

- (2) Absolute ethyl alcohol can be a good substitute for the expensive acetone-free methyl alcohol in the preparation of stain solutions required for simultaneous fixation and staining of blood films.
- (3) Even 95 per cent. alcohol can be used in the preparation of solutions of Giemsa type where fixation of thin smears is done separately and that of thick smears is unnecessary.
- (4) Ethyl alcohol, in the preparation of Leishman type solutions for staining at higher atmospheric temperatures, is definitely superior in use to the volatile methyl alcohol.

My best thanks are due to Prof. J. N. Ray, Director of Drugs and Dressings, for his kind interest in the work.

Central Research Institute,
Kasauli, and

Drugs & Dressings Directorate,
Directorate-General of Supply,
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April, 24, 1944.

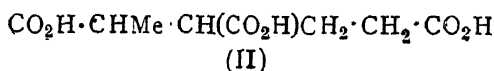
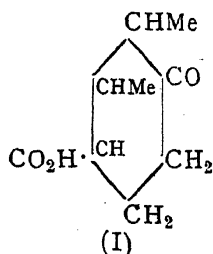
B. S. Roy.

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REARRANGEMENT OF SANTENONE-QUINONE

SAMUEL AND MANASSE¹ found that camphor-quinone on treatment with concentrated sulphuric acid undergoes molecular rearrangement to give a keto-acid, $C_{10}H_{16}O_3$, which has been definitely shown by Simonsen and his co-workers,² to be 2:2:3-trimethylcyclohexan-1-one-4-carboxylic acid. It has now been found that *dl*-santenonequinone^{3,4} (prepared by the oxidation of santenone with selenium dioxide), under precisely similar conditions, furnishes 2:3-dimethylcyclohexan-1-one-4-carboxylic acid (I), m.p. 132° (*semicarbazone*, m.p. 191°). The structure of the ketonic acid has been proved by degradation and by synthesis.

In the first instance, it has been found that this keto-acid on oxidation with nitric acid furnishes a tribasic acid, m.p. 181-82°, identical with a sample of *α*-methylbutane- $\alpha\beta\delta$ -tricarboxylic acid (II), prepared by the condensation of ethyl β -chloropropionate with ethyl α -cyano- β -methylsuccinate⁵ in presence of sodium ethoxide followed by hydrolysis of the resulting product. The formation of an acid of structure (II) by oxidation can readily be explained on the basis of structure (I) for the keto-acid.



The keto-acid itself has been synthesised by a simple and unambiguous method as follows:

Ethyl $\alpha\beta$ -dimethylacrylate has been condensed with ethyl cyanoacetate in presence of sodium ethoxide in the usual manner. The resulting sodio-salt reacts quantitatively with ethyl- β -chloropropionate to give ethyl γ -cyano- $\alpha\beta$ -dimethylpentane- $\alpha\gamma\epsilon$ -tricarboxylate, b.p. 200-204°/6 mm., which on hydrolysis and subsequent esterification furnishes ethyl $\alpha\beta$ -dimethylpentane- $\alpha\gamma\epsilon$ -tricarboxylate, b.p. 178°/7 mm. The triethyl ester on cyclisation with finely divided sodium yields ethyl 2:3-dimethylcyclohexan-1-one-4:6-dicarboxylate, b.p. 170°/8 mm. 2:3-Dimethylcyclohexan-1-one-4-carboxylic acid (I), m.p. 132° (*semicarbazone*, m.p. 191°) as obtained by hydrolysis of the above ketonic ester has been found to be identical with the ketonic acid formed by the rearrangement of santenonequinone.

My grateful thanks are due to Dr. J. C. Bardhan for the facilities offered to me and for his kind advice and criticism.

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March 20, 1944.

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THE OCCURRENCE AND INHERITANCE OF A NEW TYPE OF HAIRINESS IN ASIATIC COTTONS

APART from the degree of hairiness ranging from glabrous to a densely hairy plant-body, there is variation in the type of hairs on the cotton plant. Youngman and Pande¹ in their study of the epidermal outgrowths in the genera *Thespesia* and *Gossypium* describe two types of hairs, (i) the single hair-unicellular outgrowths and (ii) the stellate hair which originates from tufts of several cells fused at their bases.

