

Understanding the relationship between rat populations and small carnivores in oil palm plantations: Outputs for sustainable rat control

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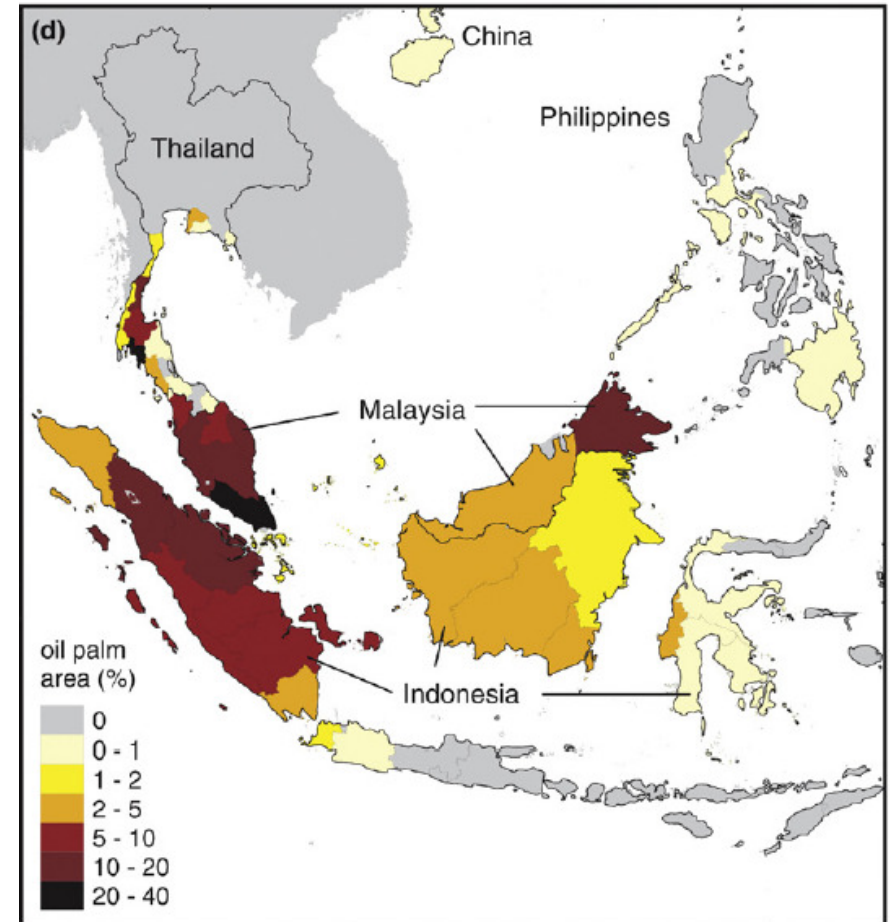
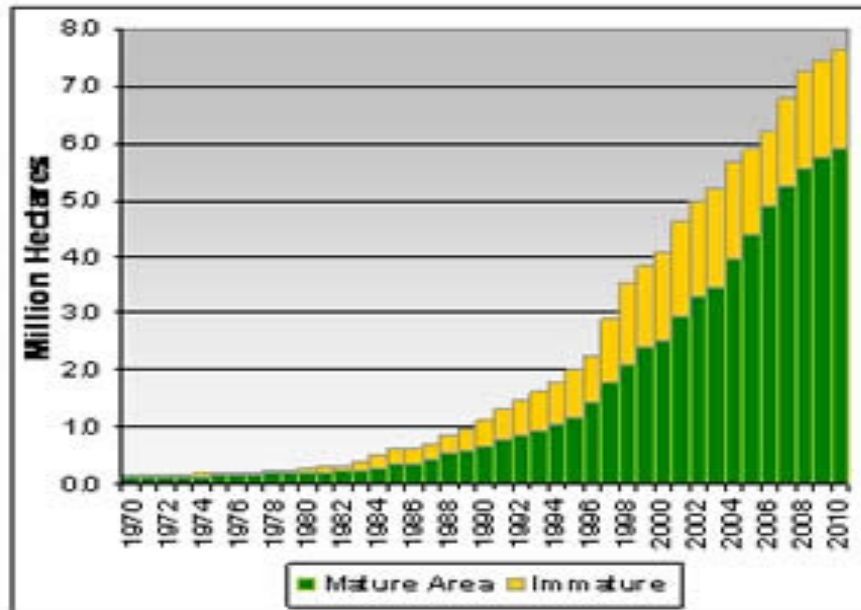
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Oil palm



TRENDS in Ecology & Evolution

Fitzherbert *et al.*, 2008

Source: Tree Crop Estate Statistics of Indonesia

Pest problem in oil palm plantation

Oil palm is subject to pest attack, from nursery to planting to the field leading to yield reduction

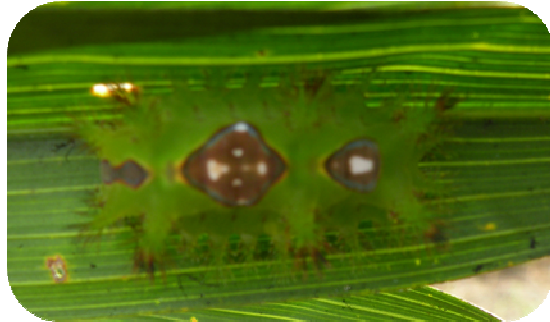
(Basri, 1993; Wood, 1994)



