

SHORT COMMUNICATIONS

Distributional Notes on Some Social Wasps (Hymenoptera: *Polistes*, *Vespa*, *Dolichovespula*, *Vespula*) in Missouri

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ABSTRACT: Collection records and observations reveal noteworthy distribution records of several social wasp species in Missouri, U.S.A. The paperwasp *Polistes exclamans* Viereck has diminished in abundance in eastern Missouri; the adventive European hornet, *Vespa crabro* L., apparently extended its range into Missouri in the late 1980's and early 1990's; a single specimen of the aerial yellowjacket, *Dolichovespula arenaria* (Fab.), has been taken south of the species' range; the adventive *Vespula germanica* (Fab.) was apparently static in distribution for more than a decade before recent range expansion.

M. J. West-Eberhard has noted that the easily-identified *Polistes exclamans* Viereck was never mentioned by Phil Rau in his voluminous writings on paperwasps of eastern Missouri that span the years 1918–1946, yet in 1967 when West-Eberhard visited Rau's field sites in St. Louis and Jefferson Counties, *P. exclamans* was common there (West, 1968). In 1974 we began field studies of social wasps in eastern Missouri at sites near those used by Rau and visited by West-Eberhard and also found *P. exclamans* to be common. *Polistes* wasps have been studied intensively since the late 1970's at Washington University's Tyson Research Center in southwest St. Louis County near Eureka and in the 1990's at the Missouri Botanical Garden's Shaw Arboretum in Franklin County near Gray Summit. In recent years *P. exclamans* has been conspicuous by its absence from these study sites; indeed, none at all have been seen by us in the St. Louis region since ca. 1989. The absence in the 1920's through 1940's, then presence in the 1960's to 1980's, and now apparent absence once again of *P. exclamans* from these sites in eastern Missouri suggests either northward extension and southward contraction of the species' range or large-amplitude, long-term cycles of abundance.

The European hornet, *Vespa crabro* L., was introduced into the U.S. in the New York area between 1840 and 1860 (Shaw and Weidhaas, 1956). Akre *et al.* (1980) show a range that extends west to the Mississippi River, crossing it only north of Missouri. A 1986–1988 survey of the social Hymenoptera of Missouri (J. H. Hunt and M. S. Arduser, unpubl.) revealed no observations, collections, or museum specimens of European hornet from the state despite specific searches for it. Beginning in 1989, however, several records came to our attention from the southeastern Ozarks region of Missouri as follows: 1989 - Perry Co., 1993 - St. Francois Co., 1994 - Bollinger Co. (2 records), Iron Co., Cape Girardeau Co., Howell Co. (3 records), 1995 - Crawford Co., Dent Co. (Fig. 1). These records, closely following the unsuccessful search for the species in Missouri in 1986–1988, are not conclusive but suggest that the species spread into the Ozark region during the late 1980's and early 1990's. Support for this supposition can be drawn from the first (1989) Missouri record coming from a county that borders the Mississippi River.

The 1986–1988 statewide survey revealed a single Missouri specimen of the aerial yellowjacket, *Dolichovespula arenaria* (Fab.), collected in September, 1982, in Maryville, Nodaway Co. (Fig. 1). The specimen is a worker and can only have come from a colony near the collection site. The aerial yellowjacket is "transcontinentally distributed in the Boreal Region of North America" (Akre *et al.*, 1980), and the Missouri specimen is a few hundred kilometers south of the nearest margin of the species' range (Akre *et al.*, 1980). This extralimital record of *D. arenaria* illustrates the potential for the species to expand its range and, so, calls for reflection on those factors that may constrain its distribution.

The German yellowjacket, *Vespula germanica* (Fab.), is an adventive pest in several regions of the world, including Australia, New Zealand, and Chile. In North America *V. germanica* was known in 1977 to have expanded its range from the mid-Atlantic states westward into Indiana and Michigan (Akre *et al.* 1980). A colony of *V. germanica*, not recognized at the time as a range extension, was collected in

