THELYMITRA 'THE SUN ORCHIDS' OF SOUTH WESTERN AUSTRALIA

The Genus by R. L. HEBERLE

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The genus name *Thelymitra* was coined by J. R. and G. Forster, botanists on Captain Cook's second voyage in 1772, when naming and describing in 1776 *T. longifolia* from the south island of New Zealand.

DERIVATION

The name is from the Greek *thelys*, a woman and *mitra* a cap or headpiece and refers to ladies head coverings of those times.

CLASSIFICATIONS AND DISTRIBUTION

Burns-Balogh (1989) included *Thelymitra, Calochilus* and *Epiblema* under *Thelymitra* and states that the staminodes form an elaborately structured mitra in most species with the rostellum extremely reduced. This author lists 60 species with major distribution in Australia and extending into New Zealand and Malaysia.

Clements (1989) lists 45 species, 2 varieties and 5 hybrids Australia wide with 22 species, 1 variety and 1 hybrid for South Western Australia. 6 of these being common to the Eastern States and the remainder endemic.
This paper attempts to cover the Western Australian content and the slide program that the registrants will have already seen.

RANGE AND DISTRIBUTION

Mother nature has lavishly distributed within a rough triangle from at least 60 kms north of the Murchison River extending south approximately 750 kms to Augusta thence east to Madura (180 kms from the South Australian border) approximately 1100 kms and to complete the triangle a span of approximately 1200 kms. Within this tremendous area most of the Sun Orchids flourish and are equally at home in the ever changing climate rainfall and habitat, along the coastline and into the hinterland and extending well into the arid Goldfields areas where they can survive in shallow pockets of soil and moss where ground level temperatures can reach 60o (truly xerophytic).
Examples are *T. macrophylla, T. antennifera* and the presumed (*putative*) hybrid *T. x macmillanii.*

THE COMMON NAME SUN ORCHIDS

This reflects the habits of the flowers opening and closing (chasmogamous) in strong sunlight, however, this process appears to be more complex. It seems that a combination of warmth, humidity, air movement and pressure combine to influence opening and closing. As obviously climate and geographic range will influence different species and a given species, the situation becomes highly complex therefore it would be speculative to suggest a precise formula for the variables.

The early flowering orchids in the Albany region seem to have adapted to suit the climate as they are able to open their flowers at a much lower temperature than the middle or late flowering species, example *T. spiralis* flowers from July-September will open under the most favourable conditions at temperatures from 17o-20o C and above. *T. variegata, T. cornicina* and *T. antennifera* flowering August - September open at 20-25C and above. The middle and late flowerers mostly open at around 25-30C. Cold winds and cloud cover can retard or inhibit flowers opening.

It is common knowledge that flowers can be induced to open in a warm room where windows and doors are kept closed and the windows are exposed to direct sunlight. The smaller the room and the more glass, brings a faster response. An interesting experiment that appears to support the theory of warmth etc. as against sunlight, is to place the flowers in water in the confined space of a car boot that is facing the sun's rays, the flowers will open much quicker than in a room, however, a word of warning, do not leave the flowers in the boot too long as they will wilt in strong sunshine.

STRUCTURE AND GROWTH HABIT

It is quite futile to dwell on height of stem, length of leaves, numbers and size of flowers as they all vary in the extreme, seasonal geographic variation changing habitat within a colony and for a given species, in other words the measurements etc. are relevant only for the specimen measured.
The flowering stem arises through the leaf sheaf that is attached directly to the two underground tubers, these can be pear shaped, round or ovoid, leaf bracts can hug the stem or be free, there is a flower bract below the ovary on every pedicle (flowering stem). The stem can bear from one to thirty or more flowers, often all open at once.

Leaves are solitary, often elongated broad to linear lanceolate or oval-oblong, all are glabrous, except one that is covered in fine downy hair (villose, *T. villosa*) and can be lined ridged, fluted and grooved. A member of the *T. macrophylla* complex has possibly the largest leaf that is ridged, fluted and semiplicate and can be extruded under pressure. The most interesting and unusual leaves are spirally twisted (anticlockwise) *T. spiralis* and *T. variegata* and can be corkscrew like, five or six turns or a slow spiral of two or three, there is an unusual process just above ground level that is spatulate and frilled. Initially leaf growth is straight and starts to curl much later and spirals towards the end of the growth cycle when the spatulate base also appears, Warren Stoutamire (pers comm) stated that this leaf is quite unique in the worlds Orchidaceae and present elsewhere with one species *T. matthewsii*. A speculative explanation of this phenomenon could be the result of the earth's rotation and the geostrophic force created. Climbing plants in this region twist to the left and snakes coil and water rotates similarly down the plughole. As to why these two species have variously spiraling leaves and others do not is a matter for scientific research.