Pest problem in oil palm plantation

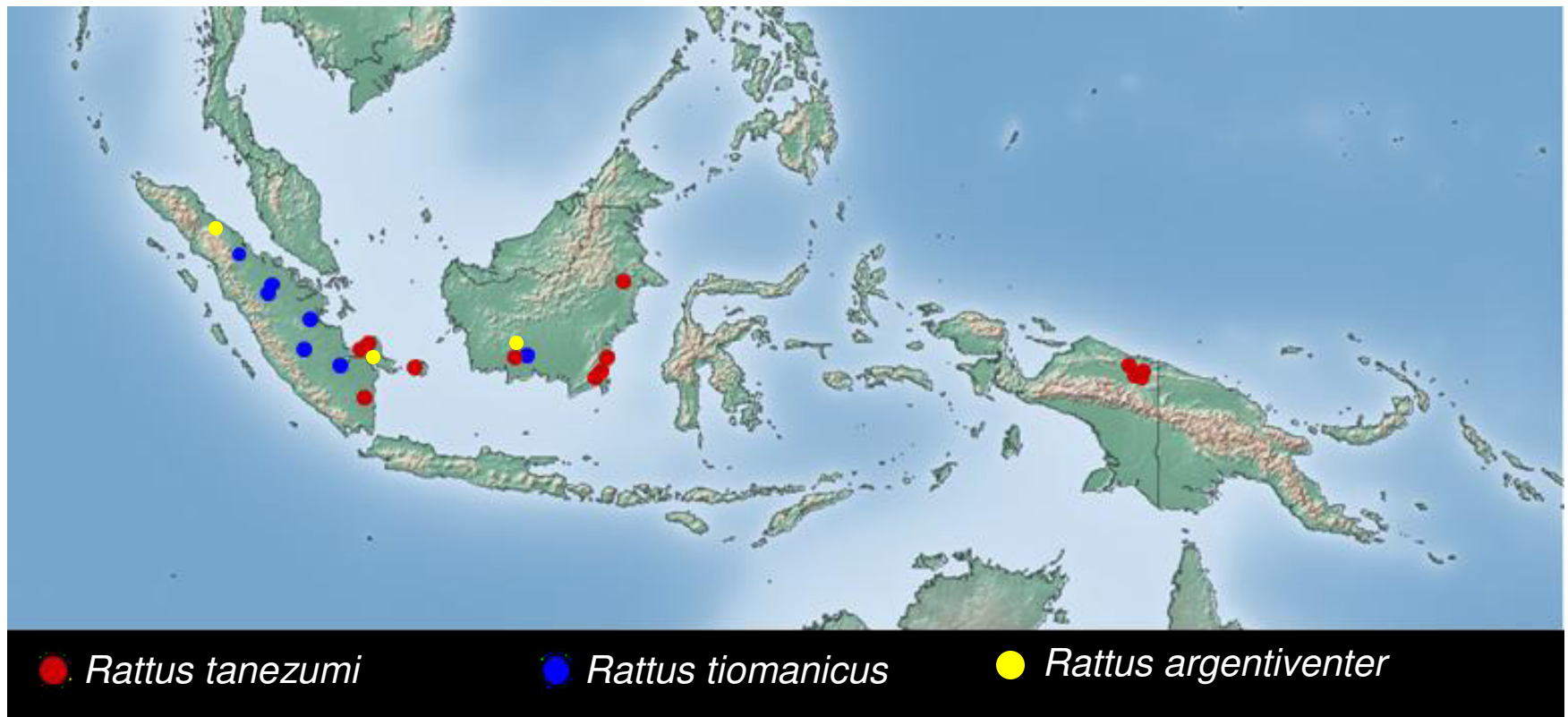
Some vertebrate and invertebrate pests were reported attack oil palm

(Wood, 1976; Chung, 2011; Sudharto and Naim., 2011)



Rats in Oil Palm

Rat Species distribution in Indonesia (Based on Molecular analysis)



(Andru , 2012)

Biocontrol of rats using Barn owls

- Mass propagated in oil palm plantation since 1980’s
- Readily move into nest boxes provisioned for them
- Diet principally of rats and one pair can consume up to 2,000 rats/year
- Breed throughout the year.
- Well adapted to fluctuations in food supply
(Lenton, 1980; Smal, 1988).



Small carnivores as potential biocontrol agent

- ✓ At least 3 small carnivores reported present in oil palm plantations (**Scott and Gemita, 2004; Maddox *et al.*, 2007; Naim *et al.*, 2012**).
- ✓ May play more important role that expected in regulating rat populations in addition to barn owls .



Objective of the study

To investigate the role of small carnivores in oil palm plantations, their relationship to rat populations, and the potential impact of small carnivores on sustainable rat control.

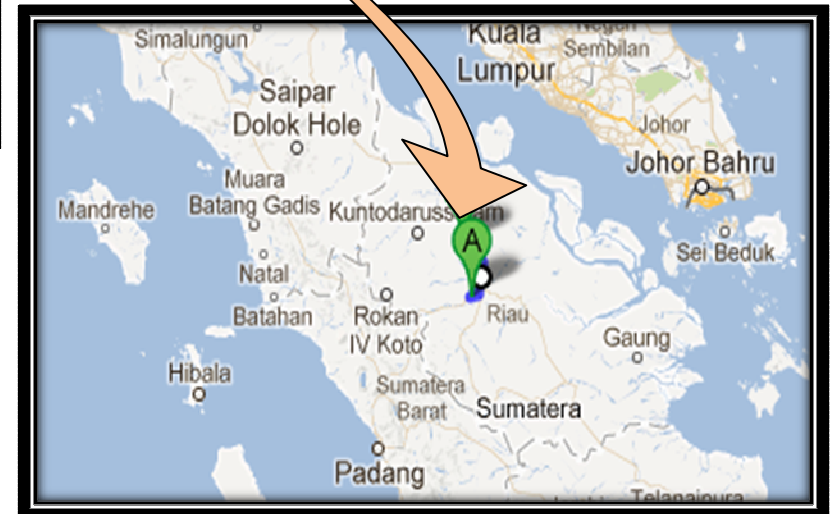
This paper presents baseline results from the first phase of a larger study (see BEFTA Project website: www.oilpalmbiodiversity.com and Foster et al in this conference for full details), before any experimental treatments (manipulating the understory vegetation complexity, herbicides, vegetation cutting, etc.) have been applied.

