A SEX ATTRACTANT FOR TRAPPING *CRAMBUS CYPRIDALIS* (LEPIDOPTERA: CRAMBIDAE)

Peter J. Landolt[1] and Diana Roberts[2]
[1]USDA, ARS, Yakima Agricultural Research Laboratory, 5230 Konnowac Pass Road, Wapato, WA 98951, USA

[2]Washington State University Extension Service, 222 N. Havana Street, Spokane, WA 99202, USA

Corresponding author, E-mail: peter.landolt@ars.usda.gov

Crambus cypridalis (Hulst) (Lepidoptera: Crambidae) is widely distributed throughout the western United States (Crawford & Harwood 1964; Powell & Opler 2010). The larvae probably feed on grasses, as do congeneric species (Robinson et al. 2002), but it is not reported as a crop pest.

Monitoring of wheat head armyworm moth *Dargida (= Faronta) diffusa* (Walker) and the sibling species *Dargida (= Faronta) terrapictalis* (Buckett) in eastern Washington resulted in serendipitous captures of male *C. cypridalis* in sex attractant-baited traps (Landolt et al. in press). This result led us to test the hypothesis that *C. cypridalis* males are attracted to the combination of (Z)-11-hexadecenyl acetate (Z11-16Ac) and (Z)-11-hexadecenal (Z11-16Ald). We also report new information on the seasonal timing of captures of *C. cypridalis* in sex-attractant traps, which was not included by Landolt et al. (2011).

Chemicals were dispensed from red rubber septa (West Co., Lionville, Pennsylvania) and tested in UniTraps (Agrisense Inc., Pontyprid, United Kingdom) with a 6 cm^2 piece of Vaportape® (Hercon Environmental, Emigsville, Pennsylvania) placed within each trap bucket. Traps were attached to stakes at the edges of wheat fields.

In 2009 and in 2010, 31 and 13 traps, respectively, were baited with septa loaded with 1 mg Z11-16Ac plus 100 µg Z11-16Ald for trapping the wheat head armyworm moth (Landolt et al. in press). Of those traps, 16 in 2009 and 13 in 2010 were maintained long enough through the season to capture *C. cypridalis.* Other traps in that study were withdrawn earlier in Sep in response to the end of captures of *Dargida* sp. Each trap was placed in a different wheat field in Grant and Lincoln Counties, Washington. We report on captures of *C. cypridalis* in the 16 traps in 2009 that were maintained from late May through Sep, and on the 13 traps in 2010 that were maintained from the first week of May through Sep. Traps were checked weekly, and lures and Vaportape® were replaced monthly. None of these traps were accompanied by control traps because the objective of the study was to determine the presence of *Dargida* sp moths, not to test the hypothesis of sex attraction.

A subsequent experiment then tested the hypothesis that *C. cypridalis* is attracted to the wheat head armyworm sex attractant, and determined if both chemicals are necessary for attraction. Four trap treatments were used: 1) a control with no lure, 2) a septum with 1 mg of Z11-16Ac, 3) a septum with 100 µg of Z11-16Ald, and 4) a septum with the combination of 1 mg Z11-16Ac and 100 µg Z11-16Ald. A randomized complete block experimental design was used with 6 replicate blocks. Each block of traps was placed at a separate wheat field in Grant and Lincoln Counties, Washington. Traps were maintained and checked each wk from 7 Sep to 5 Oct 2010.

Voucher specimens of *C. cypridalis* were deposited in the M. T. James Entomological Collection of Washington State University, Pullman, Washington.

In 2009, male *C. cypridalis* were captured in 14 of the 16 traps that were baited with Z11-16Ac plus Z11-16Ald, and that were maintained through Sep (14.2 ± 3.7 males per trap). In 2010 male *C. cypridalis* were captured in all 13 of the same sex attractant traps (4.8 ± 1.3 males per trap). In both years, all *C. cypridalis* moths were captured during the last 2 wk of Sep. We do not know when the moth flight ended because these traps were not maintained long enough into Oct.

In experiment 2, most male *C. cypridalis* were captured in traps baited with Z11-16Ac plus Z11-16Ald (Table 1). None were trapped with Z11-16Ac alone, and only 3 moths were trapped with Z11-16Ald alone. These moths were captured from 14 Sep until 5 Oct, when traps were taken down.

Male *C. cypridalis* consistently responded to the combination of Z11-16Ac plus Z11-16Ald, with no response to the unbaited traps in the second study, or to either Z11-16Ac or Z11-16Ald alone. This is a first report of an attractant for trapping *C. cypridalis*, and the second report of a sex attractant for a *Crambus* sp; Booij and Voerman (1984) captured 25 male *Crambus nemorella* (Hübner) in traps baited with Z11-16Ac.

