Summary of Losses from Insect Damage and Cost of Control in Georgia 2006

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FOR 2006

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Introduction

This publication summarizes the economic losses resulting from insect damage and cost of their control in 2006. The loss estimates are prepared by subcommittees of The University of Georgia, College of Agriculture and Environmental Sciences, Department of Entomology Special Committee on Insect Surveys and Losses. The estimates of yield loss on units treated and untreated for a given insect pest can vary greatly between commodities. This reflects differences in pest populations pressure, efficacy of control, management practices, etc., and the loss is not always lower for the treated units.

Acknowledgments

Many people other than the members of The University of Georgia Department of Entomology Special Committee on Insect Surveys and Losses have contributed significantly in this publication. Committee members had considerable aid from representatives of agribusiness, the United States Department of Agriculture, research and extension workers in other states, and County Extension Coordinators and Agents of The University of Georgia Cooperative Extension Service, the Committee thanks them all. We sincerely thank Ms. Detsy Bridges and Terry All in the Entomology Unit in Athens for their assistance in compiling, typing, proofreading and preparing the web version of this report.

Subcommittee Reports

Apiculture

K. Delaplane

The number of managed bee hives in Georgia increased from 59,000 to 63,000 between 2005 and 2006[1]. This change is within the normal range of vacillation for the state's beekeeping industry the last five years. Beekeepers continued to sustain colony losses and control costs associated with chemical-resistant Varroa mites, antibiotic-resistant American foulbrood disease, and hive-scavenging small hive beetles. Beekeepers report locally high nuisance levels of small hive beetles in honey houses and stored equipment. A few operations sustain damaging levels of beetles in apiaries, especially queen mating yards. Queen performance, measured by egg output and longevity, continues to be a problem with many queens not surviving past six months.

In 2006 the summed production of beekeepers with five or more hives was 4,662,000 pounds of honey, up from 2,891,000 in 2005. Production per hive (63 pounds) was up from 59 in 2005, paralleling the trend for increasing hive numbers. Production increases along with significant increases in price received per pound in 2006 ($1.16 from 0.89) combined to more than double the value of the 2006 crop over 2005 ($5,408,000 vs. $2,573,000).

Extension programs reached an estimated 340 people in local educational efforts aimed at honey bee parasite biology and control, optimum bee management, and public awareness of the value of bee pollinators. State-oriented educational programs reached an additional 450 persons. The fifteenth annual Young Harris College/University of Georgia Beekeeping Institute drew around 115 participants. UGA research focused on Varroa mite and small hive beetle control and pollination of rabbiteye blueberry and watermelon.

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[1]Georgia Farm Report 07(03), Mar. 30, 2007

Cotton Insects

P. Roberts and J. Ruberson

Approximately 1.37 million acres of cotton were harvested in Georgia during 2006. Growing conditions were highly variable during the season. Drought conditions persisted in many areas early and mid season, below average yields were anticipated. However, timely rains were received in late summer and some dryland acres recovered and made a late crop. Harvest conditions were generally favorable. Dryland yields were highly variable (generally better than expected) and irrigated yields tended to be above average in many areas; the average yield for Georgia during 2006 was 818 lbs lint per acre. Insect populations were generally light with the exception of aphids. The primary insect pests which required treatment included stink bugs, corn earworm, thrips, and aphids.

Thrips populations were moderate but plant injury was excessive in some areas due in large part to slow seedling growth. As a whole a greater percentage of acres were treated for thrips with foliar sprays than during recent years. Other seedling pests such as cutworms and grasshoppers were rarely an economic concern.

Aphid populations built to high numbers during June and July. The naturally occurring fungus which causes populations to crash was first observed in south Georgia during late June (normal), but was slow to spread across the state. Aphids remained in some areas until the latter part of July. More acres were treated for aphids than in recent years. Most growers were pleased with the results of treating aphids. Yields were most likely impacted in fields with high populations which were not treated with insecticides.

Spider mites infested many fields and were first observed on squaring cotton. These populations tended to linger season long but failed to build to high numbers. However, the presence of spider mites tended to influence management of other pests. Fortunately other pest problems were minimal and natural controls for spider mites were not routinely disrupted.

Corn earworm and tobacco budworm populations were moderate to heavy during July but extremely low during August and September. Control of corn earworm with pyrethroids was generally good. However, concern remains on changes in the susceptibility of corn earworm to pyrethroids. Fall armyworm infestations were occasional and sporadic. Beet armyworm and soybean looper populations were generally low.

Stink bug populations were generally low to moderate but were the most common pest treated with insecticide. Stink bug populations did not build to high numbers in August and September and afforded late cotton to mature with minimal insecticide input.

No boll weevils were captured in Georgia during 2006.

Estimates of Losses and Control Costs - 2006 Cotton

Rank	Insect	Cost of Control	Damage[1]	Total
1	Tobacco Budworm[2]	$17,951,910	$6,077,000	$24,028,910
2	Stink Bugs	14,250,000	7,080,000	21,330,000
3	Thrips	13,310,000	1,534,000	14,844,000
4	Corn Earworm[2]	8,730,637	4,543,000	13,273,637
5	Aphids	2,880,000	5,900,000	8,780,000
6	Boll Weevil[3]	3,767,500	0	3,767,500
7	Plant Bugs	780,000	2,065,000	2,845,000
8	Fall Armyworm	900,000	354,000	1,254,000
9	Spider Mites	400,000	236,000	636,000
10	Whiteflies	30,000	147,500	177,500
11	Soybean Looper	50,000	0	50,000
12	Grasshoppers	40,000	0	40,000
13	Beet Armyworm	0	0	0
14	Cutworms	0	0	0
	Scouting/Consulting	7,448,000		7,448,000
	Total	***$70,538,047***	***$27,936,500***	$98,474,547

[1]Approximate price received, $0.59/lb. Lint (cash price plus loan deficiency payment, USDA-AMS and USDA-FSA).
[2]Bt transgenic cotton costs based on $19.00 per acre technology fee on 1,231,713 acres. Seventy-five percent of total costs charged to tobacco budworm and 25 percent to corn earworm.
[3]Grower costs of Boll Weevil Eradication Program, $2.75 per acre.

Information Pertaining to Control of Major Cotton Insect Pests in Georgia - 2006

Insect	No. Acres Needing Control	No. Acres Treated	No. of Applic.	Avg. Cost Per Unit Treated[1]	Yield Loss on Units Treated[2]	Yield Loss on Units Untreated[2]
Tobacco Budworm[3]	100,000	20,000	2.0	$10.00	300,000	10,000,000
Stink Bugs	1,000,000	950,000	2.0	7.50	7,000,000	5,000,000
Thrips	1,250,000	1,210,000	1.1	10.00	0	2,600,000
Corn Earworm[3]	350,000	300,000	1.2	8.00	3,000,000	4,700,000
Aphids	600,000	360,000	1.0	8.00	3,000,000	7,000,000
Boll Weevil[4]	0	0	0.0	0.00	0	0
Plant Bugs	140,000	120,000	1.0	6.50	1,200,000	2,300,000
Fall Armyworm	100,000	100,000	1.0	9.00	300,000	300,000
Spider Mites	45,000	40,000	1.0	10.00	100,000	300,000
Whiteflies	3,000	2,500	1.0	15.00	50,000	200,000
Soybean Looper	5,000	5,000	1.0	10.00	0	0
Grasshoppers	5,000	5,000	1.0	7.50	0	0
Beet Armyworm	0	0	0.0	9.00	0	0
Cutworms