Abstract

Monitoring of Japanese Encephalitis Vector Mosquitoes (*Culex tritaeniorhynchus*) in Korea, 2020

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In order to monitoring of Japanese encephalitis (JE) outbreak in South Korea, vector mosquitoes were collected by operating black light trap in twice a week at nine locations across the whole country from April to October 2020. The number of individuals collected per trap per day was calculated and analyzed for comparison. In 2020 collecting period, 10,635 mosquitoes were collected, which marked a 53.7% decrease from 2019 when 22,962 mosquitoes were collected. Among the total mosquitoes density, the occurrence rate of vector mosquitoes density was 16.5% in 2020; a 8.5% increase from 2019. Due to the low average temperature and large number of precipitation days and amounts, the total number of mosquitoes decreased in the summer months of 2020.

In addition, large amounts of precipitation in late summer and warmer temperature in early autumn contributed to the creation of suitable habitats for vector mosquito larvae growth. Thus, the rate of occurrence of vector mosquitoes increased from 2019. 2020 JE watch and warning were issued on March 26 and July 23, respectively, and we need continuously monitoring and data analysis in high JE outbreak regions.

Keywords: Japanese encephalitis, vector mosquitoes, *Culex tritaeniorhynchus*

Table 1. Total number of mosquitoes by species in 2020

Species	Number of mosquitoes (%)
Aedes vexans nipponii	82,416 (43.4)
Anopheles spp.	63,024 (33.2)
Culex tritaeniorhynchus	31,395 (16.5)
Culex pipiens pallens	6,815 (3.6)
Armigeres subalbatus	4,280 (2.3)
Ochlerotatus koreicus	1,372 (0.7)
Culex orientalis	290 (0.2)
Ochlerotatus togoi	118 (0.1)
Aedes albopictus	72 (<0.1)
Mansonia uniformis	72 (<0.1)
Culex bitaeniorhynchus	23 (<0.1)
Culex vagans	10 (<0.1)
Coquillettidia ochracea	6 (<0.1)
Ochlerotatus dorsalis	5 (<0.1)
Total	189,898 (100.0)

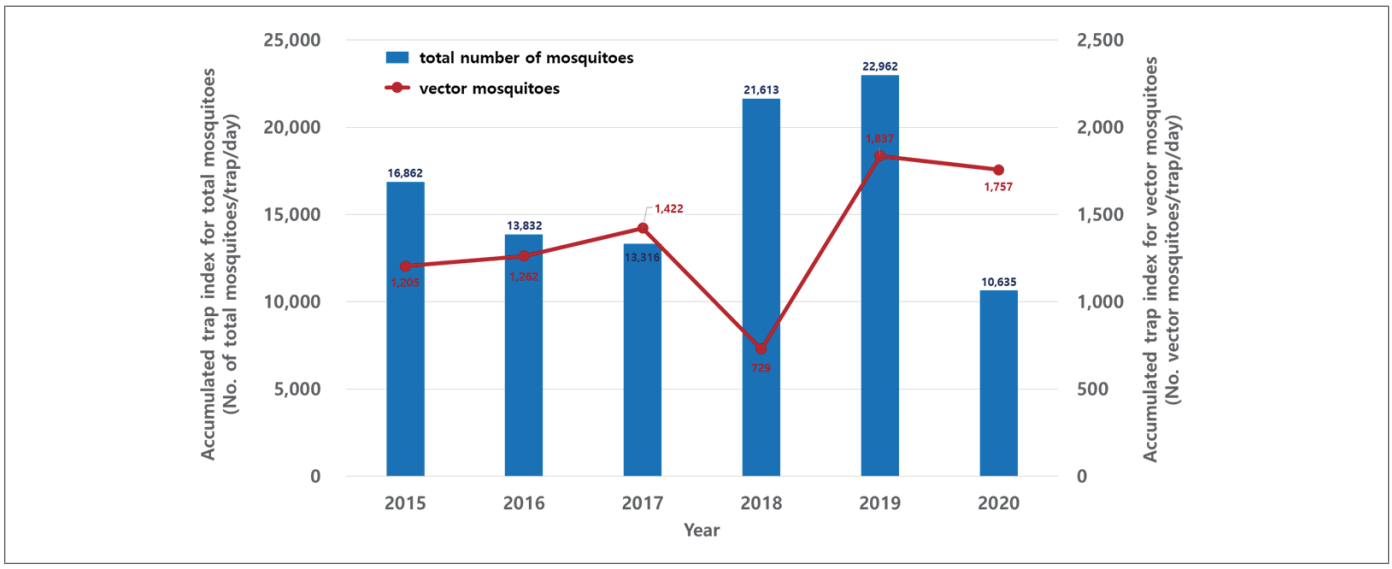


Figure 1. Outbreaks of total mosquitoes and vector mosquitoes by year (2015 to 2020)

