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EFFICACY OF INSECTICIDES TO CONTROL *TEGENARIA AGRESTIS* AND *LATRODECTUS HESPERUS* (ARANEAE: AGELENIDAE AND THERIDIIDAE)

MELISSA M. GAVER AND LAUREL D. HANSEN
Spokane Falls Community College, Biology Department MS 3180, Spokane Falls Community College,
3410 W. Fort Wright Drive, Spokane, WA 99224

Abstract Two spiders of possible medical importance in the Pacific Northwest were chosen for this study: the hobo spider, *Tegenaria agrestis*, male and female, and the black widow, *Latrodectus hesperus*, female. Three management strategies were investigated with chemicals applied to the substrate, spider webbing and spider directly. Three classes of chemicals were tested: Termidor® SC, a phenyl pyrazole (fipronil); Tempo® SC Ultra, a pyrethroid (cyfluthrin); and Premise® 2, a neonicotinoid (imidacloprid). Fipronil controlled 96% of the spiders after 8 days, cyfluthrin controlled 70% after 5 days and imidacloprid controlled 18% of the spiders after 14 days. A higher level of control was obtained with application of fipronil and cyfluthrin to female *L. hesperus* and male *T. agrestis* compared to female *T. agrestis*. Application methods showed similar results.
Key Words Hobo spider, black widow, fipronil, cyfluthrin, imidacloprid

INTRODUCTION

Pest Management Professionals (PMPs) are requested to control spiders around homes and other buildings. Most spiders are beneficial; however, several species may cause medical problems and many people are not willing to share their residence with this group of organisms (Hedges, 2003; Lacey, 2004). Efficacy of specific products areEfficacies of specific products are not usually tested on spiders. Reports from local PMPs suggest that chemical treatments on spiders have not always been consistent with applications made for indoor and outdoor perimeter treatments. Interior fogging has also been unreliable. The goal of this project was to determine which chemical group and application procedure is most effective in controlling two medically implicated spiders.

Two species of spiders in the Pacific Northwest and the western United States of possible medical importance are the hobo spider, *Tegenaria agrestis* (Walckenaer) and the black widow spider, *Latrodectus hesperus* Chamberlin and Ivie (Akre and Myhre, 1991; Baird and Akre, 1993; Goddard, 2003; Gulmahamad, 2003; Vetter and Antonelli, 2002; Vetter, 2003; Vetter et al., 2003). Tests compared three different classes of chemicals to determine which has the highest efficacy in eliminating these spiders. Groups of chemicals used in these tests include Termidor® SC, a phenyl pyrazole (fipronil); Tempo® SC Ultra, a synthetic pyrethroid (cyfluthrin); and Premise® 2, a neonicotinoid (imidacloprid) at the highest recommended application rates for perimeter sprays. Three different application techniques were investigated: application to the surface of the spider habitat, webbing, and the spider directly. All application treatments were made in the laboratory at Spokane Falls Community College.

MATERIALS AND METHODS

Female black widows and female and male hobo spiders were tested. Adult spiders were collected from the field or purchased from Hatari Invertebrates in Arizona. The majority (75%) of *Latrodectus* spiders were field collected in Arizona, shipped to Spokane, and placed in individual containers for four weeks before testing. The remaining *Latrodectus* spiders were collected in the Spokane area. All *Tegenaria* spiders were field collected under concrete cottage stones around homes in the Spokane area. Collections were made the last two weeks in July 2004. Spiders were maintained in plastic containers (15 cm x 15 cm x 5 cm) with food (live insects) and water provided every other day. At the initiation of each test, individual spiders were exposed to carbon dioxide for 10 seconds before removal from rearing containers.

The following chemical concentrations were used: 0.06% fipronil, 0.05% cyfluthrin, and 0.1% imidacloprid. The container surface or webbing was sprayed to the point of run off (3.0 ml) with a 1-liter compressed-air sprayer. Webbing was removed in containers where the substrate was sprayed. Each spider was returned to its container one hour following the application or when the surface or webbing dried. Direct application to individual spiders was made in a separate container. Each spider was returned to its original container with the webbing removed. Each test was replicated three times. Controls followed the above procedure using an application of water.

Following treatment, spiders were observed at 1, 3, and 6 hours then daily for 14 days. Mortality was recorded at each observation and percentages were averaged. In all containers where webbing was removed, surviving spiders reconstructed webbing within the first day following application.

RESULTS

Average percent mortality is shown after 1, 3, 6 hours and 1-5 days with each application method in Table 1 after exposure to fipronil, in Table 2 after exposure to cyfluthrin, and in Table 3 after exposure to imidacloprid. The highest average percent mortality for all spiders was achieved after exposure to fipronil. Black widows had the highest average percent mortality when exposed to cyfluthrin, male hobo spiders had a lower mortality and the lowest mortality occurred in female hobo spiders. When exposed to imidacloprid, all spiders had the lowest average percent mortality. Only one *T. agrestis* male in the control group died after surface application on the third day.

