duced by a single season's growth run extremely low in ephedrine, and further suggests that even moderate heat in oven curing the herb is detrimental to its alkaloidal content.

Table III, however, contained the most promising information of all. By simply allowing the perennial stems to mature this extra season, the ephedrine content increased 144 per cent over the highest figure ever obtained from the single-season stems. Those stems which were left on the ground outside cured so nicely that it assures ease in cutting and caring for the stems.

Aging the ephedra stems an extra season, then, was found to be decidedly encouraging for the following reasons:

1. It increased stem production.
2. Seed production increased 66 per cent.
3. It increased the ephedrine content.

How far the natural phenomena will continue to advance, of course, remains to be determined by continued experimentation. From data thus far obtained it is possible to suggest the following conclusions:

1. *Ephedra sinica* stems and roots are both hardy and perennial in South Dakota.

2. The plants produce viable seeds, assuring rapid propagation both from these, as well as from numerous runners that develop into new plants.

3. The crop may be handled like any ordinary hay crop, by cutting it with mowers, allowing it to cure in the field, and then bale for shipment.

4. The proper time for harvesting favors late September, since damaging frosts are expected by October first.

5. The undisturbed plants spread to form a sod which eliminates cultivation except for hand weeding.

6. Stems produced in a single growing season are small, bear few seeds and run low in ephedrine content.

7. Maturing the stems for a second growing season increased stem production from the nodes of the old stems, stimulated seed production, and increased the ephedrine content.

8. The best assay figure obtained thus far is still considerably below that of the imported drug, but in case of an emergency, ephedra of fair quality could be produced in South Dakota.

THE ASSAY OF MONOETHANOLAMINE IN THE PRESENCE OF THEOPHYLLINE.*

BY ASA N. STEVENS.[1]

The pharmaceutical literature does not appear to provide a method for the determination of monoethanolamine in mixtures containing the various xanthine derivatives. In an effort to develop a satisfactory procedure for the estimation of monoethanolamine in the presence of theophylline the following experiments were made.

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* Scientific Section, A. PH. A., Dallas meeting, 1930.

[1] Control Laboratories, Eli Lilly and Company.

EXPERIMENTAL.

Solution A.—A solution prepared by dissolving 15 cc. of monoethanolamine in sufficient distilled water to make 100 cc. A 5-cc. portion of this solution required 26.60 cc. of *N*/2 HCl for complete neutralization in the presence of methyl orange. Since 1 cc. of *N*/2 HCl is equivalent to 0.0305 Gm. of monoethanolamine it follows that in each cc. of Solution A there is 0.1623 Gm. of monoethanolamine.

1. To 1 Gm. of theophylline add 19.30 cc. of Solution A and warm on a steam-bath. Cool and titrate with *N*/2 HCl using methyl orange indicator.

2. To 1 Gm. of theophylline add 0.95 cc. of Solution A and warm on a steam-bath. In this case some of the theophylline remained in suspension. Cool and titrate with *N*/2 HCl using methyl orange indicator.

3. To 1 Gm. of theophylline add 2.0 cc. of Solution A. Warm on a steam-bath. Cool and titrate with *N*/2 HCl using methyl orange indicator.

The results obtained in these experiments were as follows:

TABLE I.

Experiment No.	Cc. *N*/2 HCl Required.	Monoethanolamine (Calculated) Grams.	Monoethanolamine (Found) Grams.
1	102.80	3.13	3.13
2	5.20	0.154	0.158
3	10.80	0.324	0.329

In order to determine whether or not the results shown in Table I would be of value in analytical control determinations a number of samples containing theophylline and monoethanolamine were assayed for their ethanolamine content. One of the samples contained starch as an added inert material. The results appear in Table II.

TABLE II.

Sample No.	Sample Wt. Grams.	Starch Grams.	Cc. *N*/2 HCl Required.	Monoethanolamine (Calculated) %.	Monoethanolamine (Found) %.
A	0.775	...	6.40	25.41	25.19
A	0.630	...	5.20	"	25.17
B	0.833	...	6.90	"	25.26
B	1.548	...	12.90	"	25.41
C	1.634	...	13.60	"	25.38
D	1.072	...	8.95	"	25.46
E	1.000	1.0	8.40	"	25.62

COMMENTS.

The indications are that this method may also be extended to include the determination of pure diethanolamine and pure triethanolamine in mixtures with other materials. No analytical results have yet been obtained by the author in the estimation of these two compounds.

CONCLUSION.

Evidence has been presented to show that monoethanolamine may be determined in the presence of theophylline and starch by titration with standard hydrochloric acid in the presence of methyl orange as an indicator.

The possibility of assaying other compounds of a similar nature by using the same procedure has also been suggested.