

## Chapter 4

### Results

#### 4.1 Field survey

For four villages, about 27 to 31 persons, ages between 20 to 68 years old were interviewed each village. Household sizes varied from two to ten persons, with averages between 5.2 to 5.8 persons. Within each household only one to four or average two persons were working in the farms. Ethnic groups were Tai Lu in Ban Ladthahae (LTH) and Khamu in Ban Houyleung (HL) of Pak Ou (PO) district and Khamu in Ban Houyman (HM) and Khamu plus Laolum in Ban Thapho (TP) of Phonxay (PX) district. Population sizes were between 289 to 497 with the highest in LTH and lowest in HM. All of them eat glutinous rice (Table 4.1.1).

Table 4.1.1 Number of household, populations, ethnic group and main staple in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

District	Villages	Characterization	Descriptive Statistic				Number of Households	Population	Ethnic group	Main staple	
			Min	Max	Mean	SD					
PX	HM	n=27					50	289	Khamu	G	
		Interviewer age (year)	26	63	45	11.1					
		Household size (person)	3	10	5.8	1.8					
			Farm labors (person)	1	4	2	0.6				
	TP	n=27					68	377	Khamu and Laolum	G	
		Interviewer age (year)	20	64	33	10.2					
Household size (person)		3	10	5.5	2						
Farm labors (person)		1	4	2	0.6						
PO	LTH	n=31				95	497	Tai lue	G		
		Interviewer age (year)	27	68	46					11.4	
		Household size (person)	3	9	5.2					1.7	
			Farm labors (person)	1	4	3	0.9				
	HL	n=27					60	336	Khamu	G	
		Interviewer age (year)	27	65	43	10.6					
Household size (person)		2	10	5.6	2						
		Farm labors (person)	1	4	2	0.8					
Total						273	1499				

SD= standard deviation, G=glutinous rice

Farmer management of varietal diversity was seen in these areas. A total of 63 samples representing 47 rice varieties were grown by farmers in four villages (Table 4.1.2). Number of varieties grown per village ranged from 13 in TP and 16 to 17 in the rest. Most of varieties were glutinous types, only 8% of non-glutinous were found. In addition, 83% of these samples were upland varieties and 17% were lowland varieties. The highest proportion of upland varieties was found in PX district which covered 94% in HM and 85% in TP, whereas in PO district 75% was maintained in LTH and 76% in HL. The average proportion of varieties planted with early, medium and late maturing varieties was 36, 35 and 29%, respectively. Farmers in PX district grew more medium than early and late maturing varieties, but farmers in PO district used more early than medium and late maturing varieties.

**Table 4.1.2** Number and percentage (in parenthesis) of ecosystem, endosperm type and maturity of rice varieties in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

District	Villages	Ecosystem Type		Endosperm Type		Total	Maturity type of rice varieties		
		UL	LL	G	N-G		Early	Medium	Late
PX	HM	16 (94)	1 (6)	16 (94)	1 (6)	17	24 (36)	26 (39)	16 (24)
	TP	11 (85)	2 (15)	12 (92)	1 (8)	13	6 (13)	24 (50)	18 (38)
PO	LTH	12 (75)	4 (25)	15 (94)	1 (6)	16	33 (46)	18 (25)	21 (29)
	HL	13 (76)	4 (24)	15 (88)	2 (12)	17	27 (42)	19 (30)	18 (28)
Total		52 (83)	11 (17)	58 (92)	5 (8)	63	90 (36)	87 (35)	73 (29)

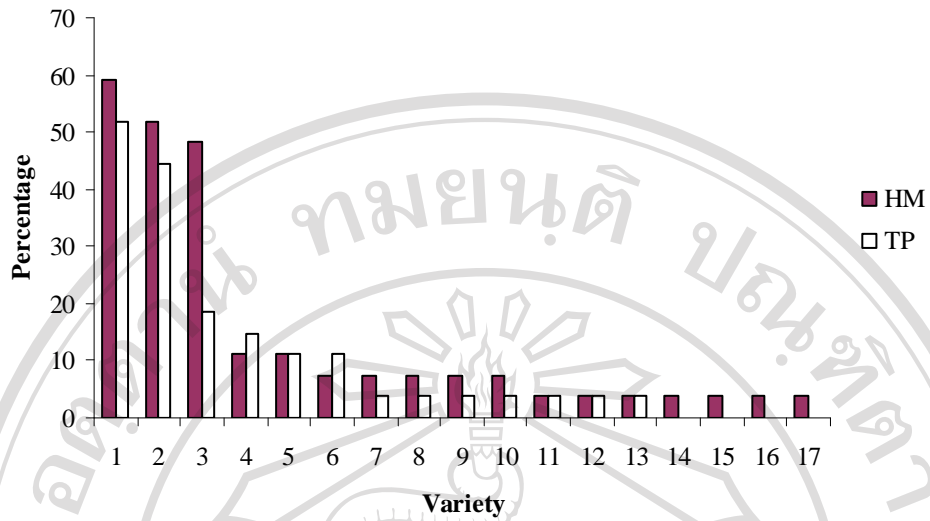
UL=upland rice, LL=Lowland rice, G=glutinous rice, N-G=non-glutinous rice, N=number of varieties.

Popular variety planted by farmers in each district was different. Within PX district popular variety had only three in HM, with Mak khuea yai (MKY), Do deng (DD) and Mai hok (MH) which covered 59, 52, and 48%, respectively, and TP at two popular varieties, with Kao chuk (KCH) and Luem phouw (LP) which covered 52 and 48% of household survey, respectively (Table 4.1.3 and Figure 4.1.1). For PO district had only one, and same variety in both villages as Phae pee (PP) was preferred in LTH and HL which covered 71 and 48 % of household survey, respectively (Table 4.1.3 and Figure 4.1.2). However, farmers in each village were still conserved minor varieties in their fields.

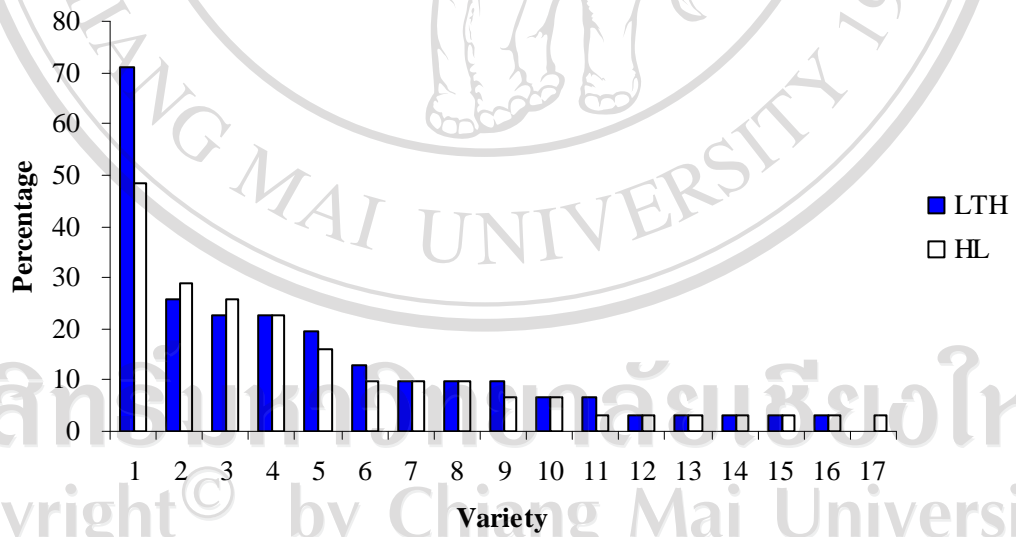
**Table 4.1.3** Rank and proportion of rice varieties (no of household) in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Number of household planted and variety name								
Rank	PX district				PO district			
	HM		TP		LTH		HL	
	Variety name	N	Variety name	N	Variety name	N	Variety name	N
1	Mak khuea yai	16	Kao chuk	14	Phae pee	22	Phae pee	15
2	Do deng	14	Luem phouw	12	Kao nok	8	Kao khao	9
3	Mai hok	13	Mak khuea yai	5	Phae do	7	Phae kang	8
4	Nam man	3	Kao louang	4	Man pou	7	Phae do	7
5	Do khao	3	Mak khuea noi	3	Nam paa	6	Nok khor	5
6	Mak khuea noi	2	Kao leung	3	Nam mak	4	Lai yai	3
7	Kao chuk	2	Kao deng	1	Phae kang	3	Kao do det	3
8	Kao bung	2	Deng phuey	1	Leung ban	3	Kao nok	3
9	Deng phuey	2	Kao bung	1	Do dai	3	Chao lao soung	2
10	Kao kum	2	Nam man	1	Na phon	2	Kao kum	2
11	Chao do	1	Pak lueng	1	Kao hea	2	Kao kan	1
12	Kao tum	1	Chao tum	1	Kao kan	1	La boun	1
13	Kao phae	1	Thadokham	1	Kao deng	1	Chao peek	1
14	Mak hin soung	1	-	-	Mon do	1	Kao deng	1
15	Kao mee	1	-	-	Chao do	1	Taa loy	1
16	Kao dum	1	-	-	RD16	1	Nam paa	1
17	Taa loy	1	-	-	-	-	Do khao	1

N= number of household



**Figure 4.1.1** Rank and proportion of rice varieties in Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district, Luang Prabang province



**Figure 4.1.2** Rank and proportion of rice varieties in Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Most of farmers planted different varieties in their fields. Some farmers in LTH planted five different rice varieties. Number of variety per household ranged from 1-5 varieties, with averages between 2 to 2.56 varieties (Table 4.1.4). Seed flow refers to exchange and transport of germplasm within or between villages. In the villages, about 49 to 91%, of farmers exchanged seed among members of the community, with the highest in TP and lowest in HL, about 9 to 51% exchanged seed between villages (Table 4.1.4). The seed for next crop were kept in anywhere inside the house and storage. Farmers in PO district maintained seeds in sacks/bags only, whereas PX district kept seeds in sack/bags and bamboo baskets.

**Table 4.1.4** Number of rice varieties per household, rice seed exchange and storage in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

District	Villages	Varieties/household		Seed exchange		Seed storage	
		Range	Average	Within village (%)	Between village (%)	Sack/bag (%)	Bamboo baskets (%)
PX	HM	1-4	2.56	69	31	75	25
	TP	1-4	2	91	9	81	19
PO	LTH	1-5	2.37	66	34	100	0
	HL	1-3	2.35	49	51	100	0
Average			2.3	69	31	89	11

## 4.2 Characterization of local rice varieties

### 4.2.1 Farmers' seed characterization

#### Husk color

About 7 to 10 samples per village had all seeds with straw hull. Only 1 to 2 samples within PX district found all seeds with reddish brown, 1 to 4 samples in HM, LTH and HL showed all seeds with brown line with straw whereas purple line with straw was found at HM and brown color was showed in PO district (Table 4.2.1). The diversity index based on husk color range from 0.13 to 1.02, the highest was collected from HM (MH).

#### Pericarp color

Pericarp of most samples were all white, one sample each from HM and HL were all purple and some had all red pericarp about 2 to 3 samples within each village. Diversity index of pericarp color varied from 0 to 0.54 (Table 4.2.2).

#### Endosperm types

Most of samples were glutinous rice. One to two samples from HM, LTH and HL were non-glutinous. Non-glutinous type mixed within seed lots ranged from 1 – 70 %. The highest showed in HL (70%) while the least found in TP (15%). Diversity index ranged from 0 to 0.61 (Table 4.2.3).

#### Seed length

For seed length, seed lots distributed from 7.3 to 12.7 mm. Mean seed length of individual seed lots ranged from 8.6 to 11.2 mm (Table 4.2.4). Average seed length of each village were between 9.4 to 10.2 mm, with seed lots in HM was the lowest (9.4 mm) and seed lots in TP was the highest (10.2 mm). When compared with the pure line variety check, KDML105, all seed lots were extra long grain and

most samples were more diverse. Coefficient of variation (CV, %) in seed length of each seed lots varied from 3.0 to 6.4 % (Figure 4.2.1), seed lots in LTH (DDa) and HL (KKH) was the lowest and seed lots in TP (PL) was the highest.

#### Seed width

Seed width of individual seed lots ranged from 2.3 to 4.9mm. Mean seed width of each seed lots distributed from 2.8 to 4.3mm (Table 4.2.5 and Figure 4.2.2). Average seed width of villages were between 3.5 to 3.7mm. When compared with the pure line variety check, KDML105, all seed lots were larger and most samples were more diverse.

#### Seed shape

Seed shape variation based on seed length and width ratio to classify grain into round, slender, and large grain type (Oka, 1988) was used. All but three of all samples were classified into large grain types and the rest were slender grain type (Figure 4.2.3).

#### 100 seeds weight (g)

Overall 100 seeds weight of individual seed lots distributed from 2.95 to 5.41 g. Average 100 seeds weight of villages were between 3.85 to 4.32g, with seed lots in HL was lowest (3.85g) and seed lots in TP was highest (4.32g) (Table 4.2.6).



**Table 4.2.1** Husk color of rice varieties in farmers' seed lots in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

		Husk color							
		PX district				PO district			
		HM		TP		LTH		HL	
MKY	Straw	KCH	Straw	PP	Straw	PP	Straw	PK	Straw
DD	Brown line with straw, purple line with straw (0.2)	LP	Straw	KN	Straw, purple line with straw (0.65)	PK	Straw, purple line with straw (0.65)	PK	Brown
KCH	Brown line with straw, purple line with straw, straw (0.53)	MKY	Straw	PD	Brown	PD	Brown	PD	Brown
MKN	Straw	MHN	Straw	PK	Brown	KN	Straw, purple line with straw (0.69)	KN	Straw, purple line with straw (0.69)
NM	Straw, reddish brown, brown line with straw (0.69)	KD	Reddish brown	MP	Brown line with straw	LY	Straw, purple line with straw (0.34)	LY	Straw, purple line with straw (0.34)
MH	Straw, reddish brown, brown line with straw (1.02)	DP	Reddish brown	NMA	Brown line with straw	NKH	Straw, purple line with straw (0.46)	NKH	Straw, purple line with straw (0.46)
KB	Straw	KB	Straw	LB	Straw	KDD	Straw	KDD	Straw
DP	Reddish brown	NM	Straw, brown line with straw (0.06)	KH	Straw, brown line with straw (0.69)	CHLS	Straw	CHLS	Straw
KKu	Straw	KLO	Straw, brown line with straw (0.65)	KK	Brown line with straw	KKu	Straw	KKu	Straw
KT	Straw	KLE	Straw	KD	Brown line with straw, reddish brown (0.3)	KK	Brown line with straw	KK	Brown line with straw
CHD	Straw	PL	Brown line with straw, purple line with straw, straw (0.69)	MD	Straw	LB	Straw	LB	Straw
KP	Straw	CHT	Straw	CHD	Straw	CHP	Straw	CHP	Straw
MHS	Brown line with straw	TDK	Straw	RD16	Straw	KD	Brown line with straw	KD	Brown line with straw
KM	Purple line with straw	-		NP	Straw	TL	Straw	TL	Straw
KDu	Purple line with straw	-		DDa	Straw	NP	Straw	NP	Straw
KD	Straw, brown line with straw (0.65)	-		NPH	Straw, brown line with straw (0.3)	KKH	Straw, brown line with straw (0.33)	KKH	Straw, brown line with straw (0.33)
DKH	Straw	-		-		DKH	Straw, brown line with straw (0.37)	DKH	Straw, brown line with straw (0.37)

Number in parenthesis was Shannon-Weaver Index ( $H'$ ) value.

