

Species: *Phormium tenax* J.R. Forster & G. Forster

Common name: New Zealand flax, New Zealand hemp

Author's Note

Within the Kamakou Preserve, the fact that original *P. tenax* populations have persisted at the same locations for over 15 years despite considerable control efforts indicates that it is a species to be viewed cautiously. This plant thrives under wet montane forest conditions on Molokai and could be a threat to areas having a similar climate. It could potentially thrive in wet lowland or rainy windward areas.

It is thought that humans transported *P. tenax* to Kamakou Preserve. TNCH Molokai staff is not aware of any other types of dispersal. New populations have not been noted in Kamakou Preserve since 1984 indicating that humans are the primary vector for this plant. Even though this plant is not likely to be dispersed over long distances, it can become a formidable problem once established. People should be aware that planting alien species outside of their gardens, or in areas that are not regularly monitored, is a great threat to the native forest.

Background

Neal (1965) wrote that *P. tenax* originates from New Zealand where it grows in swamps, by streams, and on hillsides. The silky cream-colored fiber was used to produce rope and twine. The Maoris used the fiber to make clothing, mats, baskets, and cord. The root was used medicinally.

P. tenax was cultivated in Hawaii prior to 1871 and is currently naturalized at least on Kauai and Molokai (Wagner, et al. 1990). It is unknown when or why *P. tenax* was introduced to Molokai. There are established populations on Molokai forest reserve land along the road to Puu Kauwa at approximately 2500 ft and at Kamakou Preserve.

P. tenax is currently one of the top 10 priority weed species of The Nature Conservancy of Hawaii's (TNCH) Kamakou Preserve, Molokai. *P. tenax* is established in the Montane Ohia-Uluhe rainforest of Kamakou Preserve at approximately 3750 ft. The main population, which is located just above Puu Kolekole, thrives in a very wet flat area with poor drainage. It grows in relatively intact native forest and disturbed grassland. Plants have been observed to root on the ground, in hapuu trunks, open pig disturbed grassland, and along steep ridges.

Records of *P. tenax* control at Kamakou Preserve date back to 1984 in which manual and chemical control were used. Approximately 3 acres of Kamakou Preserve was infested with *P. tenax* in 1994. In 1991, a grid line system was set-up to systematically monitor and control the primary population. TNCH crew expanded the area in 1993 to cover approximately 3,600 sq. m (0.9 acre). Outlying populations are also monitored and require regular follow-up. The main population of *P. tenax* in Kamakou Preserve has dramatically decreased due to control efforts. However, control is expected to continue indefinitely, but with less intensity than initially needed. From 1984 to 1999 volunteers

spent approximately 2500 hours on *P. tenax* control. TNC staff hours devoted to controlling this weed may be an additional 10% of the total volunteer hours.

General Description

P. tenax has smooth, leathery, sword-shaped leaves that are 100-300 cm long and 5-12 cm wide. They rise from the ground in an erect two-rowed cluster like a fan. The leaf margins are entire and distinctly red-colored with the apex usually splitting. The leaf base is keeled and bright orange at the base. The roots are orange-yellow. Flowers form on a 4-5 m long branched stalk that emerges from the center of the leaf cluster. The flower has 6 dull red tepals that are 2.5-5 cm long. The tepals are in two whorls with the inner ones orange on the lower half. Six anthers protrude from the top of the tepals. The flower holds copious nectar at the base. The ovary is superior. The fruit is a 3-celled dry capsule that splits along the center of each locule. The seeds are glossy black, 9-10 mm long, flattened and winged along the upper half. (Neal 1965; Wagner, et al. 1990)

Invasive characteristics

The plant's capability to reproduce vegetatively and sexually in Hawaii threatens the island's native plant communities. New clones sprout along a rhizome and quickly expand into a dense clump that crowds out other vegetation. Resprouts from the base of a mature plant occur even after the plant has been uprooted. Large plants can change the light regime of native communities.

Numerous winged seeds are dispersed from capsules on a 4-5 meter tall stalk. We estimate that over 10,000 seeds could be produced from one inflorescence stalk. (Note that this number is an extrapolation from a single collection at Puu Kolekole.)

Control Method

Control efforts are aimed at keeping population numbers low and eradicating mature plants before they can reproduce. In infested areas, scanning for plants along gridlines spaced 10 m apart allows for the systematic removal of mature and immature plants. Quarterly checks along the gridlines ensure that young plants will be found before flowering/fruitletting can occur.

The primary method of control is manual digging and pulling of small to medium sized plants using picks. Plants are easy to pull when young and immature. Roots must be pulled and dirt removed to prevent resprouting. The plants are either tied to trees with the roots in the air, or carried out to fenced drying pens. The pens are monitored for growth and treated as necessary. For large clumps, foliage is cut off down to its base and sprayed with 10-50 % Round-up. A second treatment is necessary to completely kill regrowth.

Additional references

http://www.botany.hawaii.edu/faculty/cw_smith/pho_ten.htm - photograph

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References

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