

Analysis of *Linepitha humile* (Hymenoptera : Formicidae) distribution and characteristics of accompanying ants near Busan Station, South Korea

Jongwon Song^p, Seung won Lee, Jeongeun Bak, Yongho Cho^c

Ecological Technology Research Team, Division of Ecological Applications Research, National Institute of Ecology, Seoecheon, 33657, Republic of Korea

Abstract

Linepithema humile (Mayr, 1868) is a native South American ant species that has invaded Europe, Asia, Africa, and North America due to human-mediated activities. The invasion of *L. humile* in Korea was first observed near the Busan Station in 2019, and the species was subsequently designated as an “Ecosystem disturbing species” in 2020 to counter its rapid spread. This study investigated the distribution characteristics of ant groups near the Busan station by installing ant traps in the *L. humile* habitat.

A total of 3,767 captured ants from 15 species, 15 genera, and one family were investigated by classification and ordination analyses in this study. The collected ants were classified into six groups on the basis of the TWINSPLAN analysis. Among these, *L. humile* appeared in four groups which did not include *Tetramorium tsushimae*. *T. tsushimae* appeared in the remaining two groups which in turn did not contain *L. humile*. A comparison of the actual distribution with the classification and ordination results revealed that while the groups without *L. humile* were concentrated only in the northern patch, those containing *L. humile* were distributed in other regions. This study thus identified the distribution of ant groups in the *L. humile* emergence area near the Busan Station. Additionally, it can be used as a reference to determine the impact of *L. humile* on native ant colonies in South Korea in future studies.

Introduction

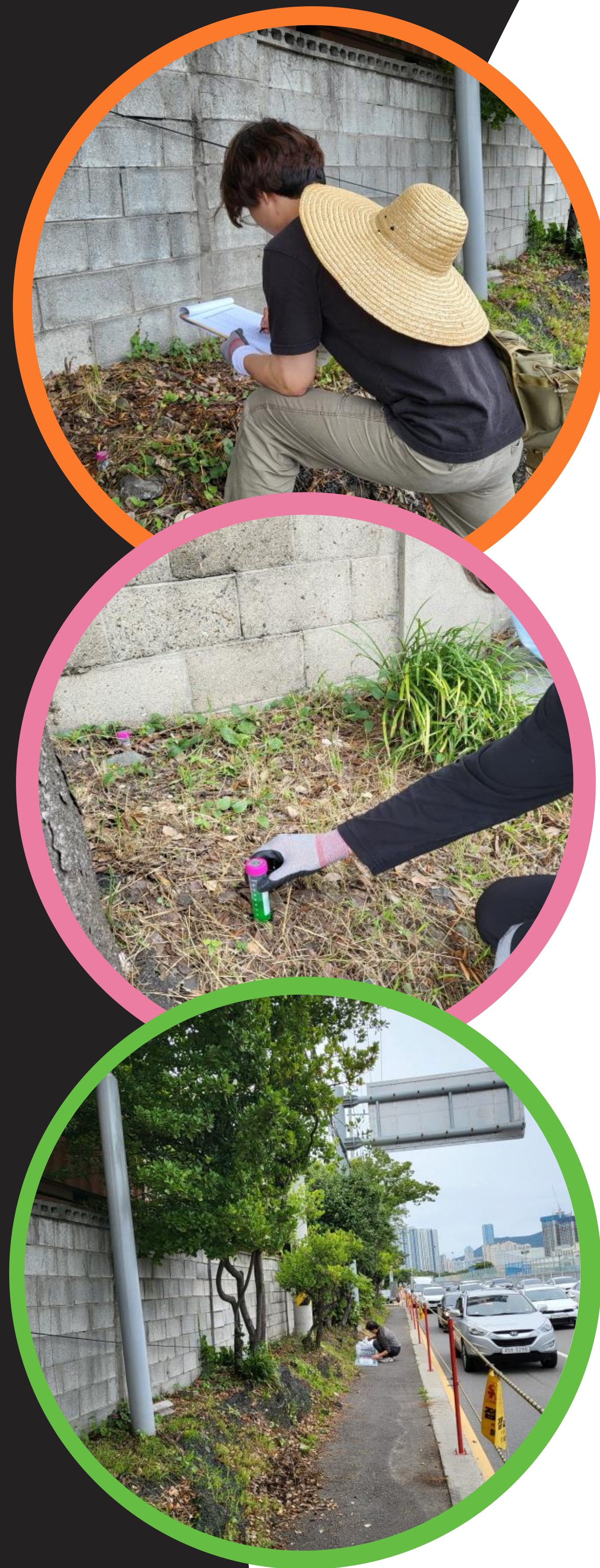
Linepithema humile (Argentine ant) is an ant species native to South America. Human-mediated activities have resulted in its invasion into Europe, Asia, Africa, and North America. Given the potential danger posed by *L. humile*, it was designated as one of the world's 100 most invasive alien species in 2000 by IUCN, which simultaneously issued a warning for its invasion in other countries around the world.