A microscopical examination of hairiness in a large number of cotton types both *arboreum* and *herbaceum* at Indore has shown that both the types of hair, single and stellate, are present in all the types but while the single hair

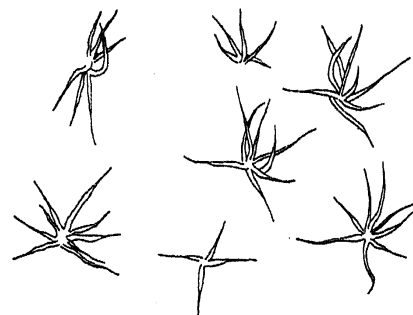


FIG. 1

is distributed all over the plant-body the stellate hair is mostly confined to the foliar organs, leaves, bractioles and petals. The number of rays in the stellate hair varies from 2 to 12, the most common number being 8 for *arborescens* and 6 for the *herbaceums* (Fig. 1). The length of the hair is generally found to be longer in the *herbaceum* than in the *arborescens*. In *G. tomentosum* which has a characteristic dense hairiness, the effect of gene H^{to} , Harland,² the hairs are all stellate with 8 rays interspersed occasionally with stellate hairs of larger number of rays in addition to single hairs to be found mainly on the leaf veins.

A new type of stellate hair (Fig. 2) has now been discovered in a *herbaceum* mutant, Viramgam lintless, where the stellate hair has

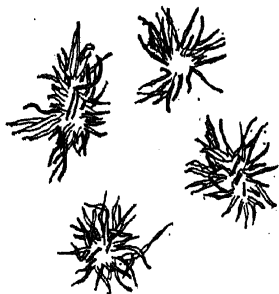


FIG. 2

20-30 short rays as against 2-12 found in other types. The distribution of this type of stellate hair over the plant-body is the same as in the ordinary stellate type. This hair gives the plant organs a characteristic waxy appearance. The leaves have a gritty feel and on rubbing with the fingers the grit comes off easily. This type of hairiness has so far not been met with in any other cotton. It may be mentioned here that this stellate hair does not



FIG. 3

correspond to the peltate scale of *Thespesia* described by Youngman. Whereas the rays of the stellate hair are free almost to four-fifths of their length, in *Thespesia* the rays are fused almost the whole length with the ends only free.

Evidence is here presented to show that this new type of stellate hair is due to a single gene designated H^{vi} and it is recessive to the

normal hair and that this gene is independent of the lintless gene *lid* (Govande)³ of Viramgam lintless in its inheritance.

This new type had been crossed with three other types mentioned below mainly for studying the inheritance of lintlessness and incidentally the behaviour of the stellate hair was recorded in the F_1 's and F_2 's.

Types	Species
1. Wagad lintless 2. Nandyal lintless	<i>G. herbaceum</i> var. <i>frutescens</i> <i>G. arboreum</i> var. <i>typicum</i> forma <i>indica</i>
and 3. N_6 .	A synthetic multiple recessive

The F_1 's, ratoons of last year (the observation was not made in the first crop) do not show any marked difference from the normal except that they appear a little more pubescent than the parents. Examination of the leaves under the microscope showed the normal stellate hairs with 6-8 rays somewhat longer than in the Viramgam lintless parent with occasional hairs having 12-16 rays. There was clear segregation for the type of stellate hair in the F_2 , even for naked eye but two leaves of each plant were examined under the microscope and scored, keeping the normal and F_1 type together as the separation between the two was rather difficult, the main difference between the two being in the number of rays.

	Segregation			
	Normal	Viramgam Stellate	Total	χ^2 3:1
1. Viramgam lintless × Wagad lintless	133	69	169	1.23
2. Viramgam lintless × Nandyal lintless	101	28	129	0.75
3. Viramgam lintless × N_6 .	70	15	85	2.45

The fit is not bad although in all the three crosses there is a consistent excess of the normal. There could, however, be little doubt about a single gene difference. Plants typical of the Viramgam stellate type were recovered only in the cross between the two herbaceums, Viramgam lintless × Wagad lintless, whereas in the other two crosses, interspecific, the stellate type was modified to a certain extent in that the number of rays of the stellate hair was slightly reduced, about 20 only, and the rays were also slightly longer than in the Viramgam type.

The two crosses, Viramgam lintless × Wagad lintless and Viramgam lintless × Nandyal lintless have not produced any bolls yet but the cross Viramgam lintless × N_6 has started producing bolls nine months after sowing.

Examination of the bolls in the last cross has shown that some of the plants with the Viramgam stellate hair are linted and that some of the lintless segregates have normal hairs, indicating that the lintness gene *lid* is independent of H^{vi} in its inheritance.

