RESEARCH ITEMS.

Binary Quadratic Forms with a Single Class-determinant in each Class.—A. Hall (*Math. Zeit.*, 44 Bd., pp. 85–91) has given certain conditions that the discriminant of a quadratic field (discriminant negative) has to satisfy in order that there is exactly one class of forms in each genus. After Heilbronn proved that the number of classes of quadratic forms with discriminant $\sqrt{-D}$ tends to ∞ with D, S. Chowla showed that the number of classes of quadratic forms in each genus also tends to ∞ with D. Gauss had conjectured that there were only 65 numbers for which the number of classes in each genera is unity. Now Hall has given a number of conditions that D satisfies, in order that it is unity, so that he has contributed a good deal towards the settling of Gauss's conjecture. Some of the theorems he proves are given below:

(1) If $D = 7, 15, 12$, or $0 \pmod{16}$,
$D \neq 7, 15, 12, 28$ or 60,
$D \neq 16n$ or $64n$, $n = 1, 3, 7, 15$
$D \neq 32 \pmod{64}$, the number of classes in any genera is always greater than unity.

(2) If p^2/D, p, a prime number the same result is true except for a finite number of values of D.

K. V. I.

Remarks on a Sequence.—An interesting property of the sequence $[n\alpha]$ where $[x]$ denotes the highest integer contained in x has recently been noticed by Sprague (*Math. Zeit.*, pp. 20–22). It is obvious that the sequence $[n\alpha]$ contains the sequence $[n \,.\, (r\alpha)]$ where r is any integer. Now apart from this trivial case does the sequence $[n\alpha]$ contain another sequence $[n\beta]$ which is not trivial in the previously explained sense? The author has shown by easy calculations [α and β are of course irrational] that $\alpha > 2$ is the criterion for the above property. If α is > 2 and l any integer $> \frac{1}{\alpha - 1}$, then the sequence $\left[n \,.\, \frac{\alpha}{l + 1 - l\alpha}\right]$ is a subsequence of the sequence $[n\alpha]$. In terms of irrational numbers the result becomes the following:—If $\frac{\alpha}{\beta}$ is irrational $\alpha > \beta > 0$, then between any multiple of α and any multiple of β there does lie some multiple of $\frac{\alpha \cdot \beta}{\alpha + \beta}$; if the distance between the multiples considered be $< \beta$, then the interval does not contain any multiple of $\frac{\alpha \cdot \beta}{\alpha - \beta}$.

K. V. I.

Sol-Gel Transformations: Sols, Jellies and Curds of Sodium Oleate.—An exceedingly interesting paper on the nature of jellies and curds of sodium oleate has been published by E. Heymann (*Trans. Faraday Soc.*, 1938, 34, 689). Sodium oleate gel is a unique system in that it can exist in two forms, the clear jelly and the opaque curd. By a study of the electric conductivity of these forms Laing and McBain have previously shown that the sol and jelly of sodium oleate which are similar, differ from the curd in structure. Further elucidation of the nature of this difference has been made by the author by a study of the densities of the system sodium oleate-water in its three states and the volume change during the sol-clear jelly-curd transformation.

20·5 per cent. solutions when cooled to 14.8° C. showed the sol-jelly transition, after several hours, followed by the clear jelly-curd transformation which was complete after several days (sometimes 2 to 3 months). The time after the first appearance of the curd nuclei till the curd formation was complete increased with increasing purity of the soap, obviously indicating that small amounts of impurities may act as centres of crystallisation.

There was no change in volume, when the clear jelly was formed from the sol. As soon as the curd formation began the volume decreased and a strong volume contraction was observed with progressive curd formation. The latter observation is significant in view of the fact that in other sol-gel transformations, volume increase owing to decrease in hydration is usually noticed.

By the measurement of densities, it was found that the observed specific volume of the sodium oleate solution was equal to that calculated from its components thereby showing the absence of electrostriction (volume contraction). The salts of lower fatty acids however (*e.g.*, sodium acetate) show very significantly electrostriction. This is obviously due to hydration as a consequence of dissociation and of the dipole moment of the COONa group. The action of this group cannot however differ much with salts of higher fatty acids. Therefore the absence of electrostriction observed is only apparent and attributed to the counteracting process which takes place simultaneously in sodium oleate solution.

The volume change during the process of dissolution of sodium oleate directly in water has been investigated. Sodium oleate swells in water giving an opaque curd which is quickly transformed into a clear jelly. Numerous experiments on soap + water → curd → clear jelly transformations show a decrease of volume in the first stage and an increase in the latter.

This significant observation on the volume decrease in clear jelly-curd transformation or the increase in the reverse process, which cannot be explained on the basis of hydration, is attributed to a change in the micellar arrangement. The liquid micelles in the sol and the clear jelly being structureless and non-crystalline are more loosely built than the crystalline particles of the curd. Therefore there is close packing of the micelles in the latter and sparse disorderly arrangement in the former. This interesting picture of the arrangement of the micelles in the soap curds and jelly explains satisfactorily the anomalous volume change associated with the clear jelly-curd transformation.

