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短 報（Short communication）

Buffer zones for placing baited traps in grasslands bordering forests and availability of riparian reserves of trees in grasslands: A preliminary study for dung beetle assemblages in East Kalimantan, Indonesia

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Abstract

Dung beetles are useful indicators of habitat quality in tropical regions. When we evaluate habitat quality with using baited traps that attract insects for a distance, traps need to be placed to limit immigration of insects from outside the study area. To determine the minimum distance from a forest edge into grassland needed to limit immigration of forest dung beetle species, we set baited pitfall traps on transects of 100, 200, and 300 m into grassland from the edge of an *Acacia mangium* plantation with a small secondary forest in East Kalimantan. Additionally, to evaluate the availability of riparian reserves of trees along the margins of grasslands as habitat for forest species, we placed traps in a riparian reserve next to the grassland. Since the species found to be most abundant in the plantation were not collected in the grassland, we suggested that 100 m buffer zone should be sufficient to limit the unwanted capture of forest beetles in baited grassland traps. Moreover, since the species that were abundant in the plantation were also abundant in the riparian reserve, we argued that riparian reserves in grasslands might act as a habitat patch for forest species. Since distance from both forest edge and riparian reserve did not relate to the result of the ordination of species composition at each trapping location in the grassland, these distances did not generally affect the communities of dung beetles in the grassland.

Key words : baited pitfall trap, carrion, coprophagous group of Scarabaeoidea, distance, *Imperata cylindrica*, Scarabaeidae, stream corridor

1. Introduction

Dung beetles (Coprophagous group of Scarabaeoidea: Bolboceratidae and parts of Scarabaeidae (Scarabaeinae and Aphodiinae) in the present study) represent an important indicator of habitat quality and environmental change in tropical regions, because they are significantly influenced by environmental disturbance (McGeoch et al. 2002, Aguilar-Amuchastegui and Henebry 2007, Barlow et al. 2007, Gardner et al. 2008, Nichols and Gardner 2011). Dung beetles also serve important ecological functions, such as promoting rapid decomposition of dung and carcasses, as well as influencing nutrient cycling, bioturbation, plant growth enhancement, secondary seed dispersal, and parasite control (Davis 1996, Andresen 2003, Larsen et al. 2005, Slade et al. 2007, 2011, Nichols et al. 2008). Thus, a higher diversity of beetles is usually indicative of a more active, complex, and perhaps resilient forest ecosystem.

When investigating insect communities for particular habitats, it is essential to take into account the distance of study plots from nearby, differing habitats so as to limit contamination from immigrating insects (Fahrig 2003). This is especially the case when comparing habitat quality among different environments using baited traps that attract insects for a distance. Communities of dung beetles are normally assessed using baited pitfall traps. Larsen and Forsyth (2005) observed in mark and recapture studies involving baited pitfall traps that the flight distance of a tropical forest dung beetle species can be as high as 50 m per day and as 100 m per four days from the release point. Wille et al. (1974) also observed that a tropical forest dung beetle was able to fly 50 - 75 m, although the recapture period after release was not determined. These results suggest that trapping sites should be placed at least 100 m from borders of habitats to eliminate immigration from

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surrounding environments. Although importance of this buffer is suggested through studies measuring the flight distance of the dung beetles (Wille et al. 1974, Larsen and Forsyth 2005), no studies have formally established that the 100 m is sufficient to eliminate immigration.

Riparian reserves of trees along stream running across oil palm plantations on Borneo Island are known to act as a refuge of forest species of dung beetles (Gray et al. 2014). In Washington, USA, such riparian reserves also act as a refuge of wildlife that provide food resources (dung and carrion) for dung beetles (Budd et al. 1987), and as a corridor that connects habitat patches of an endangered butterfly (Milko et al. 2012). There are many streams running across grasslands and agricultural lands that spread largely in the lowlands of East Kalimantan on Borneo Island, and the streams often enclosed in riparian reserves of trees. Such riparian reserves in grasslands or agricultural lands may act as refuges and corridors of organisms living in forests although their availability has never been evaluated.

The objectives of this study were to: 1) determine the buffer distance needed for baited traps from a forest edge into grassland to limit contamination of traps from immigrant dung beetles, and 2) evaluate whether a riparian reserve of trees along a stream running across a grassland could have availability as a potential habitat patch for forest dung beetle species.

2. Methods

2.1 Study sites

This study was carried out in a rural landscape of lowland of East Kalimantan, Indonesia where there was *Acacia mangium* and *Albizia falcataria* plantations with a small secondary forest (S1˚06’30”, E116˚54’20”,35m asl.) and its surrounding grasslands and agricultural lands near the Sungai Wain Protection Forest, located 23 km north of Balikpapan (Fig. 1).