Only minor variations in the results occurred after 5 days. After 8 days, the average percent mortality of *T. agrestis* females increased to 66% following direct spray application of fipronil. Exposure to imidacloprid sprayed on the webbing increased the average percent mortality to 33% on day 14 for *T. agrestis* females. One *T. agrestis* male appeared dead for the first 6 hours after direct chemical application of imidacloprid, revived and was active for the remainder of the test.

In comparing the chemicals used in these tests, 100% of the black widow spiders exposed to either fipronil or cyfluthrin died after day 1 (Table 4). Fipronil had delayed activity until day 1 when the average percent mortality reached 100%, while spiders had a more rapid knock-down after 1 hour exposure to cyfluthrin.

There was a difference in the average percent mortality between genders of *T. agrestis* where males had a high mortality after 3 days when exposed to fipronil and females had a high mortality after 5 days. *T. agrestis* males also had a higher mortality than the females after the exposure to cyfluthrin. (Table 4).

Table 1. Average percent mortality of *Latrodectus hesperus* females and *Tegenaria agrestis* females and males after exposure to fipronil applications.

L. hesperus female	**1 hr**	**3 hr**	**6 hr**	**1 day**	**2 days**	**3 days**	**4 days**	**5 days**
Surface	0	0	0	100	100	100	100	100
Webbing	0	0	0	100	100	100	100	100
Spider	0	0	0	100	100	100	100	100
T. agrestis female								
Surface	0	0	0	0	33	33	33	100
Webbing	0	33	33	33	33	100	100	100
Spider	0	0	0	33	33	33	33	33
T. agrestis male								
Surface	0	0	0	33	33	100	100	100
Webbing	33	66	66	66	100	100	100	100
Spider	33	33	100	100	100	100	100	100

Table 2. Average percent mortality of *Latrodectus hesperus* females and *Tegenaria agrestis* females and males after exposure to cyfluthrin applications.

L. hesperus female	**1 hr**	**3 hr**	**6 hr**	**1 day**	**2 days**	**3 days**	**4 days**	**5 days**
Surface	100	100	100	100	100	100	100	100
Webbing	33	33	33	100	100	100	100	100
Spider	100	100	100	100	100	100	100	100
T. agrestis female								
Surface	0	0	0	0	0	0	0	0
Webbing	0	0	0	0	33	33	33	33
Spider	0	0	0	0	0	33	33	33
T. agrestis male								
Surface	0	33	33	66	66	66	66	100
Webbing	0	0	33	66	66	66	66	100
Spider	0	0	66	66	66	66	66	66

Table 3. Average percent mortality of *Latrodectus hesperus* females and *Tegenaria agrestis* females and males after exposure to imidacloprid applications.

L. hesperus female	**1 hr**	**3 hr**	**6 hr**	**1 day**	**2 days**	**3 days**	**4 days**	**5 days**
Surface	0	0	0	0	0	0	0	0
Webbing	0	0	0	0	0	0	0	0
Spider	0	0	0	33	33	33	33	33
T. agrestis female								
Surface	0	0	0	0	0	33	33	33
Webbing	0	0	0	0	0	0	0	0
Spider	0	0	0	0	0	0	0	0
T. agrestis male								
Surface	0	0	0	33	33	100	100	100
Webbing	33	66	66	66	100	100	100	100
Spider	33	33	100	100	100	100	100	100

Table 4. Summary of average percent mortality for *Latrodectus hesperus* females, *Tegenaria agrestis* females and males following exposure to fipronil, cyfluthrin and imidacloprid at 1-6 hours and 1-5 days.

Hour/day	Spider	Fipronil	Cyfluthrin	Imidacloprid
1 hr	*L. hesperus* female	0	78	0
	T. agrestis female	0	0	0
	T. agrestis male	22	0	11
3 hrs	*L. hesperus* female	0	78	0
	T. agrestis female	11	0	0
	T. agrestis male	33	11	11
6 hrs	*L. hesperus* female	0	78	0
	T. agrestis female	11	0	0
	T. agrestis male	56	44	11
1 day	*L. hesperus* female	100	100	11
	T. agrestis female	22	0	0
	T. agrestis male	67	67	0
2 days	*L. hesperus* female	100	100	33
	T. agrestis female	33	11	0
	T. agrestis male	78	67	11
3 days	*L. hesperus* female	100	100	11
	T. agrestis female	56	22	11
	T. agrestis male	100	67	22
4 days	*L. hesperus* female	100	100	11
	T. agrestis female	56	22	11
	T. agrestis male	100	67	22
5 days	*L. hesperus* female	100	100	11
	T. agrestis female	78	22	11
	T. agrestis male	100	78	22

DISCUSSION

Research on chemical sensitivity to spiders is difficult because large numbers of spiders are not readily available for bioassay. These tests were limited to three replications per chemical per application method. The three application methods showed similar results, but may vary with other spider families. Of the three classes of chemicals used, these three spider groups were most sensitive to fipronil and cyfluthrin. The spiders were least sensitive to imidacloprid. Fipronil is not currently labeled for spider control; however, in perimeter treatments for other insects such as carpenter ants, spiders are secondarily exposed. Black widows were more sensitive than hobo spiders and hobo males were more sensitive than hobo females. This work was limited to only two species of spiders; other spider groups may show different sensitivities to these chemicals.

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