(Jm_2 and Jm_3) were found to be the most promising with improved traits particularly for grain fineness. These were crossed together and out of the promising recombinants isolated from F_3 families, one (JRm) seemed to be the most promising because of overall better agronomic performance coupled with grains even finer than those of Basmati-370 (Fig. 1). Data recorded for various metric traits (Table I) revealed that while plant height, panicle bearing tillers, grain yield and maturity period of this recombinant are nearly equal to those of parents and initial line, it is superior to Basmati-370 in these aspects. Its total fertile grains are more than those of Basmati and Jm_2, being heavier than those of initial line, Basmati and Jm_3. Furthermore, dehusked grains of this recombinant are longest amongst all these genotypes, their breadth being similar to that of Basmati and Jm_3 resulting in enhanced L/B ratio and hence the finest grains. This Jhona-349 recombinant has a high breeding value and economic return. Further studies regarding the stability and other selection parameters are in progress.

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SEED STERILITY IN *DACTYLOCTENIUM SINDICUM* BOISS. (POACEAE)

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Dactyloctenium Willd. is a genus of annual and perennial grasses belonging to the tribe Eragrosteae of the sub-family Pooideae. It comprises of 17 species distributed in India and Africa[1]. In India, the genus is represented by a total of 5 species[2]. *Dactyloctenium sindicum* Boiss. is a perennial desert grass with woody stolons. It inhabits drier localities in the plains of North-West India and is a very good soil binder. A casual examination of the mature panicles during the cytological studies in *D. sindicum* revealed a poor seed set which initiated the present study in this grass. The populations of this species growing in the Punjab plains are diploid with $2n = 20$[3].

The material was fixed in FAA from the natural populations growing around Bhatinda (Punjab) on dry sandy soil and the customary embryological methods were followed[4].

The anthers in *D. sindicum* are tetrasporangiate. The development of the anther wall conforms to the Monocotyledonous type[5]. The mature anther wall comprises of the epidermis, fibrous endothecium, a single ephemeral middle layer and a uniseriate secretory tapetum with binucleate cells. A similar feature has also been reported by Chandra[6] in *D. aegyptium* and *Eleusine indica*. The meiosis is normal and successive cytokinesis leads to the formation of isobilateral tetrads as has also been reported in *D. aegyptium* and *Eleusine indica*[6], and *E. compressa*[7], whereas T-shaped and linear tetrads have also been reported to occur in addition to the isobilateral tetrads in *E. coracana*[8]. The pollen grains are 3-nucleate at the time of shedding.

The ovary encloses a bitegmic, tenuinucellate and hemianatropous ovule. The inner integument is formed first and is two-celled in thickness. After fertilization, the cells of the inner layer of the inner integument show deposition of a darkly staining material. The outer integument is composed of 2–3 layers of cells but is slightly shorter than the inner integument, which forms the micropyle. The outer integument is ephemeral in nature. The periclinal divisions in the nucellar epidermis in the micropylar region are lacking.

There is a hypodermal archesporial cell in the nucellus which increases in size and behaves as the megaspore mother cell. In some ovules, the archesporial cell undergoes degeneration. The megaspore mother cell divides meiotically to form a linear or T-shaped tetrad of megaspores. Although it is the chalazal megaspore which functions and forms a Polygonum type of embryo sac, in some instances all the four megaspores of the tetrad showed signs of disorganization. Occasionally, degeneration was also observed during the development of the embryo sac. The organized embryo sac has an egg, 2 synergids, a central cell with its 2 polar nuclei and 3 antipodal cells. The 3 antipodal cells undergo secondary multiplication resulting in upto 12 cells. After fertilization, the antipodal cells become hypertrophied and get displaced to a lateral position, a feature frequently noticed in members of the sub-family Pooideae[6,7,9,10,11].

About 100 ovules were examined to study the process of fertilization and post-fertilization development. The formation of embryo and endosperm was, however, noticed in only 8 ovules. The process of fertilization was not observed. In all the embryo sacs which were apparently mature, there was no trace of the pollen tube at the micropylar end of the ovule or inside the embryo sac. Such embryo sacs and ovules eventually undergo disintegration. The endosperm is of the Nuclear type. An examination of mature inflorescences revealed a seed set of only about 10%.

Seed sterility in the family Poaceae has been previously recorded in *Hilaria belangeri* and *H. mutica*[12] and *Digitaria decumbens*[13]. In *H. mutica* and *H. belangeri*, the degeneration of embryo sac in a large number of ovules (85% in *H. mutica* and 65% in *H. belangeri*) before fertilization has been suggested to be the cause of seed sterility. In the present material the degeneration of the archesporial cell, megaspore tetrad and 4-nucleate embryo sac has been observed in some ovules with no indication of the aposporous development of the embryo sac. However, the percentage of such ovules is very low (about 6%) and this factor alone cannot, therefore, account for high seed sterility. The course of meiosis in the present material is perfectly normal with nearly 100% pollen fertility[3]. The germination of the pollen grains and the entry of the pollen tubes into the stigmatic hairs has been observed. However, in most of the ovules, there was no evidence of the pollen tube in the embryo sacs which were healthy and apparently mature. Thus it appears that the seed sterility in *D. sindicum* may be due to (i) the failure of the pollen tube to reach the embryo sac in most of the ovules and (ii) failure of normal megasporogenesis and megagametogenesis in a low percentage of ovules.

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STUDIES ON THE RESPONSE OF ACID LIME (*CITRUS AURANTIFOLIA* SWINGL.) TO VESICULAR ARBUSCULAR MYCORRHIZAE

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There are many reports about the beneficial and symbiotic association of vesicular arbuscular mycorrhizal fungi (VAM) with *Citrus* spp. (Mosse[1], Gerdemann *et al.*[2] and Nemec and Patterson[3]). In order to study the effect of VAM on acid lime an experiment was conducted at the Horticultural Research Station, Periyakulam, during 1979–80 using two VAM species, *viz.*, *Glomus mosseae* (Nicol and Gerd.) Gerd. and Trappe and *Glomus etunicatus* Becker and Gerd. Cultures of *G. mosseae* and *G. etunicatus* were maintained on sterilised soil containing root tissue of previous plant hosts. Inoculation was done on six month old seedlings of acid lime raised in unsterilised soil under usual nursery practices. Two methods of inoculation were adopted *viz.*, top and bottom using 20 g of soil inoculum of VAM per plant. In the bottom method the inoculum was applied to the root zone through a hole made in the soil. For top inoculation, the surface soil in the pot was removed upto 1–2 cm and the VAM culture was applied around the stem and covered with sterilised soil. Phosphorus at 300 ppm of P_2O_5 per plant was drenched as diammonium phosphate solution at 15 ml per plant. Growth parameters were taken on one year old seedlings, six months after inoculation. The data are presented in Table I.

It may be seen that both the VAM fungi have significantly increased shoot height, stem thickness, number of leaves, root length, root weight besides shoot weight. The fungi in combination with phosphorus were also found to significantly enhance the growth and vigour as seen from the data on the growth parameters in these treatments when compared to no treatment (control) and phosphorus alone. Among the two methods of inoculation, top inoculation was better than the bottom inoculation. Similar results were obtained by O'bannon *et al.*[4] and O'bannon and Nemec[5] on *Citrus limon* and Nemec and Patterson[3] in carizo citranges.

One of the bottlenecks encountered in the production of pre-immunised acid lime seedlings against citrus tristeza virus at Periyakulam was the slow growth and the thin stem of the seedlings even one year after sowing. The present study indicates that the use of VAM can be exploited for producing mycorrhizal