

Supplementary Materials

Preliminary Characterisation of Lowland and Upland Rice from Sarawak, Malaysian Borneo

ZAZEVIA FRANK CLIFTON¹, FREDDY KUOK SAN YEO^{1*}, RENEE PRISCILLA TRAWAS SYLVESTER
EMBUAS¹, MEEKIONG KALU¹, ZINNIRAH SHABDIN¹ & LEE SAN LAI²

¹Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, Jalan Datuk Mohammad Musa, 94300, Kota Samarahan, Sarawak, Malaysia; ²Agriculture Research Centre Semongok, KM20, Jalan Puncak Borneo, 93250, Kuching, Sarawak

*Corresponding author: yksfreddy@unimas.my

SUPPLEMENTARY DATA

Supplementary Table 1. List of landraces with their locality and Global Positioning System reading

Lowland Landraces				Upland Landraces			
Name	Location	GPS	Division	Name	Location	GPS	Division
UNISR2018-02 Padi Pandan	Kg Paon Gahat	0° 57' 0" North, 110° 39' 0" East	Serian	UNISR2018-06 Padi Belawi Pandan	Kg Paon Gahat	0° 57' 0" North, 110° 39' 0" East	Serian
UNISMT 2018-21 Padi Hitam	Kg Pueh	1° 51' 0" North, 109° 41' 0" East	Kuching	UNISR2018-10 Padi Belawi	Kg Paon Gahat	0° 57' 0" North, 110° 39' 0" East	Serian
UNIPDW 2018-18 Padi Merah	Kg Pesak	1° 45' 0" North, 110° 46' 0" East	Kuching	UNIPDW 2018-42 Padi Merjat	Kg Tabuan Rabak	1° 18' 39" North, 110° 20' 59" East	Kuching
UNIPDW2018- 48 Padi Kihuai	Kg Mambong	1° 22' 0" North, 110° 21' 0" East	Kuching	UNIPDW 2018-16 Padi Merjat	Kg Mambong	1° 22' 0" North, 110° 21' 0" East	Kuching
UNISAMA 2018- 44 Padi Bario	Kg Baru	1° 33' 28" North, 110° 22' 22" East	Kota Samarahan	UNIPDW 2018-17 Padi Pandan Wangi	Kg Pesak	1° 45' 0" North, 110° 46' 0" East	Kuching
UNISAMA 2018- 45 Padi Sabak Hitam	Kg Baru	1° 33' 28" North, 110° 22' 22" East	Kota Samarahan	UNISRA 2018-36 Padi Badawi	Kg Sg Tenggang	1° 04' 48" North, 111° 03' 28" East	Sri Aman
UNISAMA 2018- 47 Padi Sabak Angin	Kg Baru	1° 33' 28" North, 110° 22' 22" East	Kota Samarahan	UNISRA 2018-39 Padi Sempang	Kg Melugu Tengah	1° 06' 14" North, 111° 23' 57" East	Sri Aman
UNISRA 2018-38 Padi Arang	Kg Sg Tenggang	1° 04' 48" North, 111° 03' 28" East	Sri Aman	UNISRA 2018-41 Padi Mawang	Kg Melugu Tengah	1° 06' 14" North, 111° 23' 57" East	Sri Aman
UNISRA 2018-40 Padi Selasih	Kg Melugu Skim	1° 07' 10" North, 111° 25' 33" East	Sri Aman	UNISRA 2018-29 Padi Limbang	Kg Sg Tenggang	1° 04' 48" North, 111° 03' 28" East	Sri Aman
UNISRA 2018-26 Padi Kanowit	Kg Melugu Skim	1° 07' 10" North, 111° 25' 33" East	Sri Aman	UNISRA 2018-30 Padi Chelum	Kg Sg Tenggang	1° 04' 48" North, 111° 03' 28" East	Sri Aman
UNISRA 2018-24 Padi Bajong	Kg Panggil	1° 05' 48" North, 111° 23' 23" East	Sri Aman	UNISRA 2018-31 Padi Bario	Kg Sg Tenggang	1° 04' 48" North, 111° 03' 28" East	Sri Aman

