

Article title: Effects of artificial light on the arrival time, duration of stay, and departure time of nocturnal flying insects

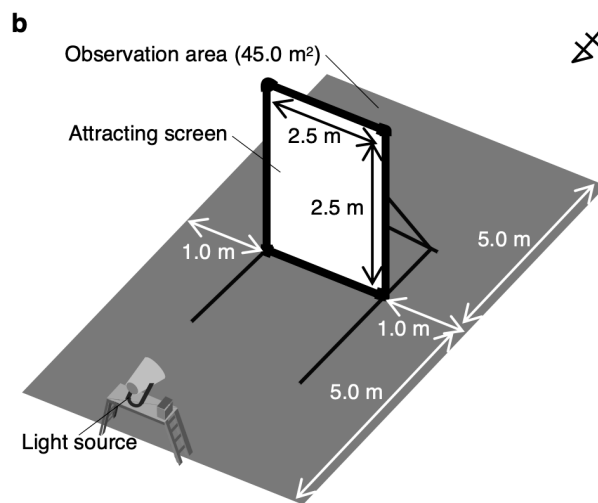
Journal name: Applied Entomology and Zoology

Author names: Masaki Kasai, Mantaro Hironaka

Affiliation and e-mail address of the corresponding author: Department of Applied Entomology, Faculty of Bioproduction Science, Ishikawa Prefectural University E-mail: m.kasai0723@gmail.com

Online Resource 1 Environmental conditions on the day of the survey

Month	Day	Mean temperature (°C)	Maximum temperature (°C)	Minimum temperature (°C)	Mean humidity (%)	Mean wind speed (m/s)	Weather at the start of the survey	Presence or absence of rainfall
May	28	17.4	27.4	13.5	68.4	1.3	Sunny	Absence
June	3	20.9	28.5	16.5	65.7	0.7	Sunny	Absence
	7	19.8	31.0	15.0	77.4	0.8	Sunny	Absence
	9	24.9	32.0	20.0	64.3	0.8	Sunny	Absence
	16	20.1	23.0	17.6	76.6	1.0	Cloudy	Absence
	21	21.7	24.0	20.0	79.8	0.9	Cloudy	Absence
	23	22.5	27.7	20.2	81.8	1.0	Sunny	Absence
July	8	22.8	25.6	22.0	97.0	0.6	Cloudy	Presence
	16	25.0	27.5	23.6	84.5	0.9	Cloudy	Absence
	19	25.2	29.6	23.6	84.5	0.4	Cloudy	Presence
	22	23.6	25.5	22.0	91.0	0.8	Cloudy	Presence
	29	25.0	27.4	24.3	81.5	0.5	Sunny	Absence
August	4	26.0	31.3	23.6	73.8	0.9	Cloudy	Absence



Online Resource 2 Picture (a) and schematic diagram (b) of the light trap. A 2.5 m × 2.5 m frame made of metal pipe with a white cloth attached was used as the attracting screen. In addition to the attracting screen, a 4.5 m × 10 m area around the attracting screen was defined as the observation area.

Online Resource 3 Taxonomic classes and observed individuals of the 63 insect species

