

Proposed by S.Charoenpong, 1970  
Revised by :  
P. Vijarnsorn and staffs, 1988  
W. Sirichuaychoo, 2004

**PHATO SERIES**

**Field Symbol: Pto**

**Distribution:** Occupies moderate extent in peninsular Thailand and some areas in Southeast Coast of Thailand.

**Setting:** Phato soils derives from coarse grain clastic rocks namely sandstone, quartzitic sandstone or equivalent rocks and occurred on denudation surface. Relief is undulating to hilly. Slope ranges from 5 to 35 percent. Elevation is higher than 50 m above mean sea level. The climate is Tropical Monsoon (Koppen 'Am') and Tropical Rain Forest (Koppen 'Af'). Average annual air temperature is from 26 °C to 28°C. Average annual precipitation is from 1,800 to 3,000 mm.

**Drainage, Permeability and Surface Runoff:** Drainage is well drained, permeability is estimated to be rapid and surface runoff is rapid. Ground water level is below 1 meter throughout the year.

**Vegetation and Land Use:** Originally, occupied with Tropical Evergreen Forest, but many areas have been cleared for para rubber growing.

**Characteristic Profile Features:** The Phato series is a member of the loamy-skeletal, mixed, semiactive, isohyperthermic Typic Hapludults (soil taxonomy, 2003). They are moderately deep soils to bed rocks and are characterized by a dark brown or brown sandy loam surface or A horizon overlying a strong brown grading to yellowish red sandy loam or sandy clay loam upper argillic B horizon. This in turn overlies a yellowish red very gravelly sandy clay loam lower argillic B horizon and C horizon occurs below 50 cm but within 1 meter from the soil surface. The coarse fractions composed mostly of angular and subangular fragments of sandstone and quartzite and commonly increase in amount and size with depth. Very strongly to strongly acid, reaction values range from 4.5 to 5.5.

**Typifying Pedon:** Phato sandy loam - para rubber plantation, The East of Ban Suan-Ban Khao Mai Keres about 400 m, Tambon Khlong Hin, Amphoe Ao Luek, Changwat Krabi, 20 to 30 percent slopes (sheet name Ban Mark, sheet number 4725 I, coordinate: 828194).

**Profile Code Number:** S-64/67, described by K. Busayamanon and staffs, 24 May 1979 (moist colors unless otherwise stated).

Horizon	Depth (cm)	Description
A	0-14	Brown (10YR5/3) sandy loam; weak fine subangular blocky structure breaking to single grain; friable, nonsticky and nonplastic; many fine and few medium roots; strongly acid (field pH 5.5); clear smooth boundary.
Bw	14-41	Reddish yellow (7.5YR6/6) sandy loam; weak fine subangular blocky structure; friable, slightly sticky and nonplastic; many fine and few medium roots; strongly acid (field pH 5.0); gradual smooth boundary.
Bt1	41-63	Strong brown (7.5YR5/8) sandy clay loam; weak fine and medium subangular blocky structure; friable, slightly sticky and slightly plastic; patchy thin cutan on ped faces; few fine and medium roots; very strongly acid (field pH 5.0); clear smooth boundary.
Bt2	63-93	Yellowish red (5YR5/8) very gravelly sandy clay loam; weak fine subangular blocky structure grading to structureless; friable, slightly sticky and slightly plastic; broken thick cutan on ped faces and in pores; few fine and medium roots; fragment of sandstone about 80% by volume of the soil matrix; very strongly acid (field pH 5.0); clear wavy boundary.
Cr	93+	weathering zone of sandstone.

**Type Location:**

Name of district, Amphoe Phato, Changwat Chumphon.

**Range of Profile Features:**

The surface or A horizon sandy loam, is between 10 to 20 cm in thickness and has 10YR or 7.5YR hues, values 3 or 4 and chromas 2 through 4. Structure is weak fine subangular blocky. Very strongly acid to strongly acid, reaction values range from 4.5 to 5.5.

