watt bandi (contour ridging), with the result that even for single catchment areas up to 45 sq. miles in extent, no severe floods have been recorded in the syphons for many years past. This is a rather remarkable result. Intensified cultivation methods, chiefly accurate terracing and properly maintained *watt bandi*, appear to be the main factor in effecting this change, though the training of three of the large south-face Pabbi torrents by the reclamation work above Kharian may also be to a smaller extent responsible for this.

SUGGESTED LINES OF TREATMENT.

With the data now available the various torrents can be classified according to their destructive tendencies, and reclamation work concentrated from the worst offenders. Such work in areas already closed to grazing consists of (i) "gully plugging" with a series of small stone bunds in the heads of each *nala* branch, not to store water but to delay the run-off; (ii) improvement of cover on all slopes by afforestation (iii) the training of the *nala* bed by planting its banks and bed with tall grasses. The object of all such work is to destroy the dangerous "peak" of sudden flood by distributing the run-off over a longer period and providing better conditions for seepage throughout the whole of the catchment. For non-forest land and areas subject to heavy grazing, the first essential is to get control of the grazing and effect a drastic reduction in the number of live-stock. Once this has been arranged, nature will herself improve the porosity by producing a better ground cover; where grazing has reduced the place to a waste of shifting sand, the natural process of recovery is a desperately slow one, but this can be hastened by the appropriate reclamation treatment.

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The Genes of *Triticum Timopheevi* Zhuk., *Secale cereale* L. and *Haynaldia villosa* Schur.

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THE basic chromosome number of the genus *Triticum* and its allied genera (*Secale*, *Haynaldia*, *Aegilops*, *Agropyrum*, *Elymus*, etc.) is 7. The species of the genus *Triticum* are divided into three groups according to the chromosome number, namely, (1) diploid wheats or *monococcum* group with $n = 7$, $2n = 14$, (2) tetraploid wheats or *durum* group with $n = 14$, $2n = 28$, and (3) hexaploid wheats or *vulgare* group with $n = 21$, $2n = 42$ chromosomes. The gene of the diploid group consisting of 7 chromosomes is designated with A or the whole gene formula of the diploid wheats is AA. Tetraploid wheats have gene A of diploid wheats and another gene designated with B. Hence the gene formula of the tetraploid wheats will be AABB. Hexaploid wheats contain both (A and B) genes of the tetraploid wheats, and in addition to these another gene, designated with C. (Japanese investigators designate this gene with D.) The formula of the hexaploid wheats will be then AABBCC. These gene formulas were stated by Sax (1921), Kihara (1924–1934) and many others.

In 1923 Zhukovsky found in Georgia a new wheat form and described it first as a variety of *Tr. dicoccoides* Schul., (1923), while 5 years later (1928) he gave it the specific name *Triticum Timopheevi* Zhuk. It has $n = 14$, $2n = 28$ chromosomes.

Interspecific crosses between *Tr. Timopheevi* and the other species of *Triticum* were produced with difficulty. The hybrids obtained were usually self-sterile. Single grains were rarely obtained from *Tr. vulgare* × *Tr. Timopheevi* and from *Tr. persicum* × *Tr. Timopheevi* hybrids, while the hybrids amongst the other tetraploid species (AABB) are usually fully fertile. The pentaploid hybrids (AABBC) are partially fertile, *i.e.*, more fertile than the hybrids AABB × *Tr. Timopheevi* and AABBCC × *Tr. Timopheevi*.

Such a peculiar behaviour of *Triticum Timopheevi* suggested the idea of studying the behaviour of the genes of this species. In the triploid hybrids produced by crossing *Tr. monococcum* (AA) with *Tr. Timopheevi* and *vice versa*, the chromosomes with gene A, form most frequently chiasmata with 7 chromosomes of *Tr. Timopheevi*, while the other 7 chromosomes remain as univalent.

(Less than 7 bivalents, as well as trivalents occasionally occur. More detailed description will be given elsewhere—see Kostoff 1936, *a. b.*) Hence *Tr. Timopheevi* has, roughly speaking, one gene homologous with gene A.

In order to study the relations between the second gene of *Tr. Timopheevi* in respect to the other two *Triticum* genes (B and C) crosses were made between AABB *Triticum* species and *Triticum Timopheevi* as well as between AABBCC *Triticum* species and *Triticum Timopheevi*. Both tetraploid as well as pentaploid hybrids were successfully produced with *Tr. Timopheevi* (Kihara and Lilienfeld did not succeed in producing pentaploid hybrids).