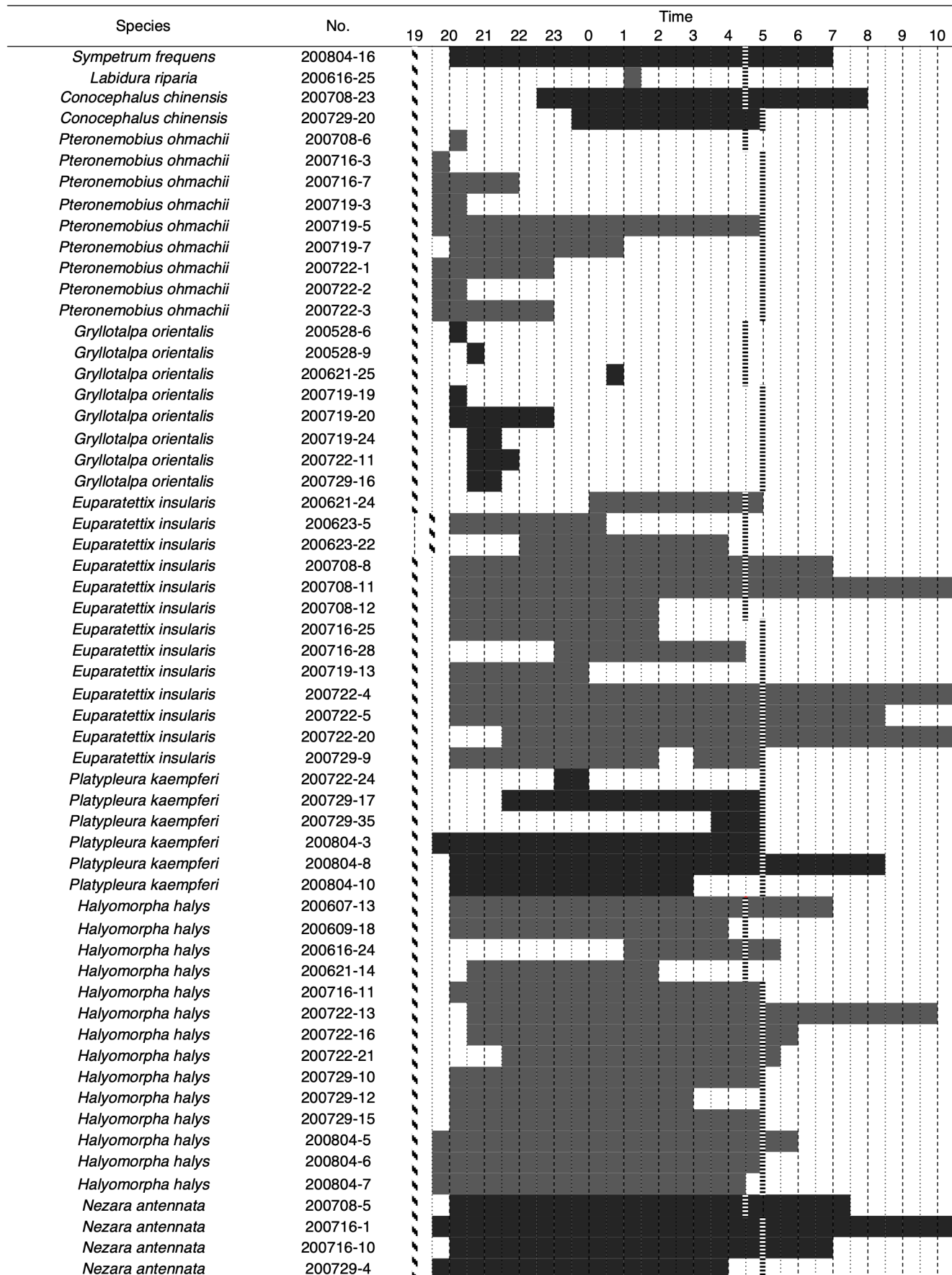
Order	Family	Species	Number of individuals	Number of return individuals ^a	Number of non-flying individuals ^b
Odonata	Libellulidae	<i>Sympetrum frequens</i>	1	0	0
Dermaptera	Labiduridae	<i>Labidura riparia</i>	1	0	0
Orthoptera	Tettigoniidae	<i>Conocephalus chinensis</i>	2	0	0
Orthoptera	Trigonidiidae	<i>Pteronemobius ohmachi</i>	9	0	0
Orthoptera	Gryllotalpidae	<i>Gryllotalpa orientalis</i>	8	0	0
Orthoptera	Tetrigidae	<i>Euparatettix insularis</i>	13	1	3
Hemiptera	Cicadidae	<i>Platyleura kaempferi</i>	6	0	0
Hemiptera	Pentatomidae	<i>Halyomorpha halys</i>	14	0	0
Hemiptera	Pentatomidae	<i>Nezara antennata</i>	9	0	1
Hemiptera	Pentatomidae	<i>Plautia stali</i>	22	1	0
Hemiptera	Pentatomidae	<i>Glaucias subpunctatus</i>	20	1	1
Hemiptera	Pentatomidae	<i>Piezodorus hybneri</i>	4	0	0
Hemiptera	Acanthosomatidae	<i>Sastragala esakii</i>	5	0	0
Hemiptera	Alydidae	<i>Riptortus pedestris</i>	10	0	0
Hemiptera	Alydidae	<i>Leptocoris chinensis</i>	3	0	0
Hemiptera	Reduviidae	<i>Sirthena flavipes</i>	9	1	0
Hemiptera	Gerridae	<i>Gerris latidominis</i>	3	0	0
Megaloptera	Corydalidae	<i>Prothermes grandis</i>	1	0	0
Neuroptera	Chrysopidae	<i>Chrysopini</i> sp.	3	0	0
Coleoptera	Carabidae	<i>Cylindera elisae</i>	2	0	0
Coleoptera	Carabidae	<i>Anisodactylus signatus</i>	11	0	0
Coleoptera	Carabidae	<i>Anoplogenus cyanescens</i>	14	1	0
Coleoptera	Hydrophilidae	<i>Hydrochara affinis</i>	16	1	0
Coleoptera	Hydrophilidae	<i>Sternolophus rufipes</i>	1	0	0
Coleoptera	Hydrophilidae	<i>Berosus punctipennis</i>	13	1	0
Coleoptera	Lucanidae	<i>Dorcus titanus</i>	1	0	0
Coleoptera	Elateridae	<i>Elateridae</i> sp.	5	0	0
Coleoptera	Scarabaeidae	<i>Anomala albopilosa</i>	23	0	0
Coleoptera	Scarabaeidae	<i>Anomala rufocuprea</i>	5	0	0
Coleoptera	Scarabaeidae	<i>Anomala daimiana</i>	1	0	0
Coleoptera	Scarabaeidae	<i>Anomara orientalis</i>	6	0	0