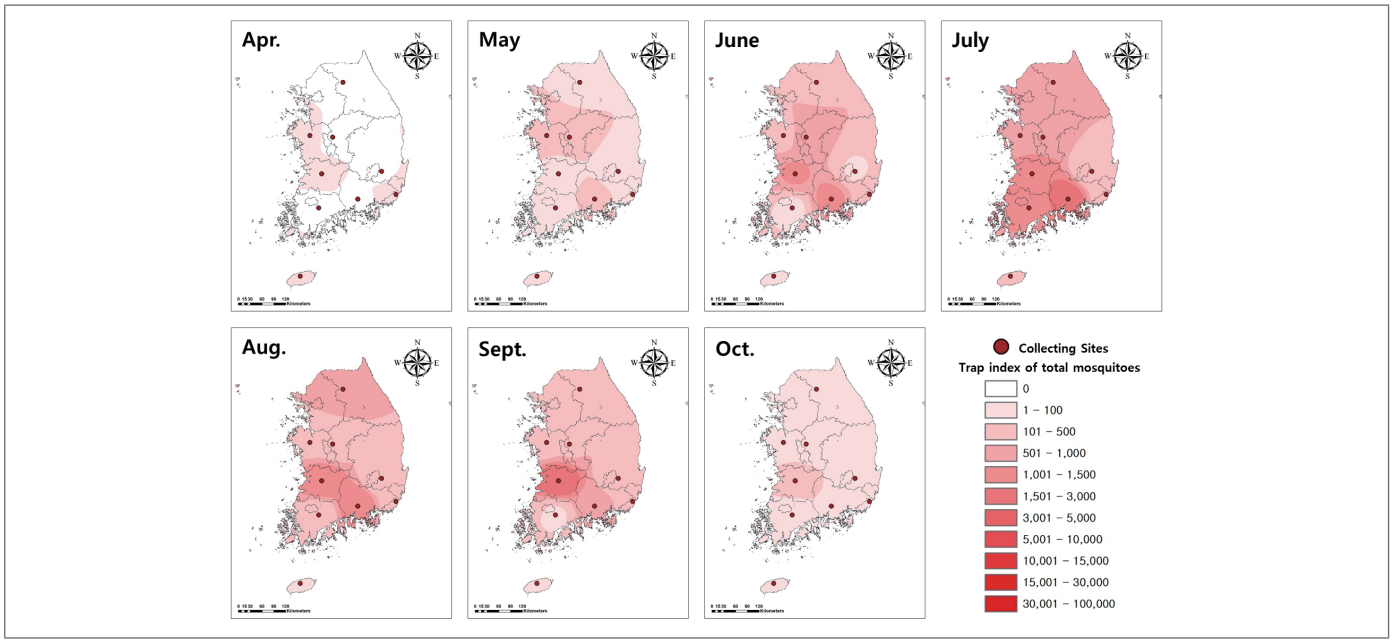
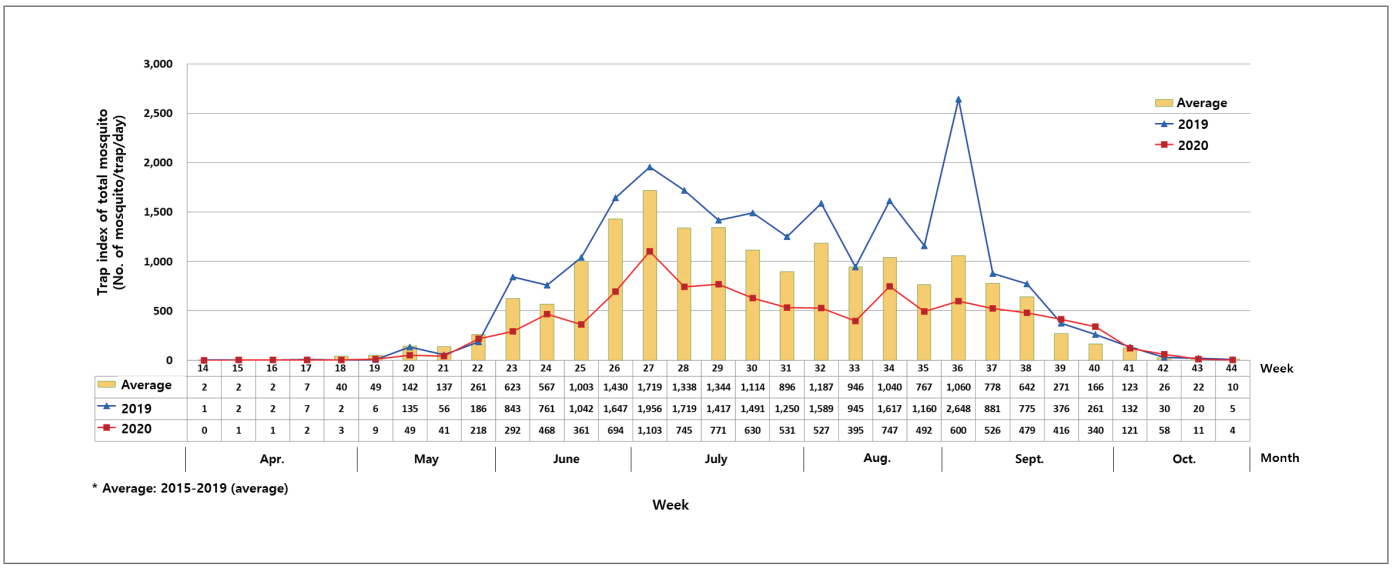