The argillic B horizon sandy loam or sandy clay loam, commonly occurs somewhere between 30 to 70 cm of the soil surface. In general, it should have less than 40 cm in thickness, has 7.5YR or 5YR hues, values 5 or 6 and chromas 6 or 8. Texture is sandy loam or sandy clay loam. Very strongly acid, reaction values range from 4.5 to 5.0. The lower argillic B horizon gravelly grading to very gravelly sandy clay loam, ordinary has 5YR hues, values 4 or 5 and chromas 6 or 8. Soil structure is difficult to describe due to the presence of sandstone and quartzite fragments. Very strongly acid to strongly acid, reaction values range from 4.5 to 5.5.

The C horizon is weathering sandstone bed rocks between 50 to 100 cm from the soil surface.

**Similar Soil Series:**

Lat Ya series (Ly): fine-loamy, siliceous, isohyperthermic Kanhaplic Haplustults, ustic moisture regime.

**Principal Associated Soils:**

These include Ranong, Tha Sae, Kho Hong and Lang Suan series. Ranong are shallow soils which occur on higher position. Lang Suan are deeper sandy soils which occur adjacent from Phato series on lower site of the foothill slope.

Ranong series (Rg): loamy-skeletal, mixed, semiactive, acid, isohyperthermic Lithic Udorthents.

Tha Sae series (Te): fine-loamy, kaolinitic, isohyperthermic Typic Kandiudults.

Kho Hong series (Kh): coarse-loamy, kaolinitic, isohyperthermic Typic Kandiudults.

Lang Suan series (Lan): isohyperthermic, coated Typic Quartzipsamments.

## ANALYSIS RESULTS

Profile code No.: S-64/67

(oven dry basis)

Soil series: Phato series (Pto)

Lab No.	Depth (cm)	Horizon	Particle size distribution analysis (% by weight)								Texture		pH		CaCO <sub>3</sub> %	P, mg kg <sup>-1</sup> Bray 2	K, mg kg <sup>-1</sup> NH <sub>4</sub> OAc
			USDA grading			Sand-fraction grading					Lab	Field	1:1 water	1:1 KCl			
			sand	silt	clay	vc	c	m	f	vf	result	estim <sup>n</sup>					
2-12997	0-14	A	66.8	24.6	8.6	0.0	0.2	6.3	24.4	35.9	sl	sl	4.3	3.8		1.8	52
2-12998	14-41	Bw	64.7	22.3	13.0	0.1	0.1	6.6	2.2	55.7	sl	sl	4.5	3.8		0.7	63
2-12999	41-63	Bt1	62.9	22.5	14.6	0.1	0.1	6.1	20.5	36.1	sl	scl	4.7	3.6		0.7	60
2-13000	63-93	Bt2	62.1	10.0	27.9	0.5	0.6	4.3	1.4	55.3	scl	vg scl	4.9	3.8		0.7	49
2-13001	93+	Cr	-	-	-	-	-	-	-	-	-	-	-	-		-	-

Depth (cm)	Air dried to oven dried	C %	N %	Exchange capacity and cations (cmol <sub>(+)</sub> kg <sup>-1</sup> )										Base satur <sup>n</sup> (%)		ECEC cmol <sub>(+)</sub> kg <sup>-1</sup> (B+D)	Al KCl extr. cmol <sub>(+)</sub> kg <sup>-1</sup> (D)	Electrical conduct <sup>y</sup> (ECx10 <sup>6</sup> ) dS m <sup>-1</sup>
								SUM	Extr.	SUM	CEC	CEC	B/Cx100	(Bx100)				
				Ca	Mg	K	Na	cations (B)	acidity (A)	(B+A)	NH <sub>4</sub> OAc (C)	100g Clay		(B+A)				
0-14	0.6	1.35		0.60	0.30	0.10	0.20	1.20	5.50	6.70	3.4	39.5	35	18			0.23	
14-41	0.6	0.44		0.30	0.10	0.10	0.20	0.70	5.00	5.70	3.6	27.7	19	12			0.08	
41-63	0.8	0.38		0.30	0.10	0.10	0.20	0.70	6.20	6.90	4.3	29.5	16	10			0.04	
63-93	1.2	0.38		0.30	0.06	0.10	0.30	0.76	10.50	11.26	7.8	28.0	10	7			0.02	
93+	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	

Surveyor: K. Busayamanon &amp; staff

Reported by: W. Sirichuaychoo

Date: May 24, 1979

Date: Jan. 30, 1999