Cytological studies of the chromosome behaviour during the I metaphase in the PMC (pollen mother cells) of *Tr. Timopheevi* × *Tr. durum* var. *melonopus* and *Tr. Timopheevi* × *Tr. persicum* var. *stramineum* showed that various number of chromosomes with the second gene of *Triticum Timopheevi* conjugate with gene B of *Tr. durum* and *Tr. persicum*; therefore it was called β-gene. It should be noted here that many more chromosomes with gene β formed chiasmata with the chromosomes having gene B of *Tr. persicum*, while somewhat less of them formed chiasmata with the chromosomes having gene B of *Tr. durum*. In the hybrid *Timopheevi* × *persicum* — 10–12 bivalents were found. In single cells even 14 were observed. (Polyvalents occurred too.) In the hybrid *Timopheevi* × *durum*, however, 9–10 bivalents were most frequently observed. (Detailed description will be given elsewhere—Kostoff 1936, *a. b.*) The chiasma formation between the chromosomes having gene B of the tetraploid wheat species with those having the gene of *Tr. Timopheevi* indicate that this gene is partially homologous with gene B. It should be mentioned here that gene β was designated by Kihara and Lilienfeld (1934) with G and considered as non-homologous with B, their data, however, were almost similar to that we obtained.

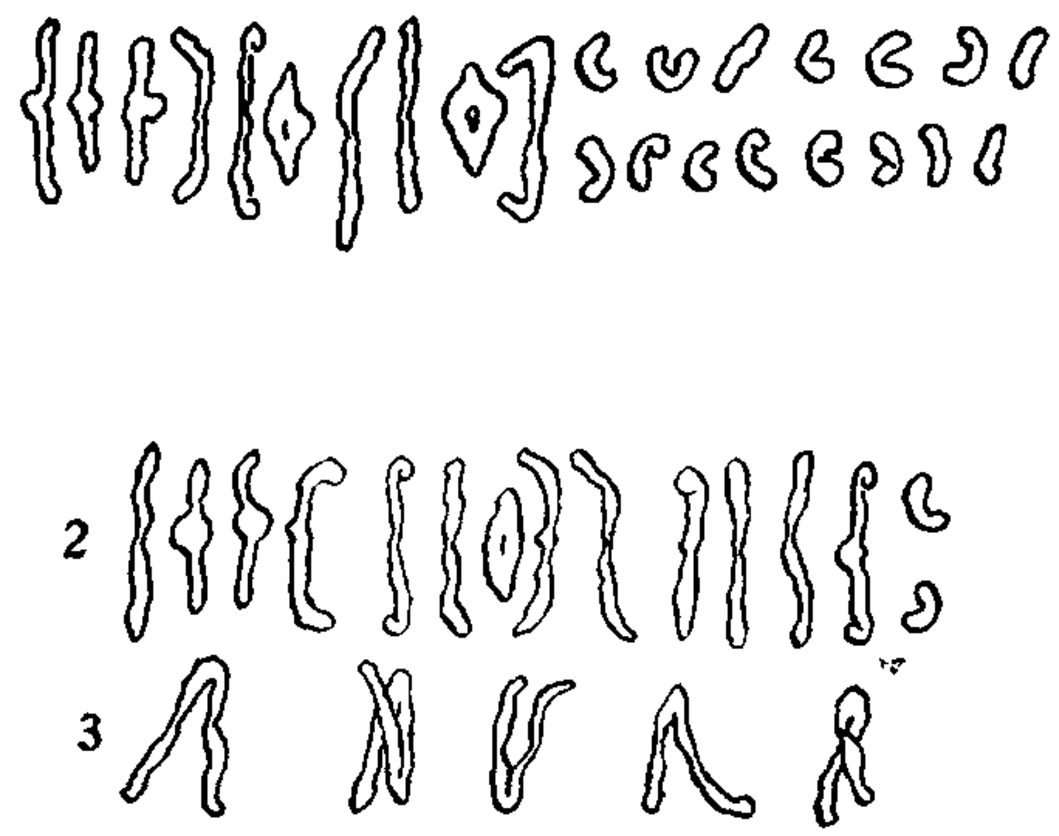

Fig. 1.
The Chromosomes from a pollen mother cell of the hybrid *Tr. compactum* × *Tr. Timopheevi*—10 bivalents and 15 univalents.

Fig. 2.
The chromosomes from a pollen mother cell of the hybrid—*Tr. Timopheevi* × *Tr. persicum*—13 bivalents and 2 univalents.

Fig. 3.
Polyvalent chromosomes from various cells *Tr. Timopheevi* × *Tr. persicum*.

The pentaploid hybrids (AABβC) between *vulgare* wheat (AABBCC) and *Tr. Timopheevi* (AAββ) had about the same number of bivalents as those observed in the tetraploid hybrids (AABβ) between *durum* wheats (AABB) and *Tr. Timopheevi*. (Detailed description will be given elsewhere—Kostoff 1936, *a. b.*) These observations indicate that the gene is not homologous with gene C.

It was interesting to find out the relations between the genes of *Triticum* and those of *Secale cereale* ($n = 7$, $2n = 14$), gene S and *Haynaldia villosa* ($n = 7$, $2n = 14$), gene V. Therefore a series of hybrids were produced and cytologically investigated.