THE FLOWERS

Sun Orchid flowers are "about" a multiplicity of colour and form, predominantly all shades of blue (most unusual in the worlds orchidaceae) including purple, magenta, maroon, red, pink, orange, yellow and white or bi-coloured can be lined, striped, peppered, speckled, spotted and blotched with contrasting colours. Over all there is a lustrous sheen that has to be seen to be believed, which camera cannot faithfully reproduce.

Flowers are considered to be regular in shape (radically symmetrical) with the labellum scarcely different from the rest and completely unadorned by glands or calli, however, some species, example: *T. variegata* where some forms have a much wider dorsal sepal and a much narrower labellum segment. The unique upright column forms a hood at the apex that can be entire, notched, fringed, bifed or cleft to varying degrees. The hood encloses and protects the pollinias, the large oval stigmatic plate covers most of the space below, the column can be broadly winged and often has erect arms that bear hairy tufts (Trichome Brushes) that can be dense, sparse, fine, coarse, tangled and variously coloured white, cream, yellow, blue, purple or maroon, the overall colour of the column is mostly yellow and can be different to the segments. The apex and behind the anthers can be variously adorned with glands, calli and tubercles. With some species there is a conspicuous crest that is mostly half-moon shaped, with others this is rudimentary or absent. The species *T. cornicina* and *T. crinita* (closely related) have clusters of densely massed fine hairs capped with gold. The complexes of *T. spiralis* and *T. variegata* have prominent three lobed appendages of gold or yellow with the centre lobe extending forward from the apex and the lateral lobes either side. A unique self-pollinating species *T. mucida* has a deeply cleft column, the apex and behind is covered with bloom (mucine) similar to powdered silver frost composed of thousands of glistening particles, it can be rubbed off and will mark paper, its function and purpose requires scientific research.

POLLEN AND POLLINATION

It is considered that various species can be derived by type of pollen and the strategies used to achieve pollination. By far the most successful are those that self pollinate (autogamous), these species having mealy pollen that crumbles or powders and falls readily on to the large oval stigmatic plate examples *T. mucida, T. gramiea* and *T. holmesii.* One group departs from the above, the *T. spiralis* complex where pollen is ejected in a semi liquid mass that completely envelopes the stigma. Within 20-30 minutes, it has shrunk and hardened and now rings the outer edge with a few wisps extant. Another process is where the pollen is ejected in two irregular sticky masses that attach themselves to the upper part of the stigma.

For both of the above, pollen transfers is effected by the under side of the centre lobe splitting from the apex and folding back in two triangular shaped flaps.

Most species are considered to achieve cross pollination by insects, an assortment of fast flying bees, flies, etc., this will certainly give an advantage to seed set. These mostly have coherent pollen where pollinias are removed whole, attached to a viscid disc that glues them to various parts of the insect's abdomen for transfer. Insects are attracted to perform this service by fragrance, mimicry, pheromones and the column crests etc. previously mentioned, however the brilliant colours and variegation is likely to be the initial attraction: Examples of this section are *T. villosa, T. sargenii, T.*

variegata, etc., most of these have a prominent rostellum, that also may play a part with *T. variegata* the rostellum is pressed hard against the underside of the centre lobe that has split exposing the pollinias, any insects would have extreme difficulty in removing these, this may explain the reason why this species is seldom observed to be carrying fertilized ovaries.

SELF POLLINATORS

A small group self pollinates in the bud (cleistogamous) and never opens, others on the border of this (subcleistogamous) will open their flowers under favourable conditions, failing that, will self pollinate. Some are initially able to avoid self pollination by sexual parts maturing at different times. Examples, forms of the complexes of *T.graminea, T. mucida* etc

NATURAL HYBRIDIZATION

Unlike the Eastern States there are few records within *Thelymitra*, if so this is quite surprising as with non specific pollinators, the reverse should be expected, natural barriers between species and the vast range of distribution and few interested people may account for this. From experience in the Albany Region it has been a most infrequent occurrence, there have been records of *T. macrophylla* and *T. benthamiana* (previously *T. fuscolutea*) Herbele 1986. Others have been the crosses *T.macrophylla, T. canaliculata* and *T. crinita*. A major factor that will influence hybridization will be the number of pollinators and the number of sunny days that influence flower opening and insect activity. This is supported by records of hybridization north of Geraldton where *T. antennifera, T. macrophylla, T. campanulata, T. sargentii* and *T. spiralis* have been observed to hybridize. In these areas there are many more sunny days and higher temperatures than in the south.