Study sites

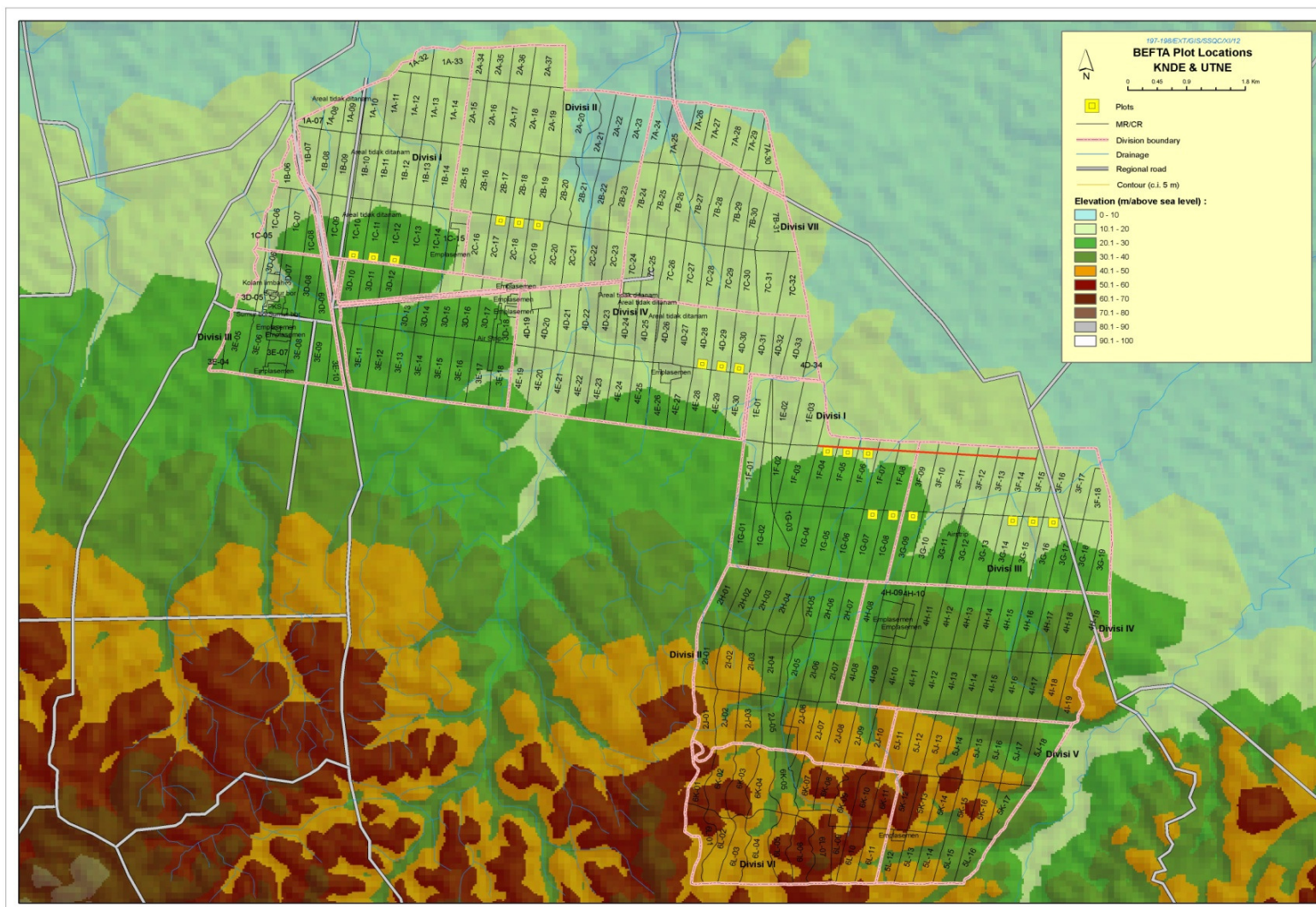


www.maps.google.com

The study was conducted in two mature oil palm plantations in Riau Province, Indonesia, from January 2013 to December 2017



Study Sites



Camera trap for monitoring the small carnivores



Rat Population Estimation

Rat population estimation was calculated using the Lincoln Index (corrected by Bailey).

$$N(B) = M(n + 1) / (m + 1)$$

(Wood, 1984; Liao, 1990).

