

published every year by the Inspection and Design Administration Office, International Trade Administration Bureau, MITI, based on a domestic Japanese questionnaire.

Results culled from the survey for the period 1988–1992 are presented in Tables 1 and 2. These reveal:

(a) The top four pirates of Japanese intellectual property in *manufacturing* in

the 'Tiger' countries are Taiwan, China (PRC), South Korea and Hong Kong, in that order.

(b) USA and the European Community follow at places six and seven. (Tea calling the pot black?)

(c) India has an exemplary record of respecting Japanese intellectual property. India's record is better than even Japan's own (self-imitation) record—old habits die hard!

(d) Europe is the worst culprit in *distributing* pirated Japanese goods. Japan itself is often the second-worst. *India has the best record.*

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## NEWS

### Plant Reproduction '96 (14th International Congress of Sexual Plant Reproduction) Lorne, Australia – Congress report

There has been an increasing interest during the last 10–15 years in studies on reproductive biology, particularly of seed plants. This is largely due to the realization of the importance of such studies for understanding the evolution of the species, to develop effective conservation strategies and to exploit full economic potential of plant resources. There has been an explosion of papers published in this area and many international meetings have been held in recent years on various facets of reproductive biology. Pollination biology, an important area of reproductive biology, was the theme of an International symposium held at Bangalore during August 1993 and *Current Science* brought out a special issue on this theme (vol. 65, No. 3, 10 August 1993).

Plant reproduction '96 was held from February 18 to 23, 1996 at the Cumberland resort at Lorne, a popular beach resort, situated 150 km from Melbourne, Australia. The Congress was organized by Prof. R. B. Knox and his associates (Univ. of Melbourne) under the auspices of the International Association of Sexual Plant Reproduction Research (IASPRR). The following are the highlights of the major themes of the Congress.

A large number of papers were devoted to the molecular aspects of flower initiation and development. Studies carried out during the last 10 years have shown that flower induction and differentiation of

floral whorls require a highly regulated expression of a large number of organ/cell-specific genes. Pollen development itself is reported to involve the expression of over 20,000 genes. A majority of papers covered characterization of many of these specific genes, their regulatory elements and their possible function deduced through analysis of mutants or through antisense approach to perturb the function of the gene in transgenic plants or through amino acid sequence similarity to known proteins. Of special interest are the reports of genes which are specifically expressed in the vegetative cell, the generative cell and the sperm cells of the pollen. Asymmetric division of the microspore seems to play an important role in differential expression of genes in the resulting vegetative and generative cells. Such studies being carried out in a number of laboratories are building up our understanding of the development of flower in general and of pollen in particular, which is essential for the effective manipulation of floral events.

There were several papers on various aspects of pollen tube growth. Since long,  $Ca^{2+}$  has been implicated in a variety of pollen tube responses. Malho (Univ. of Lisbon, Portugal) presented the results of his elegant experiments on photoactivation of caged  $Ca^{2+}$  through a short UV pulse. Increasing the  $Ca^{2+}$  concentration on one

side of the pollen tube apex resulted in a change in the direction of tube growth towards high  $Ca^{2+}$  concentration. The special award of bronze medal for the best paper by a young investigator was given to Malho. The award for the best poster by a young investigator went to Li, of the University of Melbourne, Australia, for her poster on regulation and purification of callose synthase of the pollen tube.

Pollen–pistil interaction is a dynamic process during which pollen is either permitted to complete post-pollination events or is inhibited from reaching the ovule. This interaction is mediated through extracellular matrix (ECM) present in the transmitting tract of the pistil through which the pollen tubes grow. Many of the papers were concerned with the characterization of pistil-specific genes, and the components present in the ECM. Transgenic plants in which cells/tissues of the stigma are genetically ablated by the targeted expression of the diphtheria toxin have been used to study the role of some of the components required for pollen adhesion, germination and pollen tube entry. The results on *Brassica* (Nasrallah, USA) as well as on tobacco (Mariani, The Netherlands) clearly showed that the lipids present on stigma surface are essential for the normal functioning of pollen. Evidences were presented for the role of proteinase inhi-

bitors, which form 30% of the buffer-soluble proteins of the stigma in tobacco, in preventing microbial growth on the stigmatic surface (Anderson, Australia). This explains the earlier observations that the stigmatic exudate, although rich in sugars, amino acids and proteins, is generally free from microbial growth until pollen germination and pollen tube growth are accomplished.