Five 90-m transect sites were set in the study area (Fig. 1). Sites G1, G2, and G3 were located, respectively, 100, 200, and 300 m outside from the forest edge into an *Imperata cylindrica* grassland (Fig. 1 and 2A). Site PL was located about 100 m inside from the forest edge of the *A. mangium* plantation (Fig. 1). The area and age of the plantation were 9.5 ha and 9 years old. The mean diameter of breast height of *A. mangium* trees, the tree density, and the trunk basal area were, respectively, 17.1 cm, 835 per

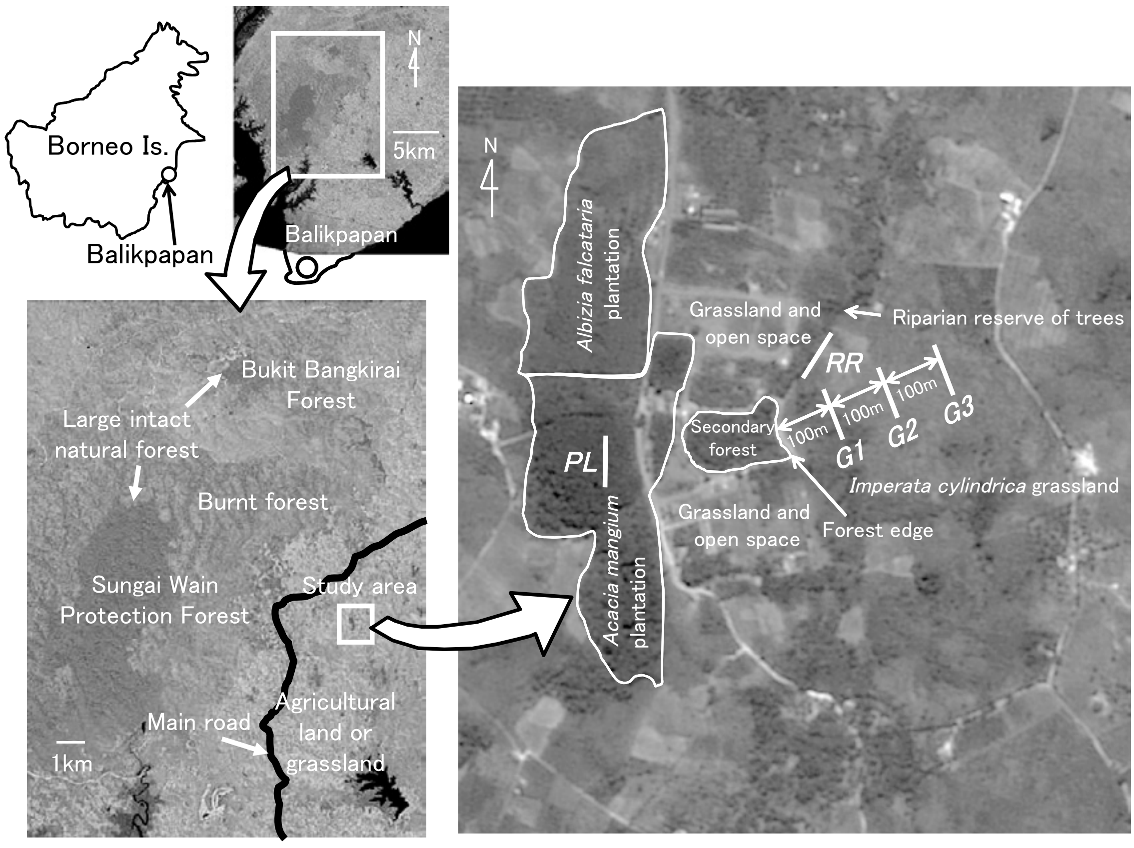

Fig. 1 Location of study area and transect sites
Locations of transect sites and their names are indicated by thick lines and bold italic characters. PL: plantation site, RR: riparian reserve site, G1, G2, and G3: grassland sites located 100, 200, and 300 m away from the forest edge, respectively. The ‘SPOTS5’ satellite took this picture at 2:27:04 (GMT) on 19 June, 2005.

