such conditions including mastitis. Occasionally *C. pyogenes* has also been isolated from the throats of human patients suffering from scarlatiniform rash. This organism is considered as probably the most important and widespread of the coryneform group associated with animal disease[8].

Infectious abortions amongst equines are associated with viruses[3], fungi[5] and bacteria like Mycoplasma[6], Leptospira[4], Salmonella, Klebsiella, Pseudomonas, *E. coli*, haemolytic streptococci, Clostridia and *Actinobacillus equuli*. Although Corynebacteria other than *C. pyogenes* have been incriminated in the causation of purulent pneumonia, ulcerative lymphangitis, internal abscess formation and pleurisy in foals, the involvement of *C. pyogenes* in the uterine infection of the mare is of questionable importance[1]. There is only one report of metritis in the mare due to *C. pyogenes*[9]. Perusal of available literature does not reveal the isolation of *C. pyogenes* from aborted equine foetuses. Therefore, this report is to document its isolation from an aborted equine foetus.

An equine foetus aborted around 8th month of gestation, was received in this laboratory for bacteriological examination. The aborted mare, a thoroughbred, had had four previous normal pregnancies. No gross abnormalities could be observed although the placenta appeared thickened. Heart blood, stomach contents and material from the liver of the foetus were collected aseptically and cultured on blood agar plates (7% ox blood) and Robertson cooked meat medium. The agar plates were incubated under 10% CO_2 tension in an anaerobic jar (Gallen Kemp, U.K.). The inoculated media were incubated at 37° C for 48 h prior to examination.

Examination at 48 h post inoculation did not reveal any growth in Robertson cooked meat medium. Blood agar plates showed large number of small glistening bacterial colonies surrounded by a zone of beta type of haemolysis. The organisms were Gram positive bacilli. Metachromatic granules were observed in about 50% of the cells when stained with Neisser's method. The isolate was non-motile and noncapsulated. It was catalase negative. M.R. and V.P. tests were negative. It did not reduce nitrates. Indol was not produced. Gelatin was liquified. Litmus milk was clotted and on further incubation, the clot was digested. Acid, but no gas, was produced from glucose, galactose, lactose, maltose, xylose, and fructose. It did not ferment arabinose, dulcitol, inositol, raffinose and trehalose. In general, the isolate conformed to the tests for *Corynebacterium pyogenes* as described by Cummins[2].

C. pyogenes, although common in other domestic animals, has not been found to play any significant pathogenic role in the equines as evident from the lack of information in this regard. It would be interesting to understand as to why *C. pyogenes* infections are infrequent in the equines. It would also be worthwhile to conduct immunological studies of this organism in the equines as these might reveal some interesting findings. The report of Zaki and Farrag[9] is the lone report of metritis in mares due to *C. pyogenes* and Bain[1] doubts any pathogenic role of this organism in equines. As already mentioned, there is no record of the isolation of *C. pyogenes* from aborted equine foetus. Therefore, this report is probably the first of its kind.

Department of Veterinary Microbiology and Public Health,
Veterinary College,
UAS, Hebbal, Bangalore,
July 20, 1978.

G. KRISHNAPPA.
SYED ZAKI.
B. UMAKANTH.
B. S. K. MURTHY.

1. Bain, A. M., *Aust. Vet. J.*, 1963, 39, 413.
2. Cummins, C. S., in *The Bergeys Manual of Determinative Bacteriology*. Eighth edn., The Williams and Wilkins Co., Baltimore, 1974, pp. 608.
3. Dimock, W. W., *J.A.V.M.A.*, 1940, 9.., 665.
4. Jackson, R. S., Jones, E. E. and Clark, D. S., *Ibid.*, 1957, **131** (12), 564.
5. Mahaffacy, L. and Adams, N., *Ibid.*, 1964, **144** (1), 24.
6. Moorthy, A. R. S., Spradbrow, P. B. and McEvoy, T., *Aust. Vet., J.*, **52**, 385.
7. Prickett, M. E., *J.A.V.M.A.*, 1970, **157**, 1465.
8. Wilson, G. and Miles, A. A. In *Principles of Bacteriology and Immunity*, Fifth edition, Edward and Arnold (Publishers), London, 1964, pp. 1705.
9. Zaki, A. O. and Farrag, H., *Vet. Med.*, 1955. **50**, 219.