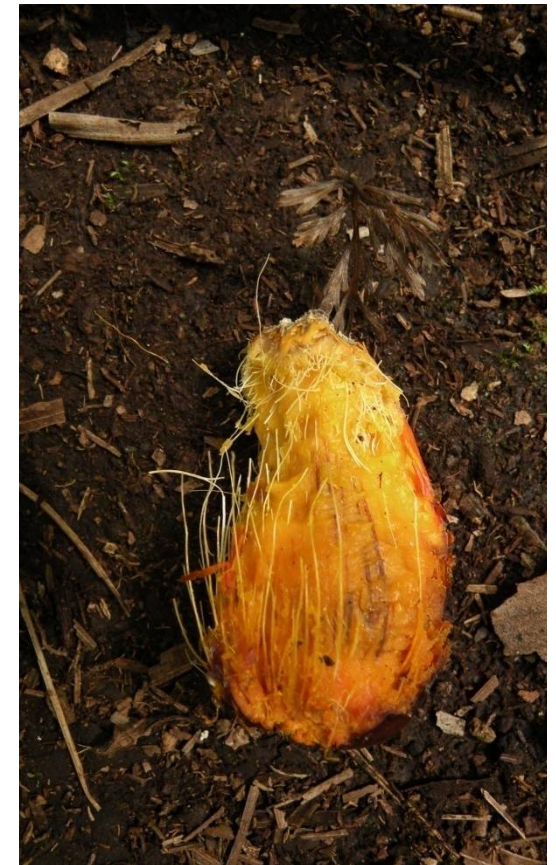


Line transects



Rat damage census

$$\% \text{ Rat Damage} = \frac{\text{No. palm damaged}}{\text{Total palm assessed}} \times 100\%$$



Results

Rat Population in oil palm plantation

Table 1. Species captured during rat ropulation study

<i>R. tiomanicus</i>	<i>R. tanezumi</i>	Tree shrew	Lizard	Frog	Water hen
830 (98.0)	12 (1.4)	2 (0.2)	2 (0.2)	1 (0.1)	1 (0.1)

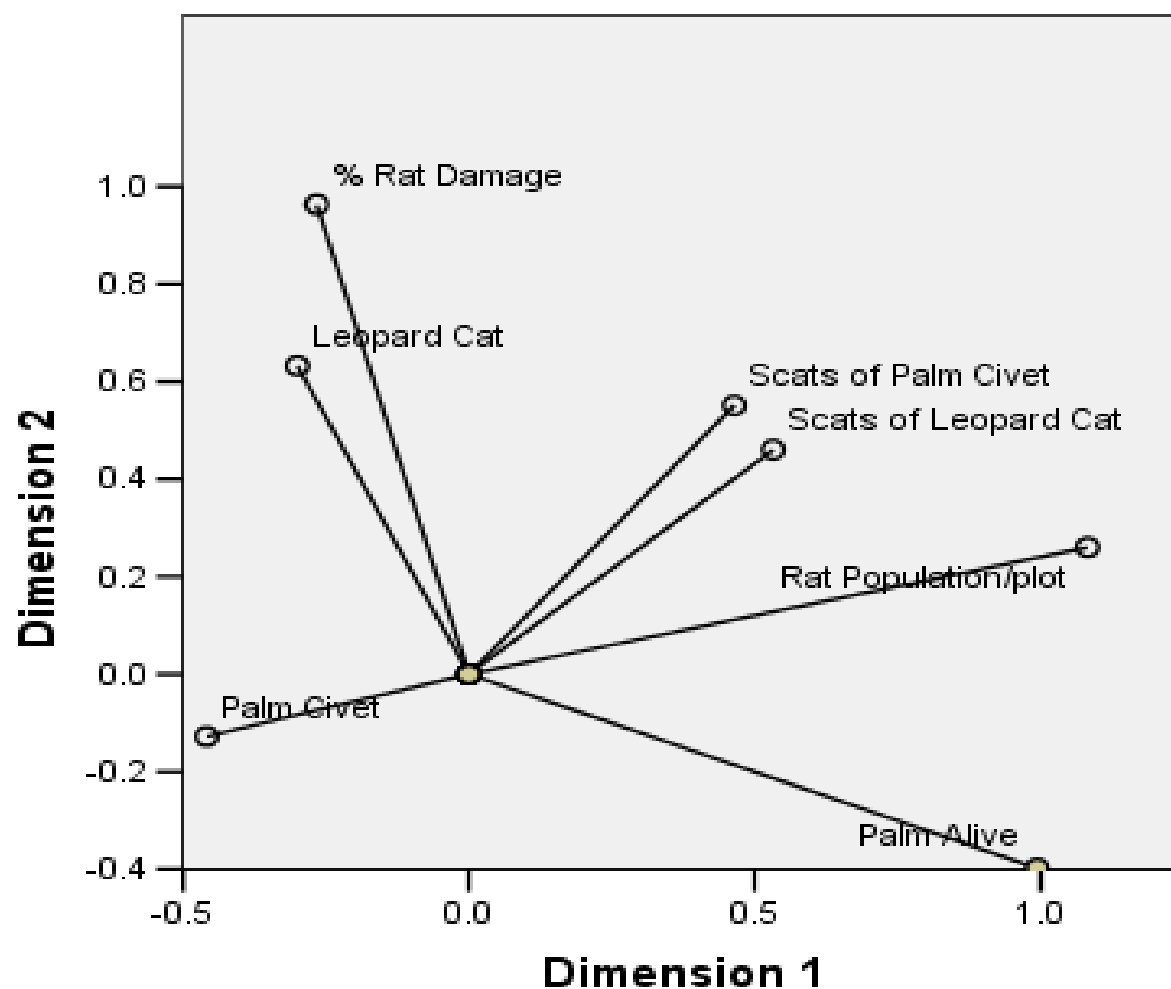


Rat Population in oil palm plantation

Table 2. Estimation of rat population/ha in each plot

Estate	Plot No	Repl.	Rat Pop./ha	Estate	Plot No	Repl.	Rat Pop./ha
A	1	1	470	B	10	4	162
	2	1	467		11	4	374
	3	1	377		12	4	196
	4	2	123		13	5	422
	5	2	84		14	5	208
	6	2	160		15	5	370
	7	3	280		16	6	564
	8	3	320		17	6	280
	9	3	242		18	6	266

Principles Component Analysis



Variable Principal Normalization.