L. humile acquires dominance in a newly invaded area by driving out native ants due to its high adaptability and density. This subsequently disturbs the surrounding ecosystem by altering the distribution of indigenous organisms in the affected area. The invasion of *L. humile* in Korea was first observed near the Busan Station in 2019 and the species was designated as an ecosystem disturbing species in 2020 to prevent its rapid spread.

We confirmed the distribution of *L. humile* near the Busan Station. Additionally, we analyzed the distribution of ant clusters by investigating captured ants from the invaded area. This study thus provides basic data on the impact of *L. humile* on native ant colonies.

Methodology

This study was conducted near the Busan Station, where *L. humile* was recorded for the first time. A field survey was conducted for 4 days from 7/12 to 7/15, 2022, during which traps were installed in flower beds, buildings, and road gaps believed to be inhabited by *L. humile* to capture ants. Classification and ordination were performed on 98 sets of traps, each comprising six traps.



Results & Conclusion

A total of 3,767 ants from 15 species, 15 genera, and one family were investigated in this study. These were classified into six groups on the basis of the classification and ordination analysis results (Fig. 2). *L. humile* was detected in four of the six groups, and not in the other two L and T groups that included *Tetramorium tsushimae*.

A comparison of the Classification & Ordination results and the actual distribution (Fig. 4) revealed that the L and T groups were localized only in the northern patch which had not been invaded by the *L. humile*. In contrast, the groups that included *L. humile*, namely, Lo, LB, LM, and LN were found throughout the Busan station.

We therefore speculate that *L. humile* and *T. tsushimae* occupy similar ecological niches, and plan on investigating further changes in the distribution characteristics of *L. humile* and their effects on native ant species.