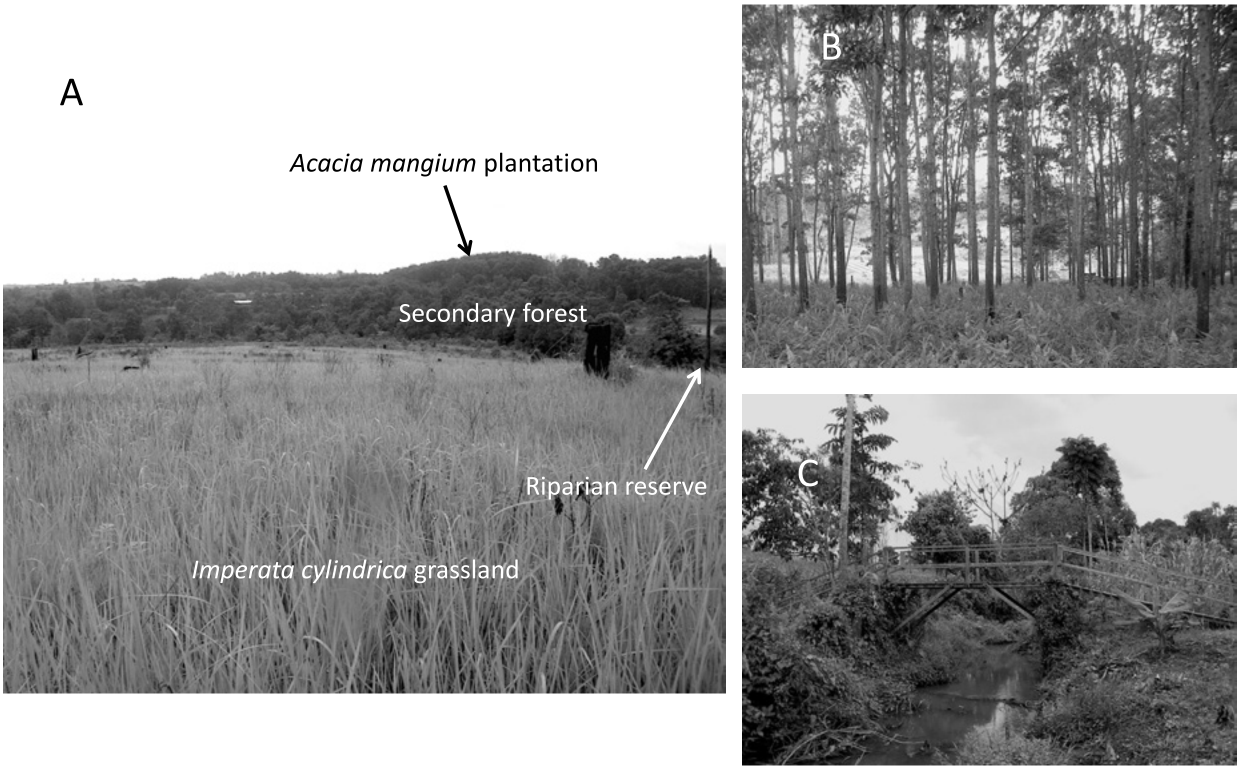

Fig. 2 View of each site
A: sites G1 and G2 in *Imperata cylindrica* grassland, B: site PL in *Acacia mangium* plantation, C: site RR along the steam.

ha, and 20.2 m^2 per ha (Fig. 2B). Site RR was located along the stream running across grasslands and open lands and accompanying with the narrow riparian reserve of trees (Fig. 1 and 2C). The widths of the riparian reserve were 0 to 5 m on each side of the stream bank. The cultivated lands were about 10 - 20 m in width and were scattered behind the bank (Fig. 2C).

2.2 Collection of dung beetles

Baited and flight intercepting pitfall traps were used to collect the beetles because they tend to capture a larger number of dung beetle species than do normal baited pitfall traps (Ueda et al. 2015). For each trap, a plastic cup (8.4 cm in open diameter, 5.6 cm in minimum diameter, and 12.2-cm high) was driven into the ground to set up each trap with its opening level with the ground surface. Two B5-size transparent plastic sheets that crossed each other were then laid over the cup, upon which a plastic bowl (ceiling: 20 cm in diameter and 5-cm high) was placed upside down. Each trap contained a 50-ml glass bottle (4.3 cm in diameter and 8.0-cm high) with a perforated lid (having six holes, each 5 mm in diameter) and was baited to attract beetles. Fresh human excrement (10 g) and raw jack fish (Carangidae sp.) (30 g) were used as bait because these baits attract large number of dung beetles, both species and individuals (Ueda et al. 2015). A cut nylon net (with a 0.5-mm mesh) was placed between the lid and bottle to prevent small beetles from entering. The traps also contained a 30% solution of propylene glycol to kill and preserve the beetles collected. All traps were set in the morning on 17 December 2007, with all captured insects being collected five days after trap installation, since in general a five day trapping period is enough to assess the beetle community when using traps baited with human excrement and raw fish (Ueda et al. 2015). Ten traps were distributed along a 90-m transect at intervals of 10 m for each site, with human excrement and raw fish used alternately as the attractant. Traps baited with human excrement and raw fish were numbered from north to south, respectively, at each site as the northernmost pair of traps baited with human excrement and raw fish was numbered as "1" whereas the southernmost pair was numbered as "5". Total number of individuals of each beetle species collected per the pair was used in analyses.

The distances from traps in the grassland to the forest edge and the riparian reserve were different between traps by their locations (Fig. 1). The distances from traps in the riparian reserve to the forest edge were also different between traps (Fig. 1). To situate each trapping location in the grassland and the riparian reserve, the distance from the middle point of each pair to the forest edge and/or the riparian reserve was measured using a satellite image taken by the 'SPOTS5' at 2:27:04 (GMT) on 19 June, 2005.