**Table 4.2.2** Pericarp color of rice varieties in farmers' seed lots in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

		Pericarp color							
		PX district				PO district			
		HM		TP		LTH		HL	
MKY	White	KCH	Red	PP	White, red (0.33)	PP	White		
DD	White	LP	White	KN	White, red (0.28)	PK	Red		
KCH	White	MKY	White, red (0.4)	PD	Red	PD	Red		
MKN	White	MHN	White, red (0.13)	PK	Red	KN	White		
NM	White	KD	White	MP	White	LY	Red		
MH	White	DP	White	NMA	White	NKH	White		
KB	White	KB	White, red (0.33)	LB	White	KDD	White		
DP	White, red (0.5)	NM	White	KH	White, red (0.46)	CHLS	White		
KKu	Purple	KLO	White, red (0.28)	KK	White	KKu	Purple		
KT	White	KLE	White	KD	White	KK	White		
CHD	White	PL	White, red (0.42)	MD	White	LB	White, red (0.49)		
KP	Red	CHT	White	CHD	White, red (0.54)	CHP	White, red (0.25)		
MHS	White	TDK	White	RD16	White	KD	White		
KM	Red	-		NP	White	TL	White		
KDu	White	-		DDa	White	NP	White		
KD	White	-		NPH	White	KKH	White		
DKH	White	-				DKH	White		

Number in parenthesis was Shannon-Weaver Index ( $H'$ ) value.

**Table 4.2.3** Percentage of non-glutinous, glutinous and Shannon-Weaver Index ( $H'$ ) of rice varieties in farmers seed lots in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Percent of non-glutinous															
PX district								PO district							
HM				TP				LTH				HL			
Variety name	% N-G	% G	$H'$	Variety name	% N-G	% G	$H'$	Variety name	% N-G	% G	$H'$	Variety name	% N-G	% G	$H'$
MKY	0	100	0	KCH	0	100	0	PP	27	73	0.58	PP	0	100	0
DD	2	98	0.1	LP	0	100	0	KN	0	100	0	PK	0	100	0
KCH	0	100	0	MKY	15	85	0.42	PD	0	100	0	PD	0	100	0
MKN	0	100	0	MHN	0	100	0	PK	0	100	0	KN	0	100	0
NM	11	89	0.35	KD	0	100	0	MP	0	100	0	LY	9	91	0.3
MH	0	100	0	DP	1	99	0.06	NMA	0	100	0	NKH	9	91	0.3
KB	1	99	0.06	KB	0	100	0	LB	0	100	0	KDD	1	99	0.06
DP	16	84	0.44	NM	1	99	0.06	KH	0	100	0	CHLS	100	0	0
KKu	0	100	0	KLO	11	89	0.35	KK	1	99	0.06	KKu	0	100	0
KT	0	100	0	KLE	0	100	0	KD	0	100	0	KK	0	100	0
CHD	100	0	0	PL	3	97	0.13	MD	1	99	0.06	LB	0	100	0
KP	0	100	0	CHT	0	100	0	CHD	100	0	0	CHP	100	0	0
MHS	0	100	0	TDK	0	100	0	RD16	2	98	0.1	KD	0	100	0
KM	9	91	0.3	-	-	-	-	NP	0	100	0	TL	0	100	0
KDu	0	100	0	-	-	-	-	DDa	0	100	0	NP	0	100	0
KD	0	100	0	-	-	-	-	NPH	0	100	0	KKH	70	30	0.61
DKH	0	100	0	-	-	-	-	-	-	-	-	DKH	0	100	0

N-G=non-glutinous, G=glutinous.

**Table 4.2.4** Seed length of local rice varieties in farmers' seed lots in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Seed length (mm)																				
PX district										PO district										
HM					TP					LTH					HL					
Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	
MKY	9.1	7.8-10.1	0.5	5.6	KCH	9.8	8.4-10.9	0.5	4.6	PP	9.2	8.0-10.5	0.5	5.9	PP	9.2	8.1-10.1	9.2	9.2	
DD	8.6	7.8-9.7	0.4	4.2	LP	11.0	9.7-12.6	0.7	6.0	KN	9.6	8.3-11.3	0.5	5.0	PK	10.2	9.3-11	0.4	3.6	
KCH	8.9	7.3-10	0.5	5.2	MKY	9.0	8.1-9.8	0.4	4.0	PD	10.6	9.4-11.8	0.5	4.6	PD	10.2	8.9-11.1	0.4	3.8	
MKN	8.6	7.5-9.4	0.4	5.2	MHN	9.7	8.5-11.1	0.4	4.4	PK	10.2	8.9-11.6	0.4	4.3	KN	9.6	8.8-10.4	0.4	3.9	
NM	10.3	9.0-11.2	0.5	4.6	KD	10.8	9.8-11.8	0.5	4.7	MP	9.1	8.2-9.9	0.4	3.9	LY	10.0	9.0-10.8	0.4	4.4	
MH	10.8	9.7-12.1	0.5	4.5	DP	10.7	9.6-11.6	0.4	3.7	NMA	9.3	8.7-10.2	0.3	3.2	NKH	8.7	7.4-9.6	0.4	4.7	
KB	9.4	7.9-10.8	0.5	5.5	KB	9.9	9.0-10.9	0.4	4.2	LB	10.3	9.2-11.3	0.4	4.2	KDD	8.9	7.7-10	0.4	4.9	
DP	10.1	8.9-11.6	0.6	5.5	NM	10.3	8.7-11.5	0.6	6.1	KH	10.3	8.7-11.7	0.6	6.1	CHLS	10.4	9.3-11.2	0.4	3.8	
KKu	9.7	8.5-10.5	0.4	4.4	KLO	9.5	8.1-10.4	0.4	4.7	KK	10.8	9.7-12	0.4	4.1	KKu	10.5	9.8-11.4	0.4	3.3	
KT	9.2	8.1-10.5	0.5	5.7	KLE	11.2	10.3-12.2	0.4	3.8	KD	10.6	9.0-11.8	0.6	5.4	KK	11.2	9.8-12.1	0.4	3.7	
CHD	9.2	8.2-10.6	0.5	5.2	PL	10.9	9.5-12.7	0.7	6.4	MD	9.9	9.2-11.1	0.4	3.8	LB	10.3	9.3-11.1	0.4	3.7	
KP	9.2	8-10.1	0.4	4.5	CHT	9.8	9.1-10.9	0.4	4.1	CHD	9.6	8.5-10.5	0.4	4.5	CHP	9.9	9.1-10.7	0.4	3.9	
MHS	8.9	7.6-10.3	0.5	6.1	TDK	9.7	8.7-10.7	0.4	4.3	RD16	10.7	9.7-11.5	0.4	4.2	KD	10.1	9.3-11.1	0.4	3.5	
KM	8.9	8.0-10.2	0.4	4.1	-	-	-	-	-	NP	10.5	9.0-11.4	0.4	4.1	TL	10.3	8.8-11.2	0.5	4.7	
KDu	9.7	8.8-10.3	0.4	3.8	-	-	-	-	-	DDa	9.3	-	0.3	3.0	NP	10.6	9.8-11.4	0.4	3.3	
KD	8.9	8.0-10	0.4	4.9	-	-	-	-	-	NPH	10.5	-	0.4	3.3	KKH	9.6	9.1-10.2	0.3	3.0	
DKH	9.5	8.8-10.2	0.3	3.3	-	-	-	-	-	-	-	-	-	-	DKH	9.4	8.2-10.6	0.5	5.0	
Mean	9.4				10.2				10.03				9.9							
Range	8.6-10.8				9-11.2				9.1-10.8				8.7-11.2							

M = mean, R = range, SD = standard deviation, CV = Coefficient of Variation

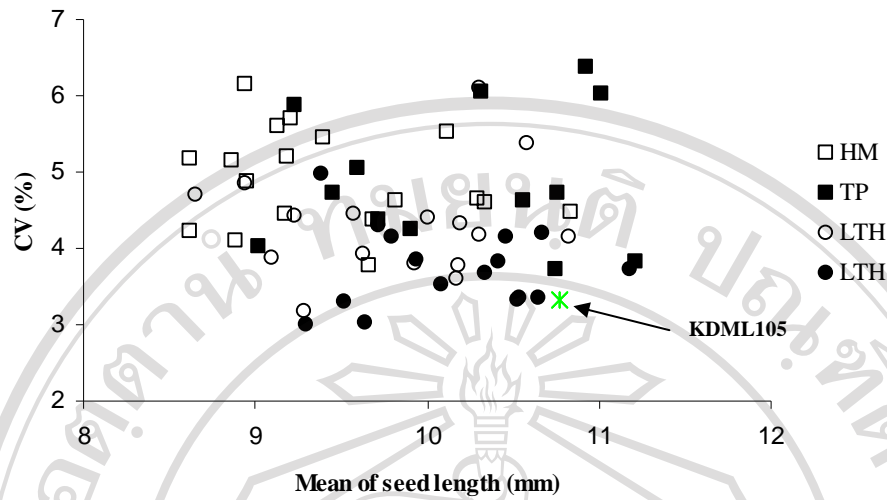
**Table 4.2.5** Seed width of local rice varieties in farmers' seed lots in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Seed width (mm)																			
PX district										PO district									
HM					TP					LTH					HL				
Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)
MKY	4.0	3.1-4.4	0.2	5.8	KCH	4.2	3.8-4.7	0.2	4.1	PP	3.4	3.0-3.8	0.1	4.4	PP	3.3	3.0-3.9	0.1	4.4
DD	3.8	3.0-4.3	0.2	5.6	LP	3.8	3.3-4.3	0.2	6.4	KN	4.1	3.5-4.5	0.2	4.0	PK	3.1	2.8-3.3	0.1	3.2
KCH	3.9	3.4-4.4	0.2	5.0	MKY	3.9	3.4-4.2	0.2	4.4	PD	2.8	2.4-3.2	0.2	5.4	PD	3.1	2.8-3.4	0.1	3.3
MKN	3.9	3.4-4.3	0.2	4.2	MHN	3.8	3.4-4.1	0.1	3.9	PK	3.3	2.3-3.6	0.2	5.7	KN	4.0	3.6-4.4	0.2	4.7
NM	3.7	3.2-4.4	0.2	6.5	KD	3.5	3.1-4.0	0.2	5.7	MP	4.1	3.4-4.4	0.2	3.9	LY	3.8	3.2-4.2	0.2	4.6
MH	3.5	2.9-3.9	0.2	5.4	DP	3.4	3.1-3.8	0.1	4.2	NMA	4.0	3.4-4.3	0.2	4.5	NKH	3.7	3.3-4	0.1	3.7
KB	3.6	3.2-4.2	0.2	4.9	KB	3.9	3.1-4.3	0.2	4.1	LB	3.9	3.4-4.3	0.2	4.5	KDD	3.9	3.7-4.2	0.1	2.5
DP	3.9	3.3-4.5	0.2	6.1	NM	3.8	3.4-4.3	0.2	4.7	KH	3.9	3.4-4.2	0.2	4.2	CHLS	3.2	2.9-3.9	0.1	4.5
KKu	3.6	3.1-4.1	0.2	6.3	KLO	4.3	3.9-4.8	0.2	5.0	KK	3.5	3.1-3.9	0.2	6.1	KKu	3.8	3.2-4	0.2	4.0
KT	3.7	3.2-4.2	0.2	5.4	KLE	3.5	3.1-4.0	0.2	5.2	KD	3.5	3.1-4.2	0.2	6.5	KK	3.6	3.1-4	0.2	5.0
CHD	3.4	2.9-3.9	0.2	5.4	PL	3.7	3.3-4.3	0.2	6.5	MD	3.9	3.4-4.1	0.1	3.5	LB	3.1	2.6-3.3	0.1	4.2
KP	3.2	2.5-3.7	0.2	5.2	CHT	2.9	2.5-3.2	0.1	4.5	CHD	3.4	3.0-3.8	0.2	4.5	CHP	3.3	3.0-4	0.2	5.0
MHS	4.1	3.6-4.6	0.2	4.3	TDK	2.9	2.4-3.1	0.1	5.1	RD16	2.8	2.4-3.2	0.2	5.5	KD	3.7	3.0-4.1	0.2	4.6
KM	3.5	3.1-3.9	0.2	5.1	-	-	-	-	-	NP	3.6	3.3-3.9	0.1	3.7	TL	3.5	3.4-1	0.2	6.0
KDu	3.4	3.0-3.9	0.2	6.3	-	-	-	-	-	DDa	4.0	3.3-4.9	0.2	4.8	NP	3.6	3.3-3.9	0.1	3.2
KD	3.4	3.0-3.9	0.2	5.5	-	-	-	-	-	NPH	3.6	3.2-4.2	0.1	4.0	KKH	3.7	3.0-4	0.1	4.0
DKH	3.6	3.2-4	0.1	3.5	-	-	-	-	-	-	-	-	-	-	DKH	3.8	3.3-4.1	0.1	3.8
Mean	3.7				3.7				3.6				3.5						
Range	3.2-4.1				2.9-4.3				2.8-4.1				3.1-4						

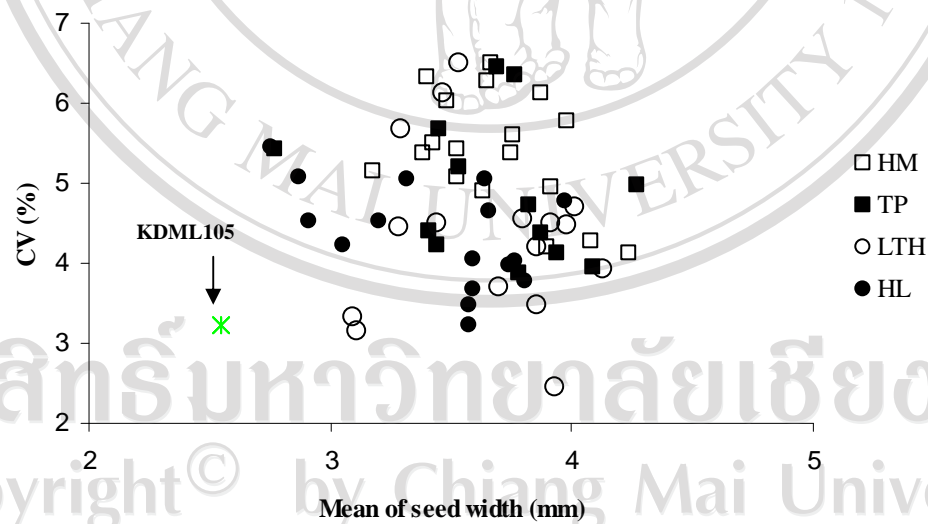
M = mean, R = range, SD = standard deviation, CV = Coefficient of Variation