Coleoptera	Scarabaeidae	<i>Miridiba castanea</i>	2	0	0
Coleoptera	Scarabaeidae	<i>Holotrichia kiotonensis</i>	1	1	0
Coleoptera	Scarabaeidae	<i>Trypoxylus dichotomus</i>	4	0	0
Coleoptera	Scarabaeidae	<i>Melolontha japonica</i>	4	0	2
Coleoptera	Tenebrionidae	<i>Gonocephalum coriaceum</i>	1	0	0
Coleoptera	Oedemeridae	<i>Xanthochroa waterhousei</i>	2	0	0
Coleoptera	Coccinellidae	<i>Harmonia axyridis</i>	11	2	0
Coleoptera	Cerambycidae	<i>Mesosa hirsuta</i>	1	0	0
Diptera	Tipulidae	<i>Tipula aino</i>	14	0	0
Diptera	Tephritidae	<i>Zeugodacus scutellatus</i>	1	0	0
Trichoptera	-	<i>Trichoptera</i> sp.	3	0	0
Lepidoptera	Crambidae	<i>Parapediasia teterrellus</i>	7	0	2
Lepidoptera	Crambidae	<i>Prodasynemis inornata</i>	3	0	0
Lepidoptera	Crambidae	<i>Sinibotys evenoralis</i>	2	0	0
Lepidoptera	Crambidae	<i>Palpita nigropunctalis</i>	2	0	0
Lepidoptera	Limacodidae	<i>Parasa consocia</i>	8	0	3
Lepidoptera	Geometridae	<i>Ourapteryx nivea</i>	1	0	0
Lepidoptera	Sphingidae	<i>Agrius convolvuli</i>	4	0	3
Lepidoptera	Sphingidae	<i>Clanis bilineata tsingtauca</i>	2	0	1
Lepidoptera	Sphingidae	<i>Callambulyx tatarinovii gabyae</i>	15	0	7
Lepidoptera	Sphingidae	<i>Ampelophaga rubiginosa</i>	1	0	0
Lepidoptera	Sphingidae	<i>Acosmeryx castanea</i>	12	0	7
Lepidoptera	Sphingidae	<i>Macroglossum pyrrhosticta</i>	1	1	0
Lepidoptera	Sphingidae	<i>Theretra oldenlandiae</i>	12	0	8
Lepidoptera	Sphingidae	<i>Theretra japonica</i>	3	0	3
Lepidoptera	Sphingidae	<i>Theretra nessus</i>	1	0	0
Lepidoptera	Sphingidae	<i>Deilephila elpemor</i>	5	0	3
Lepidoptera	Sphingidae	<i>Marumba gaschkewitschii echephron</i>	4	0	3
Lepidoptera	Notodontidae	<i>Phalera flavesces</i>	1	0	1
Lepidoptera	Noctuidae	<i>Lygephila maxima</i>	1	0	0
Lepidoptera	Noctuidae	<i>Sarbanissa subflava</i>	1	0	0
Hymenoptera	Icheumonidae	<i>Icheumonidae</i> sp.	1	0	0

