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New Crop Report

Hort. 5051

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Lepechinia hastata (A. Gray) Epling

'Pakaha'

Taxonomy:

Lepechinia hastata (A. Gray) Epling a herbaceous perennial found in USDA zones 7-10, is a member of the Lamiaceae family and is often confused with salvia. *Lepechinia hastata* is known by multiple common names and is most commonly referred to as Pakaha, Island Pitcher Sage or Baja Pitcher Sage.

Geographic Distribution:

Lepechinia hastata (A. Gray) Epling is native to the United States, specifically to Hawai'i, and indigenous to Maui. It is also found in southern Baja California, Mexico, the Revilla Gigedo Islands of the coast of southern Baja California and Socorro Island (Flora of the Hawaiian Islands). It is generally found between 40° South latitude to 40° North latitude and at a maximum elevation of 1676 feet above sea level (Smithsonian Institution). It is listed nationally and globally as a vulnerable species, which would suggest that it is not a product that would be prone to becoming invasive as a species although it has shown tendencies to naturalize in the small geographic regions it is found in.

Native Habitat:

In its native habitat, *Lepechinia hastata* (A. Gray) Epling is found within grasslands in mountainous areas having stony to sandy loam soils with good drainage

on slopes ranging from 7 to 40% (US Soil Survey). It grows well in full sun to partial shade, requires good drainage and when established is extremely drought tolerant. Pollinators including birds such as humming birds find it extremely attractive and it is resistant to deer grazing.

Taxonomic Description:

Lepechinia hastata (A. Gray) Epling is a perennial, herbaceous, dicot with an erect habit. When mature, grows 1-1.5m tall as well as wide, with an inflorescence reaching 30 cm in length. The stems circumference is approximately 1-1.5cm thick, four-angled, purplish and closely pubescent. Leaves are opposite with the largest 32 cm long, 15.5 cm wide at the widest point, hastate at the base becoming ovate on inflorescence, margin serrate-crenate, copiously tomentose, hairs transparent, branched veins impressed. Inflorescence leaves are sessile, connected across node by pubescent ridge. Flowers in axillary cymose clusters of 15, peduncles elongating with age, purplish pedicels elongating with age and 1.3 cm long; sepals 5, fused at base, somewhat bilabiate, triangular, purple, pubescent, calyx campanulate; corolla tube broad, 5-lobed, the upper love bifid, the laterals entire (Wiggins, I.L., 1980). Bracts linear 1.1cm long, purplish, pubescent. Flowers are a deep purple-magenta color and bloom from late summer into fall. Fruit, 4 nutlets glossy black, 5 mm long, 2.5 mm wide, apically blunt and basally constricted into a short neck (Morley, B., 1978). Extensive pubescence seen over the entire plant may inhibit desiccation from the wind and drought conditions inherent in its native habitat and provides a useful as well as showy trait that can be marketed to consumers.

a. flowering shoot, b. dissected corolla, c. dissected calyx showing gynoecium, d. calyx from above.

Figure 1: Morley, B. and Ontkrewiez, I. J. Adelaide Botanical Garden (1978)

Indigenous Uses:

Lepechinia hastata has been reported to be used as a traditional medicinal plant as a remedy against uterine infections by two ethnic groups, the *Cochimies* and *Pericues*, who inhabit the Baja California Sur region of Mexico (Dimayuga, R. E. et al, 1986). The knowledge to create these remedies is widespread in isolated populations where the knowledge is still preserved among the elders of the groups (Dimayuga, et al, 1986). The *Chicura de la Sierra* is drank as a tea from the decoction of the root. While research shows little in the way of how widespread this practice is, one article was found that identified carnosol as the main diterpenoid in *Lepechinia hastata* and that the compound had potent in vitro antimicrobial activity (Dimayuga, R.E. et al, 1989). Further research would need to be carried out to see if any other compounds or qualities are uniquely inherent within this species and to what end they would be useful.

Names and Description of Varieties on the Market:

Lepechinia hastata has one cultivar on the market, and is sold as a finished plant in many west coast based nurseries, there are also companies selling it as seed. It is identified as *Lepechinia hastata* or Pitcher Sage. Available quantities are often limited or sold out, suggesting it is a novel plant without a lot of recognition.

Propagation Methods:

While there is no data showing that *Lepechinia hastata* can be propagated vegetatively, most *Lamiaceae* species can be easily rooted from cuttings in water as well as propagated by seed. For this paper, seeds were the subject of experimentation.

Beginning with 88 seeds of *Lepechinia hastata*, seven different growing treatments were chosen due to the lack of information on seed propagation. With the presence of a hard seed coat, the seeds were first tested to see if the seeds would imbibe with water. After placing 5 seeds in warm water for 24 hours, and no change occurring, it was hypothesized that some type of scarification would be needed in order for germination to take place.