Supplementary Table 2. Germination date for collected landraces

Lowland Landrace	Germination Date	Upland Landrace	Germination Date
UNISR2018-02	26.10.2018	UNISR2018-06	26.10.2018
Padi Pandan		Padi Belawi Pandan	
UNISMT 2018-21	26.10.2018	UNISR2018-10	26.10.2018
Padi Hitam		Padi Belawi	
UNIPDW 2018-18	1.11.2018	UNIPDW 2018-16	26.10.2018
Padi Merah		Padi Merjat	
UNIPDW2018- 48	30.11.2018	UNIPDW 2018-17	26.10.2018
Padi Kihuai		Padi Pandan Wangi	
UNISAMA 2018- 44	1.11.2018	UNISRA 2018-29	11.11.2018
Padi Bario		Padi Limbang	
UNISAMA 2018- 45	1.11.2018	UNISRA 2018-30	11.11.2018
Padi Sabak Hitam		Padi Chelum	
UNISAMA 2018- 47	30.11.2018	UNISRA 2018-31	11.11.2018
Padi Sabak Angin		Padi Bario	
UNISRA 2018-38	1.11.2018	UNISRA 2018-36	11.11.2018
Padi Arang		Padi Badawi	
UNISRA 2018-40	30.11.2018	UNISRA 2018-39	30.11.2018
Padi Selasih		Padi Sempang	
UNISRA 2018-26	30.11.2018	UNISRA 2018-41	30.11.2018
Padi Kanowit		Padi Mawang	
UNISRA 2018-24	1.11.2018	UNIPDW 2018-42	30.11.2018
Padi Bajong		Padi Merjat	

Supplementary Table 3. List of SSR markers used for genotyping and pre-selection

SSR	Primer sequence	Chromosome	Annealing temperature (°C)
RM1	F: GCGAAAACACAATGCAAAAA R: GCGTTGGTTGGACCTGAC	1	55
RM279	F: GCGGGAGAGGGATCTCCT R: GGCTAGGAGTTAACCTCGCG	2	55
RM489	F: ACTTGAGACGATCGGACACC R: TCACCCATGGATGTTGTCAG	3	55
RM335	F: GTACACACCCACATCGAGAAG R: GCTCTATGCGAGTATCCATGG	4	55

Supplementary Table 4. The 14 morphological traits selected based on IRRI guidelines including eight additional traits and two development traits

Observed Traits	Trait Code	Recording Standard
Seedling height	SH	Measured for height at the 5-leaf stage. Height was recorded in centimetres from the base of the shoot to the tip of the tallest leaf blade.
*Plant height	PH	Height was recorded in centimetre from the base of the stem to the tip of the tallest leaf blade (flag leaf). Time: Before flowering period.
Culm length	CL	Culm length was measured in centimetre from the base of the stem to the base of the panicle. Time: After heading.
Culm diameter	CD	Data was taken in centimetre from the outer diameter of the culms measured at the midportion of the culm. Time: Flowering period.
Leaf length	LL	Measured in centimetre from the topmost leaf blade below the flag leaf on the main culm. Time: Late vegetative stage, before panicle initiation.
Leaf width	LW	Measured in centimetre from the topmost leaf blade below the flag leaf on the main culm, at the widest portion of the blade. Time: Late vegetative stage, before panicle initiation.
Blade colour	BC	Six broad classes of blade colour were recognized following International Board for Plant Genetic Resources & International Rice Research Institute Rice Advisory Committee (1980) guidelines: (1) pale green, (2) green, (3) dark green, (4) purple tips, (5) purple margins, (6) purple blotch. Leaf Colour Chart developed by IRRI, and Philippines Rice Research Institute (PhilRice) was used to score the colour on the sixth leaf. Time: Late vegetative stage, before panicle initiation.
Ligule shape	LS	Shape observation was made on random ligule. Three classes were given: (1) acute to acuminate, (2) 2-cleft and (3) truncate. Time: Late vegetative stage, before panicle initiation.
Ligule colour	LC	Colour observation was made on random ligule. Three classes of ligule colours were recognized: (1) white, (2) purple lines and (3) purple. Time: Late vegetative stage, before panicle initiation
Auricle colour	AC	Colour observation was made on random auricles. Colours of auricle were classified as: (1) white, (2) purple and (3) pale green. Time: Late vegetative stage, before panicle initiation.
Panicle type	PT	Panicles were classified according to their mode of branching, angle of primary branches and spikelet density: (1) compact, (2) intermediate and (3) open. Time: Near maturity.
*Number of panicles	NP	The panicle number of the plant was taken as the maximum of the panicle numbers extracted from the plant.
Length of panicles	LP	Measured in centimetres from the base to the tip of one panicle from the main tiller. Time: Near maturity.
Secondary branching	SB	Secondary branches of the main panicle from the main tiller bearing the spikelet were classified as: (0) absent, (1) light and (2) heavy.