Figure 2. Monthly incidences of total mosquitoes in 2020



Week	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Average	2	2	2	7	40	49	142	137	261	623	567	1,003	1,430	1,719	1,338	1,344	1,114	896	1,187	946	1,040	767	1,060	778	642	271	166	123	26	22	10
2019	1	2	2	7	2	6	135	56	186	843	761	1,042	1,647	1,956	1,719	1,417	1,491	1,250	1,589	945	1,617	1,160	2,648	881	775	376	261	132	30	20	5
2020	0	1	1	2	3	9	49	41	218	292	468	361	694	1,103	745	771	630	531	527	395	747	492	600	526	479	416	340	121	58	11	4

Figure 3. Weekly incidences of total mosquitoes in 2020

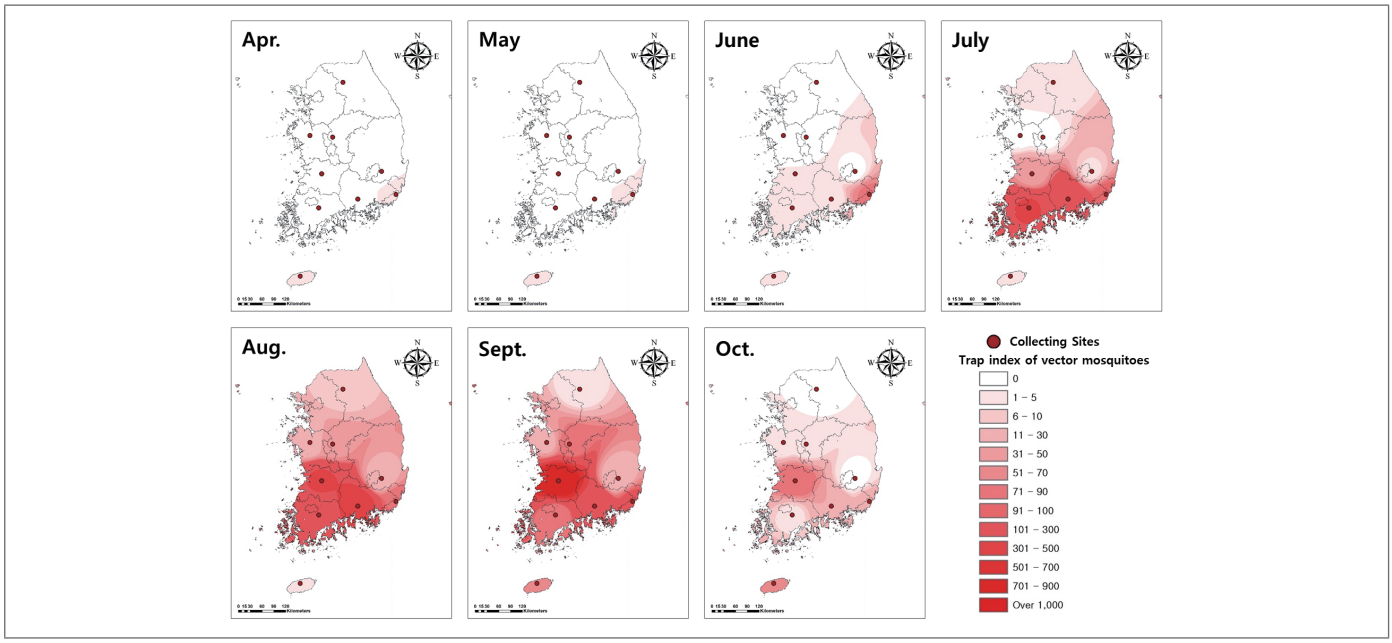
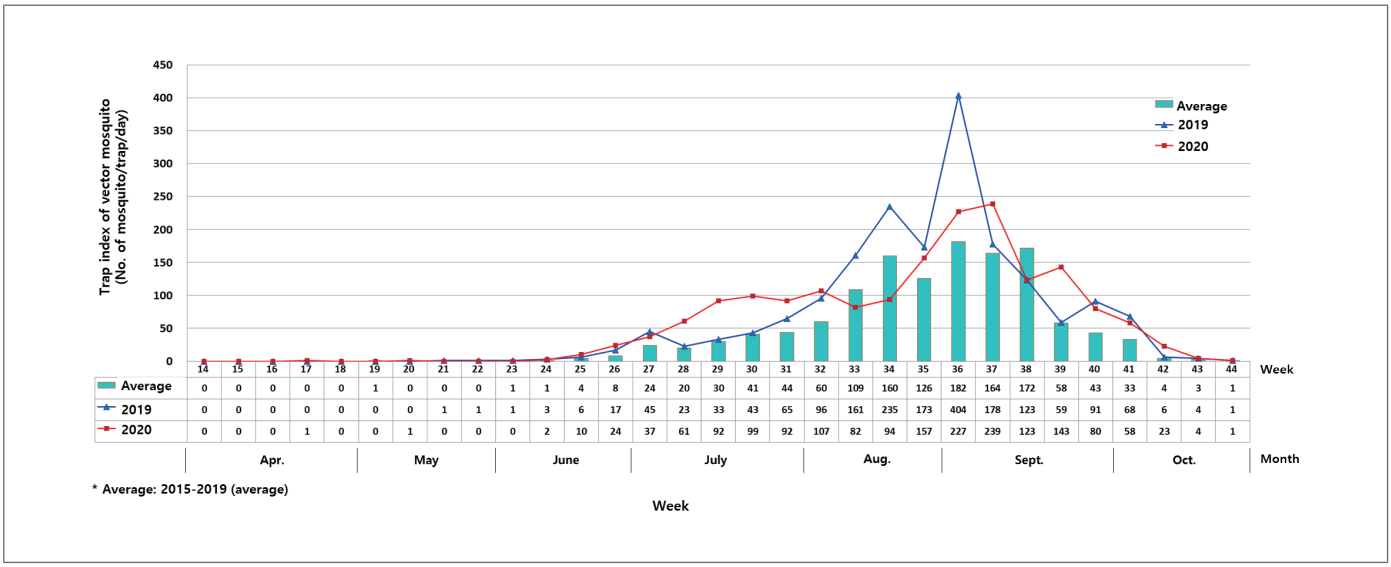


