-19 strain of *Brucella abortus* was employed in preparation of antigens and antisera.

Two of the five herds studied, consisting of a total of 36 animals, were considered clinically free of brucellosis. In addition, most of the animals had been previously tested at intervals for significant *Brucella* titers. Only one of the animals in these two herds had been previously vaccinated against brucellosis, and it showed a tube agglutination titer of 1: 256 and a rapid macroscopic titer of 1: 320. None of the remaining animals showed tube-agglutination or rapid-macroscopic titers of more than 1: 40, and none of the 36 sera possessed agglutinin-blocking properties.

TABLE 1

AGGLUTININ AND AGGLUTININ-BLOCKING TITERS* IN NINE SELECTED BOVINE SERA

Animal	Tube-agglutination titer		Blocking titer		Rapid-macroscopic titer
	Complete	Partial	Complete	Partial	
R1	0	8	32	128	640
R2	0	0	128	256	640
R5	0	0	1024	4096	640
R17	0	0	128	0	640
R18	0	0	128	256	640
R37	0	0	128	512	640
R38	0	0	256	1024	640
R40	0	16	128	1024	640
S3	0	0	32	0	640

* Expressed as reciprocals.

Three of the five herds, consisting of a total of 52 animals, had never been vaccinated or tested and were considered to be clinically "suspicious" of harboring *Brucella*-infected animals. Twenty-four of the 52 sera showed tube-agglutination titers greater than 1: 40; 35 showed rapid-macroscopic titers greater than 1: 40; and 33 showed agglutinin-blocking properties. It was of particular interest that nine sera which had negative or diagnostically insignificant titers by the tube-agglutination test possessed considerable agglutinin-blocking properties as well as high rapid-macroscopic titers. These results are shown in Table 1.

These results indicate that a significant number of sera from animals in bovine herds where brucellosis is clinically suspected may show negative or very low tube-agglutination titers while possessing agglutinin-blocking properties to a considerable degree. Furthermore, such sera have demonstrated high rapid-macroscopic titers. In this study, no sera were encountered which showed agglutinin-blocking titers, or "incomplete antibodies," which could not be detected by the rapid-macroscopic test. This apparent advantage of the rapid-macroscopic test over the tube-agglutination test would seem to be of practical importance. Further studies are being made to account for the detection of "incomplete antibody" by the rapid-macroscopic test.

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Water Absorption from the Atmosphere by Plants Growing in Dry Soil[1]

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The lower mountain slopes of southern California are blanketed by a cover consisting largely of brush. In some areas, however, Coulter pine (*Pinus Coulteri*) makes up an essential part of this cover. Both the brush species and the pine have one striking common characteristic, an ability to survive long periods of drought on shallow soils which are often at the permanent wilting

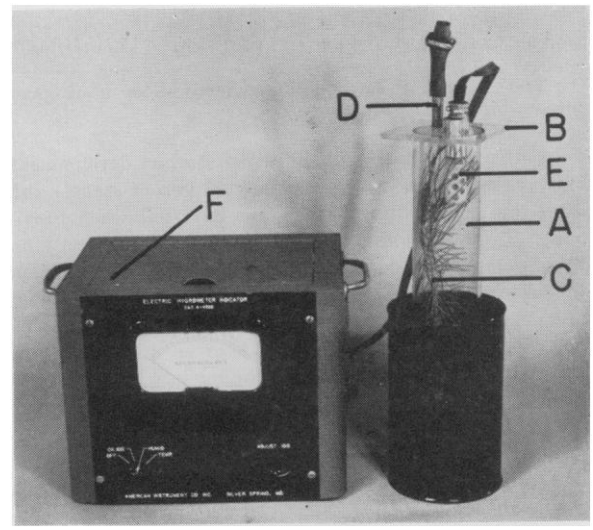

FIG. 1. Apparatus for measuring "negative" transpiration. A, chamber. B, chamber cover. C, Coulter pine seedling. D, brass pipe. E, Amico-Dunmore unit for temperature-humidity sensing. F, microammeter.

point for several months during the late summer. Unpublished lysimeter studies on the San Dimas Experimental Forest in southern California indicate that these plants can survive even on soils below the permanent wilting point as determined by the method of Briggs and Shantz (*1*). Fowells (*2*) worked with another species of pine, *Pinus ponderosa*, and reported that it also survived

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TABLE 1

CHANGE IN THE RELATIVE HUMIDITY WITHIN A TEST CHAMBER AS A RESULT OF WATER ABSORPTION AND WATER LOSS BY THE AERIAL PART OF THE PLANT