^a The number of individuals that flew away and then flew back again.

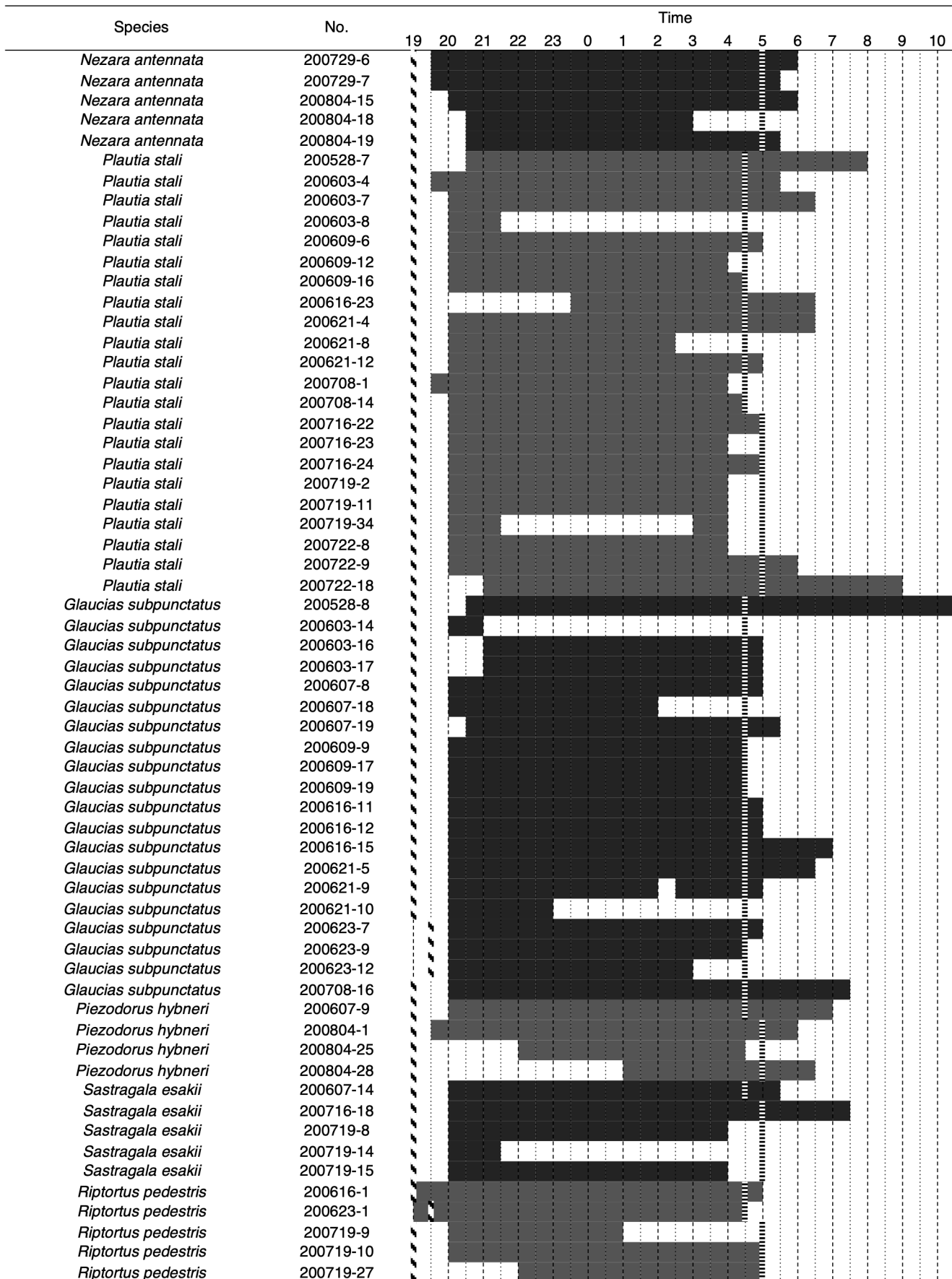
^b The number of individuals remaining at the 10:00 AM cutoff time the next day.