2.3 Identification and storage of specimens

All beetles captured in the present study were dried on absorbent cotton and identified by their morphology using a binocular (Nikon Nature Scope) and the taxonomic key provided by Ochi and Kon (1995, 1996, 2002, 2006), and Ochi et al. (1997). Some beetles were pinned and sent to the University of Shiga Prefecture, Japan to ensure their identity. Females of two *Catharsius* species (*C. dayacus* Lansberge and *C. renaudpauliani* Ochi et Kon) were difficult to distinguish from one another. However, since all of 20 *Catharsius* males collected in the present study were *C. renaudpauliani*, all of 15 *Catharsius* females were subsequently treated as *C. renaudpauliani*. All beetles were stored in the insect specimen room of Research Center for Biology, Indonesian Institute of Science (LIPI), Cibinong, Indonesia.

2.4 Measurement of body size and data analyses

It is known that body size affects flight distance potential of longicorn beetles (Holland et al. 2005). Larger species of dung beetles are expected to fly longer distance than smaller species (Larsen and Forsyth 2005, Larsen et al. 2008), suggesting that the absence of large forest species in trap catches in the grasslands explains the enough distance of the trap location from the nearest forest edge to limit immigration of forest species more persuasively compared with the absence of small forest species does. Thus we used the dry weight of the beetles to determine their body sizes as the representatives of their flight distances. Dry weight was assessed after the collected beetles of each species were dried for seven days at 70°C and then for a final day at 105°C. Since not all beetles were permitted for shipping, numbers of beetles weighed were less than those collected. For rare species, the beetles from multiple sites were pooled together and weighed.

Mean number of dung beetles collected by a pair of traps baited with human excrement and raw fish at each site was compared with using Kruskal-Wallis test (N = 5). JMP 8 (SAS Institute 2009) was used for the analysis. Species abundance in each environment was assessed only when the total number of species collected exceeded 5 individuals. Species for which more than 80 % individuals were collected at sites PL and RR were categorized as "abundant in both plantation and riparian reserve", species for which more than 80 % individuals were collected at sites RR, G1, G2, and G3 were categorized as "abundant in both grassland and riparian reserve", and species for which more than 80 % individuals were collected at sites G1, G2, and G3 were categorized as "abundant in grassland".

Nonmetric multidimensional scaling (NMS) was used for the ordination of species composition at each trapping location to analyze the similarities of beetle communities between pairs of the traps using the abundance data of each species per pair of traps and the distance measure of Sørensen. Multivariate Response Permutation Procedure (MRPP) was applied to measure the stability of beetle communities between three vegetation categories (plantation, riparian reserve, and grassland) using the abundance data of each species per pair of traps and the distance measure of Sørensen. Since there were a lot of zero data, before these two analyses all data were modified to the square root values after adding 0.5 to each (McCune and Grace 2002). PC-ORD ver. 6.07 (MJM Software Design 2011) and this adjusted data were used for these two analyses. To analyze the factors contributing the score on each axis of the NMS, we used linear regression to assess relationships between the scores of all pairs and pairs in the grassland and species richness, total abundance, and abundances of each species and category. JMP 8 (SAS Institute 2009) was used for the analyses.

To evaluate the effect of distance from each trapping location in the grassland to both the forest edge and the riparian reserve, we used linear regression to assess relationships between distances and the score on each axis of the NMS, species richness, total abundance, and abundances of each species and category. JMP 8 (SAS Institute 2009) was used for the analyses.

3. Results and discussion

3.1 Effects of distances from the forest edge to the grassland sites and the plantation site

A total of 17 species (Table 1) and 347 individuals of dung beetles were collected in our study. Mean number of dung beetles collected by a pair of traps baited with human excrement and raw fish at each site was significantly differed on *C. renaudpauliani*, *Onthophagus lilliptanus* Lansberge, and *Onthophagus uedai* Ochi et Kon (Table 1). The species most abundant in the plantation (site PL), *C. renaudpauliani*, was never captured in the grassland sites (G1, G2, and G3) (Table 1). Six species collected in the plantation, *Onthophagus schwaneri* Lansberge, *Onthophagus semiaureus* Lansberge, *Onthophagus semicupreus* Harold, *Onthophagus obscurior* Boucomont, *Onthophagus incisus* Harold, and *Onthophagus rutilans* Sharp were also never captured in the grassland sites (Table 1). These seven species are normally abundant in the disturbed forests, such as burnt forests and secondary forests (Ueda, unpublished data). The five of these seven species were the large species in the present study and their dry weights were over 40 mg (Table 1). They also had

Table 1. Mean dried body weight and mean number ± SE with the result of Kruskal-Wallis test of dung beetles collected by a pair of traps baited with human excrement and raw fish in the present study

