metacentric; the sex chromosomes were similar and both taxa had an indistinguishable pair of acrocentrics with prominent satellites. These data, particularly the common occurrence of satellited chromosomes, suggest that xerine ground squirrels and certain Asian tree squirrels may have evolved from common ancestral stock, a hypothesis amenable to further testing by means of G-band comparisons.

Finally, the discovery of $2n = 38$ in xerine ground squirrels, an old group that diverged from other squirrels early in its history, lends support to our earlier postulate that the ancestral chromosome complement of the subfamily Sciurinae was in the range of $2n = 38$–40[14].

ВЫВОДЫ. Хромосомы африканских земляной белки, *Xerus rutilus*, не отличаются от тонкопалого суслика, *Spermophilopsis leptodactylus*, из Средной Азии. Кариотип содержит 6 метацентрических, 20 субметацентрических, и 2 акроцентрических аутосом с хорошо выраженными спутниками. *X*-хромосома – метацентрик; *Y*-хромосома – очень маленькая. Хромосомный сходство оказывает поддержку для включения *Spermophilopsis* в трибу Xerini.

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Gamma-Radiation Induced Variation in some Morphological and Nutritional Components of *Cicer arietinum* L. cv. Chhola

All the prevalent commercial cultivars of *Cicer arietinum* L. in Pakistan possess an adequate nutritive value[1] but are low-yielding and susceptible to the gram pod-borer; *Heliothis armigera* Hb. This study with *C. arietinum* L. cv. Chhola has assessed the acute gamma radiation effects on the morphological and nutritional parameters.

Materials and methods. Seven 50 g seed lots of one year old *Cicer arietinum* L. cv. Chhola at 9.4% moisture content were given single γ radiation exposures of 1.0, 2.0, 3.0, 4.0, 5.0, 7.5 and 10.0 Kiloroentgens (kR) from a ^{60}Co 4500 Ci source. An extra lot served as the control.

Nutritional evaluation. 25 g seed samples with the respective treatments were ground on a micro sample mill to pass through a 40 mesh sieve size and stored at 4 °C in air-tight containers. Standard procedures for moisture and KJELDAHL protein[2], sample hydrolysis[3] and amino acid analysis[4] were adopted. Cystine and methionine were not analyzed by oxidation to cysteic acid and methionine sulfone.

Morphological evaluation. From the respective 50 g irradiated seed samples, lots of 80 seeds for each treatment were separated and immediately planted in flats containing a steam sterilized 2:1:1 mixture of soil, sand and peat. The flats were kept in the greenhouse at temperatures of 29.4 °C (day) and 18.3 °C (night). A randomized complete block design was used with 4 replicates and 20 seeds were planted for each treatment and replication. Germination and seedling height were recorded 15 days after 50% germination was observed in the control. From this data the seedling performance was derived according to the technique of OSBORNE and LUNDEN[5].

Results and discussion. The morphological data for germination, seedling height and seedling performance (Table 1) has manifested growth stimulation of varied degrees as a consequence of seed irradiation. The germination in all treatments was earlier and higher than the control while seedlings were taller in 1.0, 2.0 and 3.0 kR and shortened from 5.0 kR. The seedling performance interpolations[5] depicted an increase from 1.0 to 4.0 kR with a progressive decrease subsequently. All comparisons were significant ($p \geqslant 0.01$). Early germination in treated seeds has been a phenomenon reported and reviewed earlier by MUJEEB and GREIG[6]. In Chhola this stimulation continued up to 10.0 kR and is manifested by this trait's

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Table I. Mean values of some morphological growth characteristics of *Cicer arietinum* L. cv. Chhola as influenced by γ-radiation exposures with characteristic/dosage correlations

Characteristics[a]	Dosage (kR)								*r* for
	0	1	2	3	4	5	7.5	10	characteristic/dosage
Germination	71	74	75	74	75	75	75	75	0.702
Seedling height (cm)	6.8	7.2	7.2	7.1	6.8	6.1	5.8	5.7	−0.88[b]
Seedling performance	1.00	1.10	1.11	1.09	1.06	0.95	0.90	0.88	−0.84[b]

[a] LSD 0.01 for germination = 2; seedling height = 0.2; seedling performance = 0.04. [b] Significant at $p \geqslant 0.01$.

