Survey of Wireworms (Coleoptera: Elateridae) in Virginia and North Carolina Peanut Fields[1]

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ABSTRACT

Sixty peanut (*Arachis hypogaea* L.) fields were surveyed for wireworms (Coleoptera: Elateridae) in the Virginia-North Carolina peanut area in 1989 and 1990. A series of baited container soil traps was placed in each field once in early June and again in early August for a total of 605 trap-weeks (trap per field per week = 1 trap-week)). Trap capture was similarly low in both states and in both years with a total of 59 wireworm specimens collected: an average of one wireworm per field per year. Species composition was similarly diverse with *Conoderus vespertinus* F. comprising 58 percent, C. *lividus* De Geer 20 percent, *Glyphonx* sp. 8 percent, *Melanotus communis* Gyllenhal 7 percent, C. sp. 5 percent, and C. *bellus* Say 2 percent. Even though wireworm captures were low, moderate to high levels of pod damage were observed. The large number of southern corn rootworm (*Diabrotica undecimpunctata howardi* Barber) adults detected on nearby pheromone baited sticky traps indicated that most pod damage was not by wireworm but by southern corn rootworm. Implications are that although several wireworm species can be found in association with peanut, they appear to play only a minor role in peanut pod damage in the survey area.

Key Words: Wireworm, Elateridae, peanut, *Arachis hypogaea* L., survey.

Peanut (*Arachis hypogaea* L.) grown in the Virginia-North Carolina peanut producing area sustains high levels of pods damage from a complex of soil insects if not treated with insecticides (1). Although the exact composition of this pest complex appears to vary with years and fields, it is comprised primarily of southern corn rootworm (*Diabrotica undecimpunctata howardi* Barber), wireworms (immature elaterids) and white grubs (immature scarabaeids) (9, 12). Southern corn rootworm is considered by some to be the major soil pest (5, 12). Although high levels of white grub damage have been reported (9), in recent years, damage has been very light and can be easily distinguished from that of other soil pests (4). The role of wireworms, though, is poorly understood. Larvae are known to feed on all underground plant parts including roots and pods (7). However, neither the appearance or effect of this damage nor the exact wireworm species involved is completely understood. Grayson and Poos (5) showed that pod damage by wireworms was indistinguishable based on visual inspection from that caused by southern corn rootworm. Long and Dogger (7) suspecting that the activity of pest species peaked at different times, attempted to distinguish damage based on sample date, but were also unsuccessful.

Existing literature indicates that only one wireworm species attacks peanuts in the Virginia-Carolina peanut area. Lummus (8), using both soil sifting and solar-enhanced trapping techniques, reported catching several wireworms in Virginia during a two-year study. All were reported to be tobacco wireworm (*Conoderus vespertinus* F.). Although C. *vespertinus* has been reported as an important and common pest of corn and tobacco in North Carolina (10), a preliminary sample of peanut fields in Virginia in 1988 revealed that at least two other species were present. The objective of this work was to initiate studies to determine which species were associated with peanuts grown in the Virginia-North Carolina peanut production area, and their importance as pod damaging pests. Reported here are results of the first study; a two-year cooperative survey of Virginia and North Carolina peanut fields.

Materials and Methods

Wireworm traps were modified from a method described by Kirfman *et al.* (6). Trap baits consisted of 60 mL of an untreated 1:1 wheat/corn seed mixture wrapped in a piece of 2.0x3.0-mm mesh tulle cloth with 40 mL of water-moistened #4 Terra Lite vermiculite (W. R. Grace & Co., Cambridge, MA 02140). Tulle wraps were fastened with wire ties forming bait packets. Packets were prepared and moistened the day before placing traps into fields to ensure seed germination. In the laboratory, bait packets were placed mid-way down into 850-mL plastic drink cups filled with moistened vermiculite. In the field, cups containing bait packets and vermiculite were placed into the soil with their rims at a depth of 5 cm below the soil surface. Excavated soil was placed back into holes around cups and up to a level of 1.5 cm above cup rims. Then trap covers, fashioned from 15-cm-diam plastic plates, were placed directly over traps to prevent rain water from filtering into cups while allowing CO_2 to be emitted from germinating seeds and entrance of wireworms. Additional excavated soil was placed over trap covers to prevent dislodging by wind or animal activity (Fig. 1). Solar enhancement coverings were deemed unnecessary because of the warm soil and air temperatures typically encountered in the early June and early August trapping times.