Tendancy of abundance in each environment[a]	Species	Body weight (mg)[b]	Number of beetles collected at each transect sites (N = 5)[c]					Result of
			PL	RR	G1	G2	G3	Kruskal-Wallis test
Abundant in both plantation and riparian reserve	*Catharsius renaudpauliani* Ochi et Kon	740.5 (3)	3.8 ± 1.2	3.2 ± 1.8	0	0	0	P = 0.008
	Onthophagus schwaneri Lansberge	162.5 (9)	0.4 ± 0.2	0.6 ± 0.4	0	0	0	ns
Abundant in both grassland and riparian reserve	*Caccobius unicornis* (Fabricius)	1.3 (20)	0.2 ± 0.2	1.8 ± 1.0	0.4 ± 0.2	0.2 ± 0.2	3.2 ± 2.0	ns
	Onthophagus lilliputanus Lansberge	2.2 (3)	0	3.2 ± 1.5	6.6 ± 2.2	14.4 ± 2.3	4.4 ± 1.4	P = 0.002
	Onthophagus trituber (Wiedemann)	9.6 (20)	0.4 ± 0.2	2.8 ± 1.6	2.6 ± 1.4	2.0 ± 0.7	3.8 ± 2.7	ns
Abundant in grassland	*Panelus* sp.	1.1 (1)	0	0.2 ± 0.2	0.4 ± 0.4	0.6 ± 0.4	0	ns
	Onthophagus limbatus (Herbst)	8.6 (20)	0.4 ± 0.4	0.4 ± 0.2	0.8 ± 0.6	2.0 ± 1.3	3.0 ± 2.3	ns
	Onthophagus uedai Ochi et Kon	3.3 (4)	0	0	1.4 ± 0.7	3.4 ± 1.4	0.8 ± 0.4	P = 0.005
Unknown because of low number of data (1 or 2 indivisuals)	*Bolbochromus catenatus* (Lansberge)	31.9 (5)	0	0.2 ± 0.2	0	0	0	ns
	Onthophagus semiaureus Lansberge	44.1 (2)	0.2 ± 0.2	0	0	0	0	ns
	Onthophagus semicupreus Harold	5.7 (2)	0.2 ± 0.2	0	0	0	0	ns
	Onthophagus obscurior Boucomont	8.0 (2)	0.4 ± 0.2	0	0	0	0	ns
	Onthophagus papulatus Boucomont	2.3 (20)	0	0.2 ± 0.2	0	0	0	ns
	Onthophagus armatus Blanchard	4.3 (1)	0	0	0.2 ± 0.2	0	0	ns
	Onthophagus incisus Harold	98.9 (2)	0.2 ± 0.2	0	0	0	0	ns
	Onthophagus rutilans Sharp	55.2 (5)	0.2 ± 0.2	0	0	0	0	ns
	Onthophagus sp.	4.3 (1)	0	0	0.2 ± 0.2	0	0	ns

[a]Species collected exceed 5 individuals and for which more than 80 % individuals were collected at sites PL and RR, sites RR, G1, G2, and G3, and sites G1, G2, and G3 were categorized as abundant in both plantation and riparian reserve, abundant in both grassland and riparian reserve, and abundant in grassland, respectively.
[b]Numbers of beetles used for weighing are indicated in parenthesis. For rare species, the beetles from multiple sites were pooled together and weighed.
[c]PL: plantation site, RR: riparian reserve site, G1, G2, and G3: grassland sites located 100, 200, and 300 m away from the forest edge, respectively.

well developed wings. It is known that larger longicorn beetle species are able to fly longer distances (Holland et al. 2005), and larger dung beetle species are expected to fly longer distance compared with smaller species (Larsen and Forsyth 2005, Larsen et al. 2008). These suggest that the five large species are able to fly for long distances even though they were not collected in any of our grassland traps. Thus, our results suggest that a 100 m buffer from the forest edge into grassland is enough far for bait trap catch to eliminate immigration of dung beetles from nearby forests, even if the beetles are able to fly for long distances.

Site PL was located about 100 m inside from the forest edge of the plantation but a few beetles of grassland, *Caccobius unicornis* (Fabricius), *Onthophagus trituber* (Wiedemann), and *Onthophagus limbatus* (Herbst), were collected there (Table 1). A road dividing the plantation ran near the site PL (Fig. 1) and the grassland species may facilitate easy entry into the plantation along the road. It is known that logging roads running across the intact natural forest in lowland of Peninsular Malaysia facilitates grassland species dispersal into the forest area, including *O. lilliptanus* that is listed in Table 1 (Hosaka et al. 2014). However, the short distance (about 20 m) from the roadside is enough to eliminate the grassland species, because the canopy openness strongly affects the beetle assemblage and it at 20 m inside from the roadside reaches that at 60 m inside (Hosaka et al. 2014). From the present study, it is difficult to determine whether the grassland species collected in the plantation entered into the plantation from the road or whether they naturally inhabited the plantation

