

distillate with anhydrous copper sulphate and assaying the increase of weight of the latter has given low values in our hands.

In the present method the distillate is led into a known volume of a standard mixture of acetic anhydride and pyridine (1 : 3); when the hydrolysis is complete, the excess acetic anhydride is converted into an equivalent amount of acetic acid and acetanilide. The whole is then made up to a convenient volume and an aliquot part titrated against alkali. If x molecules of acetic anhydride were taken and the substance contained y molecules of water, the acetic acid finally obtained is $(x + y)$ molecules; since x is known, the value of y follows. The accuracy of the method is indicated by the fact that 1 c.c. of normal caustic soda solution corresponds to 0.018 g. of water, the problem resolving itself into the estimation of acetic acid in acetic anhydride.⁷

While a water-immiscible liquid is essential for the Marcusson procedure, a solvent such as dioxane, which is miscible with water and forms an azeotropic mixture containing 20% water and boiling at 86.8°/742 mm., can be conveniently employed for the hydrolytic method. Dioxane, however, needs to be carefully purified since ethylene acetal and other impurities in technical dioxane interfere with the estimation.

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¹ Marcusson, *Mitt. aus dem Konigl. Materialprüfungssamt*, 1904, 48.

² Tate and Warren, *Analyst*, 1936, 61, 367.

³ Friedrichs, *Chem. Ztg.*, 1929, 53, 287.

⁴ Bidwell and Sterling, *J. Assoc. Off. Agric. Chem.*, 1924, 8, 295.

⁵ Alexander, *Ind. Eng. Chem. Anal. Ed.*, 1936, 8, 314.

⁶ Migray, *Ind. Eng. Chem. Anal. Ed.*, 1935, 7, 348.

⁷ Menshutkin and Wasiljew, *J. Russ. Phys. Chem. Soc.*, 1889, 21, 190; "Report of International Glycerol Commission," *Analyst*, 1911, 26, 316.

Richmond, *Analyst*, 1917, 42, 133.

Rosenbaum and Walton, *J. Amer. Chem. Soc.*, 1930, 52, 3366.

Linkage between the Blackish Purple of Sheath and Glume, and Nucellar Brown in Sorghum.

THE grains of grain sorghum are mostly naked and lack the protection of enclosed glumes. Such protection is afforded in part by the seed coats (pericarp) which may be white or coloured. The colours may be degrees of yellow, red¹ or brown.²

Some varieties of sorghum possess a nucellar layer³ just above the aleurone layer. This layer is pigmented and is of a reddish brown colour. Lying under the mesocarp which is starchy and white, this nucellar colour is masked. Nevertheless, according to the thickness of the mesocarp this underlying "vinaceous drab" (Snowden)⁴ imparts a violet tint in the white chalky grained varieties, most noticeable in the variety *feterita*. This nucellar colour is usually absent in the Indian *Durra* group of sorghums. It is present in many African sorghums and is most marked in the *caffra* sub-series of sorghum.⁴ In *Sorghum caudatum*, Stapf. it finds its best representation and expression.

Regarding the nucellar layer Snowden⁴ writes as follows:—"The colour in the grain may be confined to the outer pericarp or it may be absent there but present in the nucellar-layer, or again it may be present in both regions. In the first case the coloured part is removed by husking the grain and the colour of the flour is not affected. In the other two cases, however, the colour present in the nucellar-layer cannot readily be separated from the flour and such grains produce a dirty coloured flour which is less esteemed for some purposes, such as making cakes or bread."

Almost all the varieties with brown nucellus are borne on plants whose leaf sheaths and glumes are blackish purple. The reddish purple leaf-sheaths and glume is largely in evidence in the *Durra* group of Indian sorghums. It has been noted that in this group there is an absence of nucellar brown.

The reddish purple pigment in the leaf sheath and glume has been shown to be dominant to the blackish purple.⁵ A factor Q is present in the former and absent in the latter. In crosses between varieties having nucellar brown and those not having them, the presence of nucellar brown has proved a simple dominant to its absence.⁶ Thus a reddish purple leaf-sheath and glume

and nucellar brown are dominant to a blackish purple leaf-sheath and glume and absence of nucellar brown, respectively.