**Table 4.2.6** 100 seeds weight of rice varieties in farmers' seed lots in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

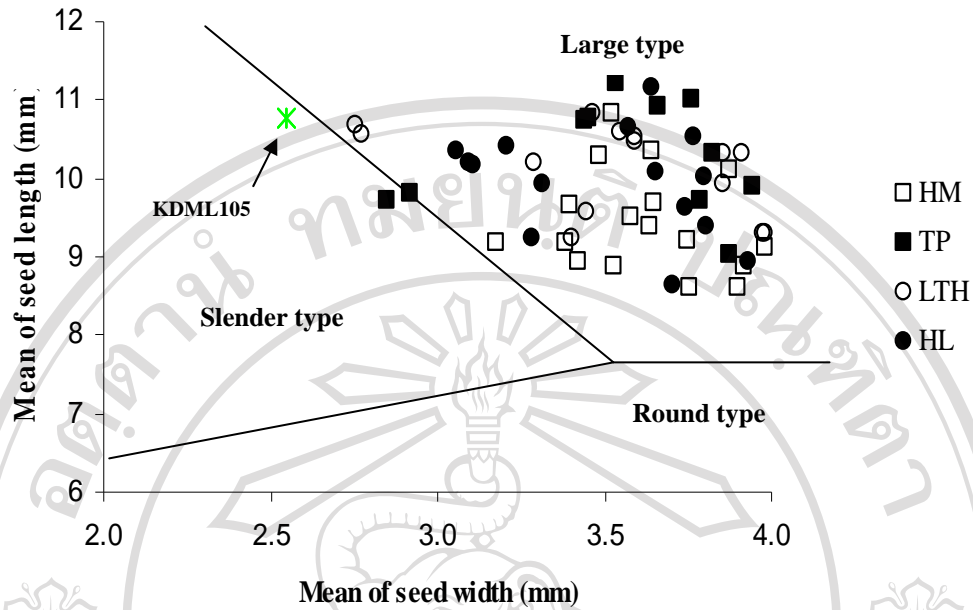
100 seeds weight (g)							
PX district				PO district			
HM		TP		LTH		HL	
Variety name	100 grain weight (g)	Variety name	100 grain weight (g)	Variety name	100 grain weight (g)	Variety name	100 grain weight (g)
MKY	4.20	KCH	5.16	PP	3.4	PP	3.1
DD	3.70	LP	5.41	KN	4.2	PK	3.3
KCH	4.10	MKY	3.86	PD	3.1	PD	3.4
MKN	3.80	MHN	4.22	PK	3.7	KN	3.4
NM	4.30	KD	4.19	MP	4.2	LY	4.4
MH	4.80	DP	4.29	NMA	4.3	NKH	3.5
KB	4.10	KB	4.23	LB	4.6	KDD	3.9
DP	4.30	NM	4.67	KH	4.5	CHLS	3.8
KKu	4.10	KLO	4.54	KK	4.3	KKu	3.9
KT	3.90	KLE	4.93	KD	4.2	KK	4.7
CHD	3.80	PL	4.73	MD	4.3	LB	3.1
KP	3.00	CHT	2.95	CHD	3.8	CHP	4.3
MHS	4.50	TDK	2.99	RD16	3.2	KD	4.1
KM	4.00	-	-	NP	4.2	TL	4.3
KDu	4.20	-	-	DDa	3.9	NP	4.2
KD	4.20	-	-	NPH	4.1	KKH	4
DKH	3.60	-	-	-	-	DKH	4.1
Mean	4.04		4.32		4.00		3.85
Range	3-4.8		2.95-5.41		3.1-4.6		3.1-4.7



**Figure 4.2.1** Average of seed length and coefficient of variation of rice varieties in farmers' seed lots in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province



**Figure 4.2.2** Mean of seed width and coefficient of variation of rice varieties in farmers' seed lots in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province



**Figure 4.2.3** Grain shapes of rice varieties in farmers' seed lots in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province



## 4.2.2 Progeny test

### Morphological characteristics

#### Leaf blade color

Low variation was found for leaf blade color. Only three types were observed including, green, purple blotch and purple margin. Leaf blade of most samples were green (Table 4.2.7). Two samples, KDu from HM and PK of LTH had all plants with purple blotch and margin leaf blade, respectively. Three samples from HL showed some variation with sample for leaf blade (Shannon-Weaver Index ( $H'$ ) 0.2 to 0.69).

#### Basal leaf sheath color

Both between and within samples diversity were found. Basal leaf sheath color consisted of green, purple and light purple (Table 4.2.8). Basal leaf sheath of most samples were green. Within PX district, most of samples were uniform with green (22), purple (3) and light purple (1). Only four samples were mixture with  $H'$  ranged from 0.2 to 0.42. Likewise, those of most samples in PO district were uniform with green and light purple. Only five samples were mixture with  $H'$  range from 0.2 to 0.86.

#### Leaf blade pubescence

Three scales of identification of leaf blade pubescence can be used, glabrous, intermediate and pubescence. Low variation was found of leaf blade pubescence.

Leaf blade pubescence of most samples were glabrous (Table 4.2.9). A few samples in each village was pubescence and intermediate. One sample of each village showed variation within sample for leaf blade pubescence ( $H'$  0.2 to 0.21).

Auricle color

Low variation was showed in auricle color. Auricle color consisted of colorless and purple (Table 4.2.10). Auricle of most samples were colorless. Three samples, PK from LTH, and KKH and DKH from HL showed variation within sample for auricle  $H'$  ranged from 0.2 to 0.5.

Collar color

Only two color pale green and purple were found in collar type. Low variation was found in collar color. Almost samples were pale green homogenous color (Table 4.2.11). Three samples were mixture between pale green and purple collar types ( $H'$  0.2 to 0.56).

Ligule color

For ligule color, almost samples exhibited colorless. Only two colors were observed including colorless and purple (Table 4.2.12). No variation was found in ligule color, except KKH from HL showed variation within sample of ligule color ( $H' = 0.69$ ).

Ligule shape

Only two types of ligule shape were observed including 2-cleft and acute. Ligule shape of most samples were 2-clef (Table 4.2.13). No variation was found in ligule shape, except KKH from HL showed variation within sample of ligule shape ( $H' = 0.69$ ).

Stigma color

Colorless and purple color was observed in stigma. No variation was found in stigma color. Those of most samples were colorless. Only four samples, PK from LTH and LB, NP and KKH from HL had purple (Table 4.2.14)

### Apiculus color

Both between and within samples diversity were found. Apiculus color consisted of straw, brown, red and purple (Table 4.2.15). Within PX district, only 11 samples were uniform for straw, purple or brown apiculus. The rest were mixture with  $H'$  ranged from 0.04 to 1.06. In contrast, those of most samples in PO district were uniform with straw (15), brown (5) and purple (5). Only six samples were mixture between straw and brown apiculus types ( $H'$  0.06 to 0.55).

### Pericarp color

Variation of diversity was found between and within samples. Four colors with white, purple, brown, and red were found in pericarp (Table 4.2.16). Within PX district, 19 samples were uniform for white, red and purple pericarp, whereas other samples were mixture between white and red pericarp  $H'$  varied from 0.2 to 0.57. Likewise, pericarp of most samples in PO district were uniform with white (18), red (4) and one purple. Ten samples were mixture with  $H'$  ranged from 0.2 to 0.99.

### Husk color

High variation both between and within samples diversity were found. Husk color consisted straw, brown, brown line with straw, purple line with straw, reddish brown, straw with brown spots, straw with reddish brown spots, and reddish brown with straw spots. In PX district, 12 samples were uniform with straw and reddish brown husk. The rest were mixture with  $H'$  contributed from 0.06 to 1.47. In contrast, most of samples in PO district were uniform with straw (16), brown (2), and brown line with straw (3). 11 samples were mixed with  $H'$  varied from 0.06 to 0.71 (Table 4.2.17).

### Awning

Only two types of awning were observed including absent and short awn. Variation of diversity was found within and between samples (Table 4.2.18). Within PX district, most of samples were observed absent. Only six samples were mixed with absent and short and partly awned  $H'$  ranged from 0.06 to 0.5. In contrast, awning of most samples in PO district was uniform with absent (18). The rest were mixture with  $H'$  ranged from 0.06 to 0.6.

### Husk pubescence

Low variation was found for husk pubescence. Only two types were observed including glabrous and pubescence. Husk pubescence of most samples were uniform with glabrous and pubescence (Table 4.2.19). Three samples, KP from HM, KB from TP and KN from LTH showed variation with sample for husk pubescence with  $H'$  ranged from 0.2 to 0.21.

Cluster analysis from 13 morphological characteristics of 63 samples of local rice varieties by UPGMA methods classified three major clusters. The first cluster consisted of samples showed the presentation of anthocyanin on many parts of the plant such as leaf-blade, leaf-sheath, auricle and stigma (KKH, NP and LB sample in HL and PK in LTH). The second group consisted of samples showed colorless stigma; leaf blade and husk pubescence, and same group of KDML105 and RD6. The last group consisted of samples showed the presentation of anthocyanin on husk color, colorless stigma, leaf blade, husk glabrous and large grain (Figure 4.2.6)

**Table 4.2.7** Leaf blade color of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Leaf blade color									
PX district					PO district				
HM		TP			LTH		HL		
MKY	Green	KCH	Green	PP	Green	PP	Green		
DD	Green	LP	Green	KN	Green	PK	Green		
KCH	Green	MKY	Green	PD	Green	PD	Green		
MKN	Green	MHN	Green	PK	Purple margins	KN	Green		
NM	Green	KD	Green	MP	Green	LY	Green		
MH	Green	DP	Green	NMA	Green	NKH	Green		
KB	Green	KB	Green	LB	Green	KDD	Green		
DP	Green	NM	Green	KH	Green	CHLS	Green		
KKu	Green	KLO	Green	KK	Green	KKu	Green		
KT	Green	KLE	Green	KD	Green	KK	Green		
CHD	Green	PL	Green	MD	Green	LB	Purple margins, green (0.5)		
KP	Green	CHT	Green	CHD	Green	CHP	Green		
MHS	Green	TDK	Green	RD16	Green	KD	Green		
KM	Green	-	-	NP	Green	TL	Green		
KDu	Purple blotch	-	-	DDa	Green	NP	Green		
KD	Green	-	-	NPH	Green	KKH	Purple margins, green( (0.69)		
DKH	Green	-	-	-	-	DKH	Purple margins, green (0.2)		

Number in parenthesis was Shannon-Weaver Index ( $H'$ ) value.

**Table 4.2.8** Basal leaf sheath color of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Basal leaf sheath color							
PX district				PO district			
HM		TP		LTH		HL	
MKY	Green	KCH	Purple	PP	Green	PP	Green
DD	Green	LP	Green, light purple (0.2)	KN	light purple	PK	Green
KCH	Purple	MKY	Green	PD	Green	PD	Green
MKN	Green	MHN	Green	PK	Green, light purple (0.2)	KN	light purple
NM	Green	KD	Green	MP	Green	LY	light purple
MH	Green	DP	Green	NMA	Green	NKH	Green
KB	Green	KB	Green, light purple (0.2)	LB	Green	KDD	Green, light purple (0.33)
DP	Green	NM	Green, light purple (0.2)	KH	Green	CHLS	Green, light purple (0.68)
KKu	Green	KLO	Green	KK	Green	KKu	Green
KT	Green	KLE	Green	KD	Green	KK	Green
CHD	Green	PL	Green, light purple (0.42)	MD	Green	LB	light purple
KP	Green	CHT	Green	CHD	Green	CHP	Green
MHS	Green	TDK	Green	RD16	Green	KD	Green
KM	light purple	-	-	NP	Green	TL	Green
KDu	Purple	-	-	DDa	Green	NP	Green
KD	Green	-	-	NPH	Green	KKH	Green, light purple (0.86)
DKH	Green	-	-	-	-	DKH	Green, light purple (0.52)

Number in parenthesis was Shannon-Weaver Index ( $H'$ ) value.

**Table 4.2.9** Leaf blade pubescence of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Leaf blade pubescence									
PX district					PO district				
HM		TP			LTH		HL		
MKY	Glabrous	KCH	Glabrous	PP	pubescence	PP	Glabrous		
DD	Glabrous	LP	Glabrous	KN	Glabrous	PK	Glabrous		
KCH	Glabrous	MKY	Glabrous	PD	pubescence	PD	Glabrous		
MKN	Glabrous	MHN	Glabrous	PK	pubescence	KN	Glabrous		
NM	Glabrous	KD	Glabrous	MP	Glabrous	LY	Glabrous		
MH	Glabrous	DP	Glabrous	NMA	Glabrous	NKH	Glabrous		
KB	intermediate	KB	Glabrous, intermediate (0.2)	LB	Glabrous	KDD	Glabrous		
DP	Glabrous	NM	Glabrous	KH	Glabrous	CHLS	Glabrous		
KKu	Glabrous	KLO	Glabrous	KK	Glabrous	KKu	Glabrous		
KT	Glabrous	KLE	Glabrous	KD	Pubescence, glabrous (0.2)	KK	Glabrous		
CHD	Glabrous	PL	Glabrous	MD	intermediate	LB	pubescence		
KP	pubescence, intermediate (0.2)	CHT	pubescence	CHD	Glabrous	CHP	Glabrous, pubescence (0.21)		
MHS	Glabrous	TDK	pubescence	RD16	Glabrous	KD	Glabrous		
KM	Glabrous	-	-	NP	Glabrous	TL	Glabrous		
KDu	Glabrous	-	-	DDa	Glabrous	NP	pubescence		
KD	Glabrous	-	-	NPH	Glabrous	KKH	pubescence		
DKH	pubescence	-	-	-	-	DKH	pubescence		

Number in parenthesis was Shannon-Weaver Index ( $H'$ ) value.

**Table 4.2.10** Auricle color of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

		Auricle color							
		PX district				PO district			
		HM	TP		LTH		HL		
MKY	colorless	KCH	colorless	PP	colorless	PP	colorless	PK	colorless
DD	colorless	LP	colorless	KN	colorless	KN	colorless	PK	colorless
KCH	colorless	MKY	colorless	PD	colorless	PD	colorless	PD	colorless
MKN	colorless	MHN	colorless	PK	colorless, purple (0.2)	KN	colorless	KN	colorless
NM	colorless	KD	colorless	MP	colorless	LY	colorless	LY	colorless
MH	colorless	DP	colorless	NMA	colorless	NKH	colorless	NKH	colorless
KB	colorless	KB	colorless	LB	colorless	KDD	colorless	KDD	colorless
DP	colorless	NM	colorless	KH	colorless	CHLS	colorless	CHLS	colorless
KKu	colorless	KLO	colorless	KK	colorless	KKu	colorless	KKu	colorless
KT	colorless	KLE	colorless	KD	colorless	KK	colorless	KK	colorless
CHD	colorless	PL	colorless	MD	colorless	LB	colorless	LB	colorless
KP	colorless	CHT	colorless	CHD	colorless	CHP	Purple	CHP	Purple
MHS	colorless	TDK	colorless	RD16	colorless	KD	colorless	KD	colorless
KM	colorless	-	-	NP	colorless	TL	colorless	TL	colorless
KDu	colorless	-	-	DDa	colorless	NP	colorless	NP	colorless
KD	colorless	-	-	NPH	colorless	KKH	colorless, purple (0.5)	KKH	colorless, purple (0.5)
DKH	colorless	-	-	-	-	DKH	colorless, purple (0.42)	DKH	colorless, purple (0.42)

Number in parenthesis was Shannon-Weaver Index ( $H'$ ) value.