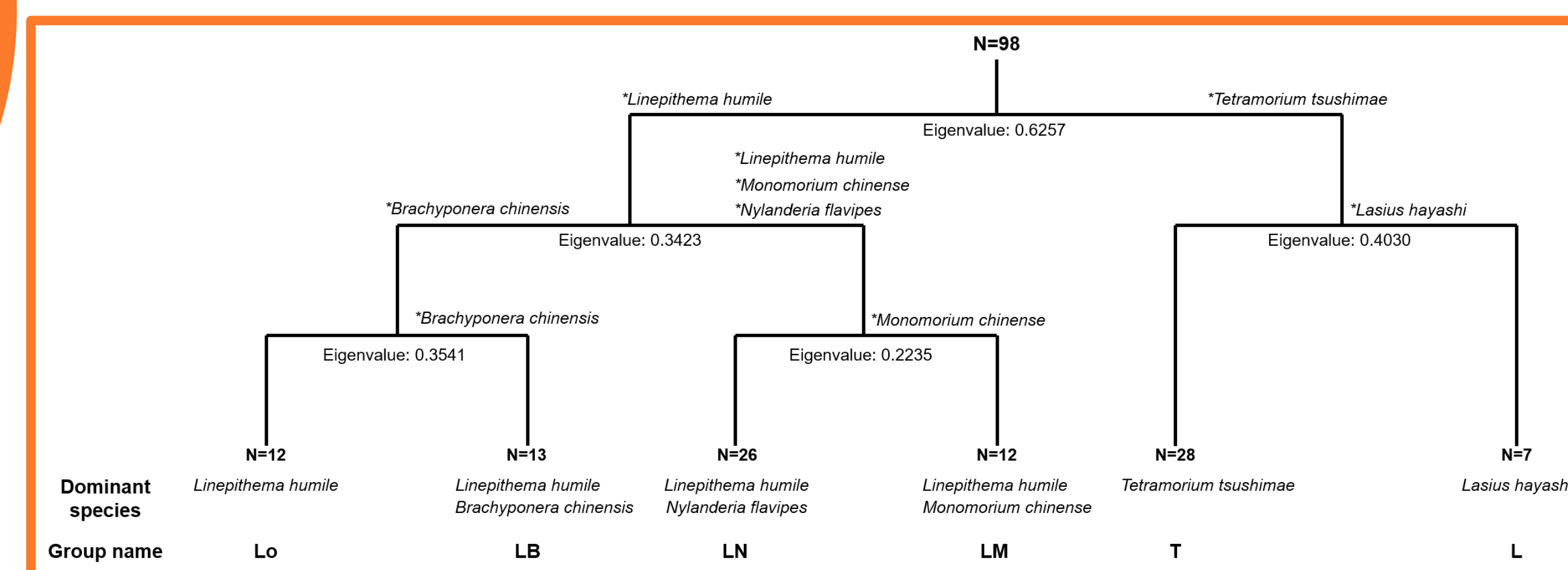


Fig. 2. Classification of 98 plots by TWINSPLAN analysis for ant assemblages (LO: *L. humile* only, LB: *L. humile* & *B. chinensis*, LN: *L. humile* & *N. flavipes*, LM: *L. humile* & *M. chinense*, T: *T. tsushimae*, and L: *L. hayashi*).