Survey fields were randomly selected in the different production areas of each state. There was no attempt to document cultivar, soil type or production practices at each location, only that all fields had been in

[1]Mention of companies or commercial products does not constitute an endorsement or recommendation by VPI-CES over others not mentioned.

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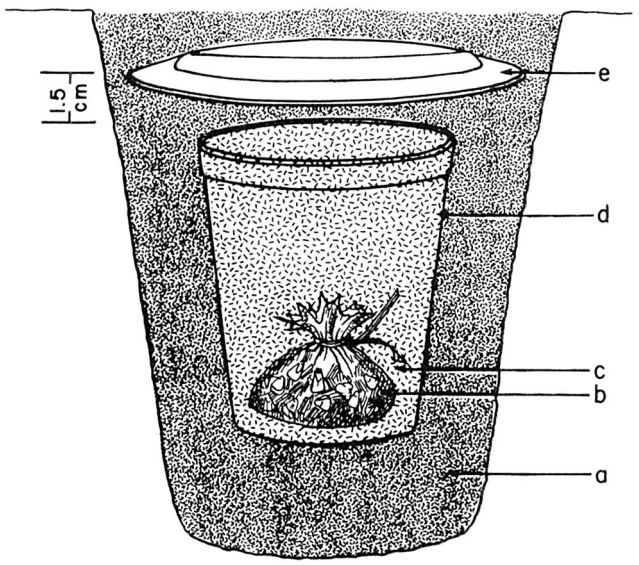

Fig. 1. Baited container soil trap used to survey wireworms in Virginia-North Carolina peanut fields: a) soil, b) 1:1 wheat/ corn seed bait wrapped in 2.0 x 3.0-mm mesh tulle cloth, c) vermiculite, d) 850-ml plastic container, and e) 15-cm plastic lid.

rotation with corn and sample areas were never treated with granular soil insecticides after planting. All fields had been treated with aldicarb in the seed furrow at planting time. Trapping was conducted at two times, once just after planting in late May or early June and again during pod formation in early August. Five traps were placed in each survey field, one in each quadrant and one in the center. All were placed into peanut rows at least 16 m from field edges. Traps were retrieved and processed after one week (= 1 trap-week). In Virginia, a total of 225 trap-weeks were conducted in five of the eight peanut-producing counties in 1989, and 220 trap-weeks in 1990. In North Carolina, six of the peanut producing counties were sampled with a total of 160 trap-weeks. A total of 605 trap-weeks were conducted at 60 different peanut fields during the two-year survey.

When retrieving traps from the field, the soil between the lid and cup rim was examined for wireworms. In the laboratory, trap contents were washed through a 1.6 mm screen sieve using a stream of water to force vermiculite through the screen. Bait packets were rinsed and discarded. All wireworm specimens were placed into vials containing 70 percent alcohol and marked according to date and location. All identifications were made at the Insect Identification Laboratory, Department of Entomology, Virginia Polytechnic Institute and State University, Blacksburg, using existing taxonomic keys (2, 11).

Results and Discussion

The container trap method was chosen for this survey because of its efficiency and replicability based on a comparison by Kirfman *et al.* (6) with the conventional solar-enhanced trapping technique (14). They determined it to be more time-efficient in terms of trap placement, retrieval and processing. The vermiculite being more porous retained moisture longer and was more easily washed through screen sieves during processing than clumped soil; the tulle cloth allowed CO_2 to readily escape but prevented wireworms from entering seeds thus allowing the examiner to wash and discard the seedlings as a whole rather than inspect the entangled mass of seedlings individually as with the conventional bait. The container trap was also more replicable in that the container standardized the amount of substrate processed and provided a more accurate count of wireworms when compared to the hand sorting method used with the conventional system.