**Table 4.2.11** Collar color of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

		Collar color							
		PX district				PO district			
	HM		TP		LTH		HL		
MKY	Pale green	KCH	Pale green	PP	Pale green	PP	Pale green		
DD	Pale green	LP	Pale green	KN	Pale green	PK	Pale green		
KCH	Pale green	MKY	Pale green	PD	Pale green	PD	Pale green		
MKN	Pale green	MHN	Pale green	PK	Pale green, purple (0.2)	KN	Pale green		
NM	Pale green	KD	Pale green	MP	Pale green	LY	Pale green		
MH	Pale green	DP	Pale green	NMA	Pale green	NKH	Pale green		
KB	Pale green	KB	Pale green	LB	Pale green	KDD	Pale green		
DP	Pale green	NM	Pale green	KH	Pale green	CHLS	Pale green		
KKu	Pale green	KLO	Pale green	KK	Pale green	KKu	Pale green		
KT	Pale green	KLE	Pale green	KD	Pale green	KK	Pale green		
CHD	Pale green	PL	Pale green	MD	Pale green	LB	Pale green		
KP	Pale green	CHT	Pale green	CHD	Pale green	CHP	Pale green		
MHS	Pale green	TDK	Pale green	RD16	Pale green	KD	Pale green		
KM	Pale green	-	-	NP	Pale green	TL	Pale green		
KDu	Pale green	-	-	DDa	Pale green	NP	Pale green		
KD	Pale green	-	-	NPH	Pale green	KKH	Pale green, purple (0.56)		
DKH	Pale green	-	-	-	-	DKH	Pale green, purple (0.2)		

Number in parenthesis was Shannon-Weaver Index ( $H'$ ) value.

**Table 4.2.12** Ligule color of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Ligure color							
PX district				PO district			
HM		TP		LTH		HL	
MKY	colorless	KCH	colorless	PP	colorless	PP	colorless
DD	colorless	LP	colorless	KN	colorless	PK	colorless
KCH	colorless	MKY	colorless	PD	colorless	PD	colorless
MKN	colorless	MHN	colorless	PK	colorless	KN	colorless
NM	colorless	KD	colorless	MP	colorless	LY	colorless
MH	colorless	DP	colorless	NMA	colorless	NKH	colorless
KB	colorless	KB	colorless	LB	colorless	KDD	colorless
DP	colorless	NM	colorless	KH	colorless	CHLS	colorless
KKu	colorless	KLO	colorless	KK	colorless	KKu	colorless
KT	colorless	KLE	colorless	KD	colorless	KK	colorless
CHD	colorless	PL	colorless	MD	colorless	LB	colorless
KP	colorless	CHT	colorless	CHD	colorless	CHP	colorless
MHS	colorless	TDK	colorless	RD16	colorless	KD	colorless
KM	colorless	-	-	NP	colorless	TL	colorless
KDu	colorless	-	-	DDa	colorless	NP	colorless
KD	colorless	-	-	NPH	colorless	KKH	colorless, purple (0.69)
DKH	colorless	-	-	-	-	DKH	colorless

Number in parenthesis was Shannon-Weaver Index ( $H'$ ) value.

**Table 4.2.13** Ligule shape of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Ligule shape							
PX district				PO district			
HM		TP		LTH		HL	
MKY	2-cleft	KCH	2-cleft	PP	2-cleft	PP	2-cleft
DD	2-cleft	LP	2-cleft	KN	2-cleft	PK	2-cleft
KCH	2-cleft	MKY	2-cleft	PD	2-cleft	PD	2-cleft
MKN	2-cleft	MHN	2-cleft	PK	2-cleft	KN	2-cleft
NM	2-cleft	KD	2-cleft	MP	2-cleft	LY	2-cleft
MH	2-cleft	DP	2-cleft	NMA	2-cleft	NKH	2-cleft
KB	2-cleft	KB	2-cleft	LB	2-cleft	KDD	2-cleft
DP	2-cleft	NM	2-cleft	KH	2-cleft	CHLS	2-cleft
KKu	2-cleft	KLO	2-cleft	KK	2-cleft	KKu	2-cleft
KT	2-cleft	KLE	2-cleft	KD	2-cleft	KK	2-cleft
CHD	2-cleft	PL	2-cleft	MD	2-cleft	LB	2-cleft
KP	2-cleft	CHT	2-cleft	CHD	2-cleft	CHP	2-cleft
MHS	2-cleft	TDK	2-cleft	RD16	2-cleft	KD	2-cleft
KM	2-cleft	-	-	NP	2-cleft	TL	2-cleft
KDu	2-cleft	-	-	DDa	2-cleft	NP	2-cleft, acute (0.69)
KD	2-cleft	-	-	NPH	2-cleft	KKH	2-cleft
DKH	2-cleft	-	-	-	-	DKH	2-cleft

Number in parenthesis was Shannon-Weaver Index ( $H'$ ) value.

**Table 4.2.14** Stigma color of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Stigma color									
PX district					PO district				
HM		TP		LTH		HL			
MKY	colorless	KCH	colorless	PP	colorless	PP	colorless		
DD	colorless	LP	colorless	KN	colorless	PK	colorless		
KCH	colorless	MKY	colorless	PD	colorless	PD	colorless		
MKN	colorless	MHN	colorless	PK	Purple	KN	colorless		
NM	colorless	KD	colorless	MP	colorless	LY	colorless		
MH	colorless	DP	colorless	NMA	colorless	NKH	colorless		
KB	colorless	KB	colorless	LB	colorless	KDD	colorless		
DP	colorless	NM	colorless	KH	colorless	CHLS	colorless		
KKu	colorless	KLO	colorless	KK	colorless	KKu	colorless		
KT	colorless	KLE	colorless	KD	colorless	KK	colorless		
CHD	colorless	PL	colorless	MD	colorless	LB	Purple		
KP	colorless	CHT	colorless	CHD	colorless	CHP	colorless		
MHS	colorless	TDK	colorless	RD16	colorless	KD	colorless		
KM	colorless	-	-	NP	colorless	TL	colorless		
KDu	colorless	-	-	DDa	colorless	NP	colorless		
KD	colorless	-	-	NPH	colorless	KKH	Purple		
DKH	colorless	-	-	-	-	DKH	Purple		

Number in parenthesis was Shannon-Weaver Index ( $H'$ ) value.

**Table 4.2.15** Apicullus color of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Apicullus color								
PX district				PO district				
HM		TP		LTH		HL		
MKY	Straw	KCH	Brown, purple (0.16)	PP	Straw	PP	Straw	
DD	Purple	LP	Straw, brown (0.23)	KN	Purple	PK	Straw	
KCH	Purple	MKY	Straw, brown (0.47)	PD	Straw	PD	Straw	
MKN	Brown, straw (0.65)	MHN	Straw, brown (0.19)	PK	Straw	KN	Purple	
NM	Straw, brown, purple, red (1.01)	KD	Purple	MP	Brown	LY	Purple	
MH	Straw, brown, red (0.88)	DP	Red, brown, purple (0.72)	NMA	Brown	NKH	Straw, brown (0.1)	
KB	Straw, brown, purple (0.2)	KB	Straw, brown (0.38)	LB	Straw, brown (0.41)	KDD	Straw, brown (0.33)	
DP	Brown, purple, red (1.06)	NM	Straw, brown (0.21)	KH	Straw	CHLS	Straw, brown (0.55)	
KKu	Straw	KLO	Purple	KK	Brown	KKu	Straw	
KT	Straw, brown (0.32)	KLE	Straw, brown (0.25)	KD	Brown	KK	Brown	
CHD	Straw, brown (0.08)	PL	Brown, purple (0.54)	MD	straw	LB	Brown	
KP	Straw, brown (0.2)	CHT	Straw	CHD	Straw, brown (0.06)	CHP	Straw, brown (0.51)	
MHS	Brown	TDK	Straw	RD16	Straw	KD	Brown	
KM	Purple	-	-	NP	Straw	TL	Straw	
KDu	Straw, purple (0.04)	-	-	DDa	Straw	NP	Straw	
KD	Brown, purple (0.06)	-	-	NPH	Straw	KKH	Purple	
DKH	Purple	-	-	-	-	DKH	Purple	

Number in parenthesis was Shannon-Weaver Index ( $H'$ ) value.

**Table 4.2.16** Pericarp color of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Pericarp color							
PX district				PO district			
HM		TP		LTH		HL	
MKY	White	KCH	White, red (0.57)	PP	White, red (0.2)	PP	White
DD	White, red (0.2)	LP	White, brown (0.2)	KN	White, red (0.52)	PK	Red
KCH	White, red (0.2)	MKY	White, red (0.29)	PD	White, red (0.52)	PD	Red
MKN	White	MHN	White, red (0.41)	PK	Red	KN	White
NM	White	KD	White	MP	White	LY	Red
MH	White	DP	White	NMA	White	NKH	White
KB	White, brown (0.3)	KB	White, red (0.33)	LB	White	KDD	White, red (0.33)
DP	White, brown (0.8)	NM	White	KH	White, brown, red (0.68)	CHLS	White
KKu	Purple	KLO	White	KK	White	KKu	Purple
KT	White	KLE	White	KD	White	KK	White
CHD	White	PL	White, red (0.43)	MD	White	LB	White, red (0.51)
KP	White, brown (0.2)	CHT	White	CHD	White, brown, red (0.99)	CHP	White, red (0.34)
MHS	White	TDK	White	RD16	White	KD	White
KM	Red	-	-	NP	White	TL	White
KDu	White	-	-	DDa	White	NP	White
KD	White	-	-	NPH	White, red (0.21)	KKH	White, red (0.33)
DKH	White	-	-	-	-	DKH	White

Number in parenthesis was Shannon-Weaver Index ( $H'$ ) value.

**Table 4.2.17** Husk color of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

		Husk color					
		PX district			PO district		
	HM		TP		LTH		HL
MKY	straw	KCH	Purple line with straw, straw (0.06)	PP	straw	PP	Straw
DD	Straw, purple line with straw, brown line with straw (0.87)	LP	Straw	KN	Straw, purple line with straw (0.68)	PK	Straw
KCH	Straw, purple line with straw (0.6)	MKY	Straw	PD	Brown	PD	Straw
MKN	straw	MHN	Straw	PK	Brown	KN	Straw, purple line with straw (0.63)
NM	Straw, brown line with straw, reddish brown (1.47)	KD	Reddish brown	MP	Brown line with straw, straw with brown spots (0.06)	LY	Straw, purple line with straw (0.5)
MH	Straw, brown line with straw, straw with brown spots (1.31)	DP	Reddish brown, reddish brown with straw spots (0.68)	NMA	Brown line with straw	NKH	Straw, brown line with straw (0.48)
KB	straw	KB	Straw, reddish brown with straw spots (0.18)	LB	Straw, straw with brown spots (0.32)	KDD	Straw
DP	Brown line with straw, purple line with straw, straw with reddish spots (1.18)	NM	Straw, straw with brown spots (0.06)	KH	Straw, brown line with straw (0.32)	CHLS	Straw, brown line with straw (0.06)
KKu	Straw, purple line with straw (0.31)	KLO	Straw, brown line with straw, purple line with straw (0.41)	KK	Brown line with straw	KKu	Straw, purple line with straw (0.1)
KT	Straw, brown line with straw (0.06)	KLE	Straw, brown line with straw (0.03)	KD	Brown line with straw, reddish brown (0.71)	KK	Brown line with straw
CHD	straw	PL	Straw, brown line with straw, purple line with straw (0.67)	MD	straw	LB	Straw

Number in parenthesis was Shannon-Weaver Index ( $H'$ ) value.

**Table 4.2.17 (Continued)**

		Husk color							
		PX district				PO district			
	HM		TP		LTH		HL		
KP	straw	CHT	straw	CHD	Straw	CHP	Straw		
MHS	Straw, brown line with straw, purple line with straw (0.37)	TDK	straw	RD16	Straw	KD	Brown line with straw		
KM	Purple line with straw, straw (0.09)	-	-	NP	Straw	TL	Straw		
KDu	Purple line with straw, straw (0.15)	-	-	DDa	Straw	NP	Straw		
KD	Brown line with straw, straw line with brown (0.66)	-	-	NPH	Straw, brown line with straw (0.39)	KKH	Straw		
DKH	Straw	-	-	-	-	DKH	Straw		

Number in parenthesis was Shannon-Weaver Index ( $H'$ ) value.



**Table 4.2.18** Grain awning of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

		Grain awning							
		PX district				PO district			
	HM		TP		LTH		HL		
MKY	Absent	KCH	Absent	PP	Absent, short and partly awned (0.22)	PP	Absent, short and partly awned (0.09)		
DD	Absent	LP	Absent	KN	Absent, short and partly awned (0.06)	PK	Absent, short and partly awned (0.24)		
KCH	Absent	MKY	Absent	PD	Absent	PD	Absent, short and partly awned (0.18)		
MKN	Absent	MHN	Absent	PK	Absent, short and partly awned (0.07)	KN	Absent		
NM	Absent	KD	Absent	MP	Absent	LY	Absent, short and partly awned (0.11)		
MH	Absent	DP	Absent	NMA	Absent	NKH	Absent		
KB	Absent, short and partly awned (0.3)	KB	Absent, short and partly awned (0.08)	LB	Absent	KDD	Absent		
DP	Absent	NM	Absent	KH	Absent	CHLS	Absent		
KKu	Absent	KLO	Absent	KK	Absent	KKu	Absent		
KT	Absent	KLE	Absent	KD	Absent	KK	Absent		
CHD	Absent, short and partly awned (0.4)	PL	Absent	MD	Absent, short and partly awned (0.14)	LB	Absent, short and partly awned (0.29)		
KP	Absent, short and partly awned (0.5)	CHT	Absent, short and partly awned (0.23)	CHD	Absent, short and partly awned (0.6)	CHP	Absent, short and partly awned (0.12)		
MHS	Absent	TDK	Absent, short and partly awned (0.06)	RD16	Absent, short and partly awned (0.1)	KD	Absent		
KM	Absent	-	-	NP	Absent, short and partly awned (0.23)	TL	Absent		
KDu	Absent	-	-	DDa	Absent, short and partly awned (0.1)	NP	Absent		
KD	Absent	-	-	NPH	Absent	KKH	Absent, short and partly awned (0.28)		
DKH	Absent	-	-	-	-	DKH	Absent		

Number in parenthesis was Shannon-Weaver Index ( $H'$ ) value.

