Odontoglossum Alliance Newsletter

Odontoglossum Alliance Meeting

13 April 1996

The Odontoglossum Alliance meeting will be held on 13 April 1996 at the Vancouver Hotel in Vancouver, British Columbia, Canada. This meeting will be held in conjunction with the Western Orchid Congress 10-14 April 1996, and the AOS Trustees meeting.

The Odontoglossum Alliance meeting is scheduled for a Saturday morning and does not conflict with any of the lectures at the Congress nor any of the other specialty meetings. Mario Ferrusi, Toronto, Canada is the session chairman. The speakers are Alan Moon, Philip Altmann, Howard Liebman, and Marilyn Light. The meeting will start at 8:30 am and end close to noon. This will be followed by a luncheon in the hotel. During the lunch and following there will be a short business meeting, and update on activities. We will again hold an auction of fine Odontoglossum Alliance material donated by our members. This auction has been, in the past, generously supported by our members and interested parties with donations of very fine plants and associated alliance material. This has been an opportunity for individuals to obtain plants and material not otherwise available.

Alan Moon will talk on "The Odontoglossums of Charlesworth". The Eric Young Orchid Foundation retains the slides of the odontoglossums of Charlesworth, Inc., the premier odontoglossum breeder for many years. These slides have been converted from the two and one quarter square to 35 mm. Alan has made a selection of these slides for his talk.

Alan Moon has been involved with orchids all his life. He started work at McBean's Orchids in Cooksbridge and moved to Jersey in the early 1960's to look after Eric Young's Cymbidiums. Now the curator of the Eric Young Orchid Foundation, he lectures all around the world. He is a member of the Orchid Committee of the Royal Horticultural Society. Alan is well known for the magnificent exhibits seen at orchid shows. The Eric Young Foundation will have a display at the Vancouver show. Great progress has been made in Odontoglossum ploidy at the Foundation. Many awarded hybrids are the result of the programs at the Foundation. The parentage of these hybrids was derived in great measure from the products of the Charlesworth efforts. Viewing these slides in the light of today's flowers will be most exciting.

Philip Altmann is a premier grower and hybridizer from Australia. His nursery, Warrnambool Orchids, is located in Warrnambool, Victoria, Australia. The ability to construct a greenhouse with materials left from building sites was a catalyst for Philip entering the orchid world twelve years ago. After a period of growing Cattleyas, Phalaenopsis and many species, ne bloomed a seedling of Oda. Shelly Anne. Besotted with its charm, a quest for more odonts began. Importing was the only way to obtain sufficient plants to satisfy his needs. and as the greenhouses increased in size and number his time and interest in building waned. Warrnambool Orchids began operating in 1986 as a part time nursery, and developed to full time in 1992. While specializing in odonts he also grows a number of orchids that are compatible. He produces his own hybrids and raises many species in the Laboratory of the nursery. These are grown in the 4500 square foot area nursery of controlled growing. The Nursery is situated in the City of Warnnambool, on the southern tip of the Australian Mainland coastline where the weather is reasonably kind.

The title of Philip Altmann's talk is **"Odm. nobile syn. pescatorei - Is It for real?"** Doubt has been cast over the validity of many plants labelled as Odm. nobile.His is a discussion of the forms commonly available with reference to chromosome counts and the use of two forms of Odm. nobile in breeding. What do Odm. nobile hybrids offer, and why use it as a parent? Commercial potential, hobbyists delight and a Judges paradox.

Dr. Howard Liebman has long been recognized in the orchid world for his work with the Odontoglossum Alliance material. He has done a great deal of intergeneric breeding and his plants have won many awards. He is a frequent speaker of the Alliance, because he continues to find new and interesting avenues. Dr. Howard Liebman has been raising orchids for over 30 years and has been growing and hybridizing odontoglossums and miltonopsis hybrids for over 20 years. He has registered 150 crosses in the odontoglossum and miltonopsis alliance and over 30 of his crosses have received awards from various societies including the AOS and the RHS. He has also presented papers at three World Orchid Conferences. Professionally, Dr. Liebman is a physician-scientist and a professor of medicine and pathology at the University of Southern California School of Medicine. He is the author of over 50 scientific papers on blood diseases and aids.
Howard recently turned his attention to the cyrtochilum species and some of the few existing hybrids. He has collected these plants in the wild and commenced a hybridization program. His results will be most interesting to hear and see.

The genus cyrtochilum, which are usually included as a subtribe of the genus oncidium, include some of the largest and most spectacular flowers of the odontoglossum alliance. Except for cyrtochilum macranthum, most growers are not familiar with other members of this genus. His talk, **"Cyrtochilums and Their Future Hybrid Potential"** will survey many of the cyrtochilum species, discuss a few of cyrtochilum hybrids made to date and review the future role of this genus in hybridizing in the odontoglossum alliance.

Marilyn Light was born on Montreal, Quebec and was educated at McGill University where she earned a B.Sc (Agriculture) and a M.Sc. (Microbiology). During her formative years, she saw land development overwhelm Yellow Lady's-Slipper orchids. She wondered why the European colonist orchid, the Broad-leaved Helleborine (Epipactis helleborine), could be so successful while intensive land use threatened native species. Her horticultural interest in orchids began at a Barbados orchid show in 1970 while living there. Her collection has grown and evolved to now include numerous species and hybrids raised from seed. Over the past 15 years, she has taught a flasking course both at the University of Ottawa where she works, as well as in other parts of Canada. Marilyn has raised and registered several hybrids including C. Doctorbird, C. Fruit Salad, Lc. Mem. Evelyn Light, Masd. Dainty Miss (reg. pending) and Odtna. Warbler. Marilyn's research program in orchid conservation involves a long term study of both Epipactis helleborine and of Cypripedium calceolus var. pubscens. Of particular interest are the factors affecting germinable seed yield in these species. She has been invited to present on this topic at an Orchid Population Biology conference in London, England in November 1995.
She is a member of the Garden Writers Association of America, Marilyn is co-author of Gardening in the Caribbean, Baannochie & Light (1993) MacMillan. She serves as Chairman of the Conservation Committee, Canadian Orchid Congress.

The title of her talk is **"Seed Propagation within the Odontoglossum Alliance"**.
Raising orchids from seed presents a series of challenges including a consideration of clonal compatibility and pollen germinability, optimal harvest times for embryo culture and for mature seed, and of seed germinability on a variety of flasking media.
Cultivar selection, line breeding, and hybridization play a major role in the development of the modern cultivated orchid. While horticultural goals address flower quality and quantity, plant vigor

and disease resistance, these goals are not necessarily consistent with conservation objectives. This presentation will address the challenges in raising Odontoglossums alliance genera from seed and will review what is known by specialist growers of particular genera and research. Among the genera to be discussed are Brassia, Cochlioda, Cyrtochilum, Lemboglossum, Miltonia, Rossioglossum and Tolumnia.

This will be a wonderful opportunity for Odontoglossum lovers to be in Odontoglossum country. The show itself is expected to have displays of the Alliance material in its peak. I have been assured that the sales area will have plenty of good quality and interesting material for you to ponder with the opportunity to acquire. Vancouver is a beautiful city and a great place to visit. I hope to see you all next April in Vancouver.

John E. Miller-Editor

Lewis Knudson (1884-1958) His Science, His Times, and His Legacy

by Joseph Arditti

Part II

Asymbiotic Germination of Orchid Seeds

Early Work- It is not clear at this point what exactly drew Knudson's interest to orchids. One possibility is simply that he followed the literature on subjects which related to his own work and in doing so read the papers by Noel Bernard and Hans Burgeff. The cultivation of plants and plant cells in vitro as well as the questions about sugar utilization by higher plants and fungal metabolism may have intrigued him. His insight, scientific intuition, keen intellect or his previous research on the organic nutrition of plants allowed him to perceive what others may have missed, and based on "... data from the experiments of Bernard and Burgeff..." he concluded that"... germination of orchid seeds might be obtained by the use of certain sugars...". These data were the use of salep by Bernard and Burgeff as well as starch and sucrose or glucose by the latter. Knudson reasoned that salep contains soluble organic matter which could be used by the seeds, and he was right. He also felt that "the fungus might...digest some of the starch, pentosans and nitrogenous substances; which digestion products, together with secretions from the fungus or products produced on decomposition of the fungus might be the cause of germination" and that "it is conceivable that germination is induced not by any action of the fungus within the embryo, but by products produced externally on digestion or secreted by the fungus..."