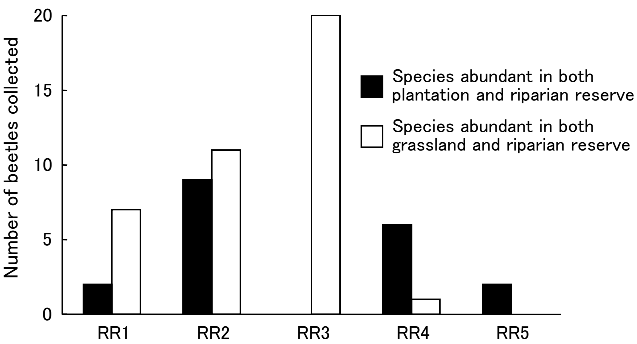

Fig. 3 Numbers of beetles abundant in both plantation and riparian reserve and beetles abundant in both grassland and riparian reserve collected from pairs of traps baited with human excrement and raw fish in the riparian reserve site (RR)
Ten traps were distributed along the 90-m transect at intervals of 10 m for site RR, with human excrement and raw fish used alternately as the attractant. The northernmost pair of traps was numbered as “RR1” whereas the southernmost pair was numbered as “RR5”.

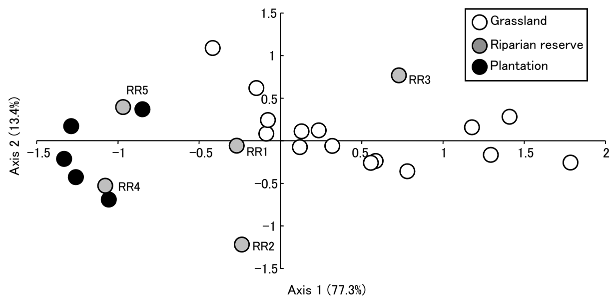

Fig. 4 Results of NMS analysis as applied to ordinate trapping locations with the similarities of beetle' s communities for all pairs of traps baited with human excrement and raw fish
Trapping locations written beside some coordinates are the same with Fig. 3. Final stress = 15.37.