Rat Population in oil palm plantation

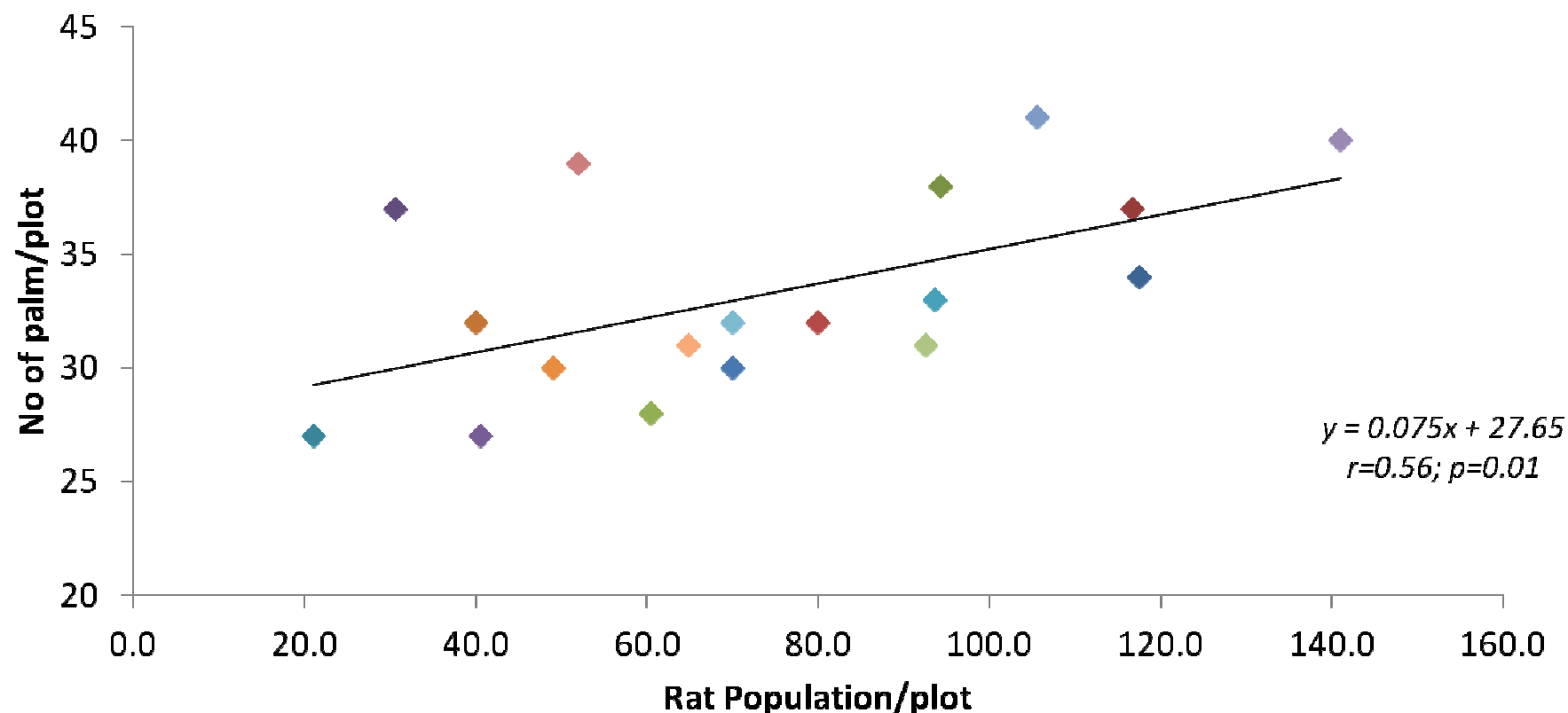


Figure 1. Relationship between the rat population and the number of palms/plot

Rat Population in oil palm plantation

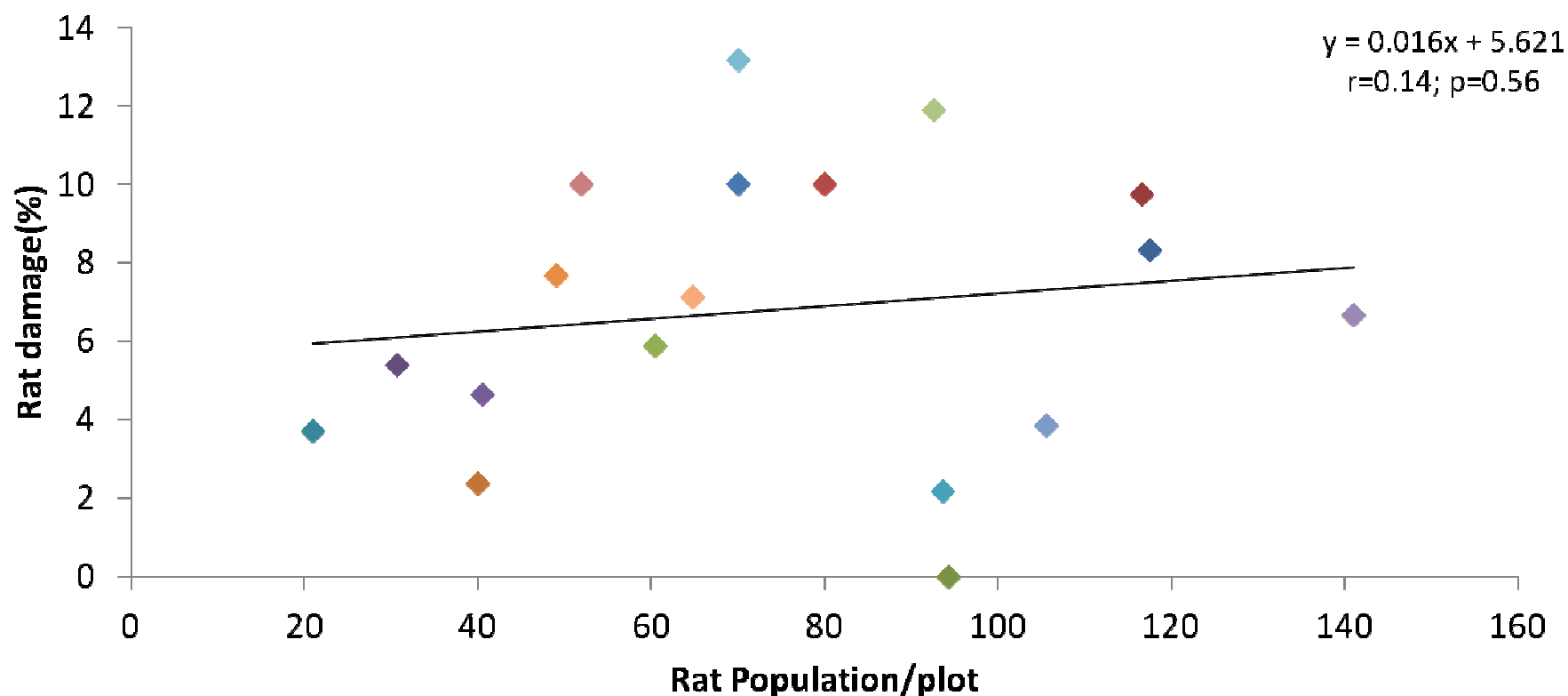


Figure 2. Relationship between the rat population and rat damage in the plots

Camera traps



Table 3. Relative abundance index and probability of detecting small carnivore in oil palm plantation

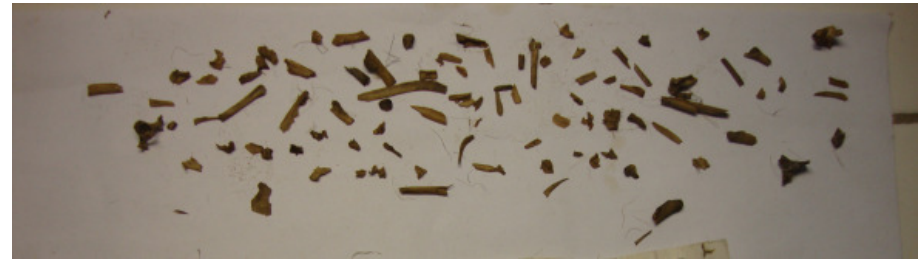
No	Estate	Plot Code	Photographed (occasion)			Total Trap night	RAI		Probability	
			Small Carnivores				LC	CPC	LC	CPC
			LC	CPC	Total					
1	1	2A	19	13	32	124	15.3	10.5	0.44	0.48
2		2B	14	4	18	124	11.3	3.2	0.36	0.16
3		2C	9	7	16	124	7.3	5.6	0.32	0.28
4		3A	20	1	21	124	16.1	0.8	0.56	0.04
5		3B	36	7	43	124	29.0	5.6	0.76	0.28
6		3C	8	3	11	124	6.5	2.4	0.28	0.12
7	2	4A	14	4	18	124	11.3	3.2	0.40	0.12
8		4B	12	1	13	124	9.7	0.8	0.36	0.04
9		4C	19	1	20	124	15.3	0.8	0.52	0.14
10		5A	2	0	2	102	1.9	0.0	0.08	0.00
11		5B	16	2	18	105	15.2	1.9	0.38	0.10
12		5C	19	4	23	92	20.6	4.3	0.85	0.31

Remarks: RAI= Relative Abundance Index; LC= Leopard Cat (*Prionailurus bengalensis*); CPC= Common Palm Civet (*Paradoxurus hermaphroditus*)

Scats of Leopard cat



Scats of Common palm civet





Small carnivore in Oil Palm Plantation

Table 4. Composition of Small Carnivores diet in oil palm plantation

Species	No. of sample	Composition of diet (% of dry weight)				
		Rats	Palm Fruit	Insect	Grass	Others
LC	73	97.1	0.0	0.7	0.4	1.8
CPC	5	51.0	28.9	2.4	8.2	9.5

Remarks: Data based on scats analysis;
 LC= leopard cat (*Prionailurus benghalensis*);
 CPC= common palm civet (*Paradoxurus hermaphroditus*)