**Table 4.2.19** Husk pubescence of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Husk pubescence							
PX district				PO district			
HM		TP		LTH		HL	
MKY	Glabrous	KCH	Glabrous	PP	pubescence	PP	pubescence
DD	Glabrous	LP	Glabrous	KN	Glabrous, pubescence (0.21)	PK	pubescence
KCH	Glabrous	MKY	Glabrous	PD	pubescence	PD	pubescence
MKN	Glabrous	MHN	Glabrous	PK	pubescence	KN	Glabrous
NM	Glabrous	KD	Glabrous	MP	Glabrous	LY	Glabrous
MH	Glabrous	DP	Glabrous	NMA	Glabrous	NKH	Glabrous
KB	pubescence	KB	Glabrous, pubescence (0.21)	LB	Glabrous	KDD	Glabrous
DP	Glabrous	NM	Glabrous	KH	Glabrous	CHLS	Glabrous
KKu	Glabrous	KLO	Glabrous	KK	Glabrous	KKu	Glabrous
KT	Glabrous	KLE	Glabrous	KD	Glabrous	KK	Glabrous
CHD	Glabrous	PL	Glabrous	MD	Glabrous	LB	pubescence
KP	Glabrous, pubescence (0.2)	CHT	pubescence	CHD	Glabrous	CHP	Glabrous
MHS	Glabrous	TDK	pubescence	RD16	pubescence	KD	Glabrous
KM	Glabrous	-	-	NP	pubescence	TL	Glabrous
KDu	Glabrous	-	-	DDa	pubescence	NP	pubescence
KD	Glabrous	-	-	NPH	pubescence	KKH	pubescence
DKH	pubescence	-	-	-	-	DKH	pubescence

Number in parenthesis was Shannon-Weaver Index ( $H'$ ) value.



**Figure 4.2.4** Variant distance clustering by UPGMA methods showing morphological relationship among samples of local rice varieties



**Figure 4.2.5** Morphological characteristics of local rice varieties. Local rice varieties exhibited color of leaf blade, Basal leaf sheath, collar and auricle.

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**Figure 4.2.6** Morphological characteristics of local rice varieties. Local rice varieties exhibited color of husk, apiculus, awning and pericarp.

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## Physiological characteristics

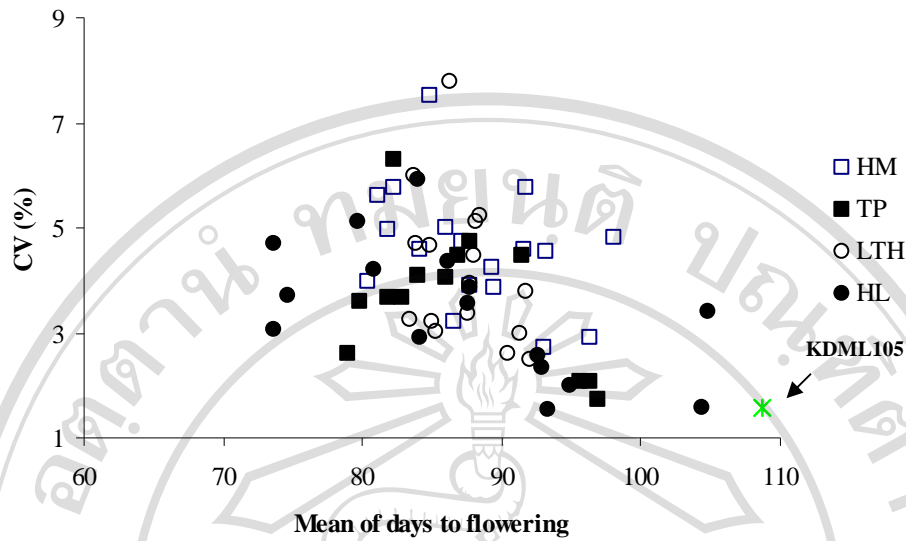
### Days to flowering

Overall days to flowering of local rice varieties ranged from 68 to 110 days (Table 4.2.20). Mean days to flowering were between 74 to 105 days, but over 80% of all samples observed flowered within 79 to 92 days after planting with CV between 1 to 8% (Figure 4.2.7). Average days to flowering among villages were not different between 87 to 88 days. The earliest samples in this study were PD and LB of HL (74 days) and the latest was KKH of HL (105 days). The highest variation within sample was found in PP of LTH and KB of HM, with CV 7.8 and 7.5%, respectively.

**Table 4.2.20** Days to flowering of rice varieties in progeny test in four villages(Planted date 29 June 2007), Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Days to flowering																			
PX district										PO district									
HM					TP					LTH					HL				
Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)
MKY	87.7	82-94	3.4	3.9	KCH	96.9	94-101	1.7	1.7	PP	86.3	74-95	6.7	7.8	PP	92.8	89-100	2.2	2.3
DD	89.3	82-98	3.8	4.2	LP	91.5	82-100	4.1	4.5	KN	90.5	87-95	2.4	2.6	PK	74.6	71-80	2.8	3.7
KCH	91.6	82-99	4.2	4.6	MKY	81.8	78-91	3.0	3.7	PD	91.8	84-100	3.5	3.8	PD	73.6	70-79	2.2	3.1
MKN	81.2	71-94	4.5	5.6	MHN	87.7	80-96	4.1	4.7	PK	85.3	78-91	2.6	3.0	KN	87.7	80-95	3.1	3.6
NM	91.7	83-101	5.3	5.8	KD	86.1	81-94	3.5	4.1	MP	83.8	78-91	3.9	4.7	LY	79.7	75-92	4.1	5.1
MH	84.2	78-92	3.9	4.6	DP	86.8	77-92	3.9	4.5	NMA	92.1	87-96	2.3	2.5	NKH	86.2	79-92	3.7	4.3
KB	84.8	78-100	6.4	7.5	KB	84.0	77-92	3.4	4.1	LB	88.0	82-94	3.9	4.5	KDD	83.9	76-98	5.0	5.9
DP	82.3	77-94	4.7	5.7	NM	82.3	77-100	5.2	6.3	KH	88.2	78-97	4.5	5.1	CHLS	93.3	91-96	1.4	1.5
KKu	93.1	88-98	2.5	2.7	KLO	96.3	92-100	2.0	2.1	KK	87.6	83-95	3.0	3.4	KKu	80.8	77-92	3.4	4.2
KT	93.2	86-104	4.2	4.5	KLE	82.8	78-89	3.0	3.7	KD	88.5	83-104	4.6	5.2	KK	87.7	82-93	3.4	3.9
CHD	81.9	77-94	4.1	5.0	PL	95.6	91-100	2.0	2.1	MD	84.8	79-93	4.0	4.7	LB	73.7	68-84	3.5	4.7
KP	96.3	87-102	2.8	2.9	CHT	79.9	73-85	2.9	3.6	CHD	83.7	73-93	5.0	6.0	CHP	92.6	89-98	2.4	2.6
MHS	87.2	80-95	4.1	4.7	TDK	79.0	75-83	2.1	2.6	RD16	85.0	75-89	2.7	3.2	KD	94.9	90-98	1.9	2.0
KM	80.4	76-88	3.2	4.0	-	-	-	-	-	NP	83.4	78-90	2.7	3.3	TL	85.9	80-101	4.3	5.0
KDu	98.1	77-104	4.7	4.8	-	-	-	-	-	DDa	91.3	86-96	2.7	3.0	NP	84.2	80-89	2.4	2.9
KD	89.4	80-97	3.5	3.9	-	-	-	-	-	NPH	88.5	82-97	4.6	5.2	KKH	105	95-109	3.6	3.4
DKH	86.6	83-97	2.8	3.2	-	-	-	-	-	-	-	-	-	-	DKH	104	102-110	1.6	1.6
Mean	88.2					87.0					87.4					87.1			
Range	80.4-98.1					79-96.9					83.4-92.1					73.6-105			

M = mean, R = range, SD = standard deviation, CV = Coefficient of Variation



**Figure 4.2.7** Distribution of days to flowering of rice varieties in progeny test in four villages (Planted date 29 June 2007), Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Number of tillers per plant

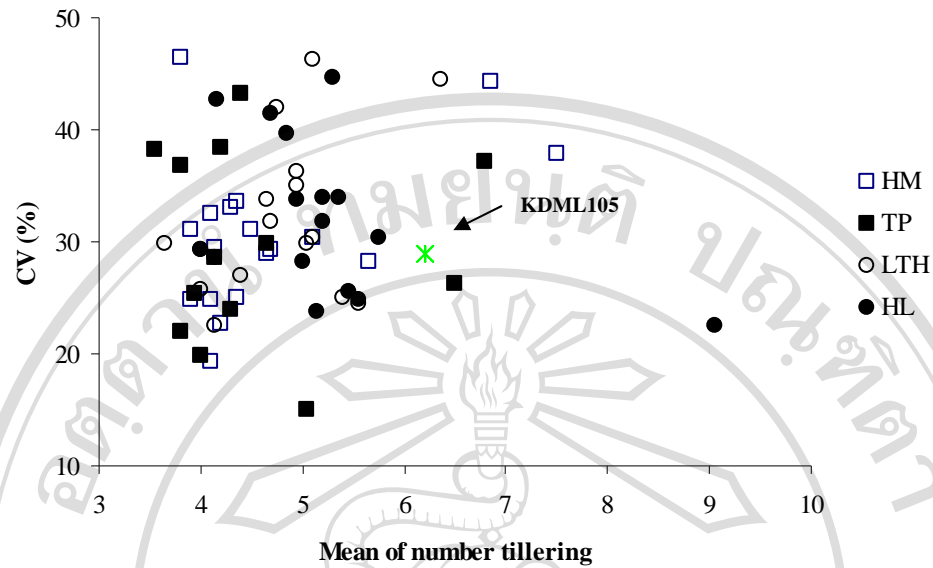
Number of tillers per plant were between 1 to 15 (Table 4.2.21). For each sample, mean tillers per plant ranged from 3.6 to 9, but majority samples distributed within 4 to 6 tillers per plant (Figure 4.2.8). Mean number of tillers per plant among villages were the same (5 tillers). Coefficient of variation ranged from 15 to 46.5 %, with the highest found in KDu in HM.



**Table 4.2.21** Number of tillers per plant of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Number of tillers per plant																			
PX district										PO district									
HM					TP					LTH					HL				
Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)
MKY	5.1	3-7	1.6	30.4	KCH	4.0	3-5	0.8	19.9	PP	5.6	3-8	1.4	24.9	PP	4.4	2-6	1.2	27.0
DD	5.7	3-10	1.6	28.3	LP	4.2	3-7	1.2	28.5	KN	9.1	6-13	2.0	22.5	PK	4.2	2-6	0.9	22.5
KCH	4.1	1-6	1.3	32.5	MKY	4.3	3-6	1.0	24.0	PD	5.4	4-11	1.8	33.9	PD	5.0	3-9	1.8	36.2
MKN	3.9	1-6	1.2	31.0	MHN	3.8	2-5	0.8	21.9	PK	4.2	3-7	1.2	28.5	KN	4.7	3-8	1.6	33.7
NM	4.1	3-5	0.8	19.2	KD	5.1	4-6	0.8	15.0	MP	4.2	1-7	1.8	42.6	LY	3.7	1-6	1.1	29.8
MH	4.1	3-6	1.0	24.9	DP	4.2	2-8	1.6	38.3	NMA	5.0	2-9	1.7	33.7	NKH	4.0	2-5	1.0	25.6
KB	4.7	3-7	1.3	29.0	KB	4.4	2-8	1.9	43.2	LB	5.2	2-8	1.8	33.9	KDD	4.0	3-7	1.2	29.2
DP	4.3	1-7	1.4	33.0	NM	4.0	2-6	1.0	25.3	KH	5.0	2-8	1.4	28.3	CHLS	5.0	2-9	1.7	35.0
KKu	3.9	2-6	1.0	24.8	KLO	4.7	2-7	1.4	29.8	KK	5.2	1-8	1.7	31.7	KKu	5.1	3-8	1.6	30.4
KT	4.5	2-7	1.4	31.0	KLE	3.6	1-7	1.4	38.2	KD	4.0	2-7	1.2	29.2	KK	5.1	3-13	2.4	46.3
CHD	4.7	1-7	1.4	29.4	PL	3.8	2-8	1.4	36.8	MD	5.5	3-9	1.4	25.6	LB	5.6	3-8	1.4	24.4
KP	7.5	2-13	2.8	37.8	CHT	6.8	4-15	2.5	37.1	CHD	4.8	2-10	1.9	39.7	CHP	4.7	2-7	1.5	31.7
MHS	4.4	2-6	1.1	25.0	TDK	6.5	3-9	1.7	26.2	RD16	5.8	3-9	1.7	30.3	KD	4.8	1-8	2.0	42.0
KM	4.4	2-8	1.5	33.6	-	-	-	-	-	NP	5.2	2-8	1.2	23.8	TL	4.2	2-7	1.2	29.5
KDu	3.8	1-7	1.8	46.5	-	-	-	-	-	DDa	5.3	2-10	2.4	44.6	NP	5.1	1-7	1.5	29.8
KD	4.2	3-6	1.0	22.7	-	-	-	-	-	NPH	4.7	1-8	1.9	41.5	KKH	6.4	1-10	2.8	44.5
DKH	6.9	3-13	3.0	44.2	-	-	-	-	-	-	-	-	-	-	DKH	5.4	4-8	1.4	25.1
Mean	4.7				4.6				5.3				4.8						
Range	3.8-7.5				3.6-6.8				4-9.1				3.7-6.4						

M = mean, R = range, SD = standard deviation, CV = Coefficient of Variation



**Figure 4.2.8** Distribution of number to tillering of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

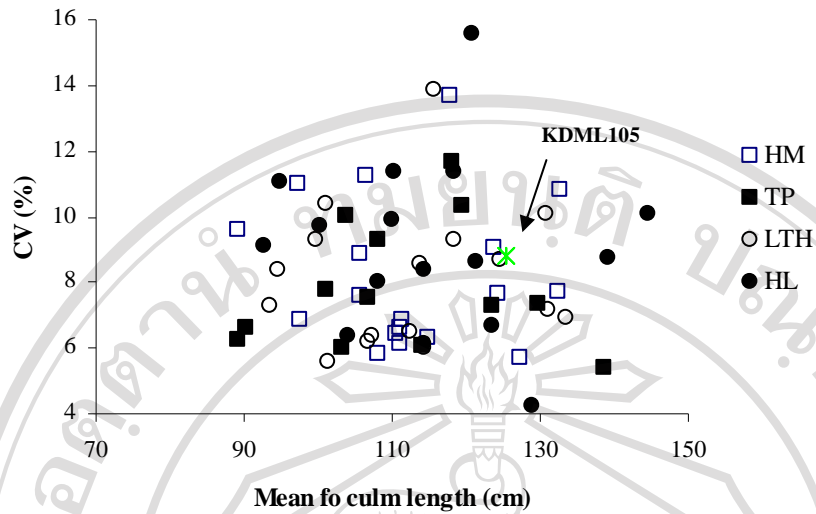
Culm length (cm)

Culm length at harvest of plants within local rice varieties ranged from 67 to 162 cm (Table 4.2.22). Average culm length for individual sample between 89.1 to 144.5 cm, but most were 100 to 130 cm. The highest culm length recorded at DKH in HL and the lowest was KT in HM. Mean of culm length among PX and PO districts was similarly (111.2 to 114.6 cm). High variation within samples were found with CV varied from 4.2 to 15.6 % (Figure 4.2.9), with the highest was PP sample in HL, PX district.