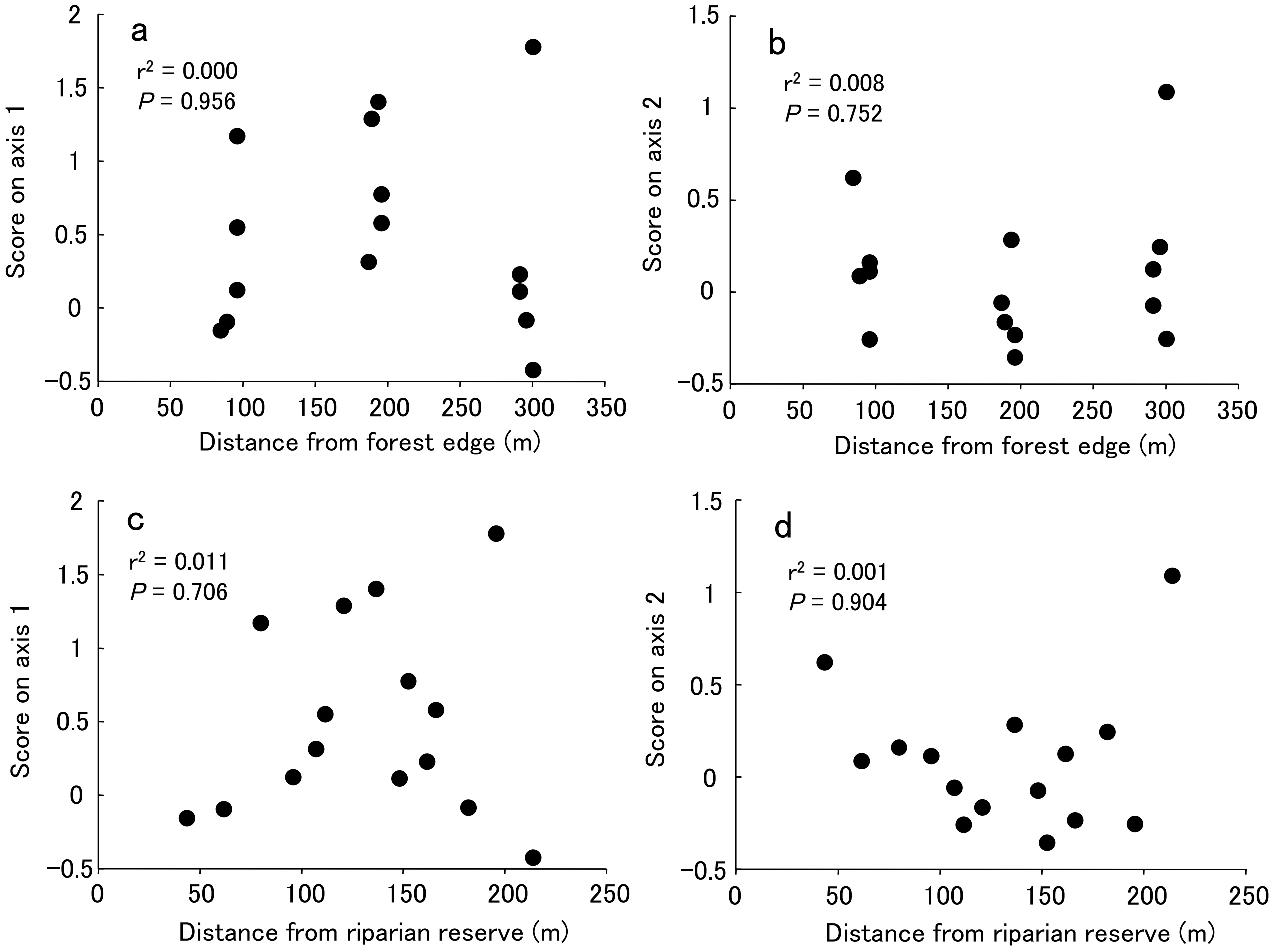

Fig. 5 Relationships between distance from forest edge and scores of NMS (shown in Fig. 4) on axes 1 (a) and 2 (b), and between distance from riparian reserve and scores on axes 1 (c) and 2 (d) at each trapping location in the grassland
Results of linear regression analyses are shown in figures.

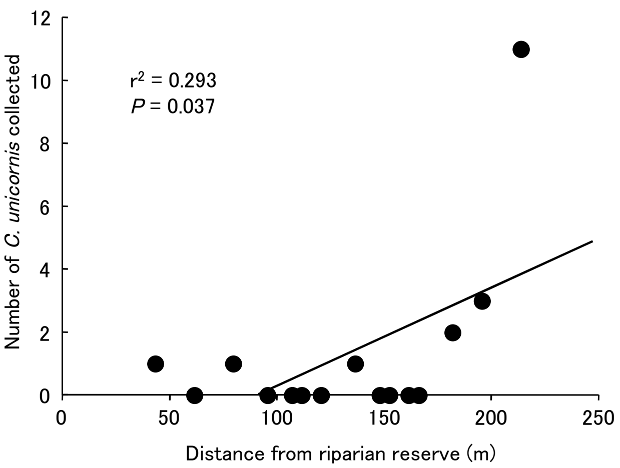

Fig. 6 Relationship between distance from riparian reserve and number of *Caccobius unicornis* (Fabricius) collected at each trapping location in the grassland
A result of linear regression analysis is shown in figure.

where the canopy might have been more open compared to that of an intact natural forest. Further study is need to determine what is a sufficient distance inside from the edge of the plantation forests to eliminate immigration of dung beetles living in grasslands.

3.2 Availability of riparian reserves of trees

The species most abundant in the plantation (site PL), *C. renaudpauliani*, was also abundant in the riparian reserve of trees (site RR) (Table 1). Species abundant in both plantation and riparian reserve were collected irrespective with locations on site RR (Fig. 3) except for the center of the site (RR3 in Fig. 3 where species abundant in both plantation and riparian reserve were not collected). These results suggest that the riparian reserve in the grassland may act as a refuge and a corridor for the forest dung beetle species, as well as riparian reserves in oil palm plantations (Gray et al. 2014). These results also coincide with the results of Díaz et al. (2009) who showed that living fences of trees in pastures were able to act as corridors to facilitate dispersal of forest dung beetles. However, because there was only one site of the riparian reserve in the present study, further study is needed to confirm its availability as a refuge and a corridor of the forest species.

3.3 Effect of distance from each trapping location to the forest edge and the riparian reserve

The analysis of NMS as applied to ordinate trapping locations with the similarities of beetle communities recommended a two-dimensional solution. The coordinates of trap pairs in the grassland and plantation were clearly apart each other along axis 1 that explained 77.3 % of the ordination (Fig. 4). The analysis result of MRPP (A = 0.170, P = 9E-5) indicated that beetle communities were different between three types of vegetation. The scores on axes 1 and 2 of NMS related to the abundance of beetles categorized as "abundant in both grassland and riparian reserve" (r^2 = 0.798, $P < 0.0001$) and the abundance of *C. renaudpauliani* (r^2 = 0.454, P = 0.0002) with the highest correlation coefficients, respectively. These results indicated that abundance of both species abundant in plantation and species abundant in grassland largely affected the dung beetle communities in the study area.