The studies of the hybrid *Tr. dicoccum* × *Haynaldia villosa* showed that 0, 1, or 2 bivalents with one chiasmata usually occur in the I metaphase of the PMC's. These observations showed that V gene of *Haynaldia* is not homologous with A and B genes of *Triticum*. In studying the hybrid *Tr. vulgare* var. *Novinka* × *Haynaldia villosa* (*i.e.*, ABCV) somewhat more bivalents were found, but they seem to be rather due to *autosynthesis* between the chromosomes having A, B and C genes than to *allosynthesis* between the chromosomes with C and V genes. (Detailed description will be given elsewhere.) In the hybrid *Tr. Timopheevi* × *Haynaldia villosa* (*i.e.*, AV) 0, 1, 2 and 3 bivalents were observed. It seems that β-gene has somewhat greater affinity with V gene, than A and B genes, but since, very often, only univalents were found in the hybrid *Tr. Timopheevi* × *Haynaldia villosa*, we can safely infer absence of homology between β- and V genes.

Secale cereale (S) gene behaves in a similar way to the gene of *Haynaldia*

villosa (V). In studying the hybrids *Tr. turgidum* × *Secale cereale* (*i.e.*, ABS) and *Tr. vulgare* × *Secale cereale* (*i.e.*, ABCS) we obtained data which showed that S gene is not homologous with genes A, B and C of *Triticum*. Similar data were reported by other students (Lebedeff, 1932; Müntzing, 1935, etc.). The relation between the *Secale* (S) gene, and β-gene of *Tr. Timopheevi* was not however studied. Kihara and Lilienfeld's attempts to cross *Tr. Timopheevi* with *Secale cereale* were unsuccessful. We raised in 1935 two hybrids *Tr. Timopheevi* × *Secale cereale* (*i.e.*, AβS). It was possible to study cytologically one of them. The absence of bivalents in the I metaphase of PMC's in the hybrid and the appearance of only one or sometimes of two bivalents with one terminal chiasma showed that β-gene is not homologous with S gene.

But what is then the relation between V gene (of *Haynaldia villosa*), and S gene (of *Secale cereale*)? Numerous attempts were made to cross *Secale cereale* with *Haynaldia villosa* but they were always unsuccessful. We produced, in 1931, only one hybrid and it died at an early stage of development. Recently, we followed another way in combining the gene of *Secale cereale* (S) with that of *Haynaldia villosa* (V), namely, by using a bridge species. *Tr. dicoccum* served as one such. In crossing the hybrid *Tr. dicoccum* × *Haynaldia villosa* (*i.e.*, ABV) with *Secale cereale* (S) a trigeneric triple hybrid with 28 chromosomes (ABVS) was produced which contained all A, B, V, and S genes. In studying the meiosis of this hybrid we found usually 28 univalent chromosomes, or 1 bivalent and 26 univalents. Such a behaviour of the chromosomes during the I metaphase of the trigeneric hybrid shows that gene S is not homologous with gene V. (Detailed description will be given elsewhere by Kostoff and Arutinnova.)

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The Photoisomerides of Ergosterol.

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IT is not the intention of this resumé to trace the history of the recognition and characterisation of vitamin D (the antirachitic accessory food factor),[1] but rather to deal with the chemistry of calciferol. It is necessary, however, at the outset to emphasise that abundant evidence has accumulated which shows that vitamin D of cod-liver oil and other natural sources is not identical with calciferol, the antirachitic photoisomeride of ergosterol.[2]

That ergosterol on irradiation is converted into a material with strong antirachitic activity was demonstrated independently by Rosenheim and Webster,[3] and by Windaus and Hess.[4] The first crystalline photoisomerides of ergosterol to be isolated were the suprasterols I and II formed by prolonged irradiation of a solution of ergosterol[5]; they are physiologically inactive and no longer exhibit selective absorption in the ultraviolet region of the spectrum. If however, ergosterol be carefully irradiated to give a product of maximum physiological activity, unchanged ergosterol can be removed by taking advantage of the fact that the irradiation products, in contrast to ergosterol, are not precipitated by digitonin. Bourdillon *et alia*,[6] isolated a crystalline product with a high antirachitic potency by high vacuum sublimation of the resin so obtained; this product was later shown to be a mixture of calciferol, m.p. 114–117°, possessing an enhanced antirachitic activity, and a physiologically inactive pyrocalciferol.[7] Almost

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[1] For such a summary see Heilbron, *J. Soc. Chem. Ind.*, 1936, **55**, 1219.

[2] Steenbock, *et alia*, *J. Biol. Chem.*, **1932, 97**, 249; Ender, *Z. Vitaminforsch.*, **1933, 2, 241**; Rygh, *Nature*, **1935, 136,** 396.

[3] *Biochem. J.*, **1927, 21,** 389.

[4] *Nachr. Ges. Wiss. Göttingen*, **1927**, 175.

[5] Windaus, Gaede, Köser and Stein, *Annalen*, 1930, **483,** 17.

[6] *Proc. Roy. Soc.*, B, 1930, **107,** 76.

[7] Askew, Bruce, Callow, Philpot and Webster, *Proc. Roy. Soc.*, B, **1932, 109,** 488.