To test his assumptions Knudson initiated his first experiments on December 7, 1918. He attempted to germinate seeds of Cattelya schroderae x Cattleya gigas on peat extract and canna tuber infusion. By January 7, 1919, the seeds on both media formed small protocorms, which he called sperules. Four months later, on April 10, 1919 seedlings on the canna extract had one or two leaves, but those on the peat were not significantly different.

On February 14, 1919, he placed seeds of Cattelya labiata x Cattleya aurea on carrot and garden peat infusions. Germination and seedling growth occurred on these extracts also. These experiments convinced Knudson that orchid seeds can germinate on complex mixtures without the aid of a fungus.

To determine whether a common disaccharide can support germination, on January 14, 1919, Knudson placed seeds of Cattleya mossiae on Pfeffer's solution plus 1% sucrose. By July 1 of that year the seedlings on the sucrose-containing solution had one leaf and measured approximately 1 mm in diameter. Those on the sugar-free medium did not grow very much.

The next set of experiments was carried out on a modification of the Pfeffer medium which Knudson called solution B (there is no mention of a solution A, but it seems reasonable to assume that the

Pfeffer medium may have been so designated;) with and without sucrose and glucose (i.e. the expected product of starch hydrolysis by the fungus). He placed seeds of Cattleya intermedia X Cattleya lawrenceana on these media on July 18, 1919. "Owing to an absence from the University (his trip to Spain and France) the cultures were not examined until 9 June 1920. At that time, in both glucose and sucrose cultures, the seedlings were well developed, although the media had lost most of the water by evaporation."

In subsequent experiments Knudson used seeds of one Laeliocattleya hybrid ("Composition Laelia perrinii Lindl. 1/4; Cattleya labiata Lindl. 1/4; Cattleya amethystoglossa Reichb. 1/4; Cattleya intermedia Grah. 1/4;) to study the effects of additional extracts; (wheat, yeast, potato, beet; 31 August 1920-27 January 1921) and of another ("Composition: Cattleya Trianaei Reichb. 1/2; Cattleya Lodigesii Lindl. 1/4; Laelia purpurata Lindl. 1/4) to investigate the influence of glucose concentration (started on 12 November 1920 and evaluated on 16 December 1920, 11 January 1921, 15 February 1921, and 15 March 1921). These experiments showed that increase of glucose levels beyond 0.8% (8 grams of 0.044 moles per liter) were"... without significant effect." They also showed that starch accumulated in seedlings grown on 0.8% glucose or higher. Knudson interpreted this to mean"...that the absorption of glucose at a concentration of 0.8% percent is in excess of the utilization, and consequently a higher concentration should be without any increased beneficial effect". Subsequent experiments by Knudson with Cattleya and "...Epidendron..." (i.e. Epidendrum) confirmed these findings, but despite this fact 2% sucrose (20 grams or 0.058 moles per liter) became the amount most commonly used for practical purposes.

The experiments with sucrose and glucose resulted in Knudson's great discovery, which is that orchid seeds can germinate asymbiotically in the presence of simple sugars. There is no question that Knudson made this discovery as a result of clear thinking and good reasoning. However, good fortune also played a part (chance favored the prepared mind). He obtained seeds and or information from Theodore L. Mead of Oviedo, Florida, a well known orchid grower at that time who, accidently perhaps, sent seeds of orchids which germinate easily under asymbiotic conditions. If Knudson used seeds of native American terrestrial orchids he would have encountered problems. Even seeds of Paphiopedilum would have been less suitable since they do not germinate easily and well on Knudson's media B and C.

"Cane sugar" is listed in one of the recipes for medium B and unless Knudson used it on purpose this another fortunate coincidence. Several subsequent reports by other workers indicate that beet sugar may not always be suitable. Both cane and beet sugar are sucrose. The reason for the difference may be the absence or presence of impurities.

Knudson used the Pfeffer medium (Table I) in his previous research on the utilization of sugars by flowering plants, and it is not surprising that it served as a basis for his early experiments with orchids. Two possible concentrations of "good nutrient solutions" were suggested by Pfeffer in his monumental *Physiology of Plants* (Pfeffer 1900). One contains 0.016% of salts (i.e. the minerals are dissolved in 7 liters of water), and the other consists of 0.025% (the same components in only 3 liters). Knudson used an intermediate concentration by dissolving the minerals in 5 liters of water. In retrospect it seems that he would have obtained satisfactory results with all three concentrations as with Knop's medium which was formulated before Pfeffer's.

The concentrations of calcium nitrate, potassium phosphate, and magnesium sulfate in the Knudson B medium are slightly higher than in the intermediate Pfeffer's solution, but this is probably due to simple rounding off (1 g rather than 0.8 g for calcium nitrate and 0.25 g rather than 0.2 for the other two). He replaced 0.2 g (0.02 moles) of potassium nitrate (KNO_3) with 0.5 g (0.038 moles) of ammonium sulfate $\{(NH_4)_2SO_4\}$. At first glance this seems like a doubling, but in fact it is a quadrupling because on ionization potassium nitrate produces a single nitrogen-containing ion (NO_3), whereas ammonium sulfate releases two such ions ($2NH_4^+$). The reason for the substitution was "...

because Burgeff stated that the orchid seeds utilized ammonium sulfate to better advantage than the nitrate salt" despite the fact that Knudson's "... experience {was} not in accordance with this". Burgeff was indeed a proponent of reduced nitrogen (ammonium, urea) for orchid seed germination; more recent evidence tends to support his views. Knudson was therefore wise to make the substitution, but his results show no compelling reason to use reduced nitrogen for the orchid seed germination.

Another modification by Knudson was the use of 0.05 g $Fe_2(PO_4)_3$ instead of 8 mg (0.04 mmoles) $FeCl_3$. Such a phosphate of iron is not listed in the 1922 edition and present editions of the *Handbook of Chemistry and Physics* and the *Merck Index*. This phosphate of iron $\{Fe_3(PO_4)_2\}$ which occurs in nature as the minerals vivianate and ludlamite is "practically insoluble in water." Due to natural and unavoidable oxidation, commercial preparations contained basic ferric phosphate. A theoretical molecular weight, 396.61, calculated from the concentration given in his recipe was 130 micromoles, which on ionization can be expected to yield twice as many ions (i.e. the equivalent of 260 micromoles). Thus, if Knudson did use this compound the amount of usable iron in his solution B (260 micromoles) was roughly the same as that in Pfeffer's medium (310 micromoles). If Knudson used vivianite (formula weight 357.5), solution B contained 140 micromoles of the mineral or 280 micromoles iron, which is also very similar to the concentration in Pfeffer's formulation. It is possible, therefore, that 1) Knudson used vivianite for reasons which are not clear at present, or 2) the numerals 2 and 3 in the subscript were transposed in the formula given in his first English-language paper.

Even if the foregoing is accepted as a reasonable speculation, questions still remain regarding the actual iron source(s) used by Knudson. In the Spanish-language paper the iron source in solution B is listed as 50 mg(332 micromoles) $FePO_4$ (molecular weight 150.83). This salt at the same concentration is also included in a later recipe. A more abbreviated English-language paper published in November 1922 lists the iron source as 50 mg (308 micromoles) $FeCl_3$ (molecular weight 162.22). In the paper announcing his medium C, Knudson also gives a recipe of solution B. This time the iron salt is $FePO_4\ 4H_2O$ (formula weight 222.89) at 25 mg of iron in the Knudson C medium is 25 mg (90 micromoles) per liter of $FeSO_4\ 7H_2O$ (formula weight 278.02).

It is clear from these figures that until 1946 Knudson attempted to maintain in his medium B an iron level similar to the one in the intermediate Pfeffer solution. To accomplish this, he either experimented with several iron salts, or used whatever salt was conveniently available. He reduced this level by two thirds (from ca 300 micromoles to about 100) around 1946 and again used more than one salt. The major problem he confronted and obviously attempted to solve was, of course, the very poor solubility of iron salts and their tendency to precipitate. Others attempted to use iron citrate or ferric tartate, but the problem was resolved fully only when chelates became available.