^c The gray-colored cells represent the 27 species for which stay patterns were analyzed, and their gray density represents the three types shown in Figure 3.

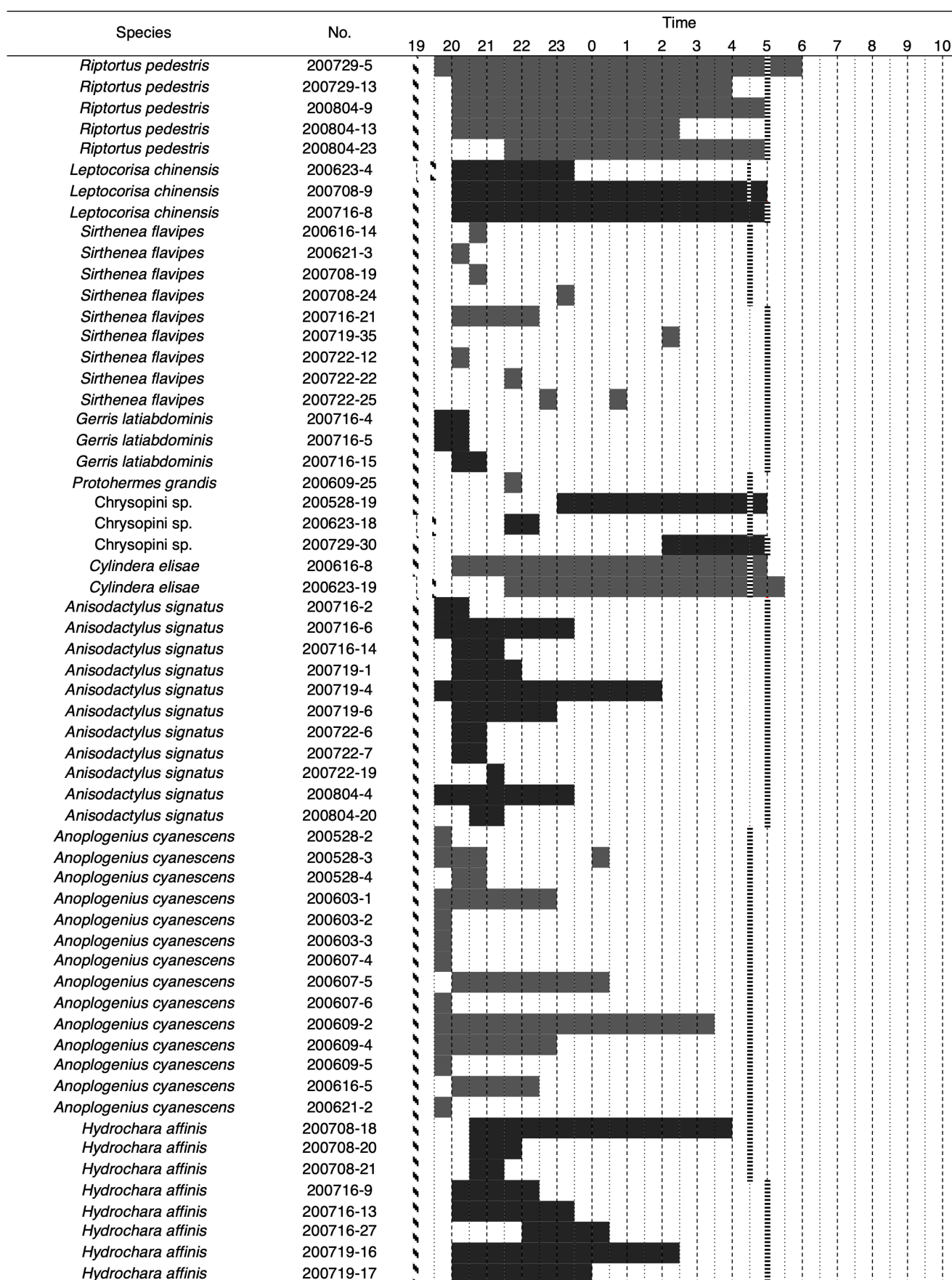
Online Resource 4 The duration of stay for all individuals representing 63 insect species. The gray areas indicate the duration of stay for each individual. The same shade of gray indicates that of the same species. The diagonal line in the figure indicates sunset on each survey day. The striped lines in the figure indicate sunset time for each survey day. Time is shown in Japan Standard Time (JST).