**Table 4.2.22** Culm length (cm) of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Culm length (cm)																				
PX district										PO district										
HM					TP					LTH					HL					
Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	
MKY	111.2	100-126	7.3	6.6	KCH	138.6	117-151	7.5	5.4	PP	130.7	109-152	13.2	10.1	PP	120.9	90-146	18.9	15.6	
DD	124.4	104-138	9.5	7.6	LP	118.0	73-133	13.8	11.7	KN	112.4	98-124	7.3	6.5	PK	114.4	100-130	9.6	8.4	
KCH	117.8	76-137	16.1	14	MKY	101.2	94-126	7.9	7.8	PD	124.5	107-145	10.8	8.7	PD	110.4	80-129	12.5	11.4	
MKN	97.3	68-116	10.7	11	MHN	106.8	92-125	8.0	7.5	PK	115.8	72-129	16.1	13.9	KN	108.2	94-122	8.7	8.0	
NM	110.5	95-122	7.1	6.4	KD	114.1	103-127	6.9	6.1	MP	107.4	89-119	6.8	6.4	LY	100.4	67-117	12.2	12.2	
MH	111.2	99-126	7.6	6.9	DP	103.7	80-122	10.4	10.1	NMA	114.2	101-131	6.9	6.0	NKH	100.3	86-128	9.8	9.7	
KB	108.0	95-123	6.3	5.9	KB	108.1	89-126	10.1	9.3	LB	118.5	98-138	11.0	9.3	KDD	94.9	72-115	10.5	11.1	
DP	123.8	104-141	11.2	9.1	NM	103.2	90-114	6.2	6.0	KH	113.9	98-135	9.7	8.5	CHLS	123.4	109-134	8.2	6.7	
KKu	132.8	109-158	14.4	11	KLO	119.4	99-152	12.3	10.3	KK	106.7	94-117	6.6	6.2	KKu	92.6	74-111	8.4	9.1	
KT	89.1	75-109	8.6	9.6	KLE	123.6	104-139	9.0	7.3	KD	93.6	68-122	10.9	11.7	KK	114.3	95-124	7.0	6.1	
CHD	106.4	73-130	12.0	11	PL	129.7	110-154	9.5	7.3	MD	101.3	89-113	5.6	5.6	LB	110.1	90-130	10.9	9.9	
KP	127.3	115-141	7.3	5.7	CHT	90.2	75-99	6.0	6.6	CHD	101.0	81-123	10.5	10.4	CHP	121.4	92-140	10.5	8.6	
MHS	114.8	102-130	7.3	6.3	TDK	89.3	80-101	5.6	6.3	RD16	99.7	86-129	9.3	9.3	KD	118.4	79-140	13.5	11.4	
KM	105.7	84-117	9.4	8.9	-	-	-	-	-	NP	131.0	109-145	9.4	7.1	TL	105.6	91-119	8.0	7.6	
KDu	132.3	114-151	10.2	7.7	-	-	-	-	-	DDa	94.6	72-105	7.9	8.4	NP	129.0	118-137	5.5	4.2	
KD	111.0	99-121	6.8	6.1	-	-	-	-	-	NPH	133.6	117-149	9.3	6.9	KKH	139.3	118-162	12.1	8.7	
DKH	97.6	78-108	6.7	6.9	-	-	-	-	-	-	-	-	-	-	DKH	144.5	98-162	14.6	10.1	
Mean	113.0				111.2					112.4					114.6					
Range	89.1-132.8				89.3-138.6					93.6-133.6					92.6-144.5					

M = mean, R = range, SD = standard deviation, CV = Coefficient of Variation



**Figure 4.2.9** Distribution of culm length (cm) of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

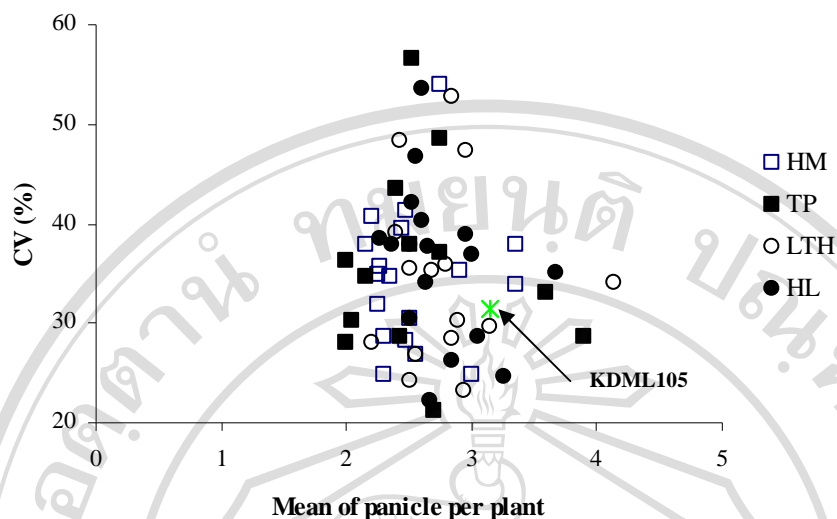
Number of panicles per plant

All number of panicle per plant were between 1 to 7 panicles per plant. For each sample, mean of number panicle per plant ranged from 2 to 4 panicles per plant (Table 4.2.23). Mean number of panicles per plant among villages were the same (3 panicles per plant). The highest number of panicles per plant was found in PK of HL, CHT and TDK of TP and DDa of LTH. High variation within samples were found with CV varied from 21.2 to 56.5 % (Figure 4.2.10), with the highest was in KB of TP, PX district.

**Table 4.2.23** Number of panicles per plant of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Number of panicles per plant																			
PX district										PO district									
HM					TP					LTH					HL				
Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)
MKY	2.9	1-5	1.0	35.2	KCH	2.2	1-3	0.7	34.7	PP	2.8	1-5	1.0	35.9	PP	2.6	1-5	1.0	37.6
DD	3.0	2-4	0.7	24.8	LP	2.5	1-4	0.9	37.8	KN	2.2	1-3	0.6	28.0	PK	3.7	1-6	1.3	35.0
KCH	2.2	1-4	0.9	40.7	MKY	2.4	1-3	0.7	28.6	PD	2.7	1-5	0.9	35.2	PD	3.1	1-5	0.9	28.6
MKN	2.5	2-4	0.7	28.2	MHN	2.1	1-3	0.6	30.3	PK	2.9	2-4	0.7	23.2	KN	2.6	1-6	1.2	46.7
NM	2.3	1-4	0.7	31.8	KD	2.7	2-4	0.6	21.2	MP	2.6	1-4	0.7	26.9	LY	2.5	1-5	1.1	42.2
MH	2.3	1-3	0.6	24.8	DP	2.8	1-6	1.3	48.5	NMA	2.5	1-3	0.6	24.3	NKH	2.4	1-4	0.9	37.8
KB	2.3	1-4	0.8	35.0	KB	2.5	1-6	1.4	56.5	LB	2.5	1-4	0.9	37.8	KDD	2.6	1-5	1.4	53.5
DP	2.3	1-4	0.8	35.6	NM	2.4	1-5	1.0	43.6	KH	3.0	1-6	1.4	47.3	CHLS	2.7	2-4	0.6	22.3
KKu	2.4	1-4	0.8	34.6	KLO	2.8	1-5	1.0	37.1	KK	2.9	2-4	0.8	28.5	KKu	3.0	1-5	1.1	36.9
KT	2.8	1-6	1.5	53.9	KLE	2.0	1-3	0.6	28.1	KD	2.4	1-4	1.2	48.3	KK	2.6	1-5	1.0	40.2
CHD	2.5	1-5	1.0	41.2	PL	2.0	1-3	0.7	36.3	MD	2.5	1-4	0.9	35.5	LB	3.0	1-5	1.1	38.8
KP	3.4	1-6	1.1	33.9	CHT	3.9	2-6	1.1	28.7	CHD	2.4	1-4	0.9	39.2	CHP	2.3	1-4	0.9	38.5
MHS	2.5	1-4	0.8	30.4	TDK	3.6	1-5	1.2	33.0	RD16	2.8	1-6	1.5	52.8	KD	2.9	1-4	0.7	26.1
KM	2.6	1-4	0.7	26.9	-	-	-	-	-	NP	2.9	1-4	0.9	30.2	TL	2.2	1-3	0.8	37.8
KDu	2.4	1-5	1.0	39.5	-	-	-	-	-	DDa	4.1	2-7	1.4	34.1	NP	3.3	1-4	0.8	24.7
KD	2.3	1-3	0.7	28.6	-	-	-	-	-	NPH	3.2	2-5	0.9	29.6	KKH	2.5	1-3	0.8	30.4
DKH	3.4	1-6	1.3	37.9	-	-	-	-	-	-	-	-	-	-	DKH	2.6	1-4	0.9	34.0
Mean	2.6				2.6				2.8				2.7						
Range	2.2-3.9				2-3.9				2.2-4.1				2.2-3.7						

M = mean, R = range, SD = standard deviation, CV = Coefficient of Variation



**Figure 4.2.10** Distribution of number panicle per plant of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

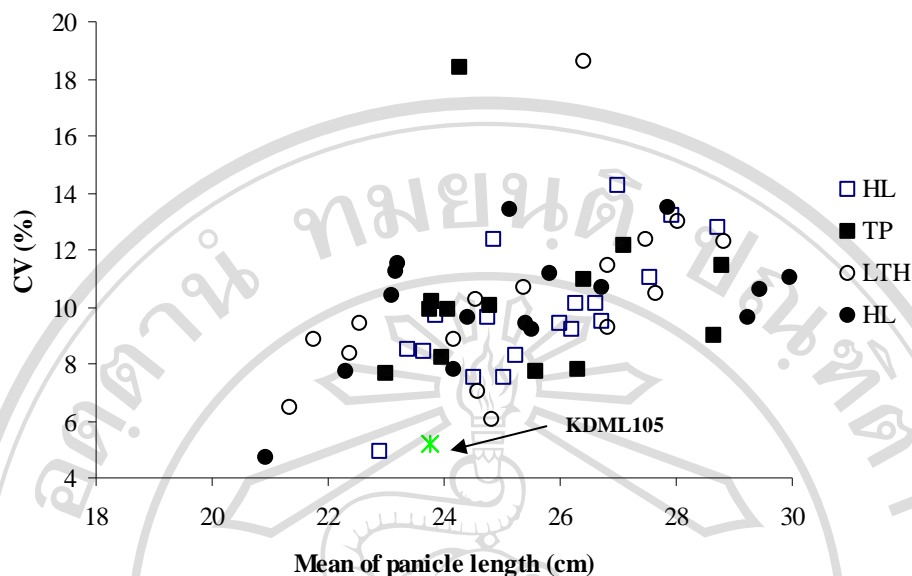
Panicle length (cm)

Panicle length of local rice varieties were between 18 to 39 cm (Table 4.2.24). Average panicle length of individual sample distributed from 20.9 to 30 cm, but over 80% all samples showed plant length within 23 to 27 cm. The longest panicle length recorded at CHP from HL and the shortest was NP from HL. Mean of panicle length among villages were similarly (25.2 to 25.5 cm). Coefficient of variation varied from 4.7 to 18.6 % (Figure 4.2.11), with the highest were found in DP of TP and PD of LTH, with CV 18.4 and 18.6%, respectively.

**Table 4.2.24** Panicle length (cm) of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Panicle length (cm)																			
PX district										PO district									
HM					TP					LTH					HL				
Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)
MKY	23.6	20-28	2.0	8.4	KCH	24.8	20-31	2.5	10.0	PP	24.6	19-28	2.5	10.3	PP	24.4	20-29	2.4	9.6
DD	26.0	22-33	2.4	9.4	LP	28.8	21-37	3.3	11.4	KN	27.5	20-36	3.4	12.4	PK	25.4	20-29	2.4	9.4
KCH	26.3	21-32	2.7	10.1	MKY	23.8	19-30	2.4	10.2	PD	26.4	24-32	4.9	18.6	PD	25.8	20-31	2.9	11.1
MKN	23.9	19-29	2.3	9.7	MHN	26.3	24-33	2.0	7.8	PK	26.8	20-32	3.1	11.4	KN	29.3	25-35	2.8	9.6
NM	27.9	20-34	3.7	13.2	KD	26.4	22-36	2.9	11.0	MP	22.6	19-28	2.1	9.4	LY	25.1	18-31	3.4	13.4
MH	25.0	20-30	1.9	7.5	DP	24.3	24-29	4.5	18.4	NMA	28.8	21-34	3.5	12.3	NKH	23.1	19-28	2.4	10.4
KB	24.9	19-34	3.1	12.3	KB	23.7	19-29	2.3	9.9	LB	28.0	20-39	3.6	13.0	KDD	24.2	20-29	1.9	7.8
DP	27.5	21-33	3.0	11.0	NM	25.6	21-31	2.0	7.7	KH	25.4	20-33	2.7	10.7	CHLS	29.4	21-35	3.1	10.6
KKu	27.0	20-36	3.8	14.2	KLO	24.1	20-29	2.4	9.9	KK	27.6	21-33	2.9	10.4	KKu	23.2	18-30	2.7	11.5
KT	23.4	19-28	2.0	8.5	KLE	28.7	22-35	2.6	9.0	KD	24.6	20-28	1.7	7.0	KK	27.9	21-33	3.8	13.5
CHD	26.6	21-31	2.7	10.1	PL	27.1	21-34	3.3	12.1	MD	22.4	19-26	1.9	8.4	LB	26.7	21-31	2.9	10.7
KP	24.5	20-28	1.8	7.5	CHT	24.0	19-28	2.0	8.2	CHD	26.8	20-31	2.5	9.3	CHP	30.0	22-35	3.3	11.0
MHS	25.2	20-29	2.1	8.3	TDK	23.0	19-26	1.8	7.7	RD16	24.8	22-28	1.5	6.0	KD	25.5	19-30	2.3	9.2
KM	24.7	19-29	2.4	9.6	-	-	-	-	-	NP	21.3	19-25	1.4	6.5	TL	26.7	21-32	2.5	9.5
KDu	28.7	21-35	3.7	12.8	-	-	-	-	-	DDa	24.2	20-29	2.1	8.8	NP	20.9	19-23	1.0	4.7
KD	26.2	20-31	2.4	9.2	-	-	-	-	-	NPH	21.8	19-26	1.9	8.8	KKH	22.3	19-26	1.7	7.7
DKH	22.9	20-25	1.1	4.9	-	-	-	-	-	-	-	-	-	-	DKH	23.2	18-29	2.6	11.2
Mean	25.5				25.4				25.2				25.5						
Range	22.9-28.7				23-28.8				21.3-28.8				20.9-30						

M = mean, R = range, SD = standard deviation, CV = Coefficient of Variation



**Figure 4.2.11** Distribution of panicle length (cm) of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Number of seeds per panicle

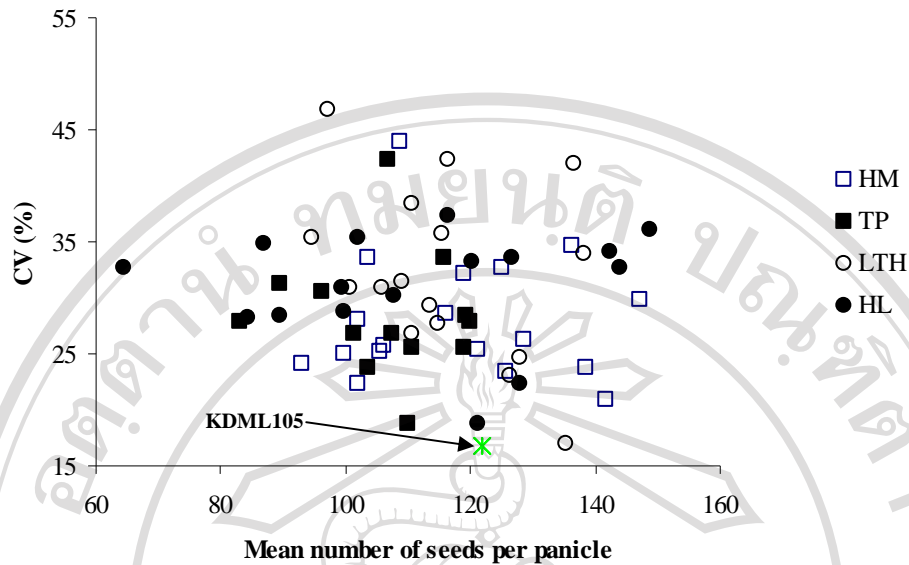
Numbers of seeds per panicle of individual local rice varieties were between 12 to 299 seeds per panicle (Table 4.2.25). For each sample, mean number of seed per panicle ranged from 65 to 149 seeds per panicle, but over 85% all samples observed seeds per panicle were 95 to 125 seeds per panicle. The highest number of seeds per panicle was found in DKH from HL, while the lowest was recorded in KKH from HL. Average seed per panicle among villages distributed from 107 to 119 seeds. Coefficient of variation ranged from 17 to 46.8% (Figure 4.2.12), with the highest was found in KH of LTH.



