NAA, all of them at low concentrations enhance the rate of tube growth. The extent of their effect on tube growth is not identical, but as a rule, higher concentrations induce inhibition of growth.

Addicot[6] pointed out that pollen germination and tube elongation are distinct physiological processes depending on different factors. Later reports[7,8] on the effect of plant hormones on the pollen growth of loquat and tomato support this contention. The present findings also recognise two phases in pollen growth. As seen in Table I, most growth substances at low concentrations prolong the time needed for pollen germination but the same concentrations enhance tube elongation up to or over 200%. Thus, although the pollen grains of *Calotropis* are enveloped by the pollinial wall, they too exhibit characteristically different responses to growth substances during germination and tube elongation phases of early pollen growth.

Thanks are due to Prof. C. A. Ninan for facilities and to the UGC for a fellowship to one of us (P. S.).

Department of Botany,
University of Kerala,
Kariavattom 695 581,
May 11, 1977.

P. Sreedevi.
A. N. Namboodiri.

1. Jalaja, S. and Namboodiri, A. N., *Ind. Sc. Cong. Proc.*, Part III, 1975, 72.
2. — and —, *Experientia*, 1975, **31**, 915.
3. Vijayaraghavan, M. R. and Shukla, A. K., *Ann. Bot.*, 1976, **40**, 417.
4. Galil, J. and Zeroni, M., *Bot. Gaz.*, 1969, **130**, 1.
5. Brewbaker, J. L. and Kwack, B. H., *Amer. J. Bot.*, 1963, **50**, 859.
6. Addicot, F. T., *Plant Physiol.*, 1943, **18**, 270.
7. Dikshit, N. N., *Curr. Sci.*, 1956, **25**, 27.
8. McLeod, K. L., *Ann. Bot.*, 1975, **39**, 59.

EVALUATION OF ROOTSTOCKS OF POME AND STONE FRUITS AND RELATED WILD SPECIES FOR RESISTANCE TO CROWN GALL

Crown gall, incited by *Agrobacterium tumefaciens* (Smith and Townsend) Conn, is an important disease of temperate fruit crops. In India, the writer has detected the prevalence of the disease on stone fruit trees in Himachal Pradesh[1] and Kumaon Hills of Uttar Pradesh. As the disease mostly attacks the underground and ground level parts of the plants, use of resistant rootstocks for commercial varieties of temperate fruits is deemed to be a suitable and effective control measure for the disease. A search for crown gall resistant rootstocks for pome and stone fruits was, therefore, considered an important and urgent manoeuvre to combat the disease in north-western hills of India. In order to identify sources of resistance, 24 stocks of pome and stone fruits and their related wild species were evaluated for their performance against the disease. The results of the evaluation are presented in this article.

Stocks of Malling Merton Series and species of the genera *Cotoneaster*, *Malus*, *Prunus* and *Pyrus* were included in the present investigation. A virulent culture of *A. tumefaciens*, isolated from galls on plum trees, was used as inoculum. At least 3 plants of each type were employed for evaluating the host reaction to the disease. Pot-grown, 2–3 year old plants were inoculated in the following manner: Crescentic annular wounds were first created on the stem at two sites—one at the soil level and another at 10–15 cm above soil—by knifing out a rectangular flap of bark and cortex of approximately 1 × 2 cm size. The wounded sites were then wrapped with absorbent cotton swabs soaked in aqueous suspension of 48 hr old culture of the bacterium (10^8 cells per ml). To avoid loss of moisture from the cotton swabs, the soil level and aerial inoculated sites were covered with soil and butter paper, respectively. Identically wounded plants but wrapped with water soaked cotton swabs served as checks. The inoculated and check plants were maintained in glasshouse at 17° to 28°C (24–26°C for about 18 hr a day). The inoculated sites were provided sufficient humidity for the development of the disease by keeping the cotton swabs moist. After 15 days, the cotton swabs were removed and regular observations were initiated for the development of the symptoms. The plants which failed to produce symtoms within 90 days of inoculation were reinoculated. Observations were continued for a period of 8 months.

On the basis of size and nature of galls produced at the inoculated sites, the plants were evaluated as susceptible, moderately resistant or resistant. In susceptible plants, the galls were characteristically active and attained conspicuously large size (diameter more than 1 cm) within 90 days. The galls continued to show peripheral meristematic activity for the whole period of observation. The galls produced on moderately resistant plants were comparatively smaller in size (less than 1 cm in diameter after 8 months) and did not show any peripheral meristematic activity. The growth of the galls was extremely slow on these plants. Failure of the plants to support any tumourous activity at the inoculated sites was designated as resistant reaction to the disease.