Sample number		Relative humidity after different elapsed times (hr)									Calculated absorption force (to the nearest 10 atm)
		0	1	2	3	6	9	24	48	96	
Test plant	A-1	98	94	91	91	90*	..	96	98	98	140
	2	97	88	89	87	86*	90	91	..	..	200
	3	99	88	85	84*	..	..	93	96	97	230
	4	98	96	89	88*	88	89	95	97	98	170
	5	85*	86	85	85	85	85	93	96	98	...
Test plant	B-1	98	96	95*	95	95	95	96	96	96	70
	2	99	97	92	90	89*	90	92	94	97	150
	3	98	96	92	89*	89	89	90	96	98	150
	4	98	97	95*	95	96	95	98	98	98	70
	5	90	90	88*	88	89	90	92	95	97	160
Control plant	C-1	98*	99	98	98	98	98	98	98	98	0
	2	98*	98	98	99	99	99	99	99	99	0
	3	98*	98	98	98	99	98	99	98	98	0
Control plant	D-1	98*	98	98	98	98	98	98	98	98	0
	2	98*	98	98	98	98	98	98	98	98	0
	3	98*	98	98	98	98	98	98	98	98	0
Empty Chamber	E-1	98*	98	98	98	98	98	98	98	98	0
	2	98*	99	99	98	98	98	98	98	98	0
	3	98*	98	98	98	98	98	98	98	98	0

* Lowest value reached for each experimental run.

on soils below the permanent wilting point. This ability to survive on soils so dry that some plants die is yet to be explained.

Several possible explanations worthy of investigation come to mind. It was decided, however, to consider only one at this time, the possibility that aerial portions of these plants take up water from the atmosphere, particularly at night when there is an appreciable increase in the relative humidity of the air.

This paper is a report on (1) the occurrence of such a water uptake from the atmosphere by Coulter pine seedlings and (2) a simple method of measurement.

The data here presented are too limited to permit an evaluation of the practical importance to the plant of such a phenomenon. However, the authors do feel that the method of measurement is direct, simple, and worth reporting, since its use makes possible the study of an interesting and perhaps critical factor in plant survival in the dry regions of the world.

Transpiration is water loss to the air from the aerial parts of the plant and may be through either the stomata, cuticle, or lenticles. Therefore we have considered water uptake from the air as a reversal of normal transpiration, whether it be stomatal, cuticular, or lenticular, and we shall for convenience refer in this paper to this phenomenon as "negative" transpiration.

Basically, the method of measurement consisted of inserting the part of the plant to be measured into a closed chamber in which the initial relative humidity could be readily adjusted and then recording changes in the relative humidity within the chamber by means of a humidity-sensing unit.

The assembled apparatus is shown in Fig. 1. The chamber (A) was made from Plexiglas tubing of 2-in. diam. It was closed at one end by a piece of ¼-in. Plexiglas (B), and at the other end by a split, one-hole rubber stopper. The stopper was slipped around the stem of the plant, in this instance a Coulter pine seedling (C), and sealed with Lubri-seal; the roots and soil sealed in their container were undisturbed. Then the stopper and plant were fitted into the chamber and enough mercury poured in through the opening in the Plexiglas cover—in which later the humidity-sensing unit (E) was threaded—to cover the stopper with a ¼-in. layer; this furnished an airtight seal. The relative humidity was adjusted by the operator's blowing into the chamber through the brass tube (D), which had been threaded through the Plexiglas cover. In preliminary runs, CO_2 was removed from the water-saturated air stream before it entered the chamber, but when it was found that this did not affect the results it was discontinued. Determination of relative humidities was made with an Amino-Dunmore unit for temperature-humidity sensing and accompanying microammeter (F). Relative humidity and temperature could be determined with an accuracy of $\pm 0.5\%$ and $\pm 1.0°$ C respectively, but humidity readings for values above 98% were found to be unreliable. These values represent anything from 98% to 100% relative humidity and must be considered accordingly.

Test material consisted of two 2-yr-old Coulter pine seedlings which had been growing in containers, sealed from the atmosphere with grafting wax, to which no water had been added for more than 10 months. During this time each container had been partially immersed in a tank of water in order to maintain constant temperatures in the soil mass, and the whole was shaded from direct sunlight by a sheet of canvas. The soil in both containers, when examined at the end of the experiment reported below, was at the wilting point as determined by the method of Briggs and Shantz (*1*).