Small carnivore in Oil Palm Plantation

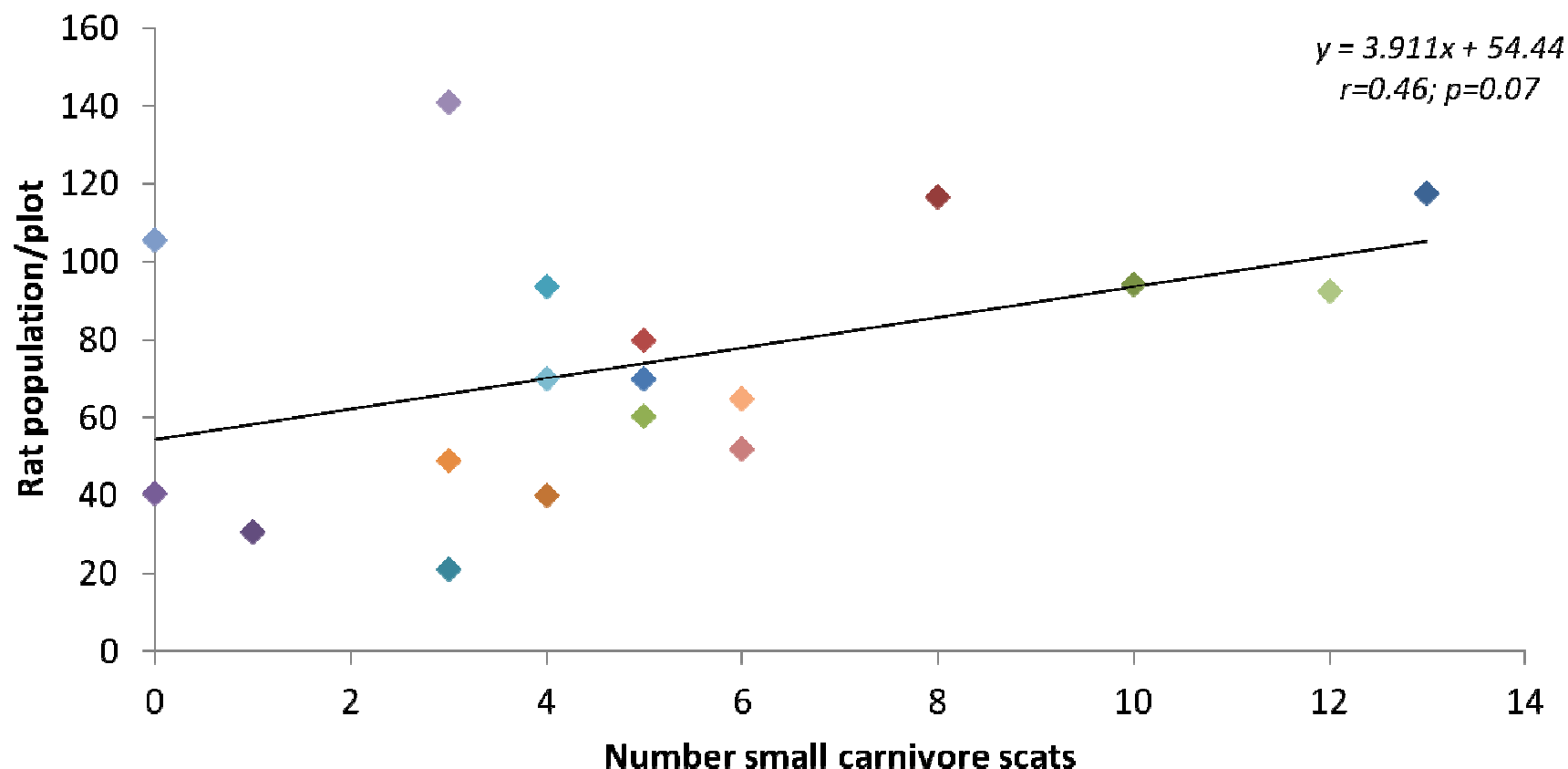


Figure 3. Relationship between the rat population and the number of small carnivore scats