Supplementary Table 4 (continue)

Observed Traits	Trait Code	Recording Standard
*Number of filled grains	NFG	Measured by counting the number of fully filled grains from all the panicles produced.
*Seed shape	SS	Four classes were given: (1) round, (2) oblong, (3) elliptic and (4) linear.
*Seed length	SL	Measured in centimetre as the distance from the base of the lowermost sterile lemma to the tip (apiculus) of the fertile lemma or palea whichever is longer, mean length for 100 seeds was recorded.
*Seed width	SW	The widest portion of seed middle section measured in centimetre, mean width for 100 seeds was recorded.
Grain length	GL	Measured in centimetre from one tip to another end, mean length for 10 grains was recorded.
Grain width	GW	The widest portion of grain middle section was measured in centimetre, mean width for 10 grains was recorded.
*Seed colour	SC	Colour of 10 random seeds were classified as: (1) yellow, (2) pale yellow, (3) blackish yellow and (4) golden brown.
*Grain colour	GC	Colour of 10 random unpolished grains were classified as: (1) milky white, (2) reddish brown, (3) dark brown, (4) black, (5) greenish white and (6) light reddish brown.
!Heading days	HD	Heading day is characterised by the emergence of the first panicle.
!Flowering days	FD	Flowering day is recorded when the flower opens, and the pollination took place.

Note. Asterisk (*) indicates eight additional traits added upon observation. Exclamation (!) indicates two development traits.

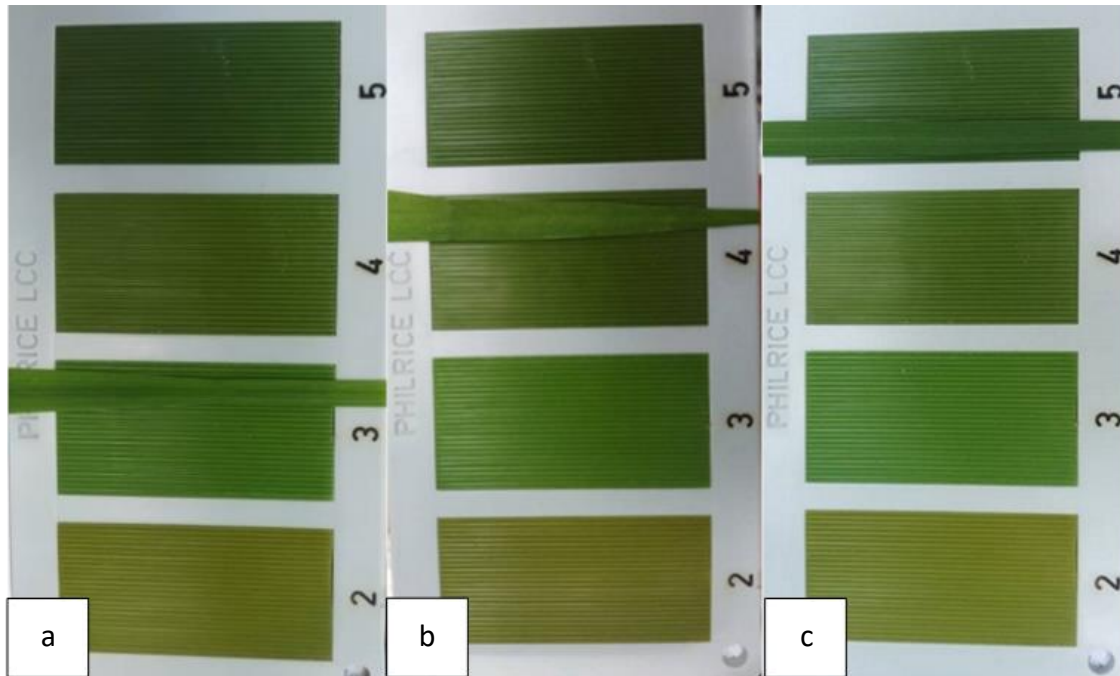
Supplementary Table 5. Genotype of the 44 selected rice accessions based on four SSR markers