An interesting experience is met with when varieties with a blackish purple leaf-sheath and nucellar brown are crossed with varieties having a reddish purple leaf-sheath and no nucellar brown. The first generation plants have both the dominant characters, reddish purple leaf-sheath and nucellar brown. In the second generation instead of the 9 : 3 : 3 : 1 ratio which the independent shuffling of these characters should give, there occurs the 2 : 1 : 1 : 0 ratio of double dominants, and parental groups, and an absence of the double recessive group. This shows that the gene *q* determining a blackish purple leaf-sheath is linked to the gene producing nucellar brown.

In a previous paper⁷ the linkage between the *Qq* (factors for leaf-sheath and glume colour) and *Bb* (factors for brown colour in dry anther and grain) has been reported. In the present instance it is the brown nucellus below the pericarp instead of the brown-wash on the pericarp. Both these manifestations of brown colour have this in common that they are linked to the *q* factor responsible for the blackish purple pigment on the leaf-sheath and glume.

A number of crosses between these African races and Indian races are under examination at the Millets Breeding Station, Coimbatore, and a fuller paper embodying the results will be published shortly.

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¹ *Ind. Jour. Agr. Sci.*, 1933, **3**, 594-603.

² *Ind. Jour. Agr. Sci.*, 1934, **4**, 81-89.

³ *Jour. Agr. Res.*, 1928, **37**, 577-588.

⁴ J. D. Snowden, *The Cultivated Races of Sorghum*, 1936.

⁵ *Ind. Jour. Agr. Sci.*, 1933, **3**, 589-594.

⁶ *Jour. Agr. Res.*, 1924, **27**, 53-64.

⁷ *Ind. Jour. Agr. Sci.*, 1934, **4**, 90-95.

Some Observations on the Ovule and Embryo-sac of *Sonneratia apetala* Ham.

A FEW observations on the embryology of *Sonneratia apetala* were made by Karsten¹ as early as 1891, but his work is rather

fragmentary and also erroneous in some points. A re-examination of this species has therefore been undertaken in connection with the writer's work on the embryology of the Sonneratiaceæ.²

Ovule.—The ovules are numerous, anatropous, two-integumented and possess a fair amount of nucellus. Both the integuments take part in the formation of the micropyle. The nucellus does not show a strand of specially differentiated cells in the chalazal region as seen in *Duabanga sonneratioides* and some members of Lythraceæ,³ but along with the ovule it is markedly bent in this dart towards the raphe.

Embryo-sac.—The primary female archesporium usually extends to more than one cell and more than one megaspore mother cells have been occasionally observed. Usually only one of them develops further. It cuts off a parietal cell, which by subsequent divisions gives rise to a 5-6 cells' thick parietal tissue above the embryo-sac. The formation of linear tetrad of megaspores is similar to that seen in *Duabanga sonneratioides*, and the chalazal megaspore is the functional one. It develops into the 8-nucleate embryo-sac after three successive free nuclear divisions in the normal manner. The mature embryo-sac (after the fusion of the polar nuclei) is 4-nucleate due to the early degeneration of the antipodals, just as in *Duabanga sonneratioides*³ and Lythraceæ. It is a long and narrow structure but even then it has never been seen to reach the epidermis at the micropylar end of the nucellus after crushing the parietal tissue as stated by Karsten.

The structure of the synergids and egg conforms to that observed in *Duabanga sonneratioides*. The polar nuclei meet at about the middle of the embryo-sac, move upwards and finally fuse with each other near the egg-apparatus.

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September 24, 1936.

¹ Karsten, G., *Bibl. Bot.*, 1891, 22 (as cited by K. Schnarf in *Vergleichende Embryologie Der Angiospermen*, 1931).

² Venkateswarlu, J., *Curr. Sci.*, 1936, **4**, No. 10.

³ Joshi, A. C., and Venkateswarlu, J., *Proc. Ind. Acad. Sci.*, B, 1936, **3**, 5.