

13942

Pantothenic Acid Content of Pollen.*

PAUL B. PEARSON.

From the Department of Animal Husbandry and the Agricultural Experiment Station, Agricultural and Mechanical College of Texas, College Station.

While data are available on the thiamin¹ and riboflavin² content of bee bread, information on the distribution of members of the B vitamins in pollen is meagre. The report by Pearson and Burgin³ that royal jelly is the richest known source of pantothenic acid suggested the possibility that this vitamin might be a factor in the development of the female larva of the honey bee (*Apis mellifera* L.) into queen bees. The queens and workers are produced from identical larvæ, as it is possible to rear queens from any female larvæ less than 3 days old by providing them with the proper food. For the first 2 days after hatching all female larvæ receive a diet of royal jelly. During the third day the diet of the larvæ that are to become workers is changed to pollen while the queen caste continues to receive royal jelly. In view of this difference in the diets between the two castes it appeared important to secure information on the pantothenic acid content of pollen.

Twenty-five samples of pollen were collected in various sections of Arkansas and Texas.† It was secured by means of pollen traps similar to the one described by Todd and Bishop.⁴ Most of the samples of pollen were from more than one species of plant. Where the pollen was from a known species the analytical data are recorded separately

in Table I. The pantothenic acid assays were made on the fresh pollen samples by the microbiological method of Pennington *et al.*⁵

A preliminary trial showed that enzymatic treatment of pollen as described by Waisman *et al.*,⁶ for animal tissues did not increase the pantothenic acid values. Seven samples of pollen after autoclaving were adjusted to a pH of 4.6 with sodium acetate buffer and filtered in a similar manner to that described by Wegner *et al.*,⁷ for removing foreign growth stimulants. The pantothenic acid values of the pollens so treated were not significantly lower than when the assays were made on the unfiltered material. The values for the filtered and unfiltered samples run simultaneously did not differ more than 3%. The pantothenic acid values reported in Table I were determined on the autoclaved pollen according to the original method.⁵ The moisture content of each sample of pollen was determined so as to permit expressing the pantothenic acid values on both the fresh and dry basis.

The data on the pantothenic acid and moisture content of pollen are recorded in Table I. Expressed on a dry basis the pantothenic acid content ranged from 14.7 µg to 59.2 µg per g of pollen with an average of 30.0 µg per g. The moisture content ranged from 8.7% to 35.3% with an average of 17.8%. It is entirely possible that the pantothenic acid content of pollen varies with the botanical species of plant from which it is obtained, soil and climatic con-

* Published with the approval of the Director of the Texas Agricultural Experiment Station as technical contribution No. 745.

¹ Haydak, M. H., and Palmer, L. S., *J. Econ. Ent.*, 1940, **33**, 396.

² Haydak, M. H., and Palmer, L. S., *J. Econ. Ent.*, 1941, **34**, 37.

³ Pearson, P. B., and Burgin, C. J., *Proc. Soc. Exp. Biol. and Med.*, 1941, **48**, 415.

† Acknowledgments are made to S. E. McGregor of the Bureau of Entomology and Plant Quarantine, U.S.D.A., for collecting the pollen.

⁴ Todd, F. E., and Bishop, R. K., *J. Econ. Ent.*, 1940, **33**, 866.

⁵ Pennington, D., Snell, E. E., and Williams, R. J., *J. Biol. Chem.*, 1940, **135**, 213.

⁶ Waisman, H. A., Henderson, L. M., McIntire, J. M., and Elvehjem, C. A., *J. Nutrition*, 1942, **23**, 239.

⁷ Wegner, M. I., Kemmerer, A. R., and Fraps, G. S., *J. Biol. Chem.*, in press.

TABLE I.
Pantothenic Acid Content of Pollen.

Plant source	No. of samples	Pantothenic acid					
		Water		Fresh		Dry	
		Avg %	Range %	Avg $\mu\text{g/g}$	Range $\mu\text{g/g}$	Avg $\mu\text{g/g}$	Range $\mu\text{g/g}$
Mixed and unidentified	19	16.3	8.7-35.3	22.1	12.7-34.0	26.9	14.7-52.6
Buckeye (<i>Ungnadia speciosa</i>)	2	21.9	10.8-33.0	34.5	30.0-39.0	45.9	33.6-58.2
Youpon (<i>Ilex vomitoria</i>)	2	31.5	29.0-33.5	35.0	29.0-42.0	51.4	43.6-59.2
Cherry laurel (<i>Prunus caroliniana</i>)	1	13.4	—	18.5	—	21.3	—
Willow (species unidentified)	1	13.8	—	18.8	—	21.8	—
Avg	25	17.8		24.4		30.3	

ditions. This might account for the variation in the amount of pantothenic acid in various samples of pollen. Evidence for a species difference is afforded by the pantothenic acid values for the Buckeye and Youpon pollens which are considerably higher than the Cherry laurel, Willow or the unidentified species. It is of interest to note that the pantothenic acid content of pollen is of the same order as that reported by Jukes⁸ for various plant materials. He reported values expressed in μg per g of dry material as follows: broccoli 46, kale 30, alfalfa 25, and spinach 10.

The pantothenic acid content of royal jelly is 511 μg per g of dry material.^{3†} Thus royal jelly contains about 17 times as much pantothenic acid as the average for pollen. This indicates that the honey-bee either has the ability to synthesize pantothenic acid or that there is a marked concentration of the

vitamin which is transmitted to the royal jelly. Of the B vitamins thus far studied, pantothenic acid is the only one in which the amounts in royal jelly and pollen are not of approximately the same order. The universal biological importance of pantothenic acid has been reviewed by Williams⁹ and from this it is evident that this vitamin is required by both the lower and higher forms of animal life. Unless it is subsequently established that the honey-bee is unique in being able to synthesize pantothenic acid, further support is afforded for the suggestion that this vitamin may be one of the factors responsible for the phenomenal properties of royal jelly in developing female larvæ into queen bees. When each of these factors has been individually determined and isolated it may then be possible to develop queen bees by artificial feeding.

Summary. Pollen samples have been assayed for pantothenic acid and found to contain an average of 30.3 μg per g on a dry basis. There is evidence that the pantothenic acid content of pollen varies with different plant species.

⁸ Jukes, T. H., *J. Nutrition*, 1941, **21**, 193.

[†] Haydak and Palmer (*J. Econ. Ent.*, 1942, **35**, 319) reported that royal jelly contains 0.68 to 0.78 μg of pantothenic acid per g. Recently Palmer advised the author by personal communication that fresh samples of royal jelly had assayed over 500 μg per g on a dry basis.

⁹ Williams, R. J., *Biol. Rev.*, 1941, **16**, 49.