Cultivar Assessment and Improvement of Ixodia Daisy for Floriculture©

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Ixodia daisy (*Ixodia achillaeoides* subsp. *alata*) has been harvested from native stands for over 40 years as a dried flower crop and cultivated increasingly since 1985 for fresh and dried flower markets in Australia and overseas. Ixodia is well placed to become a major dried flower crop because of its appearance, durability, and suitability to dying. Selected cultivars have outstanding potential as a fresh flower crop.

A major constraint to the further development of the Ixodia industry has been the export of poor quality product which has had an adverse affect on price and market demand on some overseas markets. Poor quality is directly tied to the use of unselected or unsuitable cultivars or incorrect harvest and handling procedures.

To address problems related to poor cultivar use in production, a plant improvement program was started in 1995. Commercial cultivars, new collections from the wild and previously selected forms were assembled for comparative field trials. Plants were assessed for cultivation performance, disease tolerance, appearance, and suitability for alternative markets (fresh, pot plants). Yield and quality standards for ixodia daisy grown as a cut flower crop were established, then used to assess new progeny from a breeding program. Ten cut flower and three-pot plant and landscape cultivars are now ready for commercialisation.

INTRODUCTION

Ixodia daisy has been harvested from native stands in Southeastern Australia since the 1940s and cultivated, primarily as a dried flower crop, since the emergence of the Australian native flower industry in the mid-1980s. Ixodia is a perennial shrub in the Asteraceae (Copley, 1982), which grows from 0.5 to 1.5 m in height under cultivation and produces 30 to 76 cm flowering stems for a period of 2 to 3 years.

Production performance of ixodia daisy, *Ixodia achillaeoides* subsp. *alata,* has been hampered by the use of unselected seedlings or vegetatively propagated selections with unknown yield characteristics (Barth, 1996). This subspecies is extremely variable in vegetative and flower characteristics which greatly influences floricultural potential. Opportunities existed to easily enhance production of this crop through selection of high yielding cultivars with improved floral qualities. Further development of lines to incorporated disease resistance and extended harvest periods would also improve viability of Ixodia as a successful floriculture crop (Barth et al., 1999b).

Although ixodia daisy has been considered primarily a dried flower crop, there is excellent potential for its use as a fresh flower when appropriate cultivars are selected. Problems that we have identified with postharvest handling of unsuitable cultivars as fresh flowers include stem blackening, excessive stem stickiness, or leaf browning (Barth, 1998) all of which shorten vaselife. Specific selection criteria for fresh flowers used in our assessment program included: vaselife, stem length, floriferousness, and tolerance of cool storage.

Floricultural Production Requirements. Ixodia is native to high rainfall and coastal districts of South Australia and Victoria. Its natural distribution is in cool Mediterranean-type climatic conditions with cool wet winters and warm dry summers. Under cultivation, Ixodia requires well drained sites, preferring sandy to loam soils, being short-lived on heavy soils. It tolerates a wide range of soil pH, however, chlorosis problems increase in alkaline soils and may require soil amendment. During periods of high temperature extremes, adequate irrigation is essential to prevent foliage burn and damage to developing flower buds.

Flowers are initiated by cool temperatures in winter and spring which limits production of Ixodia in subtropical areas. Plant cold hardiness varies between geographic forms and spring frost can damage developing flower heads in coastal forms. Recommended cultivation techniques are covered in detail in other publications listed in the literature (Barth et al., 1998a,b).

Origin of Cultivars. Ixodia cultivars can be grouped on the basis of their geographic origin which ranges from the northern Mt. Lofty Ranges near Adelaide in South Australia to the Grampians Ranges National Park in Victoria with isolated coastal populations between. Different populations of Ixodia have distinct and sometimes unique characteristics, the most notable relating to flowering date, floral appearance and bush (vegetative) characteristics. These characteristics have been important in selecting cultivars with the best floriculture potential, high yields, and disease tolerance (Barth and Hall, 2000).