K. S. Rao.

Seeds and Germination.—As a result of studies initiated in the Boyce Thompson Institute for Plant Research, Willlam Crocker has defined several classes of seeds in respect of the causes of their delay in germination and has worked out methods for shortening or completely overcoming the delay (*Professional Paper*, April 1936, **1**, No. 29). He finds that the hard coated seeds protect the embryos against the action of moisture and oxygen of the air, and are capable of maintaining their vitality in herbaria and seed cupboards for a century and a half. Filing the hard coat or softening it with hot water or sulphuric acid treatment and then abrading the outer coats are the methods suggested for accelerating germination. Seeds which are impervious to the oxygen supply of the embryos or, are sensitive to light, germinate when planted with little or no soil over them. In the case of seeds of the temperate zone the low temperature stratification ranging from 30° F. to 50 or 55° as a means of after-ripening them for germination, has been found to induce chemical and enzyme changes, necessary to induce the embryos to break the coats. Miss Flemion of this Institute has developed a method by which the viability of even the slowest germinating seeds can be determined. The process consists in removing the embryos from the seed coats and placing on moist filter-paper in Petri-dishes. The live embryos enlarge and in light become green. This method may prove of great value to the seed industry, especially for slow germinating seeds.

A Beetle Pest of Sugarcane.—An account of what threatens to be a serious insect pest of sugarcane in Burma on account of which in extreme cases the cultivation itself has had to be given up in some areas and of a study of various methods of combating the pest is given by C. G. Ghosh (*Ind. J. of Agric. Sci.*, **8**, Part VI). The pest is the black Dynastine beetle *Alissonotum impressicolle* Arr. of which both the larval and the adult forms are responsible for the damage; the larvæ are more serious to ratoon canes than the adults and are capable of killing off entire fields by gnawing away the roots in the course of a few months. The attack is serious only where the ratooning of cane is practised; if the cane crop should be grown only as an annual crop and if it should, in addition, be followed by a non-cereal crop, the beetle can be wholly overlooked. In Burma however, the practice is said to be to ratoon the cane continuously; three ratoons are common and even a fourth and fifth are mentioned. The conditions are, therefore, ideal for the increase of the pest. In addition to the life-history of the pest most of the familiar methods of control were tried, and studied. None of these methods was found to be satisfactory. Among the varieties tried, *viz.*, D. 74, EK 2D, B.H. 10-12, Striped Mauritius, Gilman, POJ 2727 and 2878, F 74, S Mau, Pyinmana Red and Yellow, and Co. 210, 213, 214 and 281, none was found immune; the Co. 213 was however more resistant than the thick canes. Birds, insect and fungal enemies exercised little check. Traps and baits, fumigants like carbon disulphide, potassium cyanide, paradichlorobenzene and several proprietory preparations like Seekay, R.V. 4, etc., were also ineffective. Among cultivation methods, fallowing was the only one which appeared promising, and this and a restriction of the practice of ratooning are recommended for keeping down the pest. Attention is also drawn to experience elsewhere, *viz.*, to the success with the predatory giant toad, *Bufa marinus*, introduced from Barbados to control the allied pest May beetle in Puerto Rico and in the Mauritius, Hawaii and the Philippines; and a trial of this biological method of control by means of the toad enemy is recommended as an important control measure. A. K. Y.

The Lodging of Cereal Grains.—Yet another contribution to the numerous studies on the subject of the lodging of cereal grains is one on the relation of certain plant characters to strength of straw and lodging in winter wheat by I. M. Atkins (*Jour. of Agric. Res.*, **56**, No. 2). The characters studied were breaking strength of straw, height of plant, length of the lower internodes, date of maturity, weight of grain per 100 heads, weight per 100 culms, diameter of culms at base, and stand. The studies relate to a four-year period from 1931 to 1934; the number of varieties varied from 18 in 1931 to 129 in 1934; the studies were made at the Texas-Sub-station, No. 6, Denton, U.S.A., but use was also made of data relating to the same varieties which were grown at other experiment stations. There was considerable variation in the amount of lodging in the different years due apparently to the seasons but taken in conjunction with results on the other experiment stations, the author considers the data sufficiently satisfactory for drawing conclusions. It is shown that lodging is dependent on a number of factors that vary greatly from year to year making it difficult to find any one index that may be considered reliable. Relative breaking strength of straw is shown to be fairly constant from year to year and the relation of this factor to lodging tendency appears to be high enough to justify its use for evaluating new varieties in respect to lodging. A more satisfactory character for such use however is found to be the weight per unit length of culm taken near the base of the plants; the correlation in this case was much higher between lodging and breaking strength of straw. It is suggested that this character may therefore be used as an index of lodging in preference to the breaking strength of straw as it has the additional advantage of easier and quicker measurement and requires no special apparatus. The weight per unit length of culm taken by the author is the weight of a 10 cm. section including the one node between the first upright internode above the crown of the plant and the one immediately above. A. K. Y.