Another interesting point is the pH is not mentioned in the first papers. Knudson refers for the first time to the need to pay "attention...to the hydrogen-ion concentration for best results" two years later in connection with a study by a Mr. R. S. Nanz. He states that the results of this study will be reported later by Nanz, but I have been unable to trace a publication other than a dissertation involving him. In 1925 Knudson again mentions "the studies made by Nanz in this laboratory (not yet published)..." and reports that at pH 6 "growth is slow, even though sugar is provided; but at a hydrogen ion concentration of P_H 4.7 to P_H 5.2 growth is very much accelerated..." Knudson engaged in much more detailed studies of pH and buffering capacity on his solution C when it was suggested that it was not well buffered.

Knudson published his first paper on the asymbiotic germination of orchid seeds in Spanish and Spain for reasons which are not clear at present. He visited that country at least twice and spoke the language well, but there does not seem to be a good reason to publish a paper on such a major advance in an obscure publication. The only inducement which comes to mind is rapid publication, and he may have wanted to publish his findings as soon as possible. His first English-language paper was published a year later in a major journal which is as prestigious at present as it was then. Responding to real or perceived criticism by the great British mycologist, John Ramsbottom, Knudson showed a year later that his method was also suitable for the germination of a *Cymbidium* hybrid (obtained from an early American grower, Mr. A. C. Burrage of Boston), *Odontoglossum rossii X Odontioda* (also from Burrage), *Phalaenopsis schilleriana,* and *Dendrobium nobilis (sic;* he probably meant *Dendrobium nobile).* He also attempted to germinate seeds of *Ophrys fusca, Ophrys speculum, Ophrys apifera,* and *"Ophrys fragans"* (all from Spain) and obtained small colorless protocorms. These European terrestrial orchids are very difficult to germinate, and Knudson's media are not suitable for them. Therefore, it is reasonable to assume that most of his seedlings did not develop past this stage. Seeds of *Paphiopedilum venustum* also failed to germinate perhaps "due to loss of viability". This may be one reason; another may be the relative (though not complete) unsuitability of Knudson's two media for seeds of *Paphiopedilum.* Another, recently developed, medium is more suitable for these orchids.

An obvious question to ask about orchid seedlings is: "How long do they require the presence of a symbiont before they become autotrophic?" In the laboratory this question can be answered easily by culturing the seedlings for specific period on sugar containing medium and then moving them on one that contains only minerals. Knudson and Daniel G. Clark (a graduate student?) carried out such an experiment. They transferred seedlings from sugar-containing to sugar-free medium after 1,2,3,4,6,8,12,16,and 20 days. Their findings were that "no significant difference in growth of embryos occurred with the various treatments until the seeds had been left on the sugar medium from 8 to 12 days. With these treatments the percentage of seedlings produced was 8 percent and 11 percent, respectively. With 20 days exposure to sugar the percentage...was only 11 percent. If delayed photosynthesis is the cause of the failure of seedling production, the retardation of photosynthesis...is more than 20 days." This speculation, based on experimental evidence is correct. My doctoral student, Charles R. Harrison, and I asked the same question almost half a century later. Our experiments involved culturing seedlings on 1) sugar-free medium for a specific number of days and then moving them to one containing sucrose, 2) a sugar-containing medium for a specific period, transferring them to a sugarless one for a number of days and then returning them to sucrose-containing Knudson C. Like Knudson we found seedling formation percentages to be nil or extremely low after 5-8 days or less on sugar-containing medium. The percentages are constant and similar to the ones reported by Knudson after 5-20 days on a medium which contains sucrose. Seedling formation increases sharply after that reaching 50% following 35-40 days on sugar and ca 90% in 2 months.

Harrison and I had tools which were not available to Knudson (electron microscopes, C, methods for protein analysis and chlorophyll assays). We used them to determine when seedlings became photosynthetic and to correlate physiological and ultrastructural development. Our findings confirmed Knudson's speculations in that "the retardation of photosynthesis...is more than 20 days". It is approximately 6 weeks. During that time utilization of reserves (starch and lipids) by seeds and seedlings is very low. It increases exposure to sugar for ca 40 days.

Another obvious question was whether amino acids had an effect on the germination of orchid seeds specifically or as sources of nitrogen and/or carbon. Knudson considered these possibilities and reported that "the results with glycine, leucine, and aspartic acid were negative." This question was investigated more extensively by workers at the University of Wisconsin and others.

SYMBIONTS-In his first English-language paper Knudson reported that contamination by *Penicillium and Actinomycetes* enhanced the growth of seedlings which were not covered by mycelium. He speculated that the growth enhancement may have been due to "one or a combination of the following...increase in...carbon dioxide content...change in the chemical character of the nutrient...secretion of organic substances by the fungus or by-products produced on decomposition of the fungus or changes in the sugar...." Such growth enhancement has been observed by others (including myself), and it is interesting to note that its exact causes are not clear even at present. Higher CO_2 content is probably not the cause, because experiments with increased levels of this gas have shown that elevated concentrations do not always result in such growth enhancement. Changes in the sugar are also not the reason because orchid seedlings grow equally well (or nearly so) on glucose, fructose or sucrose and can hydrolyze the later. Fungal products may well be the reason; fungi have been shown to produce vitamins which can enhance the growth of orchid seedlings. Some fungi may also produce plant hormones that can have a similar effect. However, Knudson could not have known these facts because the first plant hormones, auxin, was discovered in 1926, and the effects of vitamins on orchid seedlings were investigated several years after that.

As a result of his observations and reports by others that both *Azotobacter* and *Bacillus radicicola* enhanced the growth of *Lemna,* Knudson added these bacteria to cultures of *Laeliocattleya "Cattleya superba* Schomb. *1/4; Cattleya Dormaniana* Reichb.*1/4 Cattleya Warscewiczii* Reichb. *1/4; Laelia purpurata* Lindl. *1/4. Bacillus radicicola* had a "strikingly beneficial..." effect on media containing 1% glucose, for reasons, which were "yet to be determined" (they are still not known), but *Azotobacter* retarded growth.

His early experiments led Knudson to state that "the necessity of fungus infection for germination has not been proved" and that "germination of orchid seeds is dependent on an external source of organic food". He also found that fungi isolated from *Cattleya, Epipactis,* and *Cypripedium* (probably *Paphiopedilum*) were very pathogenic to seeds of *Odontoglossum.* These findings convinced him that:

1."...no evidence has yet been presented which indicates any favorable effect of (fungal) infection on the orchid plant." He was right at the time, and it is possible to argue that his statement is still true for epiphytic orchids and terrestrial species from warmer climates. Terrestrial orchids from both north and south temperate zones are more dependent on their fungi.
2."The presence of the fungus in the roots of orchids is no evidence that the fungus is essential." This is a philosophical statement, and Knudson was and still is right.
3. Germination of orchid seeds in the presence of fungus may be due to external changes induced by the fungus including "digestion of starch, formation of sugar, and the production of a favorable hydrogen ion concentration." Findings by a number of investigators since Knudson suggests that he was right about digestion of larger molecules by the fungus. Digestion (i.e. hydrolysis) results in smaller molecules (monosaccharides and disaccharides, for example) which can be taken up by the orchids or transported into them through fungal hyphae. The orchids can hydrolyze only relatively small oligosaccharides. Fungi may also affect the pH, but orchid seedlings can do the same.
4. "That the fungus is necessary for the growth of the orchid seed is not true." The facts as known at present are that some orchids (North and South Temperate species) are very or totally dependent on fungi for germination. Species from warmer climates are not. There is also no evidence that mature plants require fungal infection for good growth of flowering.

In 1926 Knudson presented his findings at the International Congress of Plant Sciences which was held at Cornell University between August 16th and 23rd. The presentation was essentially a summary of his previous work. He reported his findings that the fungus hydrolyzes starch into sugars and gave credit to Bernard for being the first to germinate seeds under nonsymbiotic conditions on concentrations of salep ("which contained therefore higher quantities of soluble sugars, etc"). In the conclusion of this paper Knudson gave his "opinion that the unusual requirements of orchid embryos for germination may be explained [by their] inability...to synthesize food. They are...purely saprophytic in early life and must obtain organic food from the substratum. The fungus is a pathogen held in check..." Presently available information indicates that the orchid seedlings obtain their nutrition directly from the living fungus or by digesting hyphae. In some instances they provide their fungi with vitamins and/or hormones and later on in life products of photosynthesis. Thus, it is reasonable to state that the relationship is one in which the orchids may be parasitic at first. Mutualism may occur in some cases from the start or it can develop later on.