Online Resource 4 Continued



Online Resource 4 Continued



Online Resource 4 Continued

[illegible]

Online Resource 4 Continued

Species	No.	Time																
		19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	
<i>Anomara orientalis</i>	200616-2																	
<i>Anomara orientalis</i>	200616-3																	
<i>Anomara orientalis</i>	200621-1																	
<i>Anomara orientalis</i>	200708-2																	
<i>Miridiba castanea</i>	200528-11																	
<i>Miridiba castanea</i>	200609-13																	
<i>Holotrichia kiotonensis</i>	200616-10																	
<i>Trypoxylus dichotomus</i>	200603-25																	
<i>Trypoxylus dichotomus</i>	200708-27																	
<i>Trypoxylus dichotomus</i>	200729-23																	
<i>Trypoxylus dichotomus</i>	200804-30																	
<i>Melolontha japonica</i>	200623-15																	
<i>Melolontha japonica</i>	200708-22																	
<i>Melolontha japonica</i>	200719-21																	
<i>Melolontha japonica</i>	200719-22																	
<i>Gonocephalum coriaceum</i>	200623-16																	
<i>Xanthochroa waterhousei</i>	200616-13																	
<i>Xanthochroa waterhousei</i>	200616-18																	
<i>Harmonia axyridis</i>	200528-14																	
<i>Harmonia axyridis</i>	200603-10																	
<i>Harmonia axyridis</i>	200603-13																	
<i>Harmonia axyridis</i>	200603-20																	
<i>Harmonia axyridis</i>	200607-10																	
<i>Harmonia axyridis</i>	200607-15																	
<i>Harmonia axyridis</i>	200607-16																	
<i>Harmonia axyridis</i>	200609-11																	
<i>Harmonia axyridis</i>	200621-6																	
<i>Harmonia axyridis</i>	200623-2																	
<i>Harmonia axyridis</i>	200623-10																	
<i>Mesosa hirsuta</i>	200621-21																	
<i>Tipula aino</i>	200616-4																	
<i>Tipula aino</i>	200621-19																	
<i>Tipula aino</i>	200623-21																	
<i>Tipula aino</i>	200708-3																	
<i>Tipula aino</i>	200708-15																	
<i>Tipula aino</i>	200708-17																	
<i>Tipula aino</i>	200716-12																	
<i>Tipula aino</i>	200716-20																	
<i>Tipula aino</i>	200716-26																	
<i>Tipula aino</i>	200719-12																	
<i>Tipula aino</i>	200719-23																	
<i>Tipula aino</i>	200719-25																	
<i>Tipula aino</i>	200729-21																	
<i>Tipula aino</i>	200729-31																	
<i>Zeugodacus scutellatus</i>	200623-25																	
<i>Trichoptera</i> sp.	200616-19																	
<i>Trichoptera</i> sp.	200621-20																	
<i>Trichoptera</i> sp.	200623-23																	
<i>Parapediasia teterrellus</i>	200528-1																	
<i>Parapediasia teterrellus</i>	200603-18																	
<i>Parapediasia teterrellus</i>	200603-19																	
<i>Parapediasia teterrellus</i>	200609-22																	
<i>Parapediasia teterrellus</i>	200616-20																	
<i>Parapediasia teterrellus</i>	200616-21																	
<i>Parapediasia teterrellus</i>	200621-27																	
<i>Prodasynemis inornata</i>	200609-21																	
<i>Prodasynemis inornata</i>	200621-13																	
<i>Prodasynemis inornata</i>	200623-14																	
<i>Sinibotys evenoralis</i>	200621-22																	

