A CORRECTION.—I am extremely sorry that in my paper on the Anatomy of the Cone and Fertile Stem of *Equisetum* in the Annals of Botany for July, 1912, I should, by a regrettable oversight, have misquoted Professor Jeffrey. On page 699 of my paper Professor Jeffrey should be quoted as saying: 'It appears to have been shown above and beyond any doubt that the equisetaceous strobilus perpetuates both the non-alternating strands and the complete absence of foliar gaps of the oldest Calamitean forms.' In reproducing this passage, I, by a slip of the pen, wrote 'alternating' instead of 'non-alternating'; but, as will be obvious from the subsequent sentences in which I oppose Professor Jeffrey's conclusion, I had fully realized that it was the occasional superposition of the strands of succeeding internodes of the cone that he regarded as a survival from the older Calamariae.

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VARIATIONS IN THE NaCl CONTENT OF NON-HALOPHYTES.—

When non-halophytic plants are grown at different distances from the sea-coast their leaves on analysis exhibit variations in the amount of sodium chloride present in them.

These variations may be due to one or other of two causes, viz.:

- (1) Variations in the amount of sodium chloride present in the soil-water in which the plants are grown and carried to the leaves by the transpiration-current; or
- (2) Variations in the amount of sodium chloride present in the atmosphere and absorbed by the leaves directly.

Czapek (1) refers to such variations as occurring in certain plants cultivated both on the sea-coast and at some distance from it. For example, the pure ash of the leaves of *Beta vulgaris* grown on the seashore was found to contain 21.39 per cent. of chlorine, while the ash of the leaves of the same species grown about $12\frac{1}{2}$ miles from the shore contained 16.61 per cent. of chlorine.

With the object of determining to what extent direct absorption by the leaf of the sodium chloride in the atmosphere was responsible for the sodium chloride content, estimates were made of the amounts present in the leaves of certain non-halophytes grown on the sea-coast and also at varying distances from it.

The plants analysed were *Acer Pseudo-platanus*, *Ulmus campestris*, and *Ilex Aquifolium*. All leaves experimented with were first of all thoroughly and repeatedly washed until the water used showed no trace of NaCl when tested with silver nitrate.

A solution from the leaves was obtained by slowly incinerating a weighed amount of leaf substance until a white ash only was left. This ash was washed in 100 c.c. of water and the NaCl dissolved out. The amount of NaCl in this solution was discovered by titrating it with a $\frac{N}{20}$ solution of silver nitrate, potassium chromate being used as an indicator. This solution was acid and so unsuitable for titration. Neutralization was effected by the addition of caustic soda, phenolphthalein being used as a test for alkalinity.

A solution from the soil was obtained by repeatedly washing a weighed amount of dry soil with 100 c.c. of water. The amount of NaCl in this solution was estimated in the same manner as that from the leaves.

The amount of sodium chloride in the soil-water has no influence upon the proportion found in the plant tissues. This is what one would expect from the plant's power of selective absorption. Kerner (2) demonstrated this fact in the case of *Stratiotes aloides*, *Nymphaea alba*, *Chara foetida*, and *Phragmites communis*.

The soil may contain varying quantities of NaCl. Warming (3) states that when a soil dries slowly it may contain as much as 2-3 per cent. NaCl before all but halophytic plants will be expelled from it; if a soil dries quickly only 1 per cent. is needed to act in the same manner.

The data recorded in the subjoined table show that a large amount of NaCl in the soil does not necessarily mean a large amount in the leaves nor vice versa. In analysis I 5 gr. of perfectly dry soil contain 0.01 per cent. NaCl. The soil was obtained from under a plant of *Ulmus campestris* growing six miles from high tide mark. The ash of the leaves contained 0.37 per cent. NaCl. In analysis II the amount of NaCl present in the soil was the same as in I, the sample being taken from beneath a plant of the same species growing about one mile from the sea. The leaf-ash in this case, however, contained 0.71 per cent. NaCl, i. e. almost twice as much as in case I. In analysis III the plant grew 440 yards from high-water mark and was sheltered by buildings from the sea winds, and the soil contained three times as much NaCl as in the two previous cases, whereas the leaf-ash did not contain as much as that taken from plants growing in a more exposed position further inland.

Similar results were obtained on analysis of the soil and leaf-ash, the experimental plant being *Acer Pseudo-platanus*, as may be seen from the data Nos. VI, VII, VIII. The variations, it will be noted, are not so great as in the case of *Ulmus campestris*.

The NaCl in the atmosphere.

The facts recorded in the table prove that it is the amount of NaCl in the atmosphere and absorbed by the leaves which is responsible for the amount of the salt found in them.

The NaCl from the sea may (i), according to Ackroyd (6), be carried considerable distances inland either as salt spray from the sea which is carried to the land to distances varying with the force of the wind; or (ii) the salt may be dried by evaporation and then carried further inland with the dust; or (iii) the salt may be dissolved in the rain. Ackroyd (7) also mentions that during the great storm of 1839 which 'visited Liverpool and various parts of the kingdom, on January 6th and 7th, the trees and hedges in many places—e. g. Huddersfield and Longton—appeared to be covered with a white frost which, on analysis, proved to be a briny deposit which the wind had brought from the Irish Sea'.