The question of fungal specificity was the subject of intense discussion at the time. Some investigators, especially Burgeff, believed in the existence of specificity between orchid and fungus. Knudson did not observe specificity in his experiments. In fact he showed that a pathogenetic "*Phytophtora* sp. isolated by Prof. H. H. Whetzel from Easter Lily (*Lilium* sp.) was about as effective as the orchid fungus, but...embryos were not infected". He also observed that *Penicillium* accelerated the growth of seedlings.

In cross-inoculation experiments Knudson obtained germination of *Cattleya* seeds with fungi isolated from this genus as well as from *Cypripedium* (probably *Paphiopedilum* and *Epipactis*. A fungus isolated from *Cattleya* could be used to germinate seeds of *Cypripedium (Paphiopedilum)*, *Cymbidium* and *Epipactis*, but not *Odontoglossum*. Not having observed specificity Knudson had no reason to accept the view that it existed, especially since results similar to his were reported by others. At present it is known that specificity may exist for some species of fungi and/or orchids and not for others. The reasons for this are still unclear.

By 1926 Knudson's temper must have been wearing thin due to the constant onslaught by Costantin and his associates. The criticism by Burgeff and Ramsbottom probably did not please him, either, despite being more reasonable in tone and nature. It is not surprising, therefore, that he was less than gentle in dealing with his critics. In referring to Bernard's work he wrote: "In attempting to explain the action of the fungus, Bernard made use of an experiment which should have given him the real clue. He found that the fungus could invert some sugar in a nutrient solution [i.e., hydrolyze sucrose]. This of course increased the osmotic concentration [his experience with measurements of osmotic pressure is of relevance here]. Therefore the action according to Bernard was to change starch within the embryo to sugar. This increased the concentration within the cells, and acted as a physical-chemical stimulus to growth. He compared the action of the fungus to the action of a male gamete in fertilization.... He ignored entirely the food relationships." And, "so impressed were Bernard and Burgeff with the necessity of infection that they ignored entirely the possible effect of the fungus on the organic matter of the nutrient solution." Knudson was right, of course, because the discussion was largely about tropical epiphytes. Burgeff worked with epiphytic orchids and also with European terrestrials. They are much more dependent on fungi and may explain some of his views. A year later, his temper obviously wearing thinner, Knudson felt that "certain...deductions...that are misleading...certain comments...relative to [his] investigations and conclusions...require consideration and in some cases necessitate refutation." Knudson had "no desire to enter into a controversy...," but despite this statement he did become embroiled in arguments with a number of persons.

Edward Clement who was associated with the commercial firm of Armstrong and Brown drew Knudson's ire 1) because he did not publish details about his culture medium (chances are that Clement used Knudson's or Pfeffer's media in some form), 2) with statements about pH (reporting that pH 6.5-6.8 were appropriate, which is now known not to be the case), and 3) due to incorrect reasoning about the food value of agar (he believed wrongly that agar or its component sugar galactose might be of use to the seedlings). Knudson did not mince words and called some of his statements "not only worthless...but actually misleading". Even if not very tactful, Knudson was absolutely right.

The Drs. G. and M. Ballion reported "the usual satisfactory germination with asymbiotic methods" and that the seedlings obtained in this fashion are normal. But, "inadvertently perhaps and...certainly inconsistently with..." their own views, they also suggested that asymbiotic germination was induced by a stimulus which is due to the osmotic properties of the medium. Knudson dealt gently with them, merely pointing out that "there is nothing particularly mysterious in the stimulus...by an appropriate nutrient solution." He asserted that no germination will occur on a medium with a non-utilizable sugar. This point was proven more recently through the use of sugar alcohols.

As might be expected, Costantin generated the most anger (and justifiably so), because "as previously, he considers it necessary to deal in a rather ungracious manner with those who differ with him." Knudson dealt with him by 1) presenting facts, 2) refuting arguments , and 3) suggesting that Costantin made a "theoretical contribution" and statements which have "no scientific importance...for [they] merely give expression to a guess and nothing else." He also indicated that Costantin's statements regarding the presence of starch in orchid seedlings as being a sign of abnormality "would not impress any physiologist as of importance...". In a few instances Knudson spelled Costantin's name as "Constantin" and this only added oil to the fire.

Knudson concluded his relatively angry paper by suggesting that the admonitions to consider the teachings of nature don"t mean much because "nature presents a set of conditions and the interpretation is made by man" and that proof can only be obtained from experiments. Again he was, and still is, right.

After 1927 only one of Costantin's theoretical questions remained unanswered by experimental evidence. This was his contention that plants grown from asymbiotic seedlings would not flower. He continued to press his view even after it was shown that seedlings produced by asymbiotic method grew into plants which flowered when transferred to potting medium. His argument at that point was that the plants flowered because their roots became infected in the pots. He also claimed that the fungus probably contributes substance(s) that may be required for reproduction. So sure was Costantin in his view that he challenged Knudson to produce flowers on plants raised asymbiotically.

A great scientist such as Knudson can foresee some of the questions that may arise from his work and designs experiments in advance. This was the case with the flowering of asymbiotic orchids. On October 20, 1920, Knudson germinated seeds of a *Laeliocattleya* hybrid on his medium B. Less than a year later on August 4, 1921, some of the seedlings were transferred to a 250 ml Erlenmeyer flask containing sugar-free solution B solidified with 1.5% agar and adjusted to pH 5.8. Growth was slow and on December 22, 1923, a plant with leaves 5 cm long was transferred to a 12-liter flask containing 4 liters of half-strength solution B without sugar at pH 4.9. "After transplanting, the flask was taken to the greenhouse where it was placed in a shaded chamber to prevent any burning of the inclosed [*sic*] plant by the sun".

The plant grew well, and after eight months in the large flask it reached a height of about 11-12 cm. The culture remained uncontaminated until June 1927, when a *Chlorella* species formed a colony. This was followed by a moss and later a fungus which resembled *Penicillium* and "was just visible". These did not affect the plant, which continued to grow well, develop a good root system, and flowered in November, 1928, producing two normal flowers. Its roots were free of any organisms. Cultures made from the agar surface on potato agar medium "... developed two forms of *Penicillium,* and *Fusarium,* and two forms of yeast with several bacterial colonies apparent. There was no evidence of the presence of the orchid fungus". Other seedlings from this batch planted in pots flowered October-December, 1927 and 1928. Their roots contained fungi. No additions were made to the culture medium during the five years of growth and only about two liters of water were lost.

Obtaining flowers in vitro was perhaps Knudson's greatest triumph because it proved that orchid plants grown aseptically and with out mycorrhiaze produced from asymbiotic seedlings were normal. It is possible also that his were the first plants of any kind to flower in vitro. Ironically, however this experiment was flawed and could have been challenged successfully. It was not, and subsequent research proved that Knudson was right, but he was fortunate that Costantin, who would have been the one to challenge him, was not well informed.

In 1927 Frits W. Went published his now-famous paper reporting on the discovery of the first plant hormone, auxin. To isolate the hormone Went placed oat coleoptiles on agar blocks and allowed the substance to diffuse into them. Then he used these blocks for experiments. His technique proved that substances can diffuse from excised plant tissues into agar and from there back into plants. The same could have happened in Knudson's 12-liter flasks. Substances could have diffused from the alga, fungi, moss, and bacteria into and through the agar reaching the orchids. These substances could have been Costantin's "vitamins necessary for reproduction...".

If nothing else, Costantin could have claimed that such diffusion took place. Had he done that Knudson could have: 1) ignored Costantin; 2) responded by labeling Costantin a gadfly and ignoring him (this approach would have been effective because of Costantin's manner of dealing with Knudson; 3) engaged in polemics and theoretical considerations; or 4) repeated his 12-liter flask experiment, this time more carefully with several replicates.

Everything currently known about Knudson as a scientist and a person suggests that he would have repeated his experiments despite the time and labor this would have required. Had he done that his point would have been proven because asymbiotic orchid seedlings are known to flower in vitro.

Medium C-The English *Orchid Review*, the oldest orchid publication in existence, was in its 30th year when Knudson published his first English-language paper. Critiques and summaries of this and other papers were published regularly in the *Orchid Review* (which is the only journal to cite Knudson's article in *The Garden* in 1922), but he never wrote directly for it. His first article in a specialty orchid publication appeared in the *American Orchid Society Bulletin.* In it he described the germination process of *Cattleya*, but did not elaborate on his culture medium. He did write about his medium B and media developed by others in a subsequent article, which was reprinted in 1952. In this article he elaborated on the need for an appropriate pH, commented about agar quality, threw a few barbs at old antagonists, and discussed sugars. By 1943 several sugars were screened for their ability to support orchid seed germination and seedling growth. This resulted in contradictory claims regarding the suitability or superiority of various sugars. Knudson described some of these claims, did not question any of them, and reported his own results and preferences.