Type of Rice	Landrace	Selected Accession	SSR Marker			
			RM1	RM279	RM335	RM489
LOWLAND	UNISR2018-02	UNIMAS-23	0	1	1	N/A
		UNIMAS-24	1	1	1	1
	UNISMT 2018-21	UNIMAS-25	1	1	1	1
		UNIMAS-26	3	3	3	2
	UNIPDW 2018-18	UNIMAS-27	1	N/A	N/A	1
	UNISRA 2018-24	UNIMAS-28	0	N/A	N/A	1
	UNISRA 2018-38	UNIMAS-29	1	N/A	N/A	1
	UNISAMA 2018- 44	UNIMAS-30	1	N/A	N/A	1
		UNIMAS-31	3	N/A	N/A	0
	UNISAMA 2018- 45	UNIMAS-32	3	N/A	N/A	1
		UNIMAS-33	1	1	N/A	1
	UNISRA 2018-40	UNIMAS-34	1	1	N/A	0
		UNIMAS-35	2	1	N/A	0
	UNISAMA 2018- 47	UNIMAS-36	3	1	N/A	1
		UNIMAS-37	5	1	N/A	1
	UNISAMA 2018- 48	UNIMAS-38	4	1	N/A	2
		UNIMAS-39	0	0	N/A	1
	UNIPDW2018- 48	UNIMAS-40	1	1	N/A	1
		UNIMAS-41	1	0	N/A	1
		UNIMAS-42	1	0	N/A	1
	UNISRA 2018-26	UNIMAS-43	1	2	N/A	1
		UNIMAS-44	1	1	N/A	1

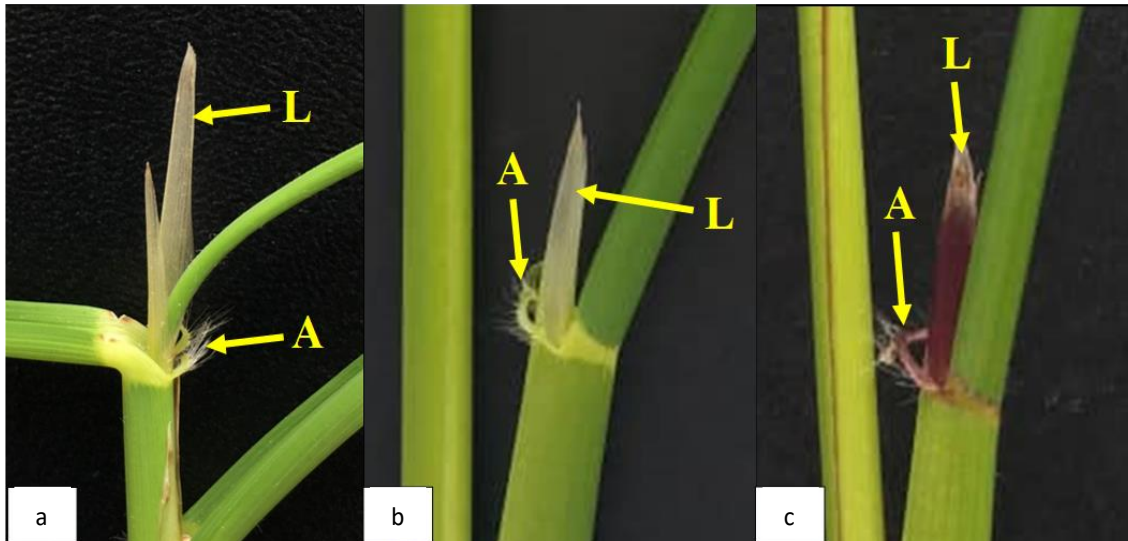
Supplementary Table 5. (continue)