METHODOLOGY

To compare the floricultural potential of existing commercial Ixodia cultivars with:

1) New collections,
2) Representatives of geographic forms, and
3) New selections from a breeding program.

Experimental field plantings were established in October 1996 at two sites in the Mt. Lofty Ranges and lower southeast of South Australia. Sixty cultivars of Ixodia were propagated at the same time from cuttings taken from a mother block collection held in a greenhouse. Cuttings were rooted under mist (3 weeks) and then grown on in 100-mm tubes (7 weeks) for spring planting. Cultivars were planted in six randomised blocks spaced at 1 m × 2.5 m in rows to avoid interactions. Fertiliser applications were based on our previous nutritional assessment program of Ixodia conducted 3 years previously (Maier et al., 1994). Irrigation was applied by drippers at rates of 8 to12 litres per plant, one to two times per week during the period October to May. Growth rates and floral initiation were monitored every 2 weeks for 2 years on five cultivars representing specific geographic forms with harvest dates ranging from October to March.

The first harvest began in Oct. 1997 (early cultivars) and extended to March, 1998. Optimal harvest period for individual cultivars is approximately 3 to 5 days, when flowers are fully opened and prior to peak pollen shed. Field data was collected at harvest to assess yield of fresh stems by weight, stem numbers in three length grades, and number of bunches. Other measurements included number of stems/

marketable bunch, dry weights, and total biomass produced per plant. Eighteen flowering stems (3 per plant × 6 reps) were harvested from each cultivar for post harvest assessments. Stems were placed in a post harvest solution (250 ppm citric acid, 200 ppm chlorine in deionised water) under lights in controlled environment rooms. End of vaselife was determined by daily observation of leaf and stem decline rather than on flower characters that show minimal quality changes on drying.

The second year of harvest was conducted at the Mt. Lofty site and a further stem length grade of >50 cm was added to accommodate the increased vigour of larger plants. Comparative yield data was made between cultivars over the two years with all data analysed by AOV with least significant differences tested at $P<0.05$. Further comparative trials were established to test new cultivars and crosses and 3rd-year data collected on outstanding plants from the main trial.

OUTCOMES

Performance. The results of field performance trials of cultivars from a wide range of geographic origins has demonstrated that outstanding cut flower forms originate from two distinct geographic regions, the Mt. Lofty Ranges above Adelaide and the Nelson district in Victoria. The average yield of all cultivars assessed at the Lenswood site in Year 1 was 1352 g and 1341 g in the 2nd year. The average yield on a per bunch basis (current commercial grade dried bunches) for all cultivars in Year 1 was 4.6 bunches and 4.5 in Year 2. This represents a range of the highest yield of 15 bu per plant to a low of 0.2 bu per plant. Considering only the top 18 yielding cultivars, the average yield was 1877 g in Year 1 (range 2488 to 1502 g) and 2029 g in Year 2. From these results we suggest that cultivars that yield <1200 fresh weight of flowering stems in their first year of harvest would be considered uneconomical to grow and be eliminated from a selection program. Acceptable performance of a new cultivar can be made by determining a combined yield from 2 years of harvest and comparing to these results. High yielding cultivars will consistently produce >1750 g fresh weight of blooms or an average of 6 bunches. Second year yields should increase by 10% or greater.

The number of stems required to make an acceptable bunch greatly impacts on harvesting costs and thus also becomes an important selection criteria. Cultivars requiring more than an average of 20 stems to form a dried bunch are uneconomical to produce as a dried product and should be replaced by cultivars with 12 to 20 stems per bu.

Fresh Flower Assessment. The average vaselife of the 60 cultivars assessed over 2 years was 10.7 days with a range of 5.0 to 17.8 days. The results of post-harvest trials suggest that cultivars best suited for marketing fresh require a vase-life >10 days, stem lengths >40 cm and freedom from stem blackening in water. Recent marketing experience suggests that both terminal and spray flowering forms are acceptable. Cool storage trials have shown no loss of vaselife with leading cultivars with 7 days of dry storage at 0°C.