The early June and early August sample times were selected to maximize the likelihood of catching specimens by coinciding with the two major larval peaks of species known to occur in the peanut area. Rabb (10) found that in North Carolina C. *vespertinus* overwintered in the larval stage, mostly as late instars, and became active in April. Those larval populations and feeding activity peaked in mid to late May which coincides with peanut planting. Populations then fell to nearly zero in late June as individuals initiated pupation, but increased again in late July and early August as current-year larvae hatched and began development, which, in the Virginia-North Carolina peanut area, would coincide with peanut pod development. Fisher (3) found that in the midwest, *Melanotus* sp. also had two peaks of larval activity in the upper 15 cm of soil, one in late spring an the other in early fall.

Our survey indicated that numbers of wireworms captured and the species represented were similar in both states and both years (Table 1). Overall trap catch was considered to be low with a total of 59 specimens captured. Although not directly comparable, Thomas (13) suggested that the recovery of one wireworm from two soil traps per acre indicated an absolute density of 20,000 wireworms per acre, which was considered an economic threshold for Missouri field corn. Our capture, if determined over all fields and years, was one wireworm per 5 trap-weeks, or one wireworm per field per year. Because so few specimens were captured, no distribution pattern was apparent. No particular fields, soil types or areas stood out as having higher numbers than others.

The species represented in our study were numerous with fifty-eight percent being C. *vespertinus*, 20 percent C.

Table 1. Wireworms captured at two different trapping times, early June and early August, during a two-year (1989-1990) survey of Virginia and North Carolina Peanut fields.

Virginia	1989					
	Early June			Early August		
	Species	No.	% of total	Species	No.	% of total
	Conoderus vespertinus	7	44	C. *vespertinus*	2	12
	C. *lividus*	6	38			
	C. sp.	1	6			
	1990					
	Early June			Early August		
	C. *vespertinus*	10	53	C. *vespertinus*	1	5
	C. *lividus*	5	26			
	C. sp.	1	5			
	Melanotus communis	2	11			
North Carolina	1989					
	Early June			Early August		
	C. *vespertinus*	9	75	C. *vespertinus*	2	16
	M. *communis*	1	8			
	1990					
	Early June			Early August		
	Glyphonyx sp.	5	42	None		
	C. *vespertinus*	3	25			
	C. *lividus*	1	8			
	C. *bellus*	1	8			
	C. sp.	1	8			
	M. *communis*	1	8			

lividus De Geer, 8 percent *Glyphonx* sp., 7 percent *Melanotus communis* Gyllenhal, 5 percent C. sp., and 2 percent C. *bellus* Say. To our knowledge, this is the first reported association with peanut of all of these species except C. *vespertinus* and C. *lividus*. C. *vespertinus* and C. *lividus* were by far the most abundant species captured. Both are known pests of corn (10, 13), the most common rotation crop for peanut in the Virginia-North Carolina peanut area. Because of their long larval development period (up to 300 days) (8, 10), it is very probable that these two species are able to sustain constant year-round larval infestations in fields in which the peanut-corn rotation is prevalent.

Implications from this work are that peanuts in the Virginia-North Carolina production area are grown in association with several wireworm species. However, whether all feed on peanut pods is still unclear. C. *vespertinus*, C. *lividus* and M. *communis* were all found feeding on young pods at some point during the study but their level of feeding was not quantified. No feeding on peanut seed was observed, or, to our knowledge, has ever been reported. The overall low numbers of wireworms captured indicated that they are not primary pod damaging pests. Peanut fields having high levels of wireworms have been reported. Lummus (8) in a two year study found some fields infested with mixed populations of wireworm and southern corn rootworm but only two fields, of about 20 sampled, had wireworms as the predominant soil pest; even in those fields, numbers caught in soil traps could not be significantly correlated ($p=0.01$, $r=0.06$) to pod damage. In the large majority of fields that we sampled, even though wireworm captures were low, moderate to high levels of pod damage were observed. The large numbers of southern corn rootworm adults detected on nearby pheromone-baited white sticky traps (Zoecon Corp, Palo Alto, CA 94394) indicated that most pod damage was not by wireworm but by southern corn rootworm. Southern corn rootworm larvae are known to occur at a time that coincides with peanut pod development and are suggested as having a predominant role in pod injury in the Virginia-North Carolina peanut growing area (5, 12). We conclude that although wireworms can be a problem in specific fields, they occur in a only a small minority of fields and play only a minor role in peanut pod damage.

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Accepted June 13, 1992