Of the 24 rootstocks tested, susceptible reaction was shown by the plants of *Cotoneaster microphylla* Wall., *Malus pumila* Mill., *M. sikkimensis* (Hook. f.) Kochne, Malling Merton 101, 102, 105, 106, 109, 110, 115, *Prunus amygdalus* Batsch, *P. armeniaca* L., *P. avium* L., *P. cerasus* L., *P. cerasoides* D. Don (syn. *P. puddum* Roxb.), *P. cornuta* Stend. (syn. *P. padus* L.), *P. domestica* L., *P. persica* (L.) Batsch., *P. salicina* Lindl.,

Pyrus communis L. and *P. pashia* Buch-Ham. Moderate degree of resistance was detected in the stocks of *Cotoneaster acuminata* Lindl., *C. bacillaris* Wall. and *Malus baccata* (L.) Borkh. None of the stocks could be rated as resistant to the disease.

The results of inoculations reveal that the plum isolate of *A. tumefaciens* is pathogenic to many plant species, indicating thereby that the disease would be occurring on plants of pome and other stone fruits in Himachal Pradesh. It is a major concern that none of the rootstocks, tested in the present studies, could be evaluated as resistant to the disease. Plants of *C. acuminata* and *C. bacillaris*, identified as moderately resistant to crown gall, may be tried as rootstocks for pear. Availability of moderate degree of resistance in rootstocks of *M. baccata* may help to avoid a situation of crown gall becoming a potential threat to apple cultivation.

Division of Mycology and Plant Pathology,
Indian Agricultural Research Institute,
New Delhi 110 012, *April* 23, 1977.

J. C. DURGAPAL.

1. Durgapal, J. C., *Indian Phytopath.*, 1971, **24** (2), 379.

A PEARL MILLET STRAIN WITH $2n = 12 + 4$ TELOCENTRIC CHROMOSOMES

IN the progeny of an autotriploid *Pennisetum typhoides* (Burm) S and H, in a population of 227 plants, 4 plants showed a deviant karyotype from the normal one. The normal chromosome number for this species is $2n = 14$, but these plants are with chromosome number $2n = 13 + 2$ fragments. These fragment chromosomes on further study proved to be telocentrics. At mitotic metaphase these two fragment chromosomes showed terminal centromeres and they corresponded in their lengths to the two arms of one of the odd chromosomes in the complement which was the longest chromosome of the complement with sub-median centromere. The two telos were slightly unequal in size. At meiosis these two telos paired with one of the normal chromosomes to form a heteromorphic trivalent. This trivalent was always a chain type with the two telos associated with the two arms of the normal chromosome. They were never observed to pair among themselves. At metaphase I, the orientation of the trivalent was non-random and resulted at Anaphase I segregation with the normal chromosome moving to one pole and the two telos to the other pole (62%).

When these plants were selfed, in the progeny plants with $2n = 12 + 4$ telos were obtained together with aneuploids and diploids (Table I).

TABLE I

Chromosome constitution of plants in the progeny of a plant with 13 + 2 *telos*

Chromosome constitution	14	13+2 telos	12+4 telos	14+1 telos	Total
Number of plants	12	51	14	1	78

The plants with 12 + 4 telos are of interest. These plants are obviously the result of the union of gametes with chromosome numbers $n = 6 + 2$ telos. In these plants two of the telos were longer than the other two telos. The four telos regularly formed two rod bivalents at Diakinesis and Metaphase I (Table II) (Figs. 1, 2 and 3).

In 364 cells out of 396 cells observed at Diakinesis, the 4 telos regularly formed 2 rod bivalents and in 31 cells they formed 1 bivalent + 2 univalents. Only in 1 cell, the four telos remained as univalents. The mean chiasma frequency per cell at Diakinesis was 12·803 and the variance was 1·066.

TABLE II

Summary of chromosome associations in plants with 12+4 *telocentric chromosomes*

Stage of Meiosis	Normal chromosomes			Telocentrics		Total number of cells
	Bivalents		Univalents	Bivalents	Univalents	
	Ring	Rod				
Diakinesis	4·742	1·132	0·035	1·922	0·156	396
Metaphase I	3·896	1·821	0·434	0·963	0·433	106