One problem with comparative studies of this nature may be the special preferences of some species. Therefore it is simply impossible to make comparisons between the preferences of *Cattleya* and *Paphiopedilum*, for example. Another problem may be the purity of the sugars. Impurities present in some cases could be injurious. In other instances impurities such as vitamins may enhance growth. This can be illustrated with maltose. Some investigators reported that maltose was well suited for orchid seed germination. But Knudson found that highly purified maltose was inferior to sucrose, glucose or fructose. The reason for this was that highly purified maltose does not contain the vitamin niacin as impurity, and it enhances orchid seed germination and seedling growth. Knudson's recommendations regarding sugars was that sucrose purchased in the grocery store was entirely satisfactory for most orchids, and he was right. For others he recommended glucose or fructose. Subsequent experiments have shown that this recommendation was sound.

Over the years Knudson attempted to germinate many different orchids on his medium B and concluded that it "has not been entirely satisfactory for seeds of ..." *Paphiopedilum, Vanilla,* and native species of *Cypripedium.* On occasion he also had problems with *Cattleya, Phalaenopsis,* and *Vanda.* His conclusion was that a possible shortage of microelements could be the reason. In an attempt to solve the problem he added boron, copper, manganese, and zinc to medium B "without any improvement in the case of *Cypripedium* and *Vanilla*". Therefore he tried a new approach..."which consisted of adding iron and manganese in a ratio of 2-3. After several experiments he settled on a solution (Table 1) in which the iron level is 5 mg $liter^{-1}$ (provided by 25 mg ferrous sulfate, $FeSO_4 \cdot 7H_2O$, l^{-1}) and the manganese sulfate, $MnSO_4$ $4H_2 liter^{-1}$), or a ratio of 2.3Fe:1.

He described this solution as being "theoretically better than B...results with *Cattleya* show it to be superior." Medium C replaced solution B very rapidly and quickly became the standard solution for the germination of orchid seeds.

The problems encountered by Knudson with *Paphiopedilum* seeds germinate on it reasonably well, but much better germination con be obtained on a medium formulated specially for this genus. *Cypripedium* seeds, like those of most other North or South Temperate species, do not germinate well on medium C. Some species may germinate asymbiotically, poorly, or rarely well, on one or another of several media, but on the whole these orchids require fungal symbionts for germination like other terrestrial species from North and South Temperate climates.

Table 1

Composition of medium, mg l^{-1} water unless indicated otherwise

	Knudson				Vacin and Went	Schenk and Hildebrand[6]	Hoagland[7]		
	Pfeffer[1]	B	C	Galambos			1	2	Knop[2]
Macroelements									
Monoammonium phosphate $NH_4H_2PO_4$						300		136	
Ammonium sulfate $(NH_4)H_2PO_4$		500	500	200	500				
Calcium chloride $CaCl_2.2H_2O$						200			
Calcium nitrate $Ca(NO_3)_2$	800	1000	1000	1000			820	656	800
Calcium phosphate $Ca_3(PO_4)_2$					200				
Magnesium sulfate $MgSO_4$[3]				250			240	240	200
Magnesium sulfate $MgSO_4.7H_2O$	200	250	250		250	400			

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[6]As used for the culture of orchid plantlets.

[7]Knudson used Hoagland's solution in one of his experiments, but did not indicate whether it was version 1 or version 2.

[2]Knop's solution predates Pfeffer's by approximately 35 years. The two solutions are very similar and Knop's is listed here for comparison purposes.

1The numbers of waters of hydration not given.

Potassium chloride KCl	100			120					
Potassiuim nitrate KNO_3	200				525	2500	505	606	200
Potassium phosphate KH_2PO_4	200	250	250	250	250	250	136		200
Iron									
Ferric chloride $FeCl_3$	8								
Ferric phosphate $Fe_2(PO_4)_3$[4]		50							
Ferric phosphate $FePO_4$				50					Trace
Ferrous sulfate $FeSO_4.7H_2O$			25			27.85			
Ferric tartate $Fe_2(C_4H_4O_6)_3 \cdot 2H_2O$					28		5	5	
Chelating agent									
Sodium EDTA Na_2EDTA						37.25			
Microelements									
Boric acid H_3BO_3						10	2.8	2.8	
Copper sulfate $CuSO_4.5H_2O$						0.025	0.08	0.08	

[4]This formula is given in Knudson's paper in English, but is doubtful that he used such a salt. See text for discussion.

Manganese chloride $MnCl_2 \cdot 4H_2O$							1.81	1.81	
Manganese sulfate $MnSO_4 \cdot H_2O$			7.5		7.5				
Manganese sulfate $MnSO_4 \cdot 4H_2O$						25			
Molybdic acid $H_2MoO_4 \cdot H_2O$							0.02	0.02	
Sodium molybdate $Na_2MoO_4 . 2H_2O$						0.15			
Zinc sulfate $ZnSO_4 . 7H_2O$						10	0.22	0.22	
Amino acid									
Asparagine[5]				500					
Sugar									
Sucrose	1%	2%	2%		2%	2%			
"Sugar"[6]				2.5%					

[5]This amino acid is not known to enhance seed germination and seedling growth, but Burgeff used it in a culture medium for endophytes. At 370 mg liter^{-1} in asymbiotic media asparagine is a better nitrogen source for seedlings than leucine and cystine.

[6]M. Galambos is reported to have used "Zucker" ("sugar"), probably sucrose, some of which breaks down to glucose and fructose during autoclaving.

AMERICAN ORCHID SOCIETY

6000 South Olive Avenue
West Palm Beach, Florida 33405-4159
TEL: (407) 585-8666
FAX: (407) 585-0654

May 24, 1995

Mr. John E. Miller, Treasurer
The Odontoglossum Alliance
PO Box 38
Westport Point, MA 02791

Dear John,

On behalf of the Officers and Trustees of the American Orchid Society, I want to extend my sincere thanks, appreciation and congratulations to The Odontoglossum Alliance for the tremendous expression of goodwill and support that was brought before the COA's and the Board's attention during our recently concluded meetings in Portland. Receipt yesterday of The Alliance's magnanimous gift — complete start-up funding ($5,100) for the Society's newest specialty award, the Robert B. Dugger Trophy — has assured that the new fund has a solid foundation. In case you hadn't heard, the vote of the AOS Board of Trustees was a ringing, unanimous one.

As you are aware, the AOS, as a non-profit organization, depends heavily on such donations in order to expand our services on behalf of orchid enthusiasts the world over. Thanks to the continuing support of generous orchidists throughout the world, the AOS is growing, at an unprecedented rate, in facilities and services to its members. New and worthwhile endeavors such as the "Dugger" award fund help make these exciting times for the AOS, and we solely have supporters such as you and your Alliance peers to thank.

I will make certain that special note is made in a future issue of the *Bulletin* of this new award and the accompanying contribution. I feel quite confident that the Dugger award fund's principle will continue to grow in future years, setting up that much higher an award amount for subsequent winners of the prestigious award.

Again, I extend a very special thanks to the members of the Odontoglossum Alliance. Such generosity plays an essential part in the success of the Society, and it is truly appreciated and gratefully acknowledged. The end result of such support, of course, is an increased capability of meeting the expectations of our members and of the world's orchid community.

In closing, I trust that, as always, you will never hesitate to contact me personally if either my staff or I can be of any assistance whatsoever to you or the members of the Odontoglossum Alliance in the future.

Sincerely,

Lee S. Cooke

Lee S. Cooke
Executive Director
American Orchid Society

AMERICAN ORCHID SOCIETY

6000 South Olive Avenue
West Palm Beach, Florida 33405-4159
TEL: (407) 585-8666
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For Review in Your Magazine

Just Published

Orchid Pests and Diseases

The American Orchid Society has just published the 1995 Revised Edition of ***Orchid Pests and Diseases.*** Written by leading authorities on the identification and control of orchid ailments, this book is an update of the popular 1991 edition that offers in nontechnical language practical advice on insect and noninsect pests, bacterial and fungal diseases, orchid viruses, and physiological disorders, along with suggested cures and treatments.

This book was written to make it possible for amateur and commercial orchid growers everywhere to be able to identify insects and other pests that may harm their orchids. All chemical recommendations have been updated through late 1994, nonchemical treatments are provided, and new color photographs show a greater range of insects and diseases.