Type of Rice	Landrace	Selected Accessions	SSR Marker			
			RM1	RM279	RM335	RM489
UPLAND	UNISR 2018-06	UNIMAS-01	0	1	1	N/A
		UNIMAS-02	1	1	1	N/A
	UNISR 2018-10	UNIMAS-03	1	N/A	1	N/A
	UNIPDW 2018-16	UNIMAS-04	1	N/A	1	N/A
		UNIMAS-05	3	N/A	1	N/A
		UNIMAS-06	0	N/A	1	N/A
	UNIPDW 2018-17	UNIMAS-07	2	N/A	1	N/A
		UNIMAS-08	1	0	1	1
		UNIMAS-09	1	1	1	0
		UNIMAS-10	1	1	1	2
	UNISRA 2018-29	UNIMAS-11	1	0	0	3
		UNIMAS-12	1	1	1	1
		UNIMAS-13	1	1	1	4
		UNIMAS-14	1	1	2	1
		UNIMAS-15	1	N/A	1	N/A
	UNISRA 2018-30	UNIMAS-16	1	N/A	1	N/A
	UNISRA 2018-31	UNIMAS-17	1	N/A	1	N/A
	UNISRA 2018-36	UNIMAS-18	0	N/A	1	N/A
		UNIMAS-19	1	N/A	1	N/A
	UNISRA 2018-39	UNIMAS-20	1	1	1	N/A
	UNISRA 2018-41	UNIMAS-21	1	1	1	N/A
	UNIPDW 2018-42	UNIMAS-22	1	1	1	N/A

Note. Scoring number indicates grouping based on allele scoring. N/A indicates data not available.



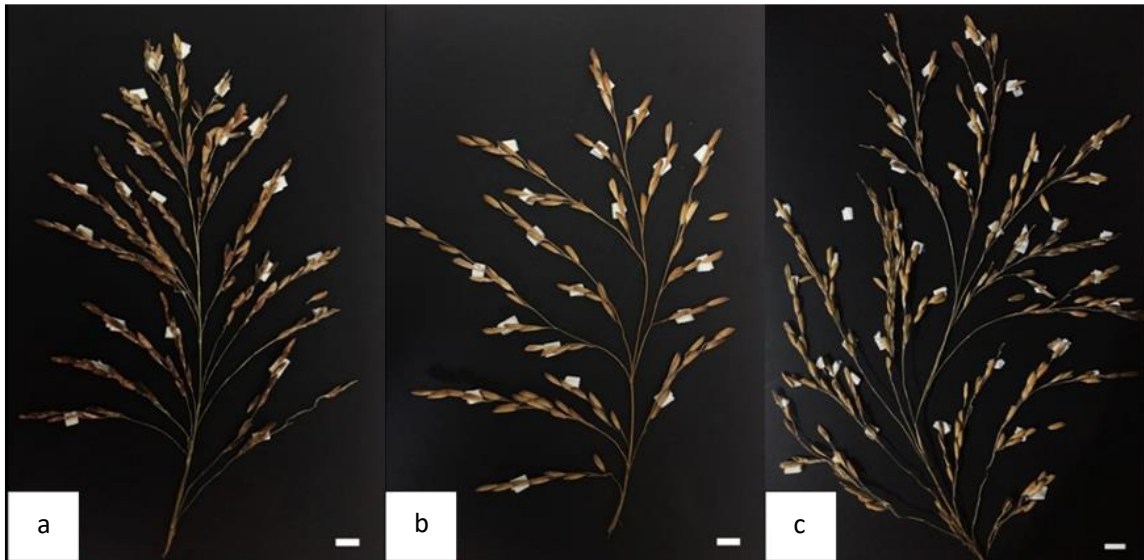
Supplementary Figure 1. Representative photos for blade colour: (a) Pale Green, (b) Green, (c) Dark Green