Lesage (4) found that sodium chloride penetrates the plant tissues of *Lepidium sativum* and *Raphanus sativus* in large quantities.

Lewis (5) showed that if the leaves of *Camellia japonica*, *Ilex Aquifolium*, *Syringa vulgaris*, *Cavendishia acuminata*, and *Arum maculatum* are immersed in 3.0420 per cent. NaCl solution and in sea-water they absorb NaCl. In the case of

Syringa vulgaris after twelve hours' immersion the weight increased 4.4 per cent., whilst the NaCl content increased 3.6 per cent. In *Arum maculatum* the weight decreased 2.09 per cent., while the NaCl content increased 5.75 per cent. The cells were not killed by this treatment.

Acer Pseudo-platanus. When grown six miles from the sea, on land which sloped very gradually seawards, the leaf-ash contained 0.32 per cent. NaCl. The plant in this situation was exposed to all the winds from the west, i.e. from the sea. In analysis VIII the leaf-ash contained 0.37 per cent. NaCl, i.e. only 0.05 per cent. more than in the former case, and this ash was obtained from a plant grown 440 yards from the sea but sheltered by buildings from all sea winds. In analysis VII, the leaf-ash contained 0.43 per cent. NaCl, and in this instance the leaves were procured from a tree growing one mile from the sea, the land between being level. Analyses IX and X show that the ash of the leaves obtained from two plants of the same species, both grown 400 yards from high-water mark, contain respectively 0.57 per cent. and 0.66 per cent. NaCl, the former having been got from a plant slightly sheltered by sandhills from the sea winds, while in the latter case the plant was fully exposed. The leaves in all these cases were gathered during the end of the month of June, 1912, and the durations of the different winds during that month were as follows:

North	= 49 hours	South	= 97 hours
North-east	= 33 „	South-west	= 98 „
East	= 73 „	West	= 197 „
South-east	= 90 „	North-west	= 83 „

(From the Records of the Southport Observatory.)

Ulmus campestris demonstrates even better the fact that the leaves obtain their supply of sodium chloride from the atmosphere. The table shows that the amount of NaCl found in the leaf-ash varies from 0.37 per cent. to 1.74 per cent. when procured from trees grown six miles inland and 400 yards from the high-water mark. In analysis II the ash was obtained from a plant growing one mile from the sea, the land between being level; it contained 0.71 per cent. NaCl—twice as much as in analysis I; but in analysis IV the ash was obtained from a plant growing two miles inland, and in this case it contained 1.02 per cent. NaCl. This excess is explained by the fact that the plant grew on the west side of Bidston Hill, Cheshire, and was exposed to much wind. The ash from the leaves of the same species grown 440 yards from the sea but sheltered from sea winds contained only 0.50 per cent. NaCl. The leaves in all these cases were gathered during the end of June, 1912, and the total durations of the different winds were the same as described under *Acer Pseudo-platanus* except in the case of the Bidston Hill plants, which were examined in May—analysis IV. In the last case the number of hours that the wind blew from each compass point was:

North	30	South	91
North-east	18	South-west	133
East	39	West	217
South-east	125	North-west	67

(From the Records of the Bidston Observatory.)

Ilex Aquifolium. Owing to the small quantity of NaCl present in the leaf-ash this plant is not so suitable for experimentation; the variations are, however, recorded in analyses XI, XII, and XIII. When the leaf-ash was obtained from a plant growing six miles from the sea it contained 0.02 per cent. NaCl. The ash was procured from other plants growing one mile from the sea, in one case (XII) slightly sheltered from the sea winds, in the other (XIII) exposed. The ash of the former contained 0.05 per cent. NaCl and of the latter 0.07 per cent. NaCl.

These facts are evidence in support of the view that it is from the sodium chloride in the atmosphere that the leaves of such plants receive their supply of sodium chloride.

TABLE.

Plant.	Distance from the sea.	Aspect.	% of NaCl in dry wt.	
			Soil.	Leaf.
I. <i>Ulmus campestris</i>	6 miles	Land sloping towards the sea	0.01	0.37
II. " "	1 mile	Slightly sheltered from the sea	0.01	0.71
III. " "	440 yds.	Sheltered from the sea	0.03	0.50
IV. " "	2 miles	Much exposed	—	1.02
V. " "	400 yds.	Exposed	—	1.74
VI. <i>Acer Pseudo-platanus</i>	6 miles	Land sloping towards the sea	0.01	0.32
VII. " "	1 mile	Slightly sheltered	0.03	0.43
VIII. " "	440 yds.	Sheltered from the sea	0.03	0.37
IX. " "	400 yds.	Slightly sheltered	—	0.57
X. " "	400 yds.	Exposed	—	0.66
XI. <i>Ilex Aquifolium</i>	1 mile	Slightly sheltered	—	0.05
XII. " "	1 mile	Exposed	—	0.07
XIII. " "	6 miles	Land sloping towards the sea	—	0.02

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