New features of this revised edition include a chapter on the natural control of insects and mites, a glossary of more than 95 terms and a list of centers in the United States that identify orchid ailments.

Table of Contents:

Orchid Pests and Diseases features more than 100 color and black-and-white photographs that permit identification of insects and other ailments. The 118-page volume is perfect bound and set in a sturdy paper cover designed to withstand repeated use it is sure to receive.

Orchid Pests and Diseases (BK 103) retails for US$12 (plus shipping, handling and, for Florida residents, appropriate sales tax). Copies can be ordered from the American Orchid Society Book Department, 6000 South Olive Avenue, West Palm Beach, FL 33405 (Book Department telephone 407-585-2510; fax 407-585-0654). A Booklist that describes nearly 250 titles may be requested from the Book Department. Members of the American Orchid Society receive a 10-percent discount on the retail price of this and most other items offered through the Society's Book Department.

Please send two copies of any review or announcement of *Orchid Pests and Diseases* in your magazine to James Watson, American Orchid Society, 6000 South Olive Avenue, West Palm Beach, Florida 33405.

ODONTOGLOSSUM ROSSII.

IN almost every collection of orchids one or more plants of this pretty and popular cool-house Odontoglossum are to be found. More than 70 years ago Mr. Barker, of Birmingham, named the species in honour of his collector, Mr. Ross, who sent the first plants over to this country from Mexico, one of which, on flowering, was figured in the *Botanical Register* of September, 1839, t. 48.

The plants are dwarf and succeed well when grown in shallow pans suspended in the cool-house. The flowers are from two to three inches across and usually borne two to four on a spike; the sepals white, closely spotted over their entire surface with dark brown; the petals white, with similarly coloured spots on the basal or inner half; lip broad with a waved margin, white, with a bright yellow crest. The flowers, which last a considerable time in perfection, are produced during the winter months.

Our illustration is from a photograph, taken April 8th, 1887, of the variety *rosefieldiense*, a remarkable plant bearing a 14 flowered spike, three of which died as buds. This is not the only plant which has produced such a remarkable spike, as a plant flowered in the collection of Mr. Philip Crowley, Waddon, Croydon, who exhibited it at the Royal Horticultural Society on March 8th, 1892, carrying a spike of 16 flowers, one of which died as a bud; but this, Mr. Crawshay informs us, was "a poor variety of narrow form," he having made the note at that time. Unfortunately, this plant was not noted in the Crowley sale catalogue, and the subject of our note has never since had another abnormal spike; perhaps this note may unearth some other examples of their gigantic spikes upon an usually four-flowered species.

O. Rossii var. F. L. Ames. This fine bold variety was dedicated to the Hon. F. L. Ames, into whose collection it passed after receiving a First-class Certificate from the R.H.S. on April 24th, 1888.

O. Rossii albens. A distinct variety in which the dark spotting is almost eliminated, leaving only slight markings of soft green. This variety first flowered in the collection of Reginald Young, Esq., of Liverpool, and received an Award of Merit from the R.H.S.

on January 12th, 1892, when exhibited by Messrs. Charlesworth and Co. It is figured in the "Orchid Album," vol. x., t. 434.

O. Rossii Low's variety. Very similar to the above; flowers pale green. Exhibited by Messrs. Hugh Low and Co. at the R.H.S., March 10th, 1903, when it received an Award of Merit.

O. Rossii immaculatum. A peculiar and very rare form of *Rossii*, every trace of spotting has vanished, leaving the sepals pale pink and the petals and lip white. It first appeared in the collection of O. O. Wrigley, Esq., some 16 years ago, being afterwards shown by de Barri Crawshay, Esq., at the R.H.S. on March 6th, 1906, when it received an Award of Merit. Figured in the *Orchid Review*, April, 1895; March, 1902.

O. Rossii rubescens. Of all the varieties of *Rossii* none are more sought after than these rosy forms, pleasing as they are to the eye and of great use to the hybridist. Only one variety of *rubescens* has been certificated by the R.H.S., and this was exhibited by Frau Ida Brandt, of Zurich, on February 11th, 1896, when it received an Award of Merit.

The variety *majus* is a stronger growing and larger flowering variety; while the plant, which received a First-class Certificate from the R.H.S., on October 19th, 1869, under the name *O. Rossii Warneri*, was probably a natural hybrid between *Rossii* and *nebulosum*.

This is not a complete list, but it embraces the greatest variations of the species.

O. Rossii Hybrids.

O. aspersum (Rossii × maculatum). At first sight this appears to be a yellow *Rossii*, but the influence of *maculatum* can also be seen in the slightly longer and narrower lip, and the extra blotching on the petals. A rare natural hybrid.

O. Humeanum. A supposed natural hybrid between Rossii × cordatum. It shows characters derived from both these species, and may be distinguished from *O. aspersum* by having longer and narrower sepals, and a lip more like *cordatum*.

O. Smithii (Rossii rubescens × crispo-Harryanum). One of the most beautiful Odontoglossums raised. The sepals and petals are white with a slight greenish tinge, tipped with very deep rich rose purple, and with many dark, almost blackish chocolate-purple spots. The lip is rose purple, white at the base with a few markings, and a yellow crest. This seedling was raised by Messrs. Charlesworth and Co., and received a First-class Certificate when exhibited by them at the R.H.S., on December 5th, 1905. It afterwards passed into the noted collection of J. Gurney Fowler, Esq. Figured in the *Gardeners' Chronicle*, December 16th, 1905.

O. Fowlerianum (Rossii rubescens × cirrhosum). A pretty hybrid with narrow sepals and petals densely spotted with dark purple and tipped and margined with bright rose-purple, the lip being of the same colour but yellow at the base. A First-class Certificate was awarded to this plant when shown at the R.H.S. by Messrs. Sander and Sons, on March 6th, 1906. Figured in the *Gardeners' Chronicle*, March 17th, 1906.

O. Theodora (Rossii rubescens × triumphans). A remarkable and fascinating Odontoglossum. Sepals clear yellow ground colour, almost covered with blotches of deep reddish-brown colour. The petals have the same ground colour but are thickly blotched for two-thirds of their length. The lip is very broad and attractive, being white, slightly rose tinted, with a horseshoe-shaped blotch of bright reddish-brown, and yellowish crest. Raised by de Barri Crawshay, Esq., and received a First-class Certificate when exhibited by him at the meeting of the R.H.S., held on April 20th, 1909. Figured in the *Gardeners' Chronicle*, April 24th, 1909.

Odontioda Graireana. A remarkable hybrid, raised by M. H. Graire, from Odontoglossum Rossii × Cochlioda Noetzliana. The sepals and petals salmon-red, obscurely spotted, the lip blush-white with a yellow crest; the flowers being fairly intermediate in shape. A Certificate of Appreciation was awarded to this hybrid when exhibited at the R.H.S., on August 31st, 1909.

O. Ceres (Rossii × Rolfeæ). A well formed flower. Sepals and petals white, tinged with primrose-yellow at the margins, the sepals being evenly spotted with claret-red, the petals having the spots on the inner halves only. Lip large, wavy, white, with a lemon-yellow crest, having slight purple markings. Raised by Messrs. Charlesworth and Co., and exhibited by them at the R.H.S., on February 22nd, 1910, when it received an Award of Merit.

O. Blackii (Rossii × Pescatorei). An interesting hybrid exhibited at the R.H.S., on March 8th, 1910, by R. G. Thwaites, Esq., Streatham. The elongated slender inflorescence of this plant was indicative of *Pescatorei*, but the individual flowers more closely resembled *Rossii*, the lip being very pandurate in shape.

O. Rossianæ (Rossii × Adrianæ). This plant was shown at the R.H.S., on April 19th, 1910, by Mons. Henri Graire, St. Fuscien, Amiens. He also exhibited the *rubens* variety of this hybrid on the same day, which was a pretty hybrid with six flowers on the spike. Sepals and petals lilac with white base, the sepals evenly spotted with dark purple and the petals having some dark spots on the inner halves; lip rose with a yellow crest.

Odontoglossum Rossii rosefieldiense.

