

Rapid expansion of range and population in the social-parasitic hornet

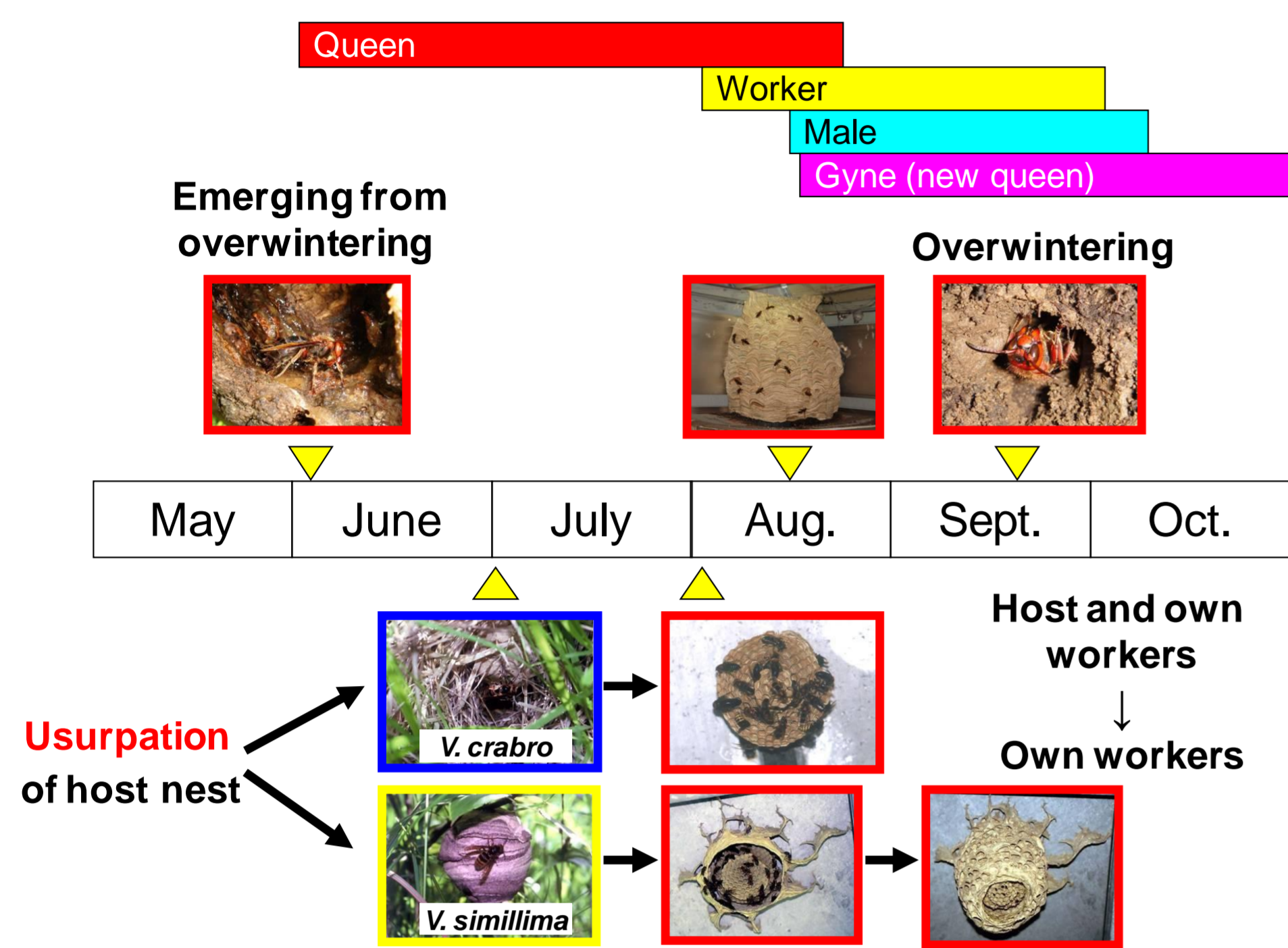
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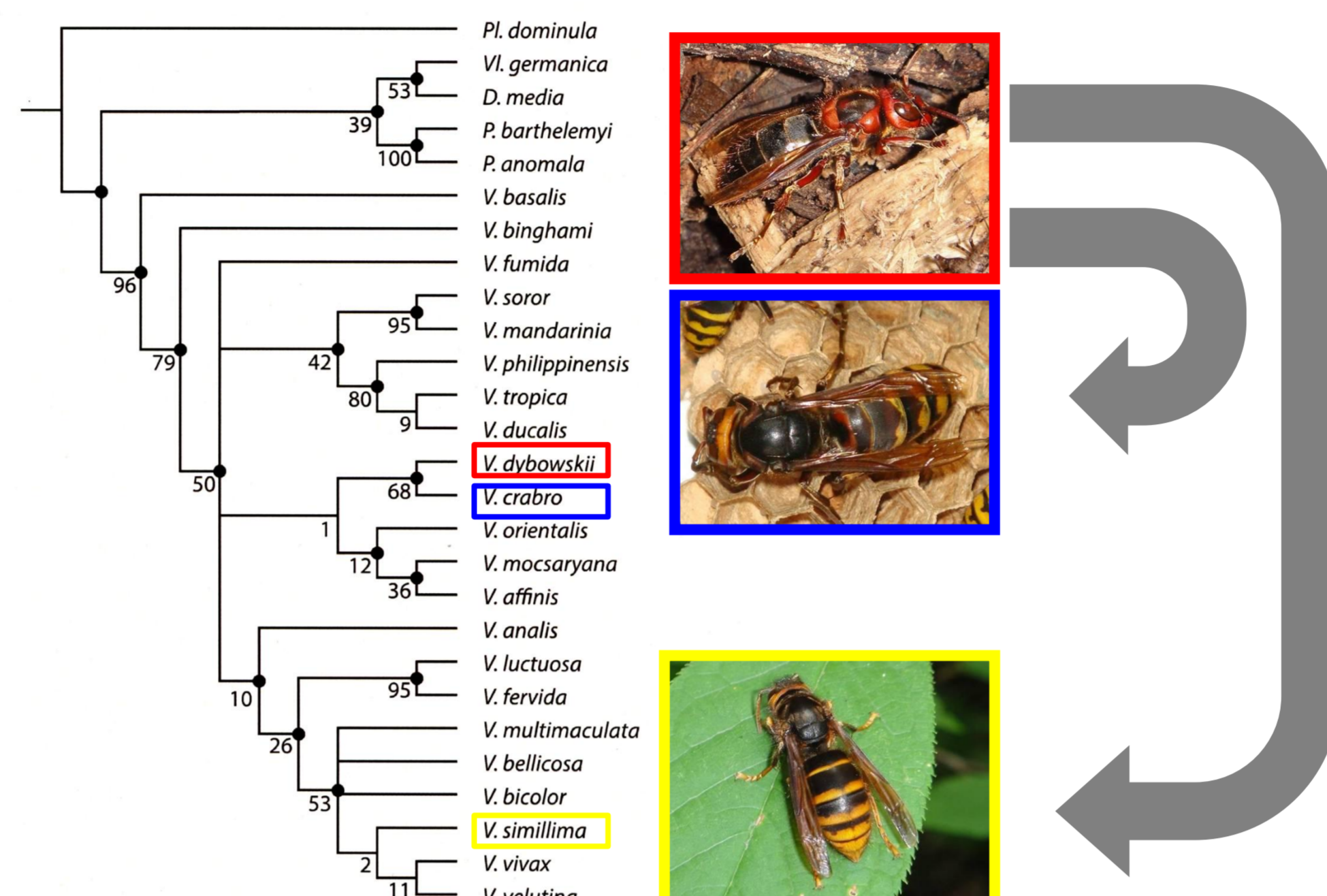
Vespa dybowskii is the only social-parasitic hornet, that usurps a nest and workers of its host species, *V. crabro* or *V. simillima*, to produce their own workers, males and gynes. This species was a rare species in Japan, the number of its occurrence records has recently been drastically increasing. In this study, we analyzed the trends of the expansion of the distribution range and population size of this hornet in Japan.