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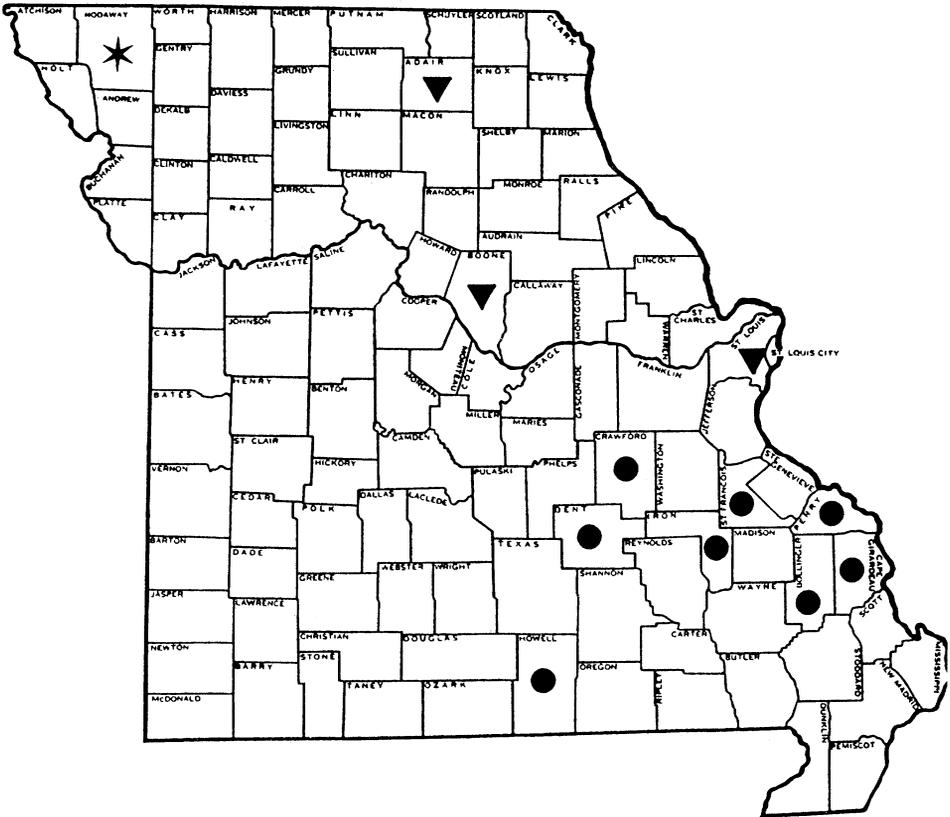


Fig. 1. Map of Missouri showing county outlines and collection localities of *Vespa crabro* (circles), *Dolichovespula arenaria* (star), and *Vespula germanica* (triangles).

Pagedale, St. Louis Co., in 1974 (Grogan and Hunt, 1977), and *V. germanica* has been seen frequently in the urban city of St. Louis and suburban St. Louis County every year since then. However, the 1986–1988 survey of the social Hymenoptera of Missouri revealed no observations or specimens from any other locality in the state. Specimens have now been taken in two other Missouri localities, both home to universities where student collections would likely reveal presence of this easily-collected species: Boone Co. (1993, 1995, 1997) and Adair Co. (1996, 2 collections) (Fig. 1). The abundance of *V. germanica* in St. Louis and St. Louis Co., which together constitute the state's highest density of human habitation, reflects the species' known preference in the U.S. of nesting in buildings (Akre et al., 1980). This preference might also partially explain the species' apparent slow dispersal to less urbanized localities in the state.

We thank M. S. Arduser for his contributions to the statewide survey of social Hymenoptera in 1986–1988, including discovery of the *D. arenaria* specimen; Richard Thoma for collecting the St. Francois Co. *V. crabro*; and Betty Nellums for collecting the Crawford Co. *V. crabro*. Vouchers of the four species discussed here are in the Museum of Natural History at University of Missouri-St. Louis and/or the Enns Entomological Museum, University of Missouri, Columbia.

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The Effects of Ambient Temperature on the Duration of Maternal Care in a Burrower Bug (Heteroptera: Cydnidae)

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ABSTRACT: Females of the subsocial burrower bug, *Sehirus cinctus* (Heteroptera: Cydnidae), terminate egg care after a predictable interval when eggs do not hatch. This study examined the influence of ambient temperature by presenting maternal females with immature stimulus eggs under various thermal regimes. Females housed in warmer temperatures terminated care earlier than females at cooler temperatures, suggesting that duration of care is associated with the rate of embryogenesis. The results of this study suggest that female *S. cinctus* use a temperature-regulated mechanism to determine the duration of maternal care, and provide the first evidence that subsocial behavior is influenced by thermal cues.

Sehirus cinctus (Heteroptera: Cydnidae) is a subsocial burrower bug that exhibits well-defined maternal behavior. Females guard eggs in small burrows throughout embryogenesis and early nymphal development, responding defensively to intruders by shielding the eggs with their bodies (Sites and McPherson, 1982; Kight, 1996). Immediately after eggs hatch, females forage and provision the burrow with host plant fruits. Several days later, nymphs disperse and maternal behavior ends.

The primary cues for the termination of care are associated with egg hatching. However, when mature eggs are experimentally replaced with immature stimulus eggs, females continue brooding long past the normal period of care, but consistently terminate care after a predictable interval (Kight, 1997). Under such conditions, the cues normally associated with egg hatching are absent, and termination of parental care may involve a temporally-sensitive endogenous process.

The duration of egg care could be related to metabolic processes. Brooding mothers do not eat, and as energy reserves dwindle their motivation to eat could supplant their motivation to brood eggs. Female basal metabolic rate and the rate of embryogenesis are both functions of ambient temperature, thus temperature-dependent changes in maternal metabolism could provide females with a reliable indicator of embryonic development.

In this study, we examine the hypothesis that ambient temperature influences the duration of care in egg-replaced *S. cinctus*. If ambient temperature cues are important, we predict that mothers kept at warmer temperatures should terminate care earlier than those kept at cooler temperatures, because eggs take longer to hatch when cool.

Methods

Adult *Sehirus cinctus* were collected in undisturbed patches of their host plant, *Prunella vulgaris* (Labiaceae). Bugs were fed *P. vulgaris* fruits ad libitum and housed in mixed-sex groups at 25°C and

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