Selection has been made of eight outstanding forms which have vaselife >12 days, are high yielding and have flower characteristics identified as superior for specific markets based on trial shipments and surveys of wholesale florists. Some of these cultivars will be commercialised and others used in the breeding program.

Quality Standards. Floral and stem appearance are important selection criteria for outstanding cultivars. Quality characteristics identified include: pure white petals, small pale flower centres, balance between centre diameter and total flower diameter, and high petal count. Flower diameter of Ixodia cultivars ranges from 4.8 to 15.3 mm with an average of 10.1 mm. Double and semi-double formsholding petals or petaloids in the flower centres have been selected which are considered desirable for their whiteness and longer harvest periods. Flowering stems should be consistently greater than 40 cm over 2 years of harvest and carry large numbers of flowers per stem, arranged as an open terminal umbel or a multibranched spray. Other vegetative considerations include leaf retention, stem colour and bush characteristics such as branching habit, size, and stability.

Flowering Pot Plants. Genetically dwarf cultivars of Ixodia have been selected that are suitable for production of flowering pot plants without the use of growth retardants. Plants are densely bushy with deep green foliage and a pleasant herbal or fruity scent. Flowering is induced by cool temperatures and day length manipulation can be used to influence the development of terminal and lateral inflorescences (Barth et al., 2000; Weiss et al., 1996). In our experimental work, material from eleven distinct geographic regions were assessed and outstanding dwarf forms were consistently sourced from one region in South Australia.

Ixodia pot plants show good potential for production in northern hemisphere greenhouses where growth in cool winter houses can be used to induce flowers, and where plants are particularly adapted to ebb and flow production systems in small pots.

Disease. Survey results have established that the most serious losses of Ixodia in commercial plantings has been from the disease *Verticillium dahliae,* which is more serious where levels of plant pathogenic nematodes are shown to be high (Hall et al., 1996). Screening of over 60 cultivars against seven diseases including *Phytophthora cinnamomi, Fusarium,* and foliar diseases has established degrees of resistance in certain cultivars, which have been utilised in our cut flower cultivar breeding program. Recommendations on control methods have been made for common disease problems during production (Barth and Hall, 2000)

Commercialisation. Ten cut flower cultivars have been identified for commercialisation in 2001. They represent a range of cultivars that flower over an extended period, have outstanding floral characteristics, and have been identified for use as either dried or fresh product or both. They include both terminal and spray forming stems and flower sizes cover the full range of available forms. Full descriptions of these cultivars will be available covering 4 to 6 years of field assessment and it is hoped that the release of these high yielding cultivars will stimulate further expansion of commercial production of Ixodia. Further releases of cultivars from our breeding program will follow in subsequent years.

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Domesticating *Haemodorum coccineum*©

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Summer visitors to tropical Queensland or the Northern Territory can hardly fail to notice the vividly coloured, lily-like flowers of *Haemodorum coccineum* (scarlet bloodroot) and it is surprising that they have not already been brought into cultivation, particularly as a cut flower crop. However, the domestication of a plant species is not always as easy and straightforward as one would hope. Despite being very easy to propagate, growth of *H. coccineum* appears to require soil temperatures in excess of 22°C at rhizome depth. This unique dormancy mechanism may limit production to tropical environments.

INTRODUCTION

The Haemodoraceae are a family of monocotyledonous plants comprising 14 genera and about 100 species worldwide. They resemble the Iridaceae and have similar characters including ensiform leaves and bulbous, rhizomatous, or stoloniferous roots. Of the seven Australian genera of Haemodoraceae only *Haemodorum* extends beyond Western Australia (Macfarlane et al, 1987). The name *Haemodorum* refers to the red colouring of the rootstock and sometimes other plant parts, hence the common name ‘bloodroots’. About 18 species have ornamental potential, and several of these could be used for cut flowers. This paper is concerned with the evaluation of *H. coccineum*, a plant species native to northern Australia, and demonstrates the value of field studies, as well as greenhouse and controlled environment studies, when attempting to bring a species into cultivation for the first time.