(1) Life cycle of *V. dybowskii*



(2) Cladogram of *Vespa* species

(after Perrard et al., 2013)



(3) Methods

Distribution range, population size, host records:

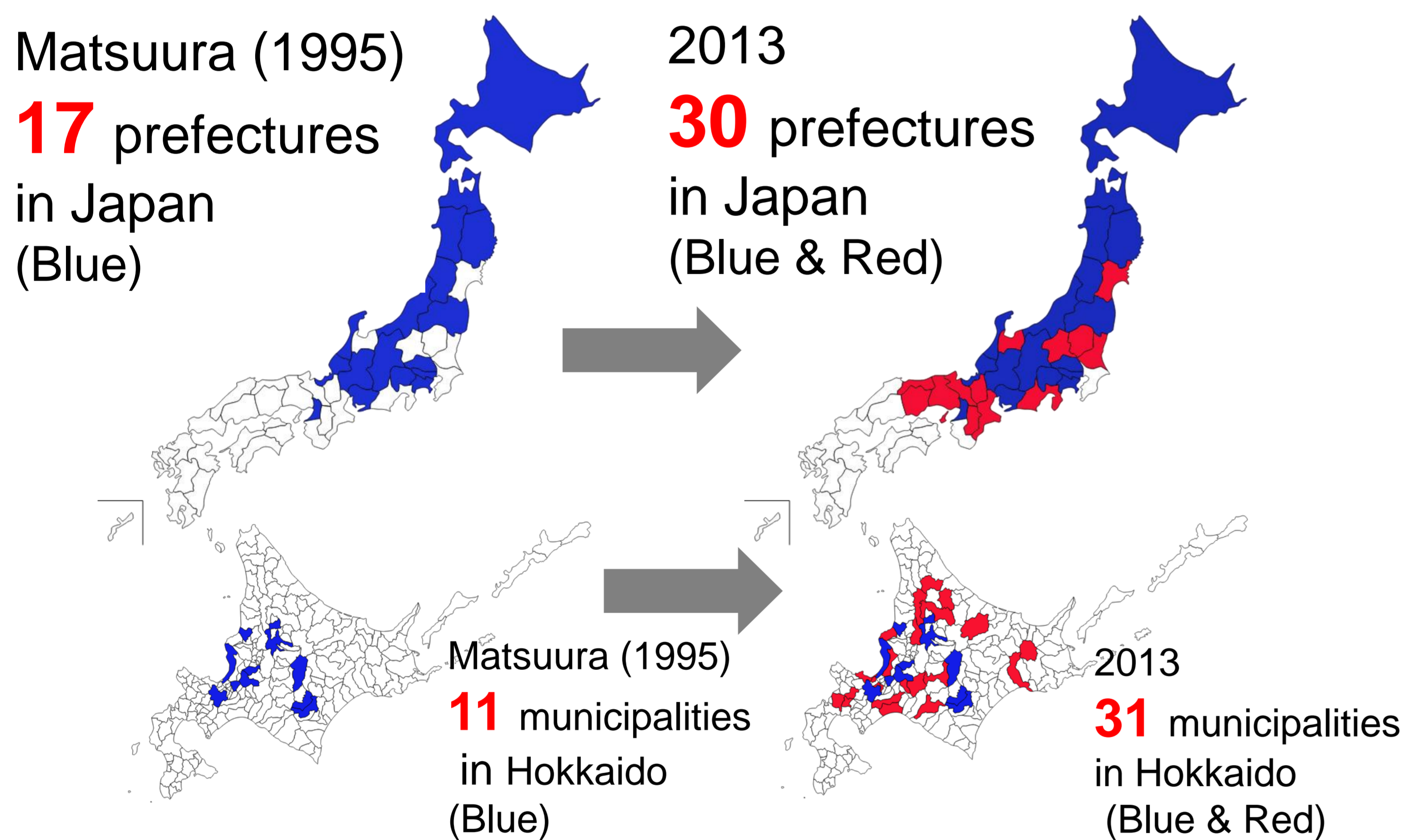
• We collected these data based on the information extracted from literatures and internet web sites, and on personal communication, in addition to our own research.