Figure 4. Monthly incidences of *Culex tritaeniorhynchus* in 2020



Week	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Average	0	0	0	0	0	1	0	0	0	1	1	4	8	24	20	30	41	44	60	109	160	126	182	164	172	58	43	33	4	3	1
2019	0	0	0	0	0	0	0	1	1	1	3	6	17	45	23	33	43	65	96	161	235	173	404	178	123	59	91	68	6	4	1
2020	0	0	0	1	0	0	1	0	0	0	2	10	24	37	61	92	99	92	107	82	94	157	227	239	123	143	80	58	23	4	1

Figure 5. Weekly incidences of *Culex tritaeniorhynchus* in 2020

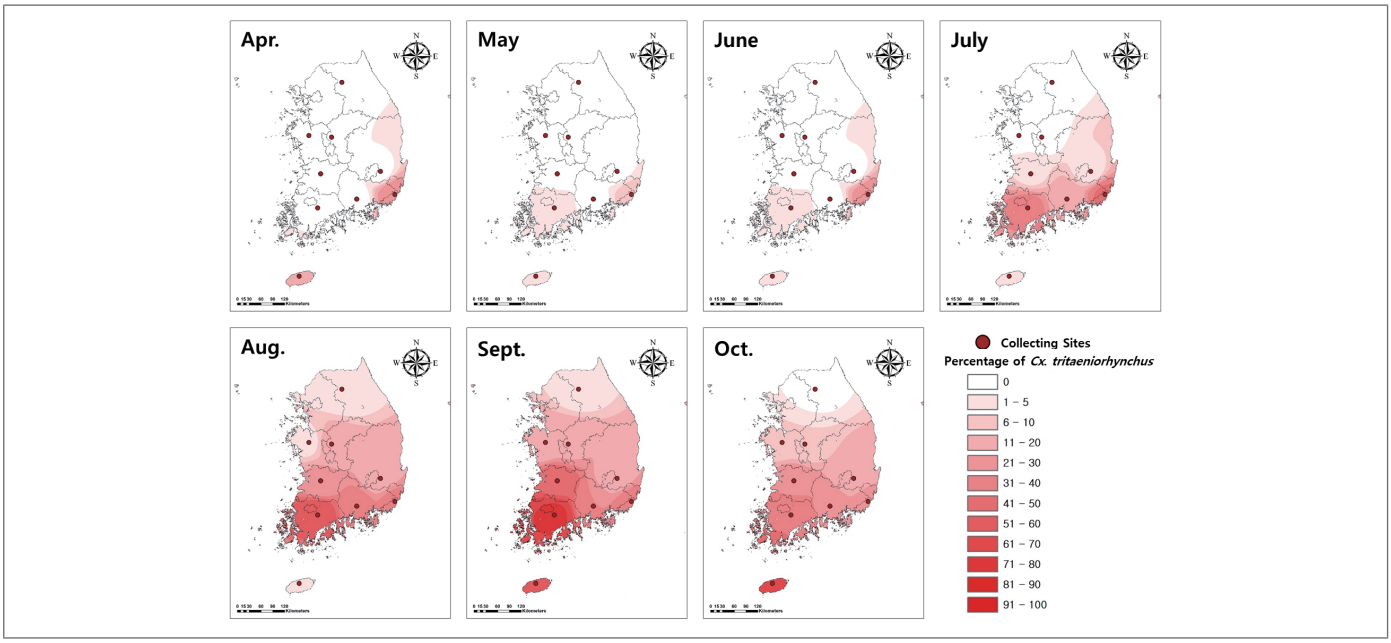
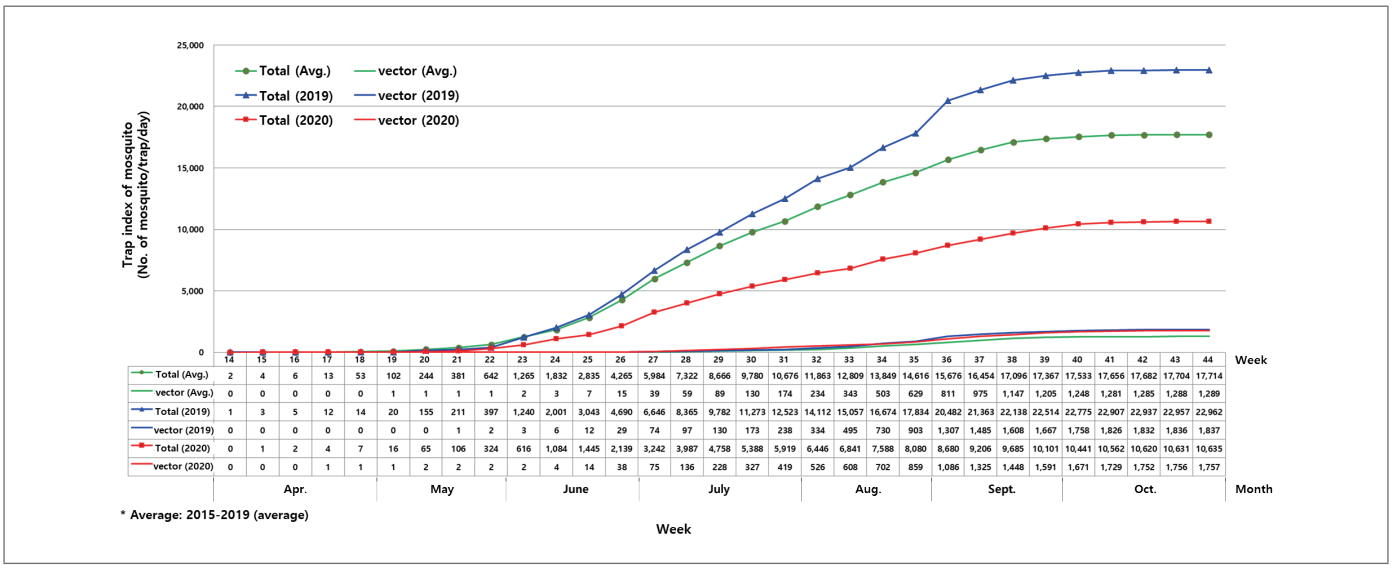