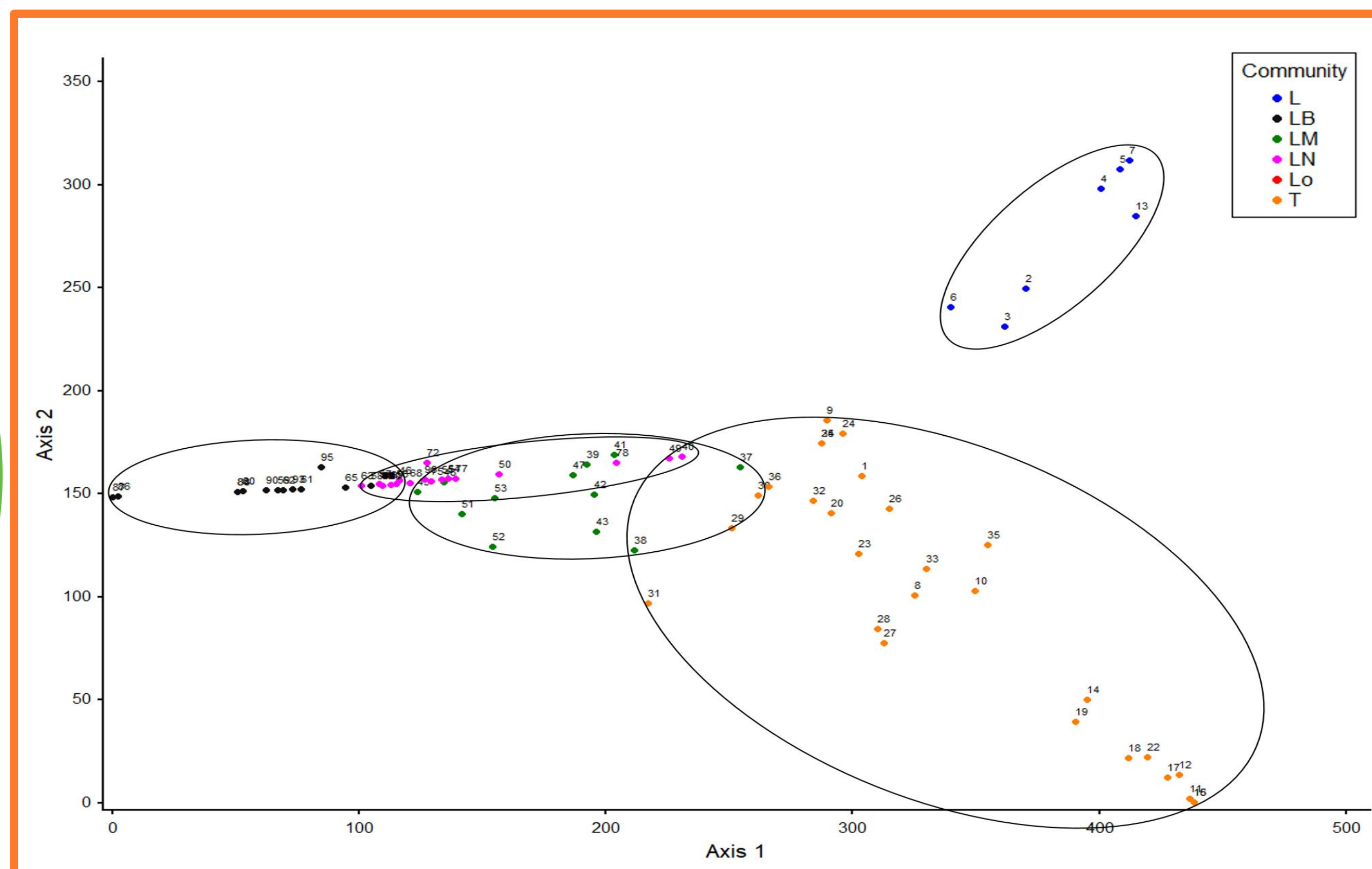


Fig. 3. Ordination of DCA for the ant assemblages(Axis1 gradient length: 4.382, Axis2 gradient length: 3.114, p<0.05).

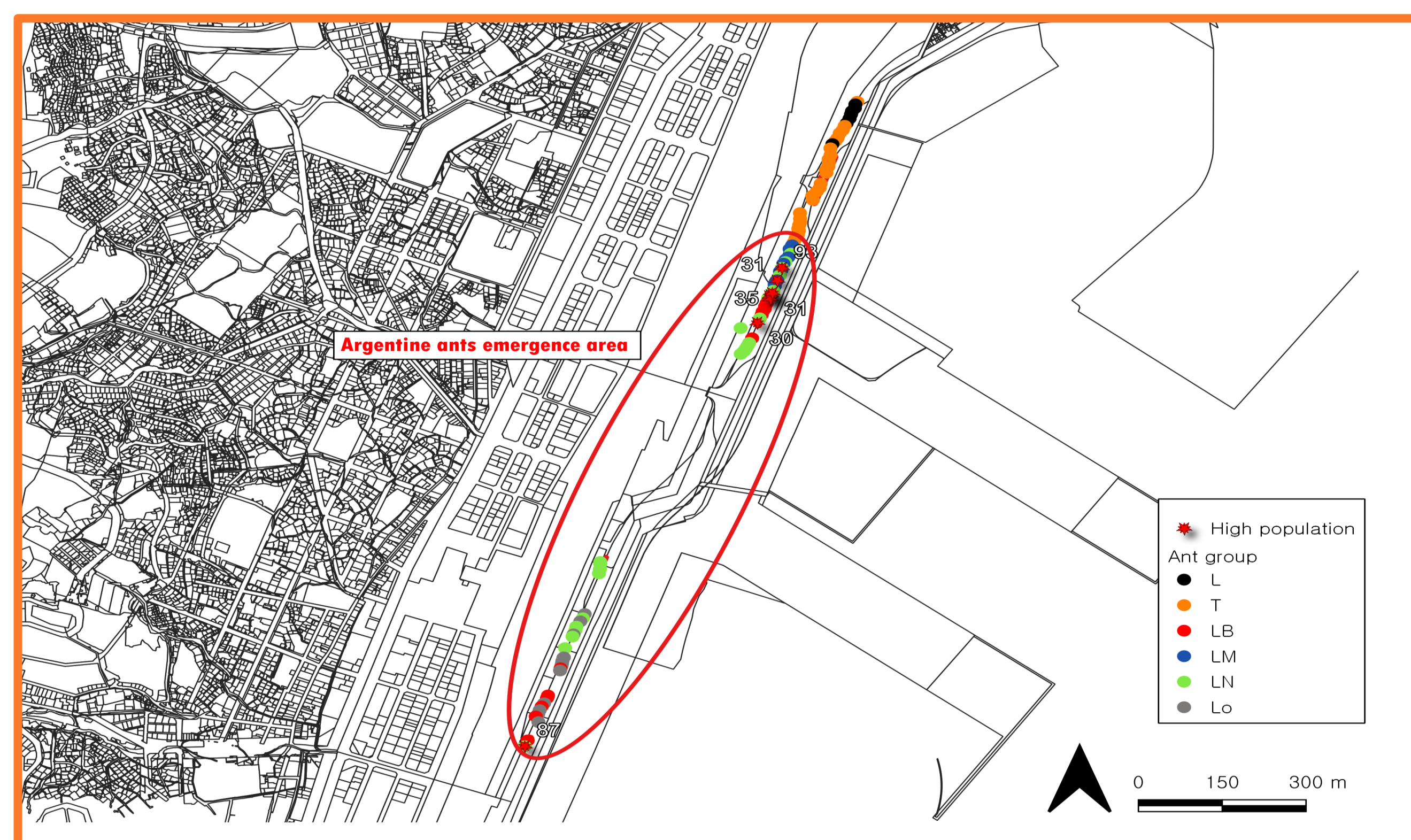


Fig. 4. Distribution of ant groups near the Busan station. The ant group notation is same as that given in the legend. Points where a number of *L. humile* appeared are marked by a star. L, T groups appeared only in the northern patch. Groups containing *L. humile* were present at every location except for the L, T groups.