**Table 4.2.25** Number of seeds per panicle of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Number of seeds per panicle																			
PX district										PO district									
HM					TP					LTH					HL				
Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)
MKY	102	37-153	22.7	22.2	KCH	111	60-169	28.2	25.5	PP	111	47-227	42.6	38.5	PP	116	52-211	43.5	37.4
DD	142	80-205	29.5	20.8	LP	107	27-244	45.2	42.3	KN	138	27-207	46.8	33.8	PK	89	28-164	25.4	28.3
KCH	147	44-232	44.0	29.9	MKY	120	41-187	33.4	27.8	PD	136	43-299	57.4	42.0	PD	84	44-129	23.8	28.1
MKN	128	53-205	33.8	26.3	MHN	119	36-169	30.4	25.5	PK	116	21-199	41.3	35.7	KN	142	31-286	48.6	34.1
NM	106	45-157	26.7	25.2	KD	101	55-175	27.1	26.8	MP	115	59-216	31.8	27.7	LY	87	22-151	30.3	34.9
MH	93	56-153	22.4	24.1	DP	90	25-151	28.1	31.3	NMA	111	44-169	29.6	26.7	NKH	120	48-199	39.9	33.2
KB	119	61-224	38.2	32.1	KB	116	54-209	39.0	33.7	LB	109	37-204	34.3	31.5	KDD	127	12-191	42.4	33.5
DP	116	40-178	33.2	28.6	NM	83	25-139	23.2	27.9	KH	97	41-224	45.4	46.7	CHLS	128	63-177	28.6	22.3
KKu	109	40-290	47.7	43.8	KLO	96	22-151	29.4	30.6	KK	106	48-187	32.7	30.9	KKu	65	18-108	21.1	32.6
KT	102	38-139	28.5	28.0	KLE	108	59-180	28.8	26.8	KD	95	25-167	33.5	35.4	KK	100	35-150	30.8	30.9
CHD	104	31-211	34.8	33.5	PL	119	65-192	33.8	28.3	MD	101	40-188	31.1	30.9	LB	102	34-164	36.1	35.4
KP	121	68-196	30.7	25.3	CHT	110	61-158	20.5	18.7	CHD	116	13-215	49.2	42.3	CHP	144	65-250	47.1	32.7
MHS	125	42-224	40.9	32.7	TDK	104	55-145	145	24.7	RD16	135	84-201	23.0	17.0	KD	108	44-170	32.5	30.2
KM	100	48-143	25.0	25.1	-	-	-	-	-	NP	113	43-181	33.2	29.3	TL	106	56-153	27.4	25.8
KDu	136	45-217	47.1	34.6	-	-	-	-	-	DDa	128	62-181	31.5	24.6	NP	121	63-173	22.7	18.7
KD	139	61-232	33.1	23.8	-	-	-	-	-	NPH	126	60-188	29.0	23.0	KKH	100	56-177	28.7	28.8
DKH	126	15-179	29.3	23.3	-	-	-	-	-	-	-	-	-	-	DKH	149	29-154	53.7	36.1
Mean	118.5				106.5					115.8					111.1				
Range	93-147				83-120					95-138					65-149				

M = mean, R = range, SD = standard deviation, CV = Coefficient of Variation



**Figure 4.2.12** Distribution of number of seed per panicle of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

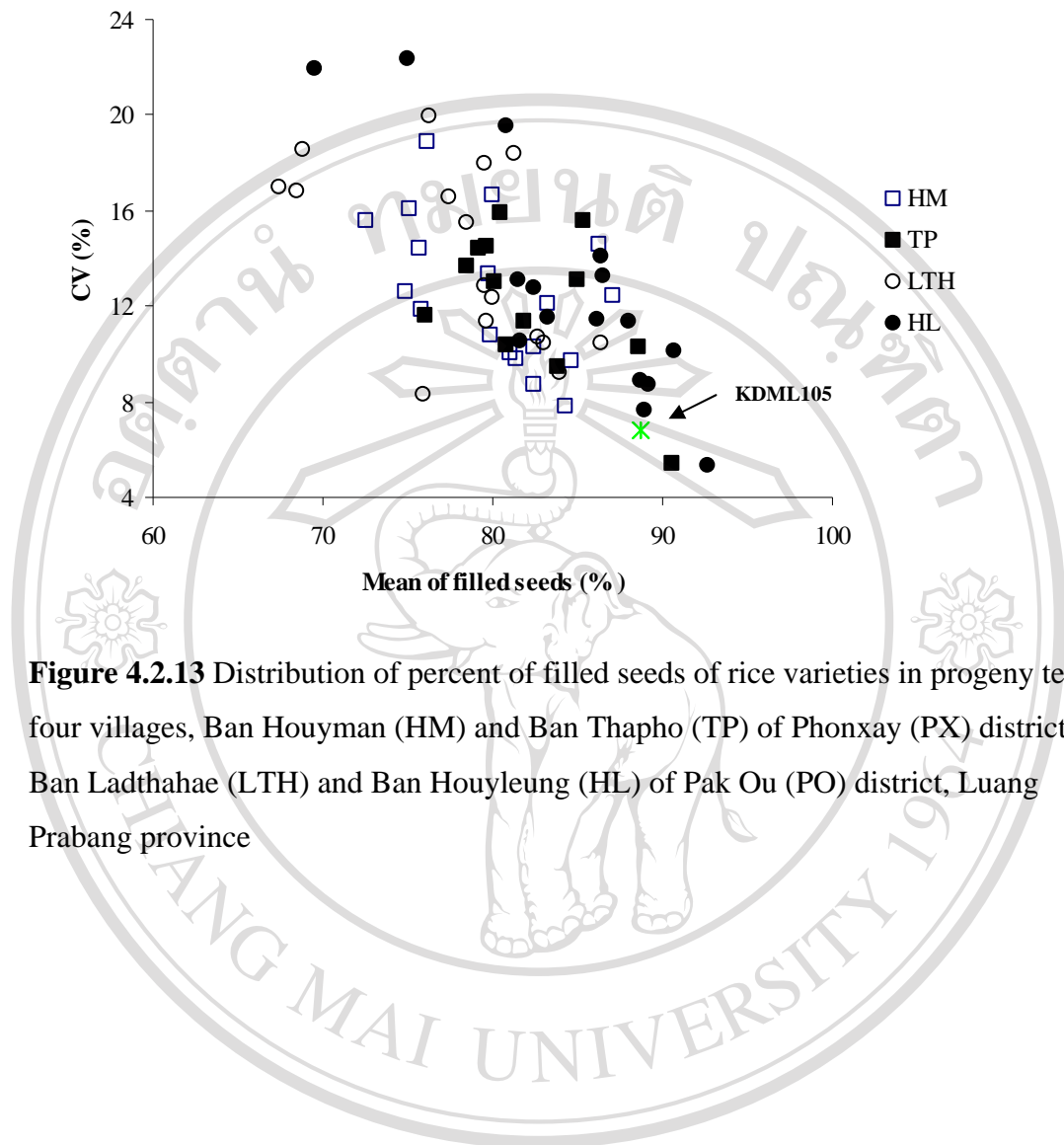
Filled seeds (%)

Overall percent of filled seeds of individual local rice varieties ranged from 14 to 100 % (Table 4.2.26). Mean percent of filled seeds were between 67.4 to 92.7 %, but over 80% all samples showed filled seeds within 75 to 85 %. Average percent of filled seeds among villages were not much different between 78.1 to 83.9%. Coefficient of variation of percent of filled seeds varied from 5.3 to 22.3 %, with the highest found in KDD of HL (Figure 4.2.13).

**Table 4.2.26** Percent of filled seeds of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

Percent of filled seeds																			
PX district										PO district									
HM					TP					LTH					HL				
Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)	Variety name	M	R	SD	CV (%)
MKY	84.3	72-99	6.6	7.8	KCH	90.5	77-97	5	5.4	PP	84.0	65-96	7.8	9.2	PP	69.5	37-93	15	21.9
DD	75.9	59-93	9.0	11.9	LP	80.8	66-98	8	10.3	KN	68.5	37-92	11.5	16.8	PK	89.2	73-100	8	8.7
KCH	81.4	59-93	8.0	9.8	MKY	85.0	59-98	11	13.1	PD	77.4	26-96	12.8	16.6	PD	86.5	53-99	11	13.2
MKN	75.1	50-95	12.1	16.1	MHN	80.5	22-97	13	15.9	PK	81.3	14-97	15.0	18.4	KN	81.5	55-97	11	13.1
NM	79.9	60-95	8.6	10.7	KD	81.8	56-96	9	11.3	MP	76.3	49-97	15.2	19.9	LY	88.7	65-99	8	8.9
MH	80.0	47-98	13.3	16.7	DP	79.7	51-98	12	14.5	NMA	79.7	65-98	9.1	11.4	NKH	82.5	55-100	11	12.7
KB	76.2	38-98	14.4	18.9	KB	79.1	51-99	11	14.4	LB	78.5	43-97	12.1	15.5	KDD	75.0	39-98	17	22.3
DP	82.4	65-95	7.2	8.7	NM	88.6	56-98	9	10.3	KH	68.9	41-97	12.7	18.5	CHLS	88.0	45-99	10	11.3
KKu	83.3	58-97	10.1	12.1	KLO	80.1	44-95	10	13.0	KK	86.4	67-99	9.0	10.4	KKu	90.7	56-100	9	10.1
KT	81.0	65-95	8.1	10.0	KLE	85.4	53-98	13	15.5	KD	80.1	50-93	9.9	12.4	KK	92.7	82-100	5	5.3
CHD	87.0	59-99	10.8	12.4	PL	83.8	61-95	8	9.4	MD	79.5	63-100	10.2	12.8	LB	86.5	35-99	12	14.1
KP	82.5	55-96	8.5	10.3	CHT	76.1	58-93	9	11.6	CHD	79.5	49-98	14.3	17.9	CHP	81.6	62-97	9	10.5
MHS	79.8	62-99	10.6	13.3	TDK	78.5	55-96	11	13.7	RD16	75.9	61-86	6.3	8.3	KD	86.1	39-99	10	11.5
KM	86.3	44-99	12.6	14.6	-	-	-	-	-	NP	82.7	63-98	8.8	10.7	TL	74.9	54-97	9.5	12.6
KDu	75.6	47-93	10.9	14.4	-	-	-	-	-	DDa	67.4	43-85	11.4	16.9	NP	83.2	45-97	10	11.5
KD	72.6	44-92	11.3	15.5	-	-	-	-	-	NPH	83.0	50-95	8.6	10.4	KKH	89.0	68-98	7	7.6
DKH	84.7	67-96	8.2	9.7	-	-	-	-	-	-	-	-	-	-	DKH	80.8	30-99	16	19.5
Mean	80.5					82.3					78.1					83.9			
Range	72.6-87					76.1-90.5					67.4-86.4					69.5-92.7			

M = mean, R = range, SD = standard deviation, CV = Coefficient of Variation



**Figure 4.2.13** Distribution of percent of filled seeds of rice varieties in progeny test in four villages, Ban Houyman (HM) and Ban Thapho (TP) of Phonxay (PX) district and Ban Ladthahae (LTH) and Ban Houyleung (HL) of Pak Ou (PO) district, Luang Prabang province

## DNA analysis of local rice varieties

### Distribution of alleles of six microsatellite loci

The local rice varieties are genetically variable at all six microsatellite loci (Figure 4.2.14). Individual plant within sample of local rice varieties was genetically variable with the level of variation by locus. Some samples were polymorphic for 5 loci whereas others samples contained only one locus (except KD-HL was monomorphic for a single allele at each locus). A total of 19 alleles were detected in six microsatellite loci in 120 individuals from 12 samples of five varieties names in four villages (Table 4.2.27). The number of allele varied by locus with a maximum of four alleles at RM164, RM259 and RM316 to only two alleles at RM5 and RM22. For RM1 three alleles were detected.