Online Resource 4 Continued

Species	No.	Time																
		19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	
<i>Sinibotys evenoralis</i>	200623-17																	
<i>Palpita nigropunctalis</i>	200528-10																	
<i>Palpita nigropunctalis</i>	200621-15																	
<i>Parasa consocia</i>	200621-26																	
<i>Parasa consocia</i>	200708-25																	
<i>Parasa consocia</i>	200708-26																	
<i>Parasa consocia</i>	200719-28																	
<i>Parasa consocia</i>	200719-29																	
<i>Parasa consocia</i>	200722-28																	
<i>Parasa consocia</i>	200722-29																	
<i>Parasa consocia</i>	200804-26																	
<i>Ourapteryx nivea</i>	200616-22																	
<i>Agrius convolvuli</i>	200621-23																	
<i>Agrius convolvuli</i>	200729-24																	
<i>Agrius convolvuli</i>	200729-25																	
<i>Agrius convolvuli</i>	200804-14																	
<i>Clanis bilineata tsingtauca</i>	200716-32																	
<i>Clanis bilineata tsingtauca</i>	200722-27																	
<i>Callambulyx tatarinovii gabyae</i>	200528-16																	
<i>Callambulyx tatarinovii gabyae</i>	200528-18																	
<i>Callambulyx tatarinovii gabyae</i>	200528-20																	
<i>Callambulyx tatarinovii gabyae</i>	200603-21																	
<i>Callambulyx tatarinovii gabyae</i>	200603-23																	
<i>Callambulyx tatarinovii gabyae</i>	200603-24																	
<i>Callambulyx tatarinovii gabyae</i>	200607-23																	
<i>Callambulyx tatarinovii gabyae</i>	200607-24																	
<i>Callambulyx tatarinovii gabyae</i>	200609-28																	
<i>Callambulyx tatarinovii gabyae</i>	200722-30																	
<i>Callambulyx tatarinovii gabyae</i>	200722-31																	
<i>Callambulyx tatarinovii gabyae</i>	200722-36																	
<i>Callambulyx tatarinovii gabyae</i>	200729-19																	
<i>Callambulyx tatarinovii gabyae</i>	200729-33																	
<i>Callambulyx tatarinovii gabyae</i>	200804-31																	
<i>Ampelophaga rubiginosa</i>	200722-33																	
<i>Acosmeryx castanea</i>	200528-13																	
<i>Acosmeryx castanea</i>	200609-27																	
<i>Acosmeryx castanea</i>	200621-28																	
<i>Acosmeryx castanea</i>	200716-30																	
<i>Acosmeryx castanea</i>	200719-26																	
<i>Acosmeryx castanea</i>	200719-31																	
<i>Acosmeryx castanea</i>	200722-32																	
<i>Acosmeryx castanea</i>	200722-34																	
<i>Acosmeryx castanea</i>	200722-35																	
<i>Acosmeryx castanea</i>	200729-22																	
<i>Acosmeryx castanea</i>	200729-26																	
<i>Acosmeryx castanea</i>	200729-27																	
<i>Macroglossum pyrrhosticta</i>	200621-17																	
<i>Theretra oldenlandiae</i>	200528-17																	
<i>Theretra oldenlandiae</i>	200609-23																	
<i>Theretra oldenlandiae</i>	200609-26																	
<i>Theretra oldenlandiae</i>	200621-18																	
<i>Theretra oldenlandiae</i>	200621-29																	
<i>Theretra oldenlandiae</i>	200623-24																	
<i>Theretra oldenlandiae</i>	200716-31																	
<i>Theretra oldenlandiae</i>	200719-30																	
<i>Theretra oldenlandiae</i>	200719-32																	
<i>Theretra oldenlandiae</i>	200722-26																	
<i>Theretra oldenlandiae</i>	200729-29																	
<i>Theretra oldenlandiae</i>	200729-32																	

Online Resource 4 Continued

[illegible]