Figure 6. The proportion of *Culex tritaeniorhynchus* to total mosquitoes in 2020



Week	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Total (Avg.)	2	4	6	13	53	102	244	381	642	1,265	1,832	2,835	4,265	5,984	7,322	8,666	9,780	10,676	11,863	12,809	13,849	14,616	15,676	16,454	17,096	17,367	17,533	17,656	17,682	17,704	17,714
vector (Avg.)	0	0	0	0	0	1	1	1	1	2	3	7	15	39	59	89	130	174	234	343	503	629	811	975	1,147	1,205	1,248	1,281	1,285	1,288	1,289
Total (2019)	1	3	5	12	14	20	155	211	397	1,240	2,001	3,043	4,690	6,646	8,365	9,782	11,273	12,523	14,112	15,057	16,674	17,834	20,482	21,363	22,138	22,514	22,775	22,907	22,937	22,957	22,962
vector (2019)	0	0	0	0	0	0	0	1	2	3	6	12	29	74	97	130	173	238	334	495	730	903	1,307	1,485	1,608	1,667	1,758	1,826	1,832	1,836	1,837
Total (2020)	0	1	2	4	7	16	65	106	324	616	1,084	1,445	2,139	3,242	3,987	4,758	5,388	5,919	6,446	6,841	7,588	8,080	8,680	9,206	9,685	10,101	10,441	10,562	10,620	10,631	10,635
vector (2020)	0	0	0	1	1	1	2	2	2	2	4	14	38	75	136	228	327	419	526	608	702	859	1,086	1,325	1,448	1,591	1,671	1,729	1,752	1,756	1,757

Figure 7. Accumulative monitoring status of total mosquitoes and *Culex tritaeniorhynchus* in 2020

Table 2. First collected week and occurrence population of *Culex tritaeniorhynchus* by region in 2020

City · Province	Region	First week of collected Ct*	Weeks of Ct* over 50% population
Gangwon	Chuncheon-si	28	-
Chungbuk	Cheongju-si	33	-
Chungnam	Yesan-gun	29	-
Gyeongbuk	Gyeongsan-si	26	-
Jeonbuk	Jeonju-si	24	36 (72%)
Gyeongnam	Jinju-si	25	-
JeonNam	Hwasun-gun	22	-
Busan	Gijang-gun	15	-
Jeju	Jeju-si	15	-

*Ct : *Culex tritaeniorhynchus*