Cytoskeletal elements and their associated motor proteins have been thoroughly investigated in animal systems. However, the data on plant systems have been fragmentary. During the last 10 years, extensive studies have been conducted using pollen as a system. Cresti (Italy) presented the latest results from his group on the localization of the three important cytoskeleton-associated motor proteins – myosin, kinesin and dynein – in the pollen system, and their possible role in organelle movement and pollen tube growth. Many other papers described the distribution of kinesin-like proteins during the division of the generative cell, and microtubular changes during the development of embryo sac and endosperm.

Several papers were devoted to self-incompatibility (SI). Adrian Clarke (Australia) gave an update on the molecular biology of SI in gametophytic systems. Other papers presented recent results which generally supported the earlier data documenting the three major self-incompatible systems exemplified by *Brassica*, *Nicotiana* and *Papaver*. A few papers provided further evidences for the involvement of S-RNase in SI in Solanaceae, Rosaceae and Scrophulariaceae. In an interesting paper Langridge (Australia) reported isolation and characterization of a probable S-gene in *Phalaris* pollen, which exhibits two locus gametophytic SI. In *Papaver*, a membrane protein which binds to S-proteins of the pistil has been identified although not in allele-specific manner (Franklin, UK).

The latest results from the laboratories of Kranz (Germany) and Dumas (France),

where *in vitro* fertilization using isolated sperm and egg cells was achieved a few years ago, were presented. Kranz reported successful *in vitro* fertilization between egg of maize and sperm of many other genera of grasses, and the division of such zygotes to produce multicellular units, demonstrating the feasibility of the method in overcoming interspecific and intergeneric barriers. Interestingly, unfertilized egg as well as the fusion product between egg and egg or sperm and sperm were incapable of division. However, subjecting unfertilized egg to a high concentration of 2,4-D pulse induced parthenogenetic development of the egg. Mathys-Rochan (France) reported successful isolation and culture of the zygote. It was possible to achieve division of the zygote after microinjection of exogenous DNA; some of the zygotes expressed inserted gene. This is the first report on the feasibility of transferring genes to plant zygotes. Russell (USA) who was the first to demonstrate sperm dimorphism in *Plumbago*, presented interesting results on the differences on surface charges of the two sperm cells of *Plumbago* and their possible role in selective fertilization. These studies have opened up novel approaches to understanding the process of fertilization in flowering plants and its manipulation for practical applications.

Although reproductive biologists consider pollen largely as the carrier of male gametes, pollen grains are also a major source of seasonal hay-fever and allergic asthma. Studies on molecular aspects of pollen allergy have gained prominence in recent years. Several papers, particularly from the laboratory of Knox at Melbourne, reported cloning of many genes encoding pollen allergens, characterization of pollen allergens and their expression in bacteria and yeast. Recombinant allergen Cyn d1 from Bermuda grass expressed in bacteria showed no reactivity in sensitive individuals, whereas that expressed in yeast showed reactivity, indicating the requirement of post-translational modification in

eukaryotes for the activity of the allergen. These advances have made it possible to produce large amounts of pure allergens and their use in immunotherapy. Recent studies conducted by Knox's group have indicated the possible involvement of carbon particles emitted by diesel engines in allergy. The sooty diesel fumes bind with allergic particles released from pollen to form microscopic airborne 'bullets' which enter the respiratory tract and trigger asthma. This report was covered in Australian Newspapers, and if confirmed, the nature of the problems associated with automobile emission in our cities would require a serious consideration.

Papers covered under biotechnology included development of different pollen sterile systems for use in hybrid seed production, use of pollen embryos and the techniques of pollen storage and embryo rescue in crop improvement programmes, and use of microspores for genetic transformation. In an interesting paper, Vipin Sawhney (Canada) presented the data on the effects of plant growth regulators, light and temperature on a genic male sterile line of tomato and their manipulation for commercial production of hybrid seeds. A few Australian biotechnology companies also presented their research activities. One of their interesting programmes has been to engineer pollen sterility in tree species. This is very valuable to forestry as it facilitates gene containment (in transgenics), and reduces nutrient loss (incurred in pollen production) and the incidence of pollen allergy.

On the basis of the number and the quality of papers presented, the Congress at Lorne was probably the most successful congress in the series. The 15th Congress will be held at Wageningen, The Netherlands, during August 1998.

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