

1 **TITLE: Identifying and Classifying Potential Red Rice Hybrids from Farm Fields through**
2 **DNA Fingerprinting**

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6 Rice and red rice are primarily self-pollinated, but can intercross at low rates. Since the
7 introduction of IMI-resistant rice cultivars in the U.S. in 2002, interest in the dynamics of
8 intercrossing between rice and red rice has increased. Red rice samples from broad geographic
9 areas in the southern U.S. are providing baseline information on the genetic backgrounds and
10 outcrossing activities of red rice. Of >400 red rice accessions from Arkansas and surrounding
11 states, nearly all produced red, medium-grain seeds, but their heights, awn lengths, and heading
12 dates have varied greatly. Some of these accessions (0.7%) were as short as semidwarf cultivars,
13 suggesting that they could have originated from crosses with these cultivars. Others (<2.5%)
14 were the height of common cultivars and produced short awns, indicating that they could be from
15 crosses of awned red rice and rice. We used visual traits and SSR DNA markers to evaluate
16 natural outcrossing between rice and red rice on three farms in Arkansas. Farm 1: Long-grain
17 red rice seeds found in 2001 in a Cypress seed production field at Stuttgart were suspected
18 crosses of red rice and rice. Second generation plants grown from these seeds were taller than
19 Cypress, and produced smooth leaves, long- or medium-grain awnless seeds that were red or
20 white in color, and purple lower stems. Visual observations and SSR marker profiles evaluated
21 thus far suggest that these plants were likely derived from a cross of long-grain rice and awned
22 red rice that had self-pollinated for at least two generations since the initial hybridization event.
23 First generation hybrids would be expected to produce rough leaves, much taller plants, and
24 long-awned medium-grain seeds, in addition to red seeds and purple lower stems. Farm 2: Two
25 red rice plant types were newly discovered on a farm in Prairie Co., AR in 2003 and were
26 suspected derivatives from a cross between red rice and rice. A short red rice accession had
27 uniform erect plants with awned seeds, rough leaves, and heights similar to semidwarf rice.
28 These plants likely were crosses of awned red rice and rice. SSR detected few heterozygous
29 alleles, suggesting that the plants had self-pollinated several times since the initial hybridization
30 event. SSR marker profiles were consistent with the hypothesis that an awned blackhull red rice
31 and a commercial rice cultivar were the parents. A tall red rice accession produced offspring that
32 varied with respect to leaf texture, and stem and awn color. These plants were erect, much taller
33 than rice cultivars, and produced awned seeds. SSR detected many heterozygous alleles,
34 suggesting that the plants had self-pollinated only a few times since the initial hybridization
35 event, and that awned blackhull red rice and long-grain rice (similar to Cypress) were the likely
36 parents. Farm 3: Bushy, rough leaved, IMI resistant plants with delayed heading were obtained
37 in 2004 from a farm in Jackson Co. with high red rice populations and recent red rice control
38 failures in IMI rice. Seeds were awnless medium-grain. Visual observations and SSR data
39 indicate that these were first generation crosses of IMI rice and awnless red rice. In previous
40 research, late-maturing bushy plant types have been consistently associated with first generation
41 crosses between awnless red rice and commercial rice. Non bushy, rough leaved, early heading,
42 IMI resistant plants with pink awns, medium-grain seeds, and purple-red lower stems probably
43 were first generation crosses of IMI rice and awned red rice. In previous research, pink awns
44 and purple-red stems have often been associated with first generation hybrids between awned red
45 rice and rice. These studies exemplify how we can use visual observation and SSR analysis to
46 understand and mitigate the consequences of outcrossing between rice and red rice.