SUCCESSFUL GRAFT CULTURE OF TOMATO IN BACTERIAL WILT SICK SOILS

BACTERIAL wilt of tomato caused by *Pseudomonas solanacearum* E. F. Smith, is a major limiting factor for its successful cultivation in India[5]. Chemical control measures have proved to be either unsuccessful or uneconomical Rao (*et al.*[3]). Out of 23 lines marked for resistance or tolerance to bacterial wilt, only one line CRA-66—Sel-A, was found resistant when screened at this Institute[3]. This line is indeterminate in growth habit, bearing green-shouldered small fruits and thus cannot be used commercially. Till such time a resistant commercial variety is bred, grafting of a susceptible cultivar on to resistant root-stocks has been investigated by the present authors.

In the present study, bacterial wilt resistant lines of tomato (CRA 66—Sel A) and Brinjal (Dingra's Multiple Purple) (Rao *et al.*[3,4]), were used as root-

stocks. The susceptible tomato cultivar, Pusa Ruby was used as a scion. Grafting was done by cleft graft method as reported by Honma.[2]. Seedlings of root-stocks were grown in thumb pots and used for grafting when they were 10 cm tall. The plants were decapitated 3–4 cm from the top and the stems split to a depth of 1 cm. Wedge-shaped terminal scions (of cv. Pusa Ruby) of approximately 2 cm (with all except the terminal leaves removed) were inserted into the cuts and tied with polythene strips. These plants after proper graft union (nearly 3 weeks after grafting) were transplanted to a uniformly wilt sick plot. Rows of (12 plants each) Tomato/Brinjal and Tomato/Tomato graft were grown alternately with the resistant and susceptible varieties of tomato, *viz.*, CRA–66—Sel–A and cv. Pusa Ruby, respectively. Observations were recorded on plant survival, yield per plant and plant height at flowering stage from both grafted and control lines (Table I).

brinjal. For growing susceptible commercial F_1 hybrids, or susceptible varieties for specific market needs, in wilt sick soils, such graft culture can be very useful even when a resistant variety is available. In areas where tomato is grown as a rainfed crop and the soil is wilt infested, graft culture using resistant brinjal rootstock can be of added advantage because brinjal is known to be more tolerant to drought than tomato Behboudian[1]. In the present study too, the Tomato/Brinjal graft survived in the field for more than 40 days after the last irrigation, while no other line did.

The cost involved in grafting is minimal, the operation being simple and the percentage of take is more than 90%.

Ind. Inst. of Hort. Research,
255, Upper Palace Orchards,
Bangalore 560 006 (India),
August 18, 1978.

S. K. Tikoo.
P. J. Mathai.
Ram Kishan.

Table I

Performance of grafted and normal plants of tomato variety Pusa Ruby in wilt sick soils

Line	% survival		Height at	Yield data per plant		Average Fruit	Remarks
	Ist harvest	Last harvest	Flowering (cm) $\bar{x} \pm$ S.D.	Frt. No. $\bar{x} \pm$ S.D.	Frt. Wt. $\bar{x} \pm$ S.D.	Weight (gm) $\bar{x} \pm$ S.D.	
Pusa Ruby	54·50	0·00	32·60±12·80	2·9 ±4·6	80·0 ±122·6	29·3 ±17·6	Susceptible
CRA 66–Sel. A	100·00	100·00	63·25±12·24	14·4 ±4·19	268·57± 55·5	18·6 ± 5·11	Resistant tomato breeding line
PR/CRA–66–Sel. A	100·00	100·00	36·0 ± 2·06	12·87±3·04	347·5 ±152·6	27·15± 5·54	Susceptible tomato on resistant tomato
PR/DMP*	100·00	100·00	38·33± 5·61	15·4 ±6·1	393·88±173·6	25·6 ± 4·51	Susceptible tomato on resistant brinjal

* Dingra's Multiple Purple

It is evident from our result (Table I), that only 54·4% plants of the susceptible variety, survived by first harvest, survival coming down to zero per cent by last harvest. On the contrary, 100% survival was observed in the graft cultures and the resistant tomato line upto the last harvest. The yield per plant of the two graft cultures was not only very much different from each other (Table I), but was 4 times more than the susceptible control.

The above observations clearly indicate that tomatoes can successfully be cultivated in wilt sick soils by grafting them on to resistant root-stocks of tomato or

1. Behboudian, M. H., *Scientia Horticulture*, 1977, 7, 303.
2. Honma, S., *Ibid.*, 1977, 7, 207.
3. Rao, M. V. B., Sohi, H. S. and Tikoo, S. K., *Plant Dis. Reporter*, 1975, 59 (9), 734.
4. —, — and Vijay, O. P., *Vegetable Science*, 1976, 3 (1), 61.
5. —, *Proc. First Intl. Planning Conference and Workshop on the Ecol. and Control of Bacterial Wilt Caused by* P. solanacearum, Religh, North Carolina, July 18–24, 1976, p. 92.