PRESENCE OF FOUR SPECIES OF STORED-PRODUCT
MOTHS IN STORAGE AND FIELD SITUATIONS IN
NORTH-CENTRAL FLORIDA AS DETERMINED
WITH SEX PHEROMONE-BAITED TRAPS

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ABSTRACT

Sex pheromone baited traps captured Angoumois grain moths (AGM), *Sitotroga cerealella* (Olivier), Indianmeal moth (IMM), *Plodia interpunctella* (Hübner), almond moth (AM), *Ephesia cautella* (Walker), and Mediterranean flour moth (MFM), *Anagasta kuehniella* (Zeller), near storage facilities and in field environments. The AGM was particularly abundant around a wheat field, and numerous in a feedmill yard and near peanut storage, and was the species captured most frequently. The IMM and AM were caught most frequently near peanut storage facilities, although each species was captured in every environment sampled. The AGM, IMM, and AM were most common during the warm months and absent during February. By contrast, MFM was absent during the summer months with peak population levels occurring during January, February, and March.

RESUMEN

Trampas cebadas con feromonas sexuales atraparon a alevillas de grano Angoumois, *Sitotroga cerealella* (Olivier), alevillas Indianmeal, *Plodia interpunctella* (Hubner), alevillas del almendro, *Ephesia cautella* (Walker), y alevillas Mediterráneas de la harina, *Anagasta kuehniella* (Zeller), cerca de lugares de almacenamiento y en medios ambientales. Alevillas de grano Angoumois fueron particularmente abundantes alrededor de un campo de trigo, y numerosas en el área de un molino y cerca de un almacenamiento de maní, y fue la especie que se capturó más frecuentemente. Las alevillas Indianmeal y del almendro se atraparon más frecuentemente cerca de almacenenes de maní, aunque cada especie fue capturada en cada lugar que se muestreó. Las alevillas de grano Angoumois, Indianmeal, y del almendro, eran más común durante los meses calídos y ausentes durante Febrero. En contraste, alevillas Mediterráneas de la harina estaban ausentes durante los meses de verano, el auge del nivel de población ocurrió durante Enero, Febrero y Marzo.

The Angoumois grain moth (AGM), *Sitotroga cerealella* (Olivier), (Gelechiidae) as well as two phycitine moths, almond moth (AM), *Cadra cautella* (Walker), and Indianmeal moth (IMM), *Plodia interpunctella* (Hübner), are important pests of stored products in the southern United States. Two other potentially destructive phycitine moths, the Mediterranean flour moth (MFM), *Anagasta kuehniella* (Zeller) and tobacco moth, *Ephesia elutella* (Hübner) also are found in this region. All these species are commonly encountered in stored-product marketing channels and many infestations undoubtedly originate in manufacturing or transportation facilities. Many other infestations are the result of inadequate sanitation; e.g., putting uninfested grain into bins that contain a residual insect infestation. A third avenue for infestation is the influx of insects into storage from field environments; it has received little attention and has not
been recognized as a significant problem. Tactics to avoid infestation would be different for each of these infestation modes.

Among moths, the AGM has a recognized potential to infest crops in the field before harvest (Cotton 1968, Stockel 1971), although mechanical harvesting at high moisture levels followed by mechanical drying was suspected to have lessened this avenue of entry into storages. AGM populations at Beaumont, Texas, were measured with pheromone-baited traps and were heaviest near rice milling and storage areas. Also substantial AGM populations were detected in rice fields and pastures, and small populations were found in forests (Cogburn & Vick 1981).

Phyctine species do not attach their eggs to grains and are unable to feed on intact grains. Although these factors would appear to make it unlikely that Phyctinae moths could survive in field situations, Cogburn & Vick (1981), in fact, found small but measurable populations of AM in field situations. Since these populations constitute a pool of insects that may be attracted to stored grains, we initiated this study to see if populations of these phyctine moths and AGM exist in field situations in North-Central Florida and to estimate their magnitude.