Small carnivore in Oil Palm Plantation

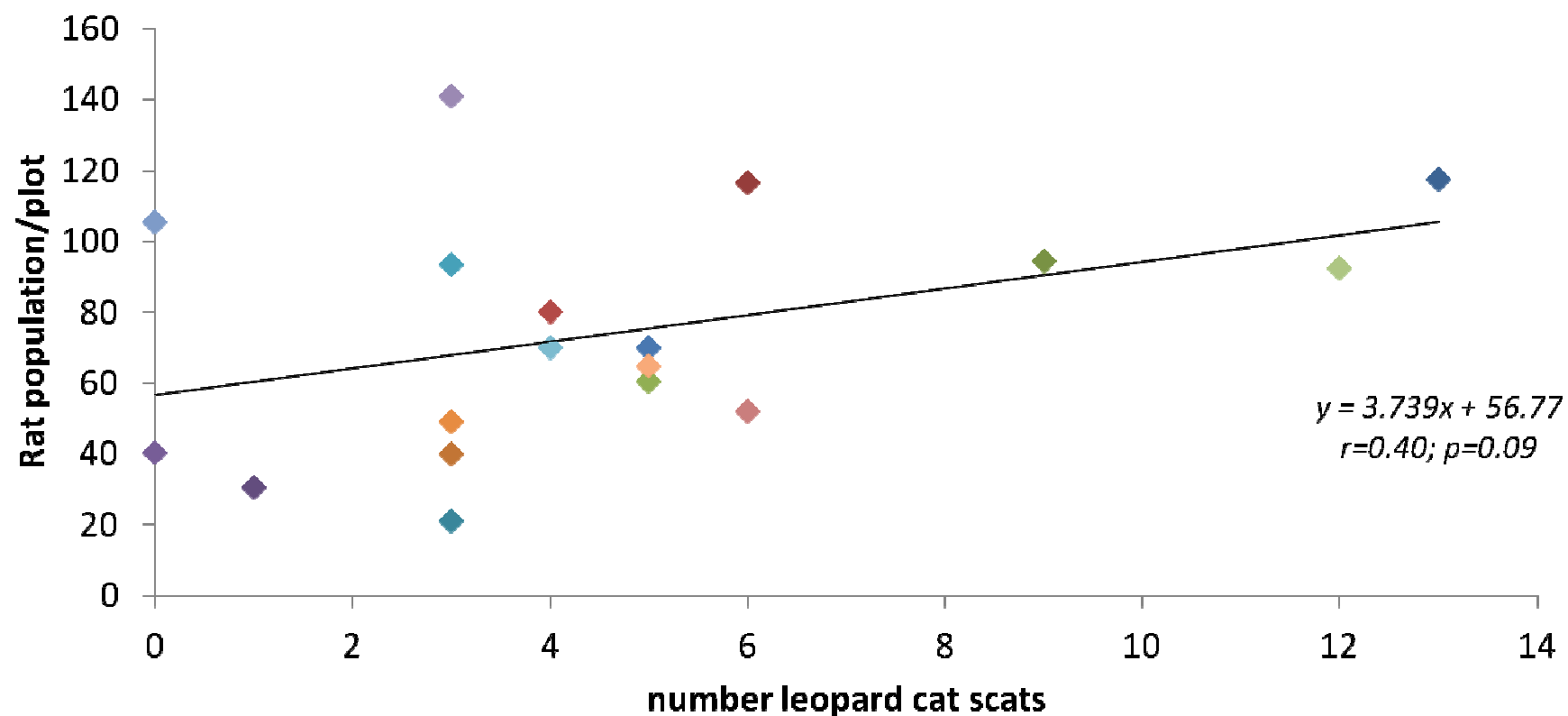


Figure 4. Relationship between the rat population and the number of leopard cat scats

Small carnivore in Oil Palm Plantation

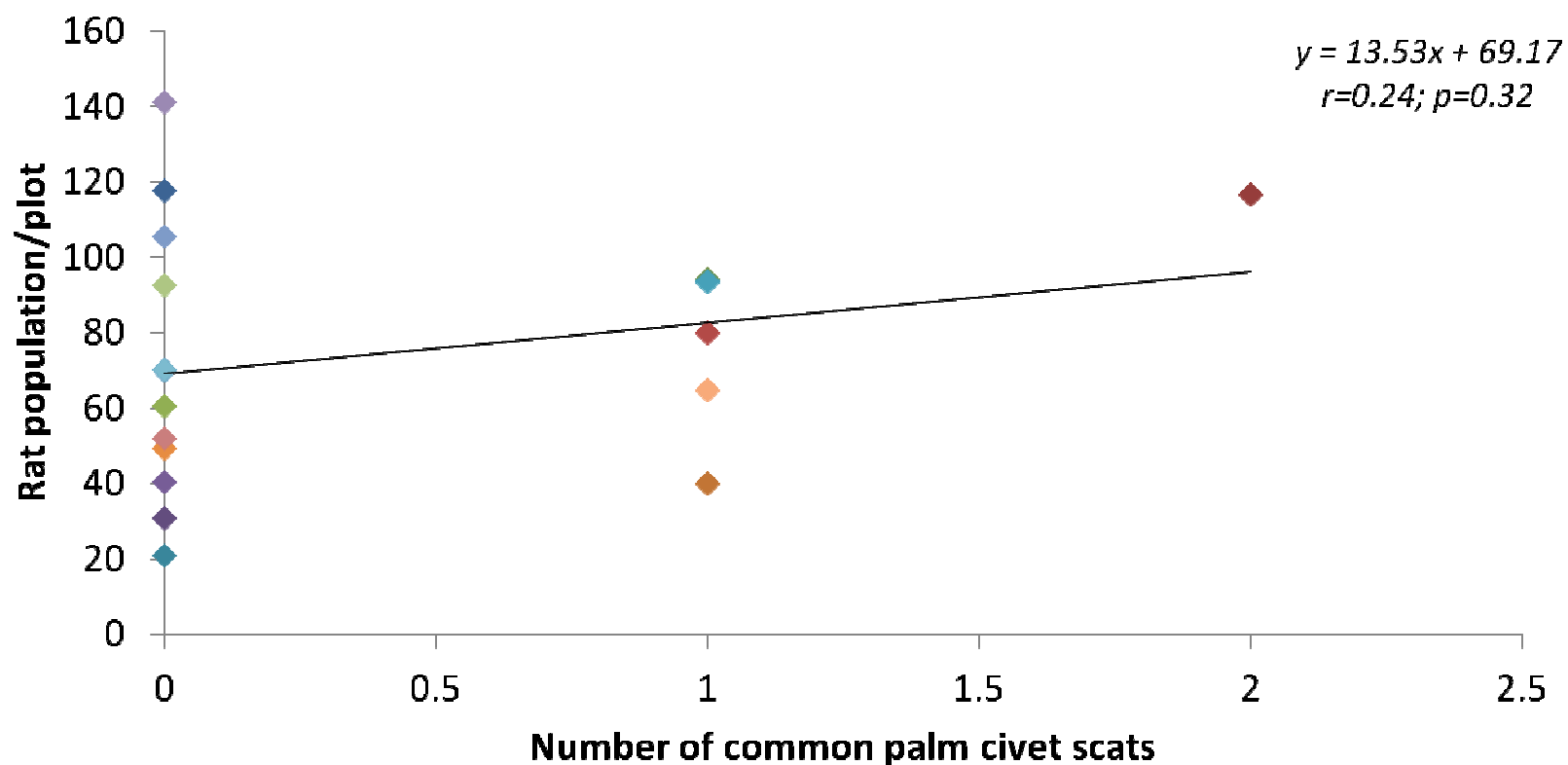


Figure 5. Relationship between the rat population and the number of common palm civet scats

Conclusion

1. **Rat populations varied widely across the plantation.**
2. **Two small carnivores (Leopard cat and common palm civet) were recorded, and spread widely in oil palm plantation.**
3. **Our preliminary results and analyses thus indicate that small carnivore species, especially the leopard cat, can be important agents in the sustainable control of rats in addition to barn owl.**

Next study

- ✓ **CMR, line transect and rat damage census will be continued and carried out regularly.**
- ✓ **Camera traps will be installed again in BEFTA plot n January 2015 to December 2015.**
- ✓ **Radio tracking for leopard cats and common palm civets in oil palm plantation.**
- ✓ **Molecular study for scats of small carnivore.**



Thank You