Treatments:

Treatment A was to be the control group and 18 seeds were placed directly into potting soil in a 288 plug tray and placed in the mist house at 21°C during Week 8. Treatment B had 18 seeds that were sand paper scarified, placed in potting soil in a 288 plug tray and also placed in the mist house Week 8. Even though it was suggested that

this is a late season blooming plant, to determine if vernalization would have an impact on germination two test treatments were done; Treatment C had 18 seeds that were placed in moist potting soil and then placed in cold stratification at 43ºF from Week 8 through Week 12. The seed coats were nicked with a knife and then placed into the mist house. Treatment D had 18 seeds that were placed in moist potting soil and then placed in cold stratification at 43ºF from Week 8 through Week 14, the seeds were then nicked with a knife and then placed in the mist house. To test to see if soilless media would have an impact on germination three treatments were created. Treatment E, F, and G included 8 seeds each that had the seed coat nicked with a knife and were then placed in three different types of media, rock wool, a bark chip/rice hull mix, and calcite clay mix. These were sown during Week 13 in a 128 plug tray and then placed in the mist house.

All seeds were exposed on the surface.

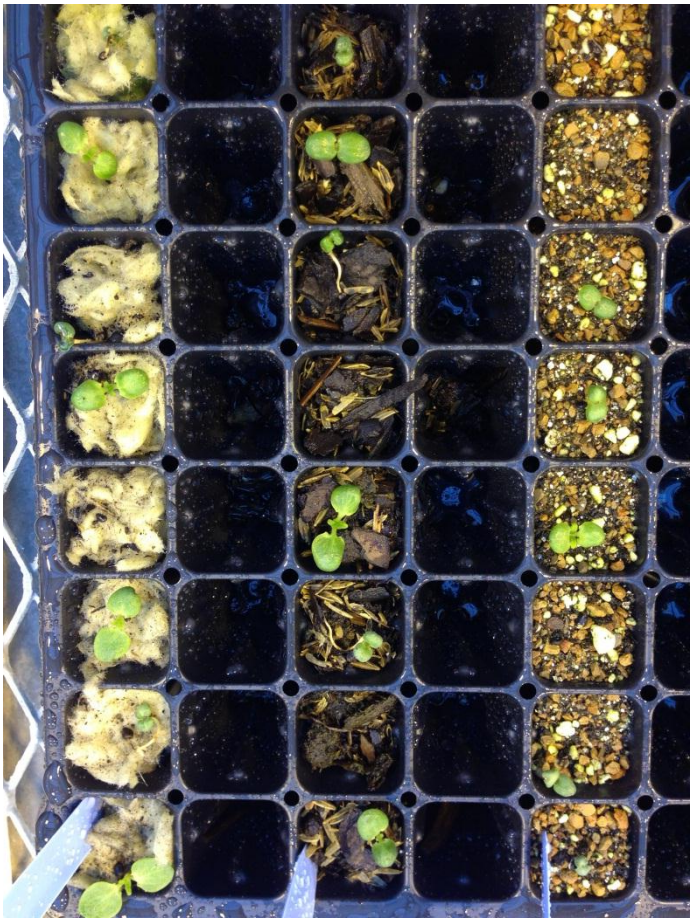

Figure 2: Rock Wool, Bark Mix, and Calcite Clay media treatments in 128 plug tray. (O'Leary, E., 2013)

Results:

Treatment	Germ. Wk. 1	Germ. Wk. 2	Germ. Wk. 3	Germ. Wk. 4	Weeks to Germ. 1
A: Control	N/A	N/A	N/A	N/A	N/A
B: sand paper scarified	N/A	N/A	N/A	N/A	8
C: 4 Wk. stratified	0	3=16%	5=28%	transplant 5	
D: 6 Wk. stratified	9=50%	9=50%	transplant		
E: Rock wool	7=87%	8=100%	transplant		
F: Bark chip mix	4=50%	6=75%	transplant		
G: Calcite Clay mix	3=37%	7=87%	transplant		

Table 1: Germination Results of Treatments

As shown in the above table, germination rates varied between treatments. As of the completion of the experiments, the control had not germinated, proving that some form of scarification is necessary with this species. With these initial experiments, the results gave good information to direct further studies, although the margin for error may be high due to the techniques used in manually scarifying the seeds. Lack of germination in these treatments could be due either to damage to the seed when the seed coat was nicked or the seed coat not being nicked sufficiently to allow moisture to penetrate the seed. The germination rates in the 6 week vernalization treatment pose the question of whether this is important to the species development. When plants were transplanted, roots were examined and the most developed roots occurred in Treatments E and F and were weakest in the standard potting soil treatments. Zero

plants were in flower or had reached visible bud date by the conclusion of the experiment at Week 18.