First appearance and solitary period of overwintered queens:

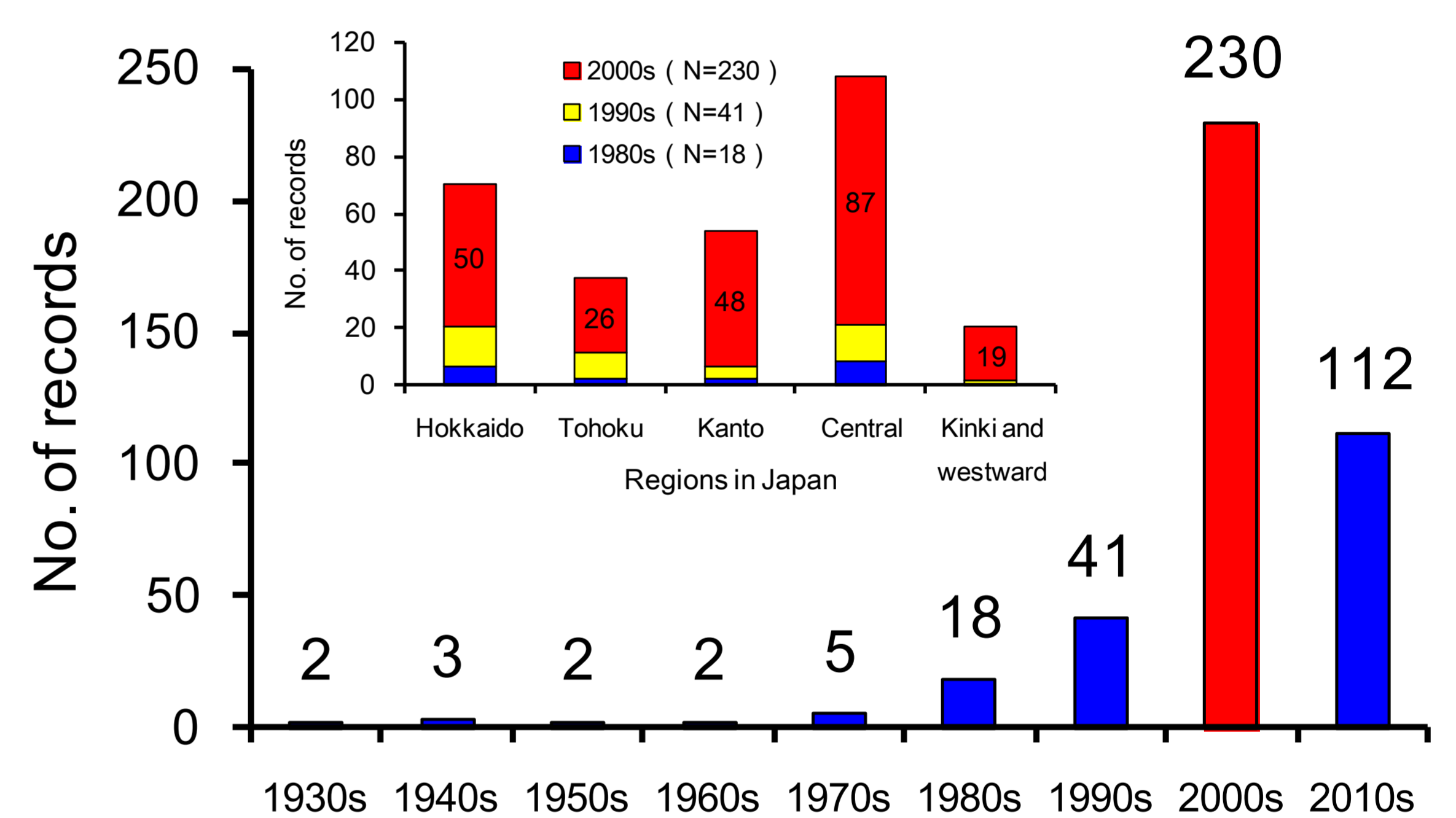
• Study site: The Hitsujigaoka Experimental Forest of the Forestry and Forest Products Research Institute in Sapporo, Hokkaido, northern Japan.

• We collected hornets using baited traps once a week from 2001 to 2013.