RARE AND ENDANGERED SPECIES

Two species *T. stellata* and *T. psammophila* are declared under the Wildlife Conservation Act 1950. Both these species status have been proved to be highly controversial as is a species loosely identified as *T. benthamiana* listed in the Conservation and Land Management Department's publication, Western Australia's Endangered Flora (1990). *T. stellata* appears to be a member of the widespread *T fuscolutea* complex as does *T benthamiana*, both could be simply different colour forms of *T. fuscolutea*. Clements (1989) states that *T. benthamiana* is the common wide-spread species that has been called *T. fuscolutea*.

T. psammophila is considered by some to be a natural hybrid between *T. flexuosa* and *T. antennifera*, from most locations both of these species are present.

As previously outlined in sections covering range and distribution it would seem that most species are adequately conserved, from my contact with enthusiasts over this range, it is apparent that the knowledge is with those who live close to where orchids grow, there is a need for this knowledge to be

pooled and for the professional sector to take advantage, without this the full story will never be known.

FIRE

It's incidence and frequency has an impact on the flowering cycle, whilst I know of no species that is entirely dependent on fire to flower, fire can influence a greater abundance in a given season. Some swamp growing species will not flower without it, whereas in other locations they are independent, examples, *T. tigrina, T. cucullata* and *T. canaliculata*, the timing of the fire is critical.

Early flowering species will respond to a previous December-January fire, middle flowerers late January, February to early March, late flowerers March, April

It is debatable just how the fire influences this flowering phenomena. It seems most unlikely that gasses released from the combustion of vegetative material would penetrate the soil to the depths of the tubers, 15 cm or more below the surface (gas rises). The residue ash after rain could provide nutrients or heated soil could reactivate dormant mycorrhizal fungal associates, there could be other unknown factors, here again scientific research is needed.

It follows that Conservation and Land Management's policy of controlled fuel reduction burning in the autumn or at late spring will effectively prevent most orchids flowering in that and the subsequent year. Most orchids have their leaves above ground or close to the surface in the autumn, fire destroys these and prevents flowering.

Late spring fires destroy all flowering plants, prevent seed set and ensure that most do not flower the following year. This could be a reason why orchids are declared rare and endangered.

CALOCHILUS AND EPIBLEMA

As Burns-Balogh and Bernhardt (1989) have included these two with *Thelymitra*, it is necessary to cover them.

There are four *calochilus* recorded for Western Australia, *C. robertsonii* is widely distributed and shows the typical bearded segment. *C. compesteris* was found by a member of the Albany Branch of the Wildflower Society, Mrs. Barbara Hall in early November 1983 flowering in the sand plains of the South Stirlings east of Albany. It has since been found in the Hopetown area and last year was recorded in the Fitzgerald National Park nearby, flowering on a previous summer burn. These species appear to be capable of being pollinated by insects but eventually self pollinate. Two species are found in the Kimberlies in the far north. *C. caeruleus* and *C. holtzei.*

Epiblema is a monotypic genus, the species *E. grandiflora* is one of our most unique and attractive species. The distribution is from the Metropolitan areas of Perth along the coastal plain to the east of Esperance where it flowers January-February in winter wet swamps, sometimes in water. Over this range it maintains its integrity varying only in colour from deep purple to violet. Erickson (1951) gives an interesting coverage and tells a delightful story of how children influenced the common name Babe-in-the-Cradle.

SUMMARY
It would appear that the genus in the South Western Australia reflects many unique features. The super abundance of most species (in the right year) and the tremendous range of most of species reflects a high degree of development and specialization that has been extremely successful in perpetuating the species, suggesting that contrary to the findings of Van Der Pijil and Dobson (1966) the genus is far from primitive.

EDITOR'S NOTE
This paper is written to clarify some of the complexities of the genus and does not attempt to cover all of the species and is complimentary to the slide program presented at the Conference.

These two sections are a combination of my personal activities and observations assisted by Don Voigt, Mary Sherwood, Viv Holly, Patricia Dundas, Eric and Patricia O'Halloran, Wayne Merritt, Tibor Bodrogai and the late Herb Foote, to whom I owe my grateful thanks, also to my wife Pauline for her tolerance and field work over the years.

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