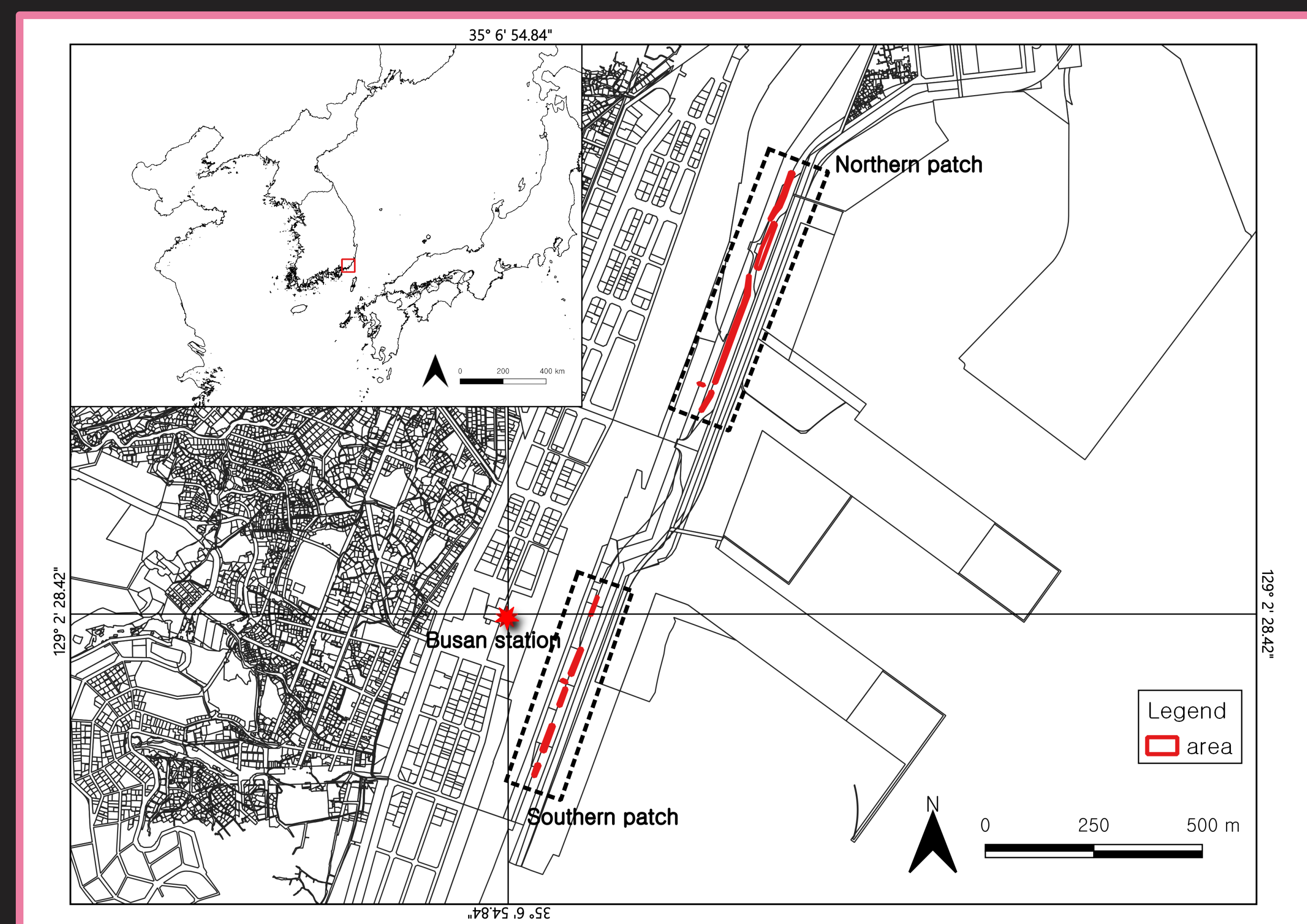


Fig. 1. Geographic location of the survey location in Busan, South Korea, which is indicated by the red line. The star indicates the Busan station.

Acknowledgements

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