Trends: (1) Distributional range in Japan and Hokkaido

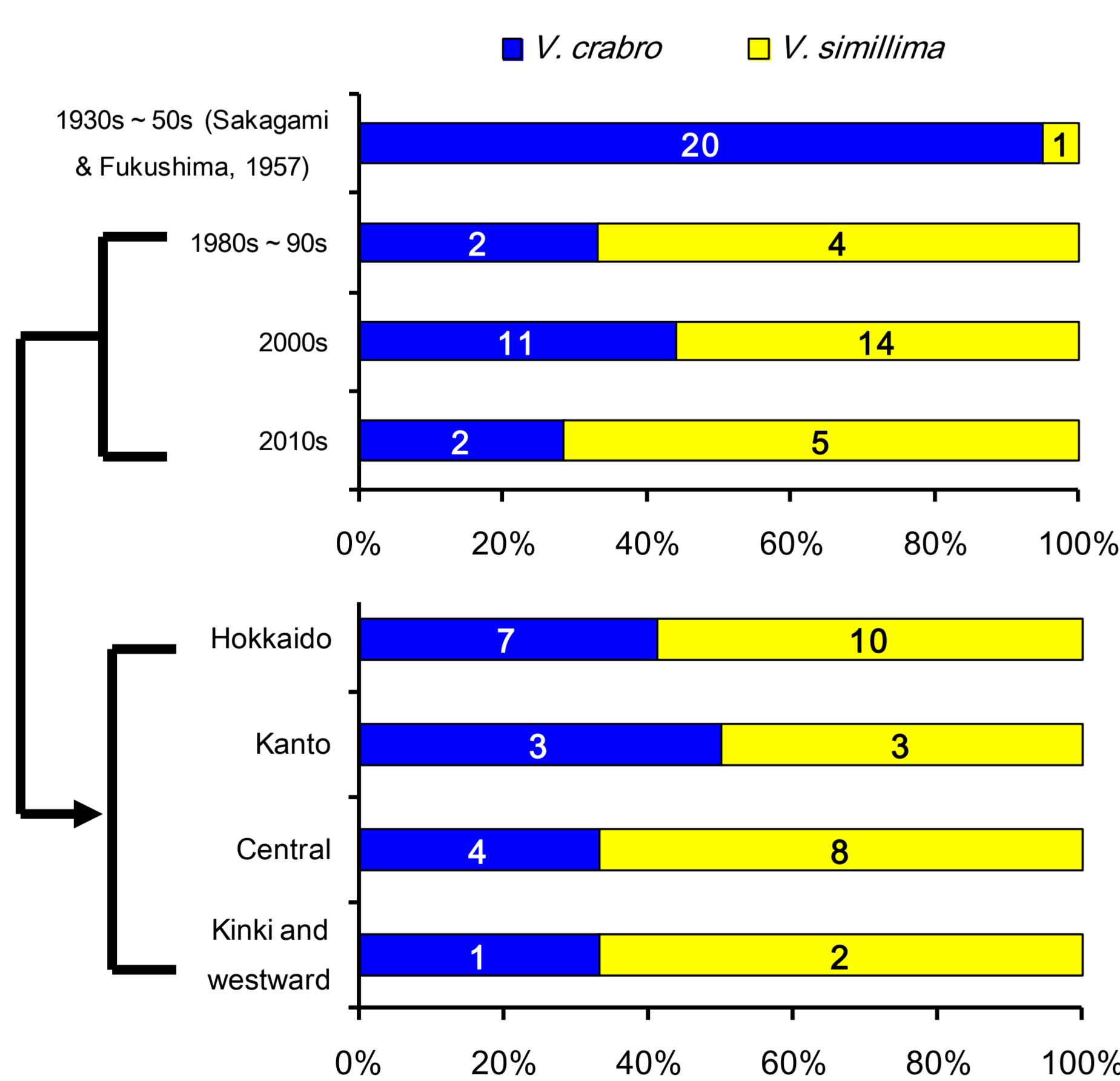


(2) The number of records in each decade and region

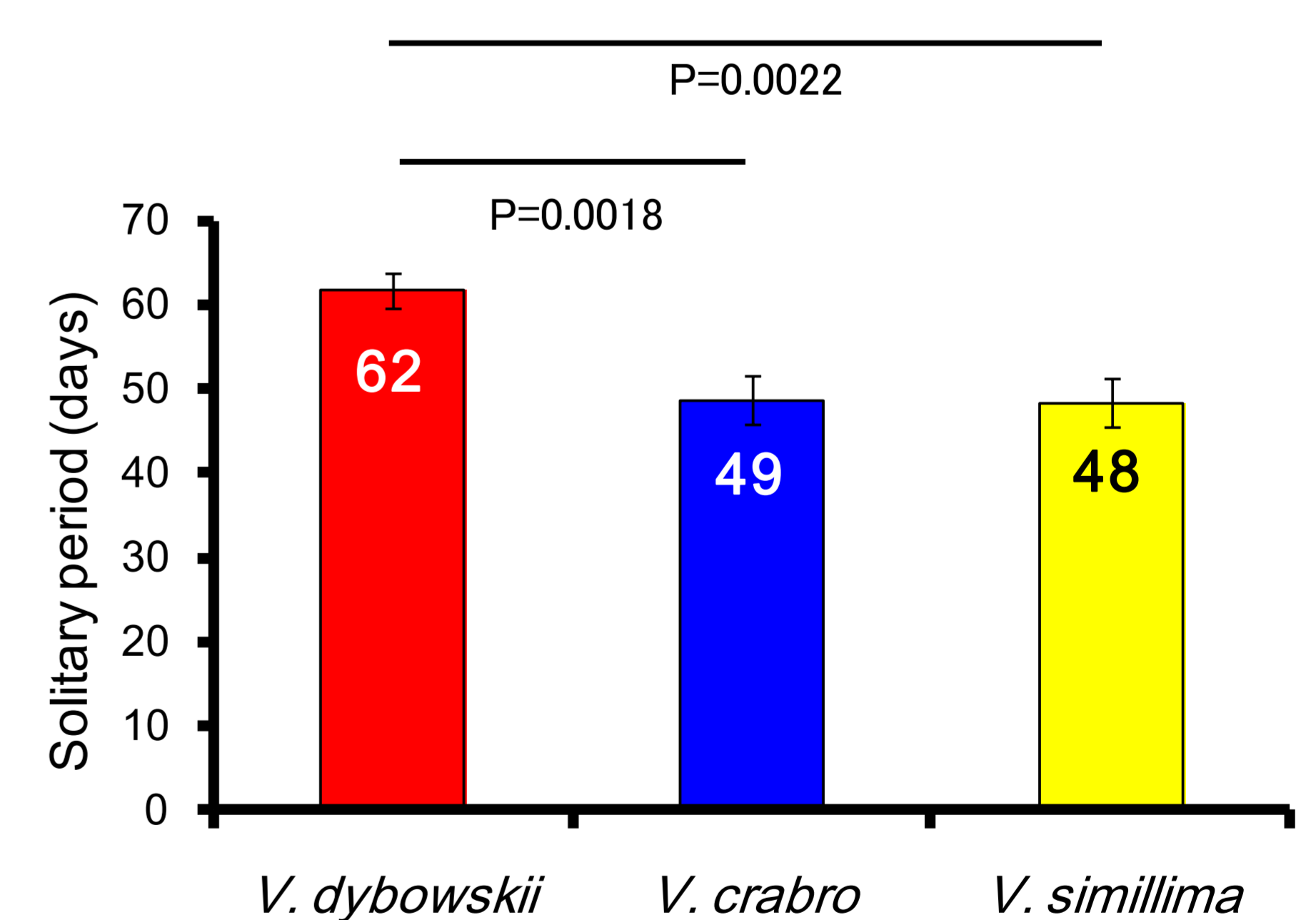


• The number of records has increased rapidly in the 2000s in each region. About 30 examples reported in Sakagami & Fukushima (1957) are not included.

Factors: (1) Host shift from *V. crabro* to *V. simillima*? (2) Shift from usurping host nests to founding own nests?: A facultative parasite or an obligatory parasite?



Species	First appearance (Mean date ± SE)	
	Queen (N=12)	Worker (N=13)
<i>V. dybowskii</i>	6 June ± 1.2	7 Aug. ± 2.2
<i>V. crabro</i>	23 May ± 2.1	10 July ± 2.3
<i>V. simillima</i>	20 May ± 2.0	8 July ± 2.1



• In the 1930s-50s, major host species was *V. crabro*. Recent host records showed that more than half of the host-identified nests belonged to *V. simillima*.

• First appearance of overwintered queens of *V. dybowskii* was later than that of two host species. However, solitary period of overwintered queens of *V. dybowskii* was significantly longer than that of two host species (Mann-Whitney *U*-test). Thus, *V. dybowskii* is suggested to be an obligatory temporary social parasite.

Conclusion

Vespa dybowskii has expanded its distribution range rapidly and increased its population size since the second half of 1990s. Recent host records showed that more than half of the host-identified nests originally belonged to *V. simillima*, which is more common than *V. crabro* in many parts of Japan. Therefore, a possible shift in the major host from *V. crabro* to *V. simillima* is one of the factors underlying the rapid range expansion and increase in the population size of *V. dybowskii*.