**Table 4.2.27** Number of alleles of six microsatellite loci, of twelve samples of five local rice varieties collected from different villages

Varieties	Sources	RM1	RM5	RM22	RM164	RM259	RM316	Total
MKY	HM	2	1	2	1	2	1	9
MKY	TP	1	2	2	1	1	2	9
KCH	HM	2	1	1	1	2	2	9
KCH	TP	2	1	1	2	2	1	9
PP	LTH	1	2	2	1	2	2	10
PP	HL	2	2	1	2	2	2	11
PD	LTH	1	1	2	2	1	2	9
PD	HL	1	1	1	1	2	1	7
KD	HM	1	1	1	1	2	2	8
KD	TP	2	1	2	2	2	2	11
KD	LTH	2	2	1	2	3	2	12
KD	HL	1	1	1	1	1	1	6
Average		3	2	2	4	4	4	19

MKY=Mak khuea yai, KCH =Kao chuk, PP=Phae pee, PD=Phae do, and KD=Kao deng

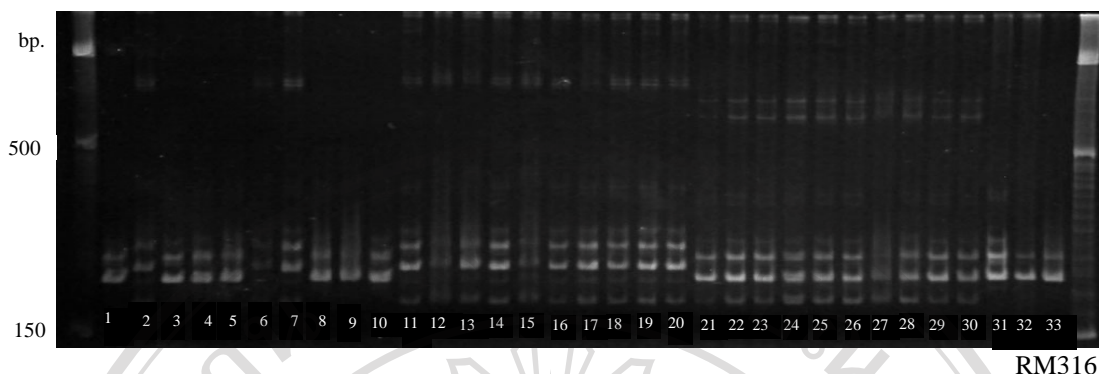


Figure 4.2.14 Microsatellite amplification product from of twelve samples of five local rice varieties genomic DNA with primer RM316. M25bp ladder, Lane 1-3 MKY-HM, Lane 4-6 KHC-HM, Lane 7-9 KD-HM, Lane 10-12 MKY-TP, Lane 13-15 KHC-TP, Lane 16-18 KD-TP, Lane 19-21 PP-LTH, Lane 22-24 PD-LTH, Lane 25-27 KD-LTH, Lane 28-29 PP-HL, Lane 30-31 PD-HL and Lane 32-33 KD-HL.

#### Microsatellite gene diversity

Genetic diversity was determined for all samples of each locus (Table 4.2.28). Gene diversity ranged from 0.328 at RM259 to 0.137 at RM164. Genetic diversity of KD-HL was fixed (0) for all loci. Average genetic diversity ranged from 0.03 at PD-HL to 0.337 at KD-TP. In addition, a few samples were detected only single or two loci.

**Table 4.2.28** Gene diversity per locus for six markers loci, of twelve samples of five local rice varieties collected from different villages

Varieties	Sources	RM1	RM5	RM22	RM164	RM259	RM316	Average
MKY	HM	0.356	0	0.556	0	0.533	0	0.217
MKY	TP	0	0.356	0.200	0	0	0.533	0.163
KCH	HM	0.200	0	0	0	0.200	0.467	0.13
KCH	TP	0.556	0	0	0.533	0.467	0	0.233
PP	LTH	0	0.533	0.533	0	0.556	0.200	0.273
PP	HL	0.478	0.533	0	0.356	0.356	0.467	0.333
PD	LTH	0	0	0.467	0.200	0	0.200	0.13
PD	HL	0	0	0	0	0.200	0	0.03
KD	HM	0	0	0	0	0.489	0.467	0.15
KD	TP	0.467	0	0.356	0.356	0.533	0.533	0.337
KD	LTH	0.522	0.356	0	0.200	0.600	0.356	0.307
KD	HL	0	0	0	0	0	0	0
Average		0.215	0.148	0.176	0.137	0.328	0.269	

MKY=Mak khuea yai, KCH=Kao chuk, PP=Phae pee, PD=Phae do, and KD=Kao deng

Genetic diversity within sample

All of the samples are genetically diverse. Total number of alleles ( $A$ ), was highest in KD-LTH containing 12 of the 19 total alleles, while PD-HL contained only 7 alleles. Allelic richness ( $A_R$ ) measures the number of alleles independent of sample size and allows for comparisons across samples. Average allelic richness for the 12 samples was 2.947 with KD-LTH showed the highest allelic richness 2.00 and with PD-HL showing the lowest allelic richness 1.167 (Table 4.2.29). With Nei's gene diversity ( $h$ ) ranged from 0.03 in PD-HL to 0.337 in KD-TP, with average gene diversity across all samples of 0.572. Based on all of these measures of diversity, the sample PD-HL in HL, PO district was the least variable of all samples whereas the sample of KD-TP in Ban TP, PX district, had the highest level of diversity. Percentage of polymorphic loci ( $P$ ) varied from 16.67 in PD-HL to 83.33% in KD-TP, KD-LTH and PP-HL. For fixation index ( $F_{IS}$ ), a measure of heterozygote from Hardy-Weinberg equilibrium,  $F_{IS}$  ranged 0.722 to 1, indicated that individuals within samples were homozygotes.

The genetic differentiation among samples ( $F_{ST}$ ) was 0.665. It suggested that approximately 66% of variation were resulted from the differentiation between sample and 34% remaining was differentiated within samples.

**Table 4.2.29** Genetic parameter for samples of twelve samples of five local rice varieties collected different villages.

Varieties	Sources	N	A	A <sub>R</sub>	h	P (%)	F <sub>IS</sub>	H <sub>S</sub>	H <sub>T</sub>	F <sub>ST</sub>
MKY	HM	10	9	1.500	0.217	50	1			
KCH	HM	10	9	1.500	0.130	50	1			
KD	HM	10	8	1.333	0.150	33.33	0.722			
MKY	TP	10	9	1.500	0.233	50	1			
KCH	TP	10	9	1.500	0.163	50	1			
KD	TP	10	11	1.833	0.337	83.33	1			
PP	LTH	10	10	1.667	0.273	66.67	1			
PD	LTH	10	9	1.500	0.130	50	1			
KD	LTH	10	12	2.000	0.307	83.33	0.902			
PP	HL	10	11	1.833	0.333	83.33	0.772			
PD	HL	10	7	1.167	0.030	16.67	1			
KD	HL	10	6	1.000	0	0.00	1			
<b>Overall samples</b>		<b>120</b>	<b>19</b>	<b>2.947</b>	<b>0.572</b>	<b>100</b>	<b>0.902</b>	<b>0.212</b>	<b>0.607</b>	<b>0.665</b>

A = total number of alleles, A<sub>R</sub> = allelic richness, h = gene diversity, percentage of polymorphic loci (P), F<sub>IS</sub> = fixation index, H<sub>S</sub> = average gene diversity within samples, H<sub>T</sub> = total gene diversity, F<sub>ST</sub> = degree of genetic differentiation among samples

#### Genetic diversity within and among varieties

Between samples with the same names was varied of genetic diversity. In each MKY-HM, MKY-TP, KCH-HM and KCH-TP varieties were similar total number of allele (A), allelic richness (A<sub>R</sub>) and percentage of polymorphic loci (Table 4.2.30). Genetic diversity (h) was not much different, but with highest level of genetic differentiation between sample within the same name F<sub>ST</sub> = 0.505 and 0.743, respectively. With PP-HL was higher genetic diversity than PP-LTH together with high level of total number alleles, allelic richness and percentage of polymorphic loci. For PD in LTH and HL have moderately low level of genetic variation, genetic diversity varied 0.03 at PD-HL and 0.13 at PD-LTH, and low genetic differentiation between samples within the same name F<sub>ST</sub>=0.11. The differentiation of genetic variation within KD variety in four villages, genetic diversity varied from 0.15 at KD-HM to 0.337 at KD-TP (except KD-HL no variation fixed zero), and high level of



genetic differentiation between samples within the same name  $F_{ST}=0.47$ . Based on all of varieties measures of diversity, the variety of PD showed the lowest variable of all varieties whereas the variety of PP was the highest level of diversity.

**Table 4.2.30** Genetic parameter for varieties of twelve samples of five local rice varieties collected different villages.

Varieties	Sources	N	A	$A_R$	h	P (%)	$F_{IS}$	$H_S$	$H_T$	$F_{ST}$
MKY-HM	HM	10	9	1.500	0.217	50	1			
MKY-TP	TP	10	9	1.500	0.233	50	1			
<b>Overall MKY</b>		<b>2</b>	<b>12</b>	<b>2</b>	<b>0.353</b>	<b>100</b>	<b>1</b>	<b>0.250</b>	<b>0.507</b>	<b>0.507</b>
KCH-HM	HM	10	9	1.500	0.130	50	1			
KCH-TP	TP	10	9	1.500	0.163	50	1			
<b>Overall KCH</b>		<b>2</b>	<b>14</b>	<b>2.250</b>	<b>0.434</b>	<b>83.33</b>	<b>1</b>	<b>0.163</b>	<b>0.633</b>	<b>0.743</b>
PP-LTH	LTH	10	10	1.667	0.273	66.67	1			
PP-HL	HL	10	11	1.833	0.333	83.33	0.772			
<b>Overall PP</b>		<b>2</b>	<b>13</b>	<b>2.158</b>	<b>0.446</b>	<b>100</b>	<b>0.875</b>	<b>0.334</b>	<b>0.588</b>	<b>0.432</b>
PD-LTH	LTH	10	9	1.500	0.130	50	1			
PD-HL	HL	10	7	1.167	0.030	16.67	1			
<b>Overall PD</b>		<b>2</b>	<b>10</b>	<b>1.543</b>	<b>0.090</b>	<b>75</b>	<b>1</b>	<b>0.089</b>	<b>0.100</b>	<b>0.111</b>
KD-HM	HM	10	8	1.333	0.150	33.33	0.722			
KD-TP	TP	10	11	1.833	0.337	83.33	1			
KD-LTH	LTH	10	12	2.000	0.307	83.33	0.902			
KD-HL	HL	10	6	1.000	0	0	1			
<b>Overall KD</b>		<b>4</b>	<b>15</b>	<b>2.244</b>	<b>0.358</b>	<b>100</b>	<b>0.906</b>	<b>0.218</b>	<b>0.411</b>	<b>0.470</b>
<b>Overall varieties</b>		<b>12</b>	<b>19</b>	<b>3.072</b>	<b>0.571</b>	<b>100</b>	<b>0.952</b>	<b>0.345</b>	<b>0.643</b>	<b>0.464</b>

A = total number of alleles,  $A_R$  = allelic richness, h = gene diversity, percentage of polymorphic loci (P),  $F_{IS}$  = fixation index,  $H_S$  = average gene diversity within samples,  $H_T$  = total gene diversity,  $F_{ST}$  = degree of genetic differentiation among samples.

Genetic diversity within and among villages

When varieties were partitioned based on village level. The samples from LTH had the highest number of alleles (17), while the lowest (13) was found in TP and HM (Table 4.2.31). Correspondingly, allelic richness ( $A_R$ ) was the highest in LTH (2.833), whereas the TP and HL had the lowest value observed (2.167), with an average of 3.122. The highest average gene diversity within village ( $H_S$ ) was in TP (0.272) and the lowest was HL (0.133) with an average of 0.441. Total gene diversity ( $H_T$ ) ranged from 0.441 in TP to 0.666 in LTH, with average across all villages of 0.620. Between villages within district, LTH and HL having the same variety names, but different level of genetic differentiation between villages more than HM and TP.

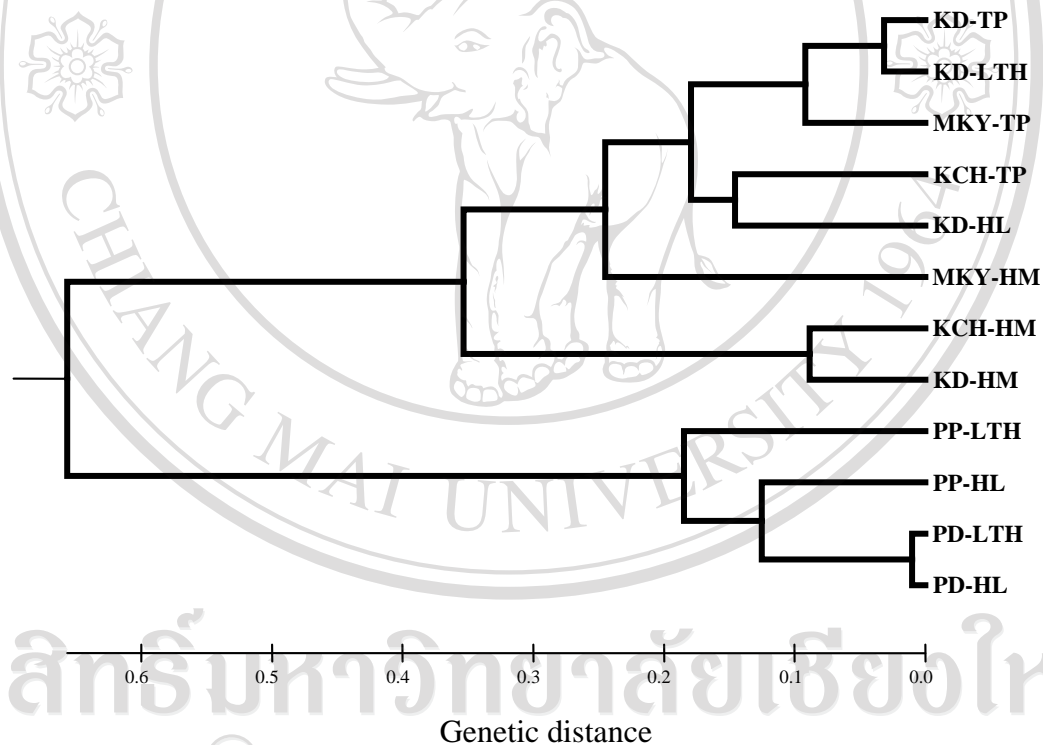
**Table 4.2.31** Genetic parameter for villages of twelve samples of five local rice varieties collected different villages.

Villages	Sources	N	A	$A_R$	h	P (%)	$F_{IS}$	$H_S$	$H_T$	$F_{ST}$
Overall HM	HM	3	15	2.500	0.426	100	0.755	0.181	0.557	0.674
Overall TP	TP	3	13	2.167	0.375	100	1	0.272	0.441	0.383
Overall LTH	LTH	3	17	2.833	0.523	100	0.958	0.262	0.666	0.606
Overall HL	HL	3	13	2.167	0.383	83.33	0.791	0.133	0.514	0.742
Overall villages		12	19	3.122	0.572	100	0.886	0.441	0.62	0.289

A = total number of alleles,  $A_R$  = allelic richness, h = gene diversity, percentage of polymorphic loci (P),  $F_{IS}$  = fixation index,  $H_S$  = average gene diversity within samples,  $H_T$  = total gene diversity,  $F_{ST}$  = degree of genetic differentiation among samples.

### *Genetic distance*

Genetic relationship among samples of local rice varieties by UPGMA clustering diagram derived genetic distance (Nei's 1972) classified two major clusters at genetic distance 0.35. The larger group consisted of samples KD-TP, KD-LTH, MKY-TP, KCH-TP, KD-HL, MKY-HM, KCH-HM and KD-HM, while smaller group consisted of PP-LTH, PP-HL, PD-LTH and PD-HL (Figure 4.2.15). For KD only TP and LTH were closed together but not HL and HM. The same as PD LTH and HL was closed. For MKY, KCH and PP samples were different.



**Figure 4.2.15** Genetic distance clustering by UPGMA methods showing genetic relationship among samples of twelve samples of five local rice varieties collected different villages.