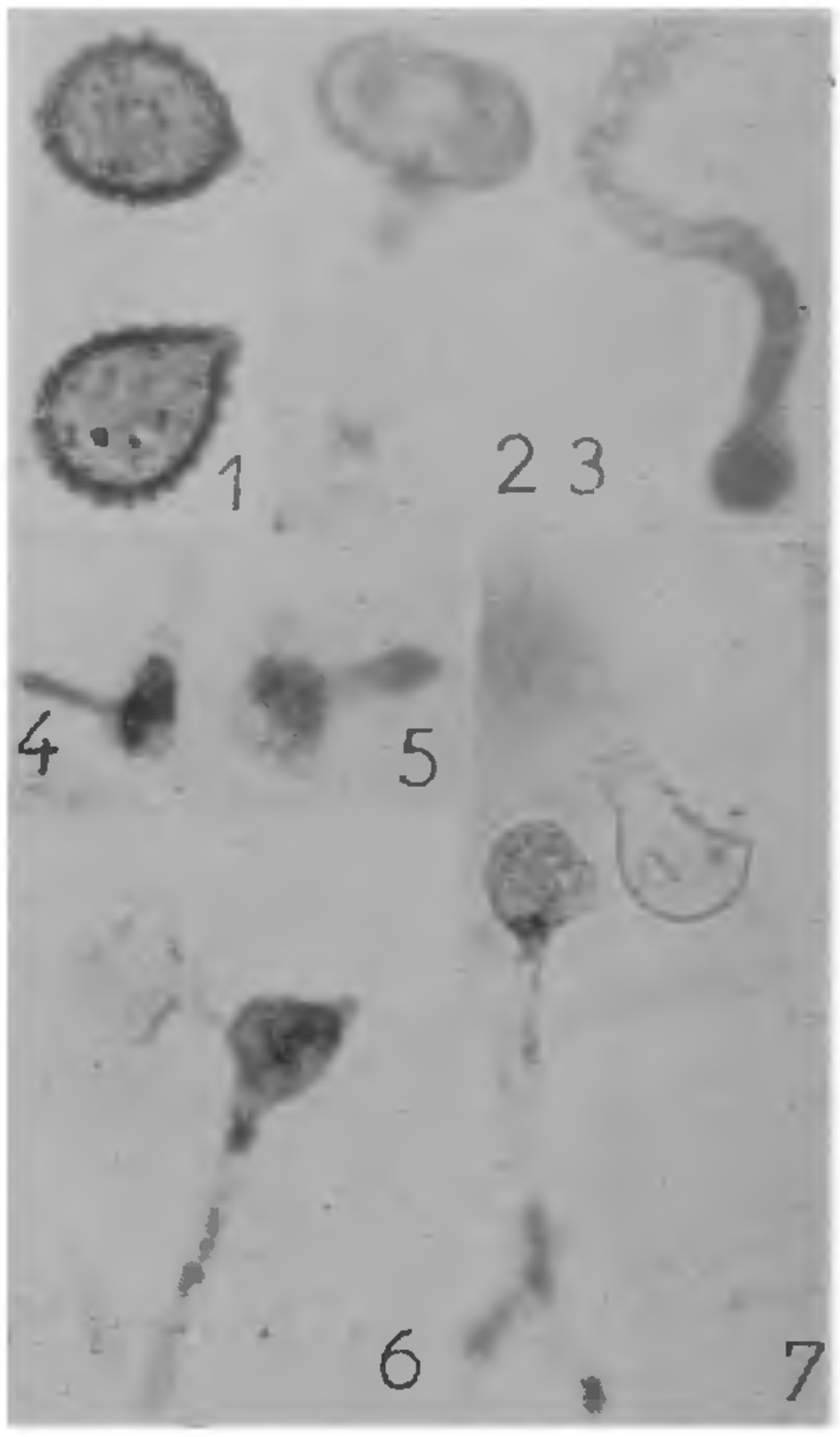
this vesicle (Figs. 6, 7); but this was never over 70 μ in length. The germ tubes required an incubation period of 18 to 24 hours for complete development of the infection structure. Unfortunately, the infection structure could in no condition be induced to develop further.



FIGS. 1–7. Fig. 1. Uredospores. Fig. 2. Germinated uredospore. Fig. 3. Germ tube showing appresorium at its apical end. Fig. 4. Development of infection peg from the appresorium. Fig. 5. Development of substomatal vesicle at the tip of the infection peg. Figs. 6 and 7. Fully developed infection structures showing appresoria, infection pegs, substomatal vesicles and infection hyphae.

The development of infection structure described above essentialy resembles the mode of development of similar structure observed earlier by Maheshwari *et al.*[5]. The uredospores of *Puccinia ruelliae* germinated and formed infection structure satisfactorily in water on glass slides, and for this purpose no host stimulus or nutrient was required. This observation, therefore, contradicts the report of Hurd–Karrer and Rodenhiser[4] who noted infection structure development only in the presence of nutriemts. On the other hand, Dickinson[2,3] emphasized the importance of physical contact in exciting rust spores to form appresoria. But in the present study germ tube differentiation was found to depend on photoperiod, temperature and pH of water, irrespective of any particular contact stimulus.

The author is grateful to Dr. Anjali Roy for her guidance and to the Council of Scientific and Industrial Research, New Delhi, for providing financial assistance by a Senior Research Fellowship.

Department of Botany, A. B. DE
Visva-Bharati University,
Santiniketan (W.B.),
November 12, 1979.