Upcoming Shows and Announcements

XXI International Orchid Show of Colombia, S.A.
The 21st International Orchid Show of Colombia will be held in Medellin, Colombia 21-25 March 1996. The show will be at the Joaquin Antonio Uribe Botanical Garden in Medellin. Information on the show for attendees and exhibitors may be obtained from:
XXI Colombian International Orchid Show
Apartado Aereo 4725
Medellin, Colombia
Telephone Numbers
+ 574-233-89-52
+ 574-244-83-84
+ 574-351-02-17
+ 574-351-01-18
FAX + 574-233-89-52
+ 574-351-02-34

An alternative to the CD Orchid Listing

While in Portland, Oregon last April I attended a demonstration of Steve Gray's Wildcat program. This is a computerized data base of the Orchid Registration and some of the AOS Awards data. This program was supplied on a floppy disk, either 5 1/4 or 3 1/2 size. The program was built on a commercial available PC software data base.
I found the menu driven system on a 486 laptop to be very fast. The capability for various searches were there. I found the system easy to use. What was important to me was the floppy disc input which means I would not need to buy a CD reader. Since then the software has been advertised in the AOS Bulletin at about $160.00 which is much lower in price than the CD ROM version.
John E. Miller-Editor

A Request to Members

I have two requests for you as a member of the Odontoglossum Alliance. First I would be very pleased to have you write an article for our newsletter. It can be on any topic related to the Odontoglossum Alliance . It can be submitted to me either in typewritten form or on a disc in Word Perfect 6.0 or 5.1 or in Microsoft Word or Works. If your article has color photographs you can send them as slides or as prints. I use prints as the reproducible form so if you send slides I will have prints made. In either case Iwill return your original material.

Second I would like to hear from you on the topics or material that you would like to see in the newsletter. Just drop me a short note in the mail:
Odontoglossum Alliance
P.O. Box 38
Westport Point, MA 02791
or FAX to:508-636-8409
or e-mail to:jemiller49@aol.com
The Alliance has been generous to support the effort to establish an Odontoglossum Alliance Trophy of the American Orchid Society. It is Robert B..Dugger AOS Trophy. This project was successfully

accomplished and contributions to the trophy endowment fund continue to be received. There are several ideas for other projects that might be done by the Alliance. We would like to hear from you, our member, as to your ideas for projects. You should communicate your ideas to the address listed above.
I hope to hear from you.
John E. Miller

Speakers at the April 1995 Odontoglossum ALliance Meeting.

Page 26 illustrations are of several of the program speakers at the April 1995 meeting of the Odontoglossum Alliance held in Portland, Oregon.
Starting at the upper left hand corner of the page and proceeding clockwise we have:

Robert Hamilton, President, Odontoglosssum Alliance

Wim Velsink, Session Chairman

Helmut Rohl, lecturer "Oncidinae Intergenerics"

Steve Gettel, lecturer "Classic Odonts"

Juan Felipe Posada, lecturer " Colombian Orchids: Description and Species for Hybridizing"

Sandro Cusi, lecturer "Lemboglossums and Their Habitats"

Election

In the May 1996 Newsletter we will send out a ballet accompanying the notice of dues form for the period August 1996-May 1997. Voting will be done by returning the ballot before 1 August 1996. At that time we will be electing eight directors from the slate submitted plus any write-in votes. The top eight by vote count will be elected as Directors for the next three years. The Board of Directors will elect the Officers of the Alliance: President, Vice-President, and Secretary-Treasurer. These results will be published in the August 1996 Newsletter.

Lewis Knudson

Editors Note:
This complete (except for illustrations and bibliography) and interesting biography of Lewis Knudson was reprinted here with permission of the Author, Dr. Joseph Arditti, and the American Orchid Society, Lindleyana publication (The issue for March (1:1-80) published March 29, 1990). The original publication contains a number of interesting photographs, none of which are reproduced here. Also the complete bibliography is omitted. Readers who wish to see either of these items are referred to the original publication. Other than that this is a true and accurate reproduction of the original material. It is planned that this will be printed in the Odontoglossum Alliance Newsletter in five (5) parts. The Odontoglossum Alliance is grateful to Dr. Arditti for his generous permission to publish the story of Lewis Knudson.

Hybrids Involving the Genus Ada

by Helmut Rohrl

John Lindley described the first Ada species in 1853; it was Ada aurantiaca. In 1891 Ada lehmmannii was added to the genus by Rolfe. This was the extent of the genus Ada until N.H. Williams transferred into it the Glumacea section of the genus Brassia. Depending on the taxonomist there are currently 10 - 17 described Ada species. From Colombia and from Ecuador 8 Ada species have been reported. All known Ada species are found in the Andes of South America where most of them are encountered at altitudes from 1800 m to 2500 m, although some appear as low as 650 m and as high as 2700 m. The plants are small to medium in size and have short rhizomes and erect inflorescences. The growth habit is fan-like and the pseudobulbs are usually flattened and inconspicuous. The inflorescences are relatively short and seldom longer than the leaves. In some species the sepals and petals are partly fused, while in others they are widely spread. Few of the species such as Ada aurantiaca, Ada bennettorum, and Ada lehmannii are brightly colored. But most of them present dull colors with yellow to greenish tepals having a heavy overlay of brown and a white to yellowish lip with dark spots or design.
Ada species are easily cultivated. They enjoy subdued light, cooler temperatures, good air circulation, and a moist atmosphere. The planting medium should not be allowed to dry out.
Next we quote three books in which pictures of Ada species can be found:

Bechtel, H., Cribb, P., and Launert, E.: The Manual of Cultivated Orchid Species, third ed., Cambridge 1992
(Ada aurantiaca, glumacea, keiliana)

Native Colombian Orchids, vol. 1, Medellin 1990
(Ada aurantiaca, elegantula, glumacea, keiliana, ocanensis)

Native Ecuadorian Orchids, vol. 1, Medellin 1992,
(Ada andreettae, elegantula, glumacea, mendozae, ocanensis, pozoi).

The Orchid Hybrid Registration lists the following 16 genera, registered prior to 31. December 1994, that contains Ada species. N. lists the number of hybrids in the genus, Year lists the year of the registration of the genus. See Table I, page 23.
A breakdown of the numbered of registered hybrids according to the year of registration shows the following shown in Table II onpage 24.
Four hybrid genera were originated by G. Black of Brize Norton, UK, while three were introduced by the indefatigable W.W.G. Moir of Honolulu, Hawaii, USA. Each of them registered four Ada hybrids. Moreover two Ada hybrids were registered by each of the following hybridizers: McBean's Orchids, H. Rohrl, A. Schilliger, and Santa Barbara Orchid Estate; two more were originated (but not registered) by the Beall Orchid Company.
The "classical" period of Ada hybrids (-ø to 1979) has produced four hybrid genera, namely Adgm., Ado., Brsa., and Mtad., and a total of six hybrids. Five of these are simple primary crosses, that is species x species. The remaining one is a complex primary hybrid, that is hybrid x species; it is Adgm. Nanum = Ada aurantiaca x Odm. Phoebe, the latter one being Odm. cirrhosum x Odm.

crispum. The "modern period of Ada hybrids (1980 to + ø) adds the remaining eleven genera (plus one hybrid Ada) and a total of twenty six hybrids.

Of the 32 registered Ada hybrids one contains Ada allenii, twenty six are based on Ada aurantiaca, two involve Ada glumacea, three come from Ada keiliana, and one is made with Ada ocanensis. The obvious preference for Ada aurantiaca comes from its orange color. The other two brightly colored species, that is Ada bennettorum and Ada lehmannii, have not been used yet.

Ada aurantiaca appears as pod parent fourteen times and as pollen parent only once. Ada allenii was used as a pollen parent once. Ada glumacea served once as a pod parent and once as a pollen parent. Ada keiliana shows up as a pod parent once and as a pollen parent twice. Ada ocanensis, finally, was used as a pollen parent once. These numbers may suggest that Ada aurantiaca has a higher chromosome number (namely 60) than the bulk of the Oncidiinae. The corresponding number for the Ada species of the Glumacea section are much smaller. However they seem to indicate that these Ada species perform equally well as pod parents as pollen parents. This may mean that their chromosome number is the same as that of most Oncidiinae (namely 56). There is another Ada hybrid that has found multiple use in hybridizing: Brsa. Mem. Bert Field. It shows up as a pod parent six times and as a pollen parent twice.