Males of the glassy cutworm moth, *Apamea devastator* (Brace), are also attracted to Z11-16Ac plus Z11-16Ald (Steck et al. 1977; Underhill et al. 1977; Landolt et al. 2011). The glassy cutworm co-occurs in eastern Washington wheat fields with *D. diffusa*, *D. terrapictalis* and *C. cypridalis*. All are attracted to this same combination of chemicals, raising the question of how they might avoid inter-specific sexual

TABLE 1. MEAN NUMBERS OF MALE *CRAMBUS CYPRIDALIS* CAPTURED IN TRAPS BAITED WITH THE SEX ATTRACTANT COMPOUNDS Z11-16AC AND Z11-16ALD. GRANT AND LINCOLN COUNTY, WASHINGTON, SEP 2010.

	Control	Z11-16Ac	Z11-16Ald	Z11-16Ac + Z11-16Ald
C. cypridalis	0.0 ± 0.0a	0.0 ± 0.0a	0.17 ± 0.17a	3.33 ± 1.28b

Means followed by the same letter are not significantly different by the Mann-Whitney Test at $P < 0.05$, df = 5. ANOVA $F = 6.44$, df = 3, $P = 0.003$

interactions. There is a seasonal separation in their flight patterns, which should provide some reproductive isolation among them, with the 2 *Dargida* species flying in late spring (May/Jun) (Landolt et al. 2011), the glassy cutworm flying in summer (July/Aug), and *C. cypridalis* flying in early autumn (Sep/Oct). There may be additional chemicals present in the female sex pheromones of these moths that contribute to reproductive isolation. Steck et al. (1977) indicated a role of (Z)-7-dodecenyl acetate in sex attraction of *C. devastator*, as well as Z11-16Ac and Z11-16Ald. There are no reports however of characterization of pheromones produced or emitted by females of any of these 4 moth species.

The late season capture of male *C. cypridalis* in sex attractant traps in 2009 and 2010 is not consistent with other reports of the seasonality of occurrence of the adult. Powell & Opler (2010) indicate that this moth flies in mid summer; and Crawford & Harwood (1964) reported the flight of the same species in late summer. Perhaps the moth flight period varies with latitude and altitude, or there might be unresolved taxonomic issues with this species.

SUMMARY

Males of *C. cypridalis* were consistently captured in traps baited with Z11-16Ac plus Z11-16Ald. The consistent presence of *C. cypridalis* in eastern Washington wheat fields suggests the possibility that it infests wheat, but additional study is needed to determine its host plant(s), abundance, and any pest significance in this habitat. These moths were trapped in late Sep and early Oct, which differs from prior reports of activity. This report provides a new sex attractant for potential use in monitoring this species, as well as new information on its seasonality and geographic distribution.

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REFERENCES CITED

BOOIJ, C. J., AND VOERMAN, S. 1984. (Z)-11-Hexadecenyl compounds as attractants for male microlepidoptera of the subfamilies Argyresthiinae, Glyphipterygi-nae, and Crambinae. Entomol. Exp. Appl. 36: 47-53.

CRAWFORD, C. S., AND HARWOOD, R. F. 1964. Bionomics and control of insects affecting Washington grass seed fields. Wash. State Univ. Agric. Exp. Stat. Tech. Bull. 44: 25 pp.

LANDOLT, P. J., ROBERTS, D., CORP, M., AND RONDON, S. I. 2011. Trap response of *Dargida terrapictalis* (Buckett) (Lepidoptera: Noctuidae) to a sex attractant in wheat growing areas of eastern Washington and neighboring Oregon. J. Kansas Entomol. Soc. 84: 139-147.

POWELL, J. A., AND OPLER, P. A. 2010. Moths of Western North America. Univ. California Press, Berkeley, 369 pp.

ROBINSON, G. S., ACKERY, P. R., KITCHING, I. J., BECCALONI, G. W., AND HERNANDEZ, L. M. 2002. Host plants of the moth and butterfly caterpillars of America north of Mexico. Mem. Am. Entomol. Inst., Gainesville, Florida.

STECK, W., UNDERHILL, E. W., BAILEY, B. K., AND CHISHOLM, M. D. 1977. A sex attractant for male moths of the glassy cutworm, *Crymodes devastator* (Brace): a mixture of Z-11-hexadecen-1yl acetate, Z-11-hexadecenal, and Z-7-dodecen-1-yl acetate. Environ. Entomol. 6: 270-271.

UNDERHILL, E. W., CHISHOLM, M. D, AND STECK, W. 1977. Olefinic aldehydes as constituents of sex attractants for noctuid moths. Environ. Entomol. 6: 333-337.