1. De, A. B. and Roy, A., *Nova Hedwigia*, 1979, **63**, 7.
2. Dickinson, S., *Ann. Bot.*, 1949, **13**, 219.
3. —, *Ibid.*, 1955, **19**, 161.
4. Hurd–Karrer, A. M. and Rodenhiser, H. A., *Am. J. Bot.*, 1947, **34**, 377.
5. Maheshwari, R., Hildebrandt, A. C. and Allen, P. J., *Can. J. Bot.*, 1967, **45**, 447.

EFFECTS OF SIMAZINE ON DNA, RNA AND TOTAL NITROGEN OF PEAS (*PISUM SATIVUM* L.)

SIMAZINE (2-chloro-4-6bis (ethylamino)-S-triazine, a pre-emergence herbicide, used to control weeds in many agronomical and horticultural crops[1,2], has been shown to influence the seed weight, crop yield, total amino acids and protein contents of the treated crop plants in the first and second generations[3–5]. In some cases, the high protein content attributed to herbicidal treatment was only due to supplemental nitrate fertilization without a change in the dry weight of the treated plants[5]. We have studied the effect of Simazine treatments on peas that do not require additional nitrogen fertilization under commercial growing conditions for maximum yield.

Pea seeds, cultivar Perfected Freezer, were grown as described earlier[6]. Harvested seeds were freeze dried for 24 hrs, ground and sieved through a 60-mesh screen for further analysis. Nitrogen determination was made using the micro-kjeldahl procedure[7]. DNA and RNA were extracted, purified, and determined by UV absorption according to the method described by Holdgate and Goodwin[8]. A Beckman DB–G spectrophotometer equipped with a recorder was used for measurements. Highly polymerized RNA and DNA (Calbiochem) were used as standards and received the same treatments as the plant extracts.

Sub-herbicidal levels of Simazine induced a marked increase in total nitrogen of the seeds (Table I). The maximum increase of 24·9% occurred with the 0·10

TABLE I

Effects of Simazine on DNA, RNA and total nitrogen of peas

	DNA μg/g[a,b]	% increase	RNA μg/g[a,b]	% increase	Total nitrogen[a,b] mg/gm	% increase
Control	11·0	..	147·3	..	46·5	..
Low dosage (0·02 lb/acre)	12·2	11·1	181·2	23·0	53·0	14·0
Medium dosage (·10 lb/acre)	15·3	39·0	193·7	31·5	58·1	24·9
High dosage (·50 lb/acre)	12·7	15·0	161·7	9·8	49·0	5·3

a Average of four replicates per treatment.
b Results expressed on dry weight basis.

lb/acre treatment. At the higher doses, however, the increase in the total nitrogen was less. It is not known whether Simazine had a direct effect, but certainly the increase in total nitrogen cannot be attributed to supplemental nitrogen fertilization as reported for wheat[6]. This is especially true since peas, which are legumes, do not require supplemental nitrogen fertilization for maximum yield for commercial culture of peas on the optimal soil fertility.

To determine whether other constituents in the seeds were influenced by the Simazine treatment and whether they could be responsible for the increase in total nitrogen, we looked to nucleic acids. The RNA content of the seeds (Table I) corresponded closely with the increase in total nitrogen. This indicates that the increase in total nitrogen is RNA-dependent and may occur in the form of organic nitrogen such as protein, as reported by earlier workers[5]. The DNA increase noted in this experiment may possibly be explained on the basis of an enhanced cell division in treated plants, which in turn could induce the RNA-dependent increase in the total nitrogen.

College of Agril. Technology, Marathwada Agril. University, Parbhani 431 402.
S. S. KADAM.

and

Utah State University, UMC 87, Logan, Utah 84322, U.S.A.,
D. K. SALUNKHE.

October 18, 1979.

1. Freney, J. R., *Aust. J. Agric. Res.*, 1965, **16**, 257.
2. Ries, S. K., Larsen, R. P. and Kenworthy, A. L., *Weeds*, 1963, **11**, 270.
3. —, Chmiel, H., Dilley, D. R. and Filner, P., *Proc. Nat. Acad. Sci.*, 1967, **58**, 526.
4. —, Schweizer, C. J. and Chmiel, H., *Bio-Science*, 1968, **18**, 205.
5. Schweizer, C. J. and Ries, S. K., *Science*, 1969 **165**, 73.
6. Wu, M. T., Singh, B. and Salunkhe, D. K., *Plant. Physiol.*, 1971, **46**, 517.
7. *Official Methods of Analysis*, Association of Official Agricultural Chemists, Washington, D.C., ed. 10, 1965, pp. 744.
8. Holdgate, D. P. and Goodwin, T. W., *Phytochem.*, 1965, **4**, 841.

SCREENING BREAD WHEAT GERMPLASM FOR GRAIN PROTEIN CONTENT AND GLUTEN STRENGTH

THE indigenous tall Indian wheat varieties and the semi-dwarf germplasm imported from CIMMYT have a low Pelshenke value (less than 150 minutes)[1]. On the contrary, the hard red winter wheats exported from the U.S.A., Australia, Canada, etc., normally belong to a strong and very strong flour categories and are ideally suited for making quality bread. In order to improve the quality of local germplasm a few high quality winter and spring wheat varieties (Chris, Crim, Selkirk, Scout, Gage, Justin, Sage, Homestead, Sentinel, Olaf and Eova) were imported from Nebraska (U.S.A.) during 1968–69 and hybridized at Gurdaspur with the local and Mexican germplasm.

Spectacular results have been achieved during the last ten years. Two hundred phenotypically uniform progenies were bulked during 1978–79 at the Regional Research Station, Gurdaspur. These progenies were grown under high fertility irrigated condition (N, P_2O_5 and K_2O were applied @ 120, 60 and 30 kg/ha respectively). Composite samples of each variety were drawn and evaluated for grain protein content and Pelshenke value.

Variation for grain protein content ranged from 10·4 to 13·8%. Two standard wheat varieties, WG 357