The coordinates of trap pairs in the grassland were scattered along both axes 1 and 2 (Fig. 4). Their scores on axes 1 and 2 of NMS related to the abundance of beetles categorized as "abundant in grassland" (r^2 = 0.802, $P <$ 0.0001) and the abundance of *C. unicornis* (r^2 = 0.543, P = 0.0017) with the highest correlation coefficients, respectively. These results indicated that abundance of species abundant in plantation did not affected the dung beetle communities in the grassland. There was no significant relationship between distance from both forest edge and riparian reserve to each trapping location in the grassland and the score of NMS on both axes 1 and 2 (Fig. 5). There were also no significant relationships between these distances and species richness, total abundance, and abundances of each species and each category (P > 0.05), except for the relationship between the distances from the riparian reserve and the numbers of *C. unicornis* collected, which were positively correlated (Fig. 6). These results indicate that the distance from both the forest edge and the riparian reserve did not generally affect the communities of dung beetles in the grassland. *C. unicornis* is abundant in the heavily disturbed locations, such as urban areas (Kawai et al. 2005), which may indicate that it thrives away from forest conditions.

The distance from each trapping location in site RR to the forest edge varied from 66 m to 139 m. We did not analyze the relationship between distance from forest edge and the numbers of beetles collected by trap pairs due to the low sample size in that site (N = 5). However, the coordinates of the three northernmost locations (RR1 to RR3) of site RR were distributed within the range of those in the grassland on axis 1, while those of the two southernmost locations (RR4 and RR5) were within the range of those in the plantation (Fig. 4). This difference was caused by the beetles abundant in both grassland and riparian reserve that were not collected at the two southernmost locations (Fig. 3). Unfortunately, since we did not investigate the environmental variables such as the width of the riparian reserve and the canopy openness at each trapping location, it was not known whether the different distances from the trapping location to the plantation or other environmental factors affected the numbers of beetles abundant in both grassland and riparian reserve collected.

3.4 Reliability of data

Studies have shown that dung beetle communities can be effectively assessed using data from a single baited trap over several days or from several baited traps for one day (Nichols and Gardner 2011). Similarly, the communities of dung and carrion beetles attracted by carrion can also be assessed with data from a single baited trap (Ueda 2015). In the present study we used 5 traps per bait per site and installed these for 5 days. Our intensive trap catch system should be reliable for analyses despite the relatively short research period. Our research was performed only in December, although it may be better to have several months of trapping design in order to determine the full beetle community. However, annual data of dung beetle captures in tropical regions with no severe dry season have showed little variation in species richness and/or abundance (Peck and Forsyth 1982, Hanski and Krikken 1991). In tropical regions with a severe dry season beetle captures are generally highest in the wet season with few species collected in the dry season (Janzen 1983, Andresen 2005, Neves et al. 2010). Mean monthly rainfall in the Bukit Soeharto Grand Forest Park (BSGFP), located about 20 km northwest from our study area, is between 120 mm in August and 220 mm in December (Toma et al. 2000). This indicates that our study area is located in a tropical region with no severe dry season where we might expect little seasonal variation in dung beetle captures. Moreover, December has the largest rainfall in a year in BSGFP, suggesting that the large species richness and abundance of dung beetles may occur during the wet season. Because there was no severe dry season and considerable rain during December in our study area, our trapping period should be adequate for comparative studies of dung beetles communities.

It should be noted that this study was a preliminary study carried out in only one area. Due to the paucity of data in this study, we were forced during data analysis to pool the data from trap pairs for providing proper replication though they came from the same transect. As such, further study is needed to confirm the results of this study.

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森林と境界をもつ草原内にベイトトラップを配置する場合の緩衝帯および草原内の河畔林の有用性：インドネシア共和国東カリマンタン州の食糞性コガネムシ類群集についての予備的研究

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要 旨

食糞性コガネムシ類（以下糞虫）は熱帯地域において生息地の質の有用な指標者である。昆虫を誘引するベイトトラップを用いて生息地の質を評価する場合、調査地外からの昆虫の移入を制限するようにトラップを配置する必要がある。森林性糞虫種の草原への移入を制限する林縁からの最短距離をみるために、東カリマンタンのアカシアマンギウム植林地と小さな二次林からなる林の林縁から 100、200、300 m草原内に入ったトランセクト上に落とし穴式ベイトトラップを設置した。また、草原の縁に沿う河畔林の、森林性種の生息地としての有用性を評価するために、草原に接する河畔林にトラップを設置した。植林地内にもっとも多かった種が草原内で捕獲されなかったことから、100 mの緩衝帯は、草原内ベイトトラップへの森林性種の不要な捕獲を制限するのに充分であると考えられた。また、植林地内に多い種が河畔林でも多かったことから、草原内の河畔林が森林性種の生息地として作用すると考えられた。林縁と河畔林からの距離は、いずれも草原内の各トラップ位置における種構成の序列化の結果と関係しなかったことから、これらからの距離は草原内の糞虫群集に影響しないと考えられた。

キーワード：落とし穴式ベイトトラップ、腐肉、コガネムシ上科食糞群、距離、チガヤ、コガネムシ科、細流回廊

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