Figure 3: Root development in Rock Wool (O'Leary, E., 2013)

Figure 4: Root development in Bark-Rice Hull mixture (O'Leary, E., 2013

Figure 5: Root development in standard germination mix (O'Leary, E., 2013)

Conclusions:

Lepechinia hastata will germinate in 7-14 days under warm (21°C) temperatures and moist conditions with some manual scarification to the seed coat. From these initial treatments it was not conclusive whether vernalization had an impact on speeding up germination or if it would impair growth, and it is suggested that further research should be conducted. Further studies should also include chemical scarification which may reduce the risk of damage to the seed, or inconsistencies that may occur with manual efforts to scarify. Deeper plug trays initially showed better root development in seedlings

than shallower plug trays and may help to ensure stronger and quicker plant development.

Product Specifications:

The ideal form of a marketable variety of Lepechinia hastata is an erect plant approximately 1.0 to 1.25 meters tall and 1 meter wide with an inflorescence approximately 30 cm long. Developing cold hardiness so as to include markets in higher latitudes would potentially increase market value.

Market Niche:

As a tall, shrubby perennial this would be marketed as a “back of the bed” planting choice for warmer climates, although it is unknown whether high humidity would affect this plant pathologically, there are nurseries in North Carolina and the San Francisco area selling *L. hastata*, which would initially suggest that it is able to withstand some amounts of higher relative humidity’s. Trialing in southeastern zones or areas of high relative humidity would have to be done to see if it would be susceptible to pathogens, fading, or collapse. It would be able to be sold from Week 17 on in these zones with enough time to establish for flowering in the late summer. Competing or comparable products would be members of Salvia, although *L. hastatas* size, inflorescence and silvery pubescence make it a unique enough product. Its drought and deer tolerance as well as its ability to attract pollinators such as hummingbirds will also be a draw to those consumers looking to the natural and sustainable plantings category for purchases. Its vulnerability in the landscape, its island history, and its unique look

would make it a novelty item to customers but most likely would not have wide spread appeal due to its cultural requirements.

Anticipated Cultural Requirements:

Lepechinia hastata is hardy in USDA zones 7-10, but has been advertised by nurserys currently selling the product as able to withstand temperatures to 0°C. Once established it is extremely drought tolerant, and able to withstand high temperatures. It thrives in poor soils as long as they are well drained and prefers to not have its roots standing in water. There has not been any information developed on the effect of plant growth regulators or the effects of nutrients on development. For this experiment, plants were germinated at 21°C during the day and 21°C at night with zero DIF, lighting was set at long days, 16 hours at 150 umol of light. Misting frequency was every ten minutes on seven second duration for seeds. Once seedlings were transplanted into 4" pots in growers soilless media, they were placed in the greenhouse that maintained day and night temperatures at 18.3°C and early morning temperature dip at sunrise to 9.9°C for 2-3 hours (if possible). Lighting was on for 16 hours at 150 umol of light and fertilized on constant liquid feed (CLF) using 125 ppm N, CLF 15-5-15 Calcium-Magnesium. From the results, it would be suggested to use a 128 plug tray with rock wool to encourage strong root development, although transplanted into 4" pots for experimentation, with the final size of the crop, it should be marketed in a 6" pot or larger, to allow for the plant to develop to visible bud stage. Further experimentation is needed to determine whether vernalization treatments would be beneficial to germination, or if products such as plant growth regulators or fungicides would produce a better product. Plant growth regulators

might encourage a more compact plant that could be sturdier; fungicides might prove beneficial in areas where relative humidity is higher than the native habitat.

Production Schedule:

Plug Production:

Media

Use disease-free, soilless media such as rock wool, or other pH neutral product

Sowing

Sow 1 seed per cell in 128 or larger plug tray. Seeds do not need to be covered but they do need to be scarified.

Stage 1:

- Radicle emergence takes 5-7 days
- Soil temperature needs to be at 20-22°C
- Keep moisture levels high in Stage 1
- Light is insignificant at this stage

Stage 2:

- Soil temperature needs to be 20-22°C
- Keep moisture levels high in Stage 2 to allow the roots to penetrate into the media. Do not let the media dry out.
- Light 16 hours at 150 umol of light

Stage 3:

- Soil temperature 20-22°C
- Allow media to slightly dry between watering but not dry out completely. A capillary mat would work best.
- Do not fertilize until true leaves appear. Fertilize with 50 ppm N calcium nitrate ($CaNO_3$) using a hozon proportioner
- Light 16 hours at 150 umol of light

Stage 4:

- Soil temperature: Same as Stage 3
- Light: Same as Stage 3
- Moisture: Same as Stage 3
- Fertilizer: Same as Stage 3

Growing on to Finish

Container Size

6” or quart pots, one plug per pot, well drained, soilless media. Allow media to dry between watering and keep fertilizer to a minimum.

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