Table II. Protein and significant amino acid compositions of *Cicer arietinum* L. cv. Chhola as influenced by γ-radiation seed treatment

Characteristics	Dosages (kR)								LSD (0.05)
	0	1	2	3	4	5	7.5	10	
Protein (moisture free)	19.5	19.3	19.4	19.5	19.5	19.5	19.0	19.0	NS
Amino acids[a]									
Arginine	9.22 ± .04	9.43 ± .07	8.49 ± .04	9.25 ± .04	9.16 ± .11	9.04 ± .22	8.68 ± .04	8.91 ± .10	.37
Aspartic acid	12.02 ± .01	12.01 ± .03	12.24 ± .10	12.12 ± .02	11.96 ± .02	12.21 ± .02	12.17 ± .04	12.16 ± .03	.13
Recovery (nitrogen basis)	93.09	94.25	93.22	92.34	93.53	91.89	96.31	94.42	

[a] Amino acid values were corrected to 100% recovery of KJELDAHL protein and to a moisture free basis.

nonsignificant correlation with dosage. The significant growth reductions so characteristic of high dosages, existed for height and seedling performance. The negative correlations of seedling height and performance with dosage have provided additional support for this growth trend (Table 1). Such reductions have been earlier reported[7–10].

Significant variations in amino acid compositions were obtained for arginine and aspartic acid. The latter provided a definite increasing trend from 5.0 kR while erratic decreases were obtained for arginine at 2.0 and 7.5 kR (Table II). The nutritional parameters studied[11] suggest that up to 10.0 kR no adverse trends developed to create possibly deleterious first generation effects that may enhance the frequency of not overcoming the negative yield/protein/nutritional quality correlations. Current mutation breeding programmes have attached importance to improvement of protein content and quality. This trait has been given due importance as the final selection sieve for mutants in advanced generations[12] or as an M_1 selection parameter[13]. The merits and demerits of either approach have been considered[13] earlier, with the essentiality of such qualitative assessment put forward by JOHNSON et al.[14] and GOTTSCHALK and MULLER[15]. For *C. arietinum* L., a diploid, the author feels that the nutritional aspects should form the initial sieve. Subsequent efforts may then be directed towards isolating progenies depicting maximum combination of desirable characters and possessing the adverse negative-correlation breaks.

The morphological data in general did not manifest adverse irradiation effects up to 4.0 kR, and has provided information for controlling treatments that a greater desirable frequency of mutability is achieved in order to facilitate making multidirectional selections. This may lead to blending in an 'ideal variant' the improved desired trait/s coupled with the carry through of the nutritive quality genetic pool as is or be positively directed. Although the nutritional status was not adversely effected up to 10.0 kR, negative trends did appear for the growth parameters. It may hence be advantageous not to use the higher range for induced mutation studies, considering the greater possibility of altering the otherwise optimum cultivar characters.

The influence of acute γ-radiation exposures upon the nutritional and growth parameters of *Cicer arietinum* L. cv. Chhola was studied. Consistent adverse variations in protein and amino acid compositions did not occur up to 10 kR. Growth parameters of germination and seedling height provided varying degrees of significant ($p \geqslant 0.01$) stimulatory responses and growth reductions. Interpretations from the nutritional and morphological data have been made for developing a mutation breeding programme.

Zusammenfassung. Nachweis, dass es mittels Röntgenstrahlen bei *Cicer arietinum* L. cv. Chhola gelingt, günstige Mutationen bezüglich Aminospuren und Proteinen herzustellen.

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The Effect of Starvation on the Chemical Composition of Red and White Muscles in the Plaice (*Pleuronectes platessa*)

Recent studies[1,2] have shown that red and white muscles respond differently to prolonged starvation. In the present study on the plaice (*Pleuronectes platessa*) the levels of nucleic acids have been investigated in the red and white myotomal muscles during starvation. The previous investigations[2] concerning water, glycogen and protein content of the two muscles have also been extended to fish starving for up to 30 weeks.

Materials and methods. The method of capture and treatment of fish has been described previously[2]. Fish