The control was of two kinds. One consisted of two 2-yr-old Coulter pine seedlings which had been well watered throughout their entire lives; the other consisted of an empty chamber.

The apparatus was checked before each experimental run for leaks and drifts in the relative humidity readings with time. When drifting did occur, more moist air was added to the empty chamber until readings remained constant for 6 hr; not until then was the chamber used.

Before each experimental run, both the test plants and the control plants were placed in front of a fan for 48 hr in order to assure a water deficit in the aerial part of the plant. Preliminary runs had shown that the same effect could be obtained by placing the plants in full sun for a week or more. The 48-hr exposure in front of the fan merely made possible a larger number of runs in the same period of time.

All experiments were carried out in diffused light at room temperatures which remained relatively constant (24.5° ± 0.7° C).

Five experimental runs were made with each test plant (A 1–5 and B 1–5 in Table 1). After each test plant a control plant was run; only six of these are shown (C 1–3 and D 1–3 in Table 1). Before each experimental run a blank run was made in which the chamber was empty; only three of these are shown (E 1–3, Table 1).

Results in Table 1 indicate that water was removed from the air by the aerial parts of the plants growing at the wilting point, but not by the control plants growing in well-watered soil. As a result of this negative transpiration, relative humidities as low as 84% were obtained in the test chamber.

Data in Table 1 also show that the test plants, which at first display "negative" transpiration, later display normal transpiration after a 24-hr period in the test chamber, even though the rate is extremely slow. This could be explained on the basis of a slow water uptake by the roots when in soil at the wilting point. When first placed in the chamber, the aerial portions of the plant remove water from the air until the vapor pressure of the water at the leaf surface is equal to the vapor pressure of the water in the surrounding chamber. As water is gradually removed from the soil by the roots, it passes through the conducting system into the leaf; then vapor pressure of the water in the leaf increases and water loss to the atmosphere begins, showing as normal transpiration.

Five-year averages of the relative humidity in the San Gabriel mountains of southern California during the period from July to October show that values of 90% or more were recorded an average of 18 days per month with an average duration of 8 hr, at 1,500 ft and 8 days per month with an average duration of 7 hr, at 2,800 ft. These are conservative figures (probably low), since they were taken in a standard shelter 4 ft above the ground in a cleared area, and not at the leaf surface where radiation effects are operative. Nevertheless, they do show that relative humidities are such during the summer that negative transpiration can occur under field conditions.

Calculations of the maximum absorption forces (suction pressures or diffusion pressure deficits) attained in each experimental run are shown in the last column in Table 1. Relative humidities of 98% and above are considered as 100%, because of the inaccuracy of the instrument in this range; absorption forces are consequently considered as 0 under such conditions. Calculations were based upon the relation existing between vapor pressure, relative humidity, and osmotic concentration of a salt solution contained in a closed vessel. At a specific temperature such a salt solution has a specific vapor pressure and the air above it a specific relative humidity. If air of a higher or lower relative humidity is introduced into the closed vessel, the original relative humidity is again attained after a short period of time; this will continue to happen as long as the concentration of the salt solution is not appreciably changed by the gain or loss of water in the form of vapor. Therefore, when the relative humidity above a solution is known, the osmotic concentration of the solution, which is identical to the absorption force for water, can be calculated. For example, in one of the experimental runs cited in Table 1, water at the leaf surface was in equilibrium with an atmosphere of 84% relative humidity. This relative humidity would also exist over a salt solution with an osmotic concentration of about 230 atm; hence, the absorption force developed at the leaf surface was considered to be 230 atm.

Since such large forces are developed, one would not expect leaves with large thin-walled cells, as on the sunflower plant, to display negative transpiration of a measurable magnitude, or to develop high absorption forces in the leaves. On the other hand, leaves of many of the desert and Mediterranean type plants are mechanically much stronger, and in them negative transpiration and high absorption forces under drought conditions may be expected. Even if this is found to be generally true, much more experimental work must be carried out to determine whether this absorption of water in itself is an important survival factor or whether it is merely a phenomenon that can occur in plant tissues rigid enough to resist collapse when desiccated.

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Disruption of Mitosis by Desiccated Thyroid Tissue

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It has been reported that numerous substances, notably colchicine (*1*), acenaphthene (*4*), salts of heavy elements (*5*), and ribose nucleic acid (*3*) disrupt onion root mitosis in producing polyploidy, c-mitosis, nondisjunction, and chromatin bridges. Except for colchicine and ribose nucleic acid, the substances used were mainly those not found in living organisms. With this in mind,