A brief listing of the AOS awards through 1994 is of interest. The only species awarded is Ada keiliana 'JEM' AM/AOS. The awarded hybrids are Adgm. Wild Kingdom 'Santa Barbara' HCC/AOS; Brsa. Mem. Bert Field (cultivars) 'Linda Marie Sellon' AM/AOS; 'Orange Sherbert' HCC/AOS; 'Tangerine' AM/AOS; Brsa. Orange Delight (cultivars) 'Orange Lou' HCC/AOS, 'Sarbek Orange' HCC/AOS; Dugg. Robbie 'Sun Drop' HCC/AOS. In addition, the Awards Quarterly vol. 26 (1995), #3, lists an AM/AOS for Brsa. Orange Delight 'Lou's Orange'.

The main problem with hybridizing with Ada is their crowded inflorescence and, at least in the more colorful species, the shape of the flowers. As a consequence they should be bred preferably with plants that have good flower count and shape, and long spikes with well spaced flowers. The obvious candidates are Oncidium and Odontoglossum species and their hybrids. Also Brassias and Miltonias and their hybrids could be good partners, as long as they satisfy the stated requirements. And I wouldn't be surprised if some on the minor Oncidiinae, such as Comp. speciosa, would make excellent hybrids with some of the Adas. At any rate, hybridizing with Ada has been neglected for a long time and I believe that their inclusion in the main stream of Oncidiinae breeding would be a desirable and awarding endeavor.

Obvious candidates for further breeding are the awarded Brassadas. Generally, Brassadas show improved spike length, flower shape, and flower size when compared with Adas, and better color than their Brassia parent. In my opinion this means that Brassadas will be better parents than straight Adas. Crossing them with long-spiked Brassias such as certain cultivars of Brs. gireoudiana or Brs. thyrsodes would give us improved Brassadas, and mating them with Odontoglossums or Oncidiums with long peduncles would bring about better and more colorful Banfieldaras and Pettitaras. Another potentially good breeder is Adcdm. Orange Charm. Some clones have fairly long branched spikes, good flower count, and well displayed and colorful flowers. More Adacidiums should be made, using floriferous Oncidiums. They all will produce rewarding hybrids. Of course many of the hybrid genera listed in this note contain cultivars worthy to be included in hybridizing programs. But it will take time and dedication to locate them, and good luck to get hold of them. For instance, I saw a marvelous clone of Ado. Saint Fuscien in a friend's greenhouse and was promised a piece of it. Alas, when I came back at a later date the plant had died. C'est la vie.

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Table I

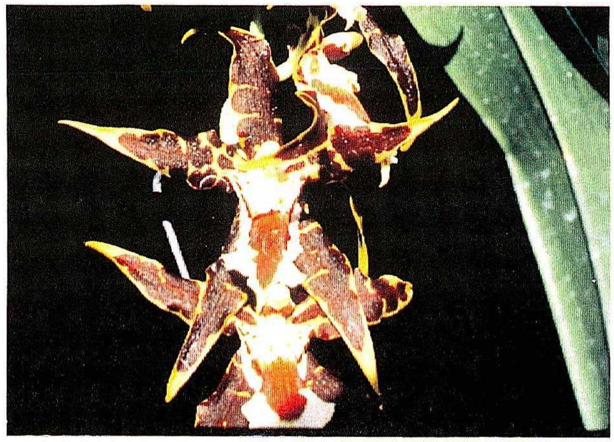
NAME (ABBREVIATION)	N	REGISTER/ORIGIN	YEAR
Ada (Ada)	1	J&L	1992
Adacidium (Adcm.) = A. x Onc.	1	Rohrl	1990
Adaglossum (Adgm.) = A. x Odm.	8	McBean's Orchids	1913
Adioda. (Ado.) = A. x Cda.	1	Graire	1911
Banfieldara (Bnfd.) = A. x Brs. x Odm.	1	Burnham (Beall)	1981
Biltonara (Bilt.) = A. x Cda. x Milt. X Odm.	1	G. Black	1993
Brassada (Brsa.) = A. x Brs.	5	G.S. Field (E.K. Field	1970
Duggerara (Dugg.) = A. x Brs. X Milt.	2	W.W.G. Moir	1982
Gomada (Gmda.) = A. x Gom.	1	A. Schilliger	1991
Hamiltonara (Hmtn.) = A. x Brs. x Cda. x Odm.	1	Fordyce	1994
Maunderara (Mdna.) = A. x Cda. x Milt. x Odm. x Onc.	1	G. Black	1994
Miltada (Mtad.) = A. x Milt.	2	Pettit (Beall)	1980
(Miltassia	1	W.W.G. Moir	1960)
Miltadium (Mtadm.) = A. x Milt. x Onc.	1	S.B.O.E.	1982
Morrisonara (Mrsa.) = A. x Milt. x Odm.	1	G. Black	1993
Pettitara (Pet.) = A. x Brs. x Onc.	1	W.W.G. Moir	1983
Stewartara (Stwt.) = A. x Cda. x Odm.	3	G. Black	1983

The genus Miltassia is listed as there is one cross, namely Mtssa. Puakinikini, that has Ada allenii (a.k.a. Brs. allenii) as a parent.

Table II

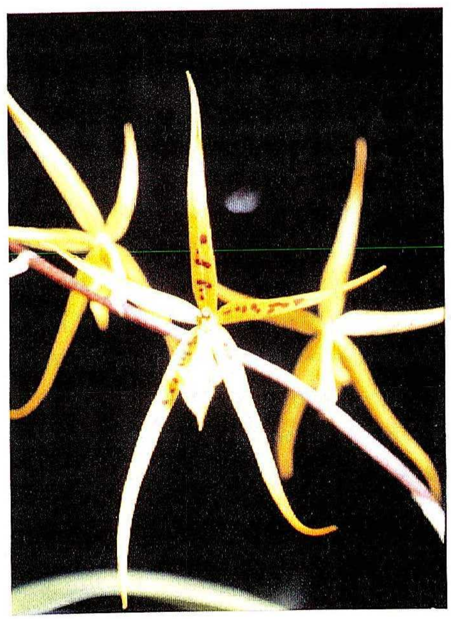
Year of Registration	Number Registered
1911	1
1913	1
1919	1
1926	1
1960	1
1970	1
1980	1
1981	2
1982	3
1983	3
1984	1
1985	1
1987	1
1989	2
1990	1
1991	3
1992	3
1993	2
1994	3

Brsa. Orange Delight



Adgm. Wild Kingdom

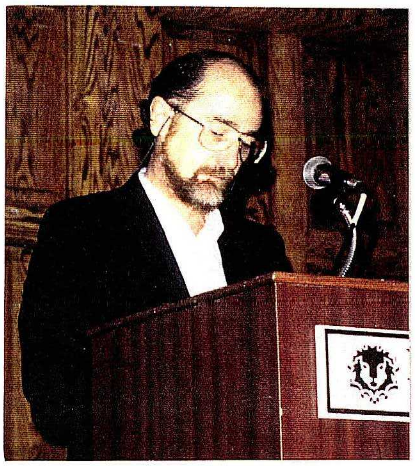
**Dugg. Robby
'Sun Drop' HCC/AOS**



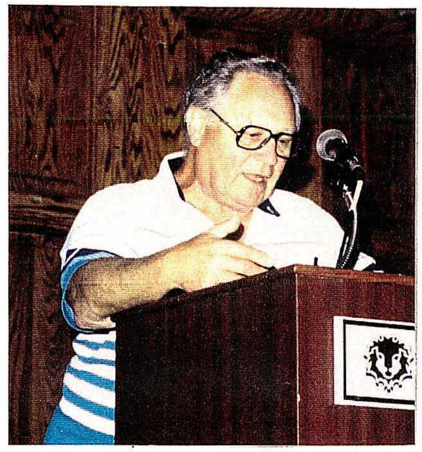
**Brsa. Mem. Bert Field
'Orange Sherbert' HCC/AOS**

Robert Hamilton

Wim Velsink

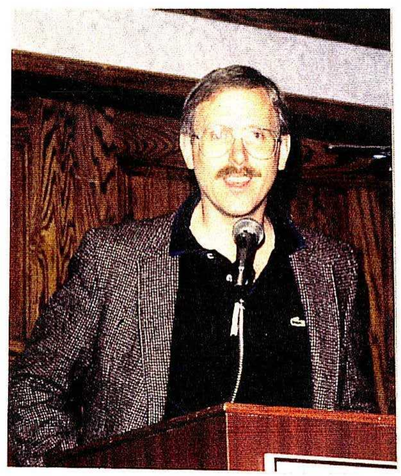


Sandro Cusi



Helmut Rohrl

Juan Felipe Posada



Steve Gettel