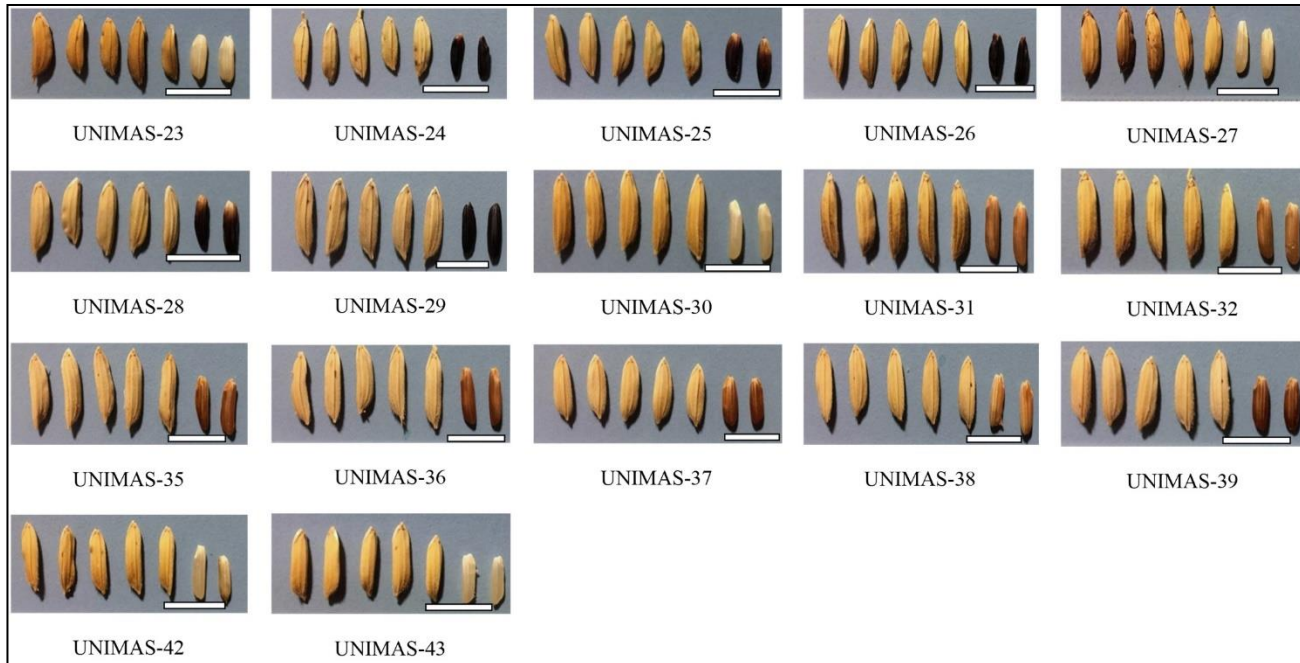
Supplementary Figure 2. Representative photos for auricles, ligules colouration and shape: (a) 2-Cleft LS, white auricle and ligule, (b) Acute to acuminate ligule shape, white auricle and ligule, (c) Acute to acuminate ligule shape, purple auricle and ligule. L indicate Ligule, A indicate Auricle