The work here reported was conducted as part of the Cotton Genetics Research Scheme, Indore, financed by the Indian Central Cotton Committee. We are indebted to Mr. P. D. Gadhari who made the Viramgam lintless crosses when he was at Indore.

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Indore, C.I.,
May 1944.

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STUDIES ON THE PHYSIOLOGY OF MUSTARD

A NUMBER of experiments on the fundamental aspects of the physiology of growth and development, with reference to time of flowering and fruiting of mustard plant was devised with selected varieties of the Agricultural Department, Bengal, Tori No. 7 and Rai No. 5 in pots with five replicates and twenty individuals in each case and the results are reported below.

(1) *Effect of time of sowing*.—Sowings of the two varieties at interval of 15 days commencing from 1-9-'43 to 15-11-'43 were investigated.

In Tori, the flowering time for the five sowings varied between 16 and 20 days and the time of fruiting between 24 and 28 days. There is thus no significant effect of the time of sowing on the time of flowering and fruiting, though it is evident that temperature, humidity and length of day gradually decreased as the sowing time was delayed. It was, however, found that all plants sown on 1-9-'43 and 20 per cent. of those sown on 16-9-'43 failed to set seed.

In Rai for the six sowings on 1-9-'43 and the subsequent dates the times of flowering were 46, 44, 34, 26, 27, 27 days and the times of fruiting 55, 55, 43, 40, 39 and 38 days. It is thus seen that the vegetative period gradually shortened from 46 to 27 days from the first to the fourth sowing and then remained more or less constant in the last three sowings.

(2) *Photoperiodic effect*.—To study the effect of length of day on flowering and fruiting time, two sets of experiments were devised. In the first set with the two varieties, sown on 16-9-'43 plants were exposed to 14 hours and 10 hours light period when the control were exposed to normal daylight which gradually decreased from 12 hrs. 15 mins. to 11 hrs. 26 mins. The prolongation of light period was done by exposing the plants to electric light from a 100 c.p. bulb in a chamber at a dis-

tance of 5 feet from the pots, after sunset for the additional period and the shortening was done by taking the pots in a dark chamber for the required period before sunset and then brought out. It was found that with 14 hours the flowering time was 42 days and with 10 hours 53 days against 44 days in the control for Rai and for Tori the flowering time was 20 days for 14 hours, 22 days for 10 hours and 20 days for the control. It is thus seen that in Rai the shortening of light period prolonged the vegetative phase and for Tori the effect is negligible.

The second set was therefore designed with Rai only. Sown on 15-11-'43 and the light period used were 16 hours, 14 hours, 10 hours and 8 hours as against control where the light period gradually decreased from 10 hrs. 56 mins. to 10 hrs. 36 mins. The flowering time was 24 days for 16 hours, 26 days for 14 hours, 33 days for 10 hours and 47 days for 8 hours as against 27 days in the control. Shortening the light period thus shows a lengthening of the vegetative period in this set also though the actual flowering time in light periods common to both sets was much greater in the first set.

In the experiment on photoperiodism it is found by a comparison of the two sets of experiments with Rai sown on 16-9-'43 and 15-11-'43 that in the second set the vegetative periods were shorter than those in the first set for the same light periods used. In the time of sowing experiments also the flowering time became gradually shortened with lateness of sowing, though according to the photoperiodic effect recorded for Rai, the flowering time should have become gradually longer as the daily light period gradually decreased with lateness of sowing from 12 hrs. 34 mins. to 10 hrs. 35 mins.

It is, however, seen that the temperature gradually decreases from September to December the monthly mean temperatures for September, October, November and December being 29.2° C., 28.5° C., 24.0° C. and 21.4° C. It appears, therefore, that the vegetative period shortens with lower temperature, but for the sowings on 15-10-'43, 1-11-'43 and 15-11-'43, it is more or less the same. It seems thus that 24-27 days is about the minimum vegetative period which is not further decreased either by lower temperature or by longer photoperiod under conditions of the experiment.

Thus it may be concluded that a longer vegetative period in the first set of photoperiodic experiments and a gradual decrease in flowering time in case of time of sowing experiments is due to the vegetative period being shortened with decrease of temperature. Under conditions of experiment of the two varieties studied the time of flowering in Tori seems to be practically indifferent to light period and to the time of sowing, though Rai shows a lengthening of vegetative period with the shortening of the light period and a greater shortening of the vegetative period is observed with increased temperature range and this confirms Sen and Chakrabarty's findings (1942). In the time of sowing experi-