**Materials and Methods**

Synthetic sex pheromone of the Angoumois grain moth, \((Z,E)\)-7,11-hexadecadien-1-ol acetate, was purchased from Farchan Division, Story Chemical Co., Willoughby, Ohio, and purified to >98% by the method of Vick et al. (1979). The pheromone was formulated into plastic laminated strips (Hercon®). A square of the material (0.5 by 0.5 cm) was used to bait each trap. A 1-μl amount of Phyctinae sex pheromone, \((Z,E)\)-7,11-hexadecadien-1-ol acetate, was placed in a 250-μl capacity cap (size #3, BEEM polyethylene embedding capsule C) (Ladd Research Industries, Inc., Burlington, Vermont). Pheromone release rates were ca. 77 and 320 ng/h for the Angoumis grain moth and Phyctinae pheromones, respectively (Vick et al. 1979). Pairs of traps, one with each bait, were placed at each trapping location. Pheromone baits were replaced every 2 weeks, and trap linens were changed as needed. Traps were checked once a week from July 1980 through July 1981. The moths were identified by dissection of the male genitalia.

Ten trapping locations were selected roughly on a ca. 35 mile line between High Springs (Alachua County), and Williston (Levy County), Florida. This region of Florida has sandy-loam soil, diversified agriculture of row crops, truck crops and pasture land that is interspersed by stands of mixed hardwood and planted and natural pines. Climate is typical of much of the coastal southeastern United States with humid, hot summers and mild winters (ca. 25 nights below 0°C each winter). Traps were set in the following habitats: pastures (three locations), cornfields (two locations), feedmill yards (two locations), peanut warehouse yard (two locations), and a wheat field (one location).

**Results**

More AGM were caught than any other species (Fig. 1). They were particularly abundant near the wheat field where more than 3X as many were captured as at any other location. Substantial numbers were also captured in the vicinity of the peanut warehouses and feed mills. Fewer AGM were caught at the other two locations.

Three species of Phyctinae moths were caught: IMM, AM, and MFM. The relative efficiency of the pheromone used for the Phyctinae species is unknown for field conditions. Therefore, conclusions were not drawn on relative abundance of the three species based on numbers of insects caught in traps. Every location yielded specimens of each
Fig. 1. Average number of Angoumois grain moth (AGM), almond moth (AM), Indianmeal moth (IMM), and Mediterranean flour moth (MFM) males caught per week over a year period in the following habitats: 1—peanut warehouse yard (two locations), 2—pasture (three locations), 3—corn field (two locations), 4—feedmill yard (two locations), and 5—wheat field (one location).

species. Predictably, AM and IMM captures were greatest in the vicinity of peanut warehouses since both species are major pests of this commodity. Traps for these two species at other locations captured <0.5 insects/trap/week. The MFM by contrast was no more numerous around the peanut warehouses than at other locations.

The AGM was captured in every month of the year except January, February and March (Fig. 2). Likewise IMM and AM populations were at a low level during these months; neither of these species was captured during the month of February. By contrast, MFM were only captured between November and May with the peak population levels occurring during January, February and March.

DISCUSSION

The presence of AGM in substantial numbers in every habitat that was surveyed mirrors the results reported by Cogburn & Vick (1981). They reported that MFM and IMM were rare or absent from trap catches although both species were found in all habitats in this study. The populations of AM were larger in this study than in the Beaumont, Texas study.

The capture of the MFM in all trap locations was unexpected, since it is thought to be rare in Florida. There are only scattered reports of MFM in interdictions of infested commodities being transported into the state (Florida Division of Plant Industry records). This species was not found in trapping studies inside a peanut warehouse, a military food distribution warehouse, or a civilian food distribution warehouse (Vick et
Fig. 2. Monthly totals of Angoumois grain moth (AGM), almond moth (AM), Indianmeal moth (IMM), and Mediterranean flour moth (MFM) males caught over a year period in the following habitats: 1—peanut warehouse yard (two locations), 2—pasture (three locations), 3—corn field (two locations), 4—feedmill yard (two locations), and 5—wheat field (one location).
The presence of MFM in only winter trap catches suggests that it may not be well adapted to the hot, humid summers of the southeastern United States. However, its seemingly ubiquitous distribution in Alachua and Levy Counties and its documented preference for milled products (Cotton 1963) suggest the likelihood that a search of flour and feed mills might yield this insect.

Before the advent of grain storage by neolithic women, many species of stored grain insects undoubtedly were field insects attacking kernels of grain as they ripened in the field (Cotton 1963). Other species may have been able to survive on grain found in bird nests or rodent dens. The advent of human agriculture with its necessary grain storages provided an ideal habitat for these insects. Many stored-product insects, including the four species studied in this paper, are cosmopolitan, having been spread in transported agricultural commodities. Although none of these species are thought to be native to the United States, it would appear from the results of this study and the study by Cogburn & Vick (1981) that at least in mild climatic areas, four of these species have found niches where they can survive apart from the typical storage situation where they do so well.

REFERENCES CITED