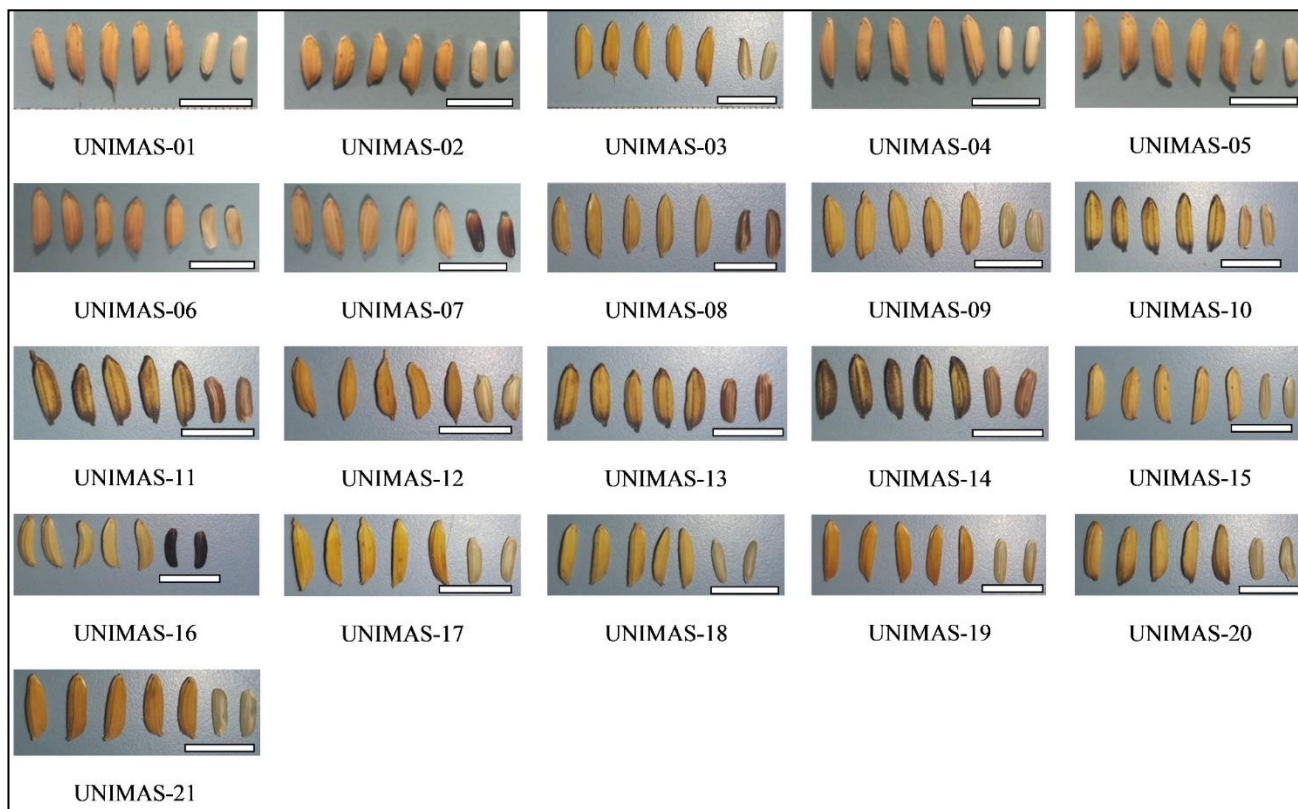
Supplementary Figure 3. Representative photos for types of panicle: (a) Compact panicle, (b) Intermediate panicle, (c) Open panicle. White bar indicates scale = 1 cm



Supplementary Figure 4. Representative type of secondary branching: (a) Absent, (b) Light, (c) Heavy. White bar indicates scale = 1 cm



Supplementary Figure 5. The seed and unpolished grain morphology of the 17 lowland rice accessions. White bar indicates scale = 1 cm



Supplementary Figure 6. The seed and unpolished grain morphology of the 21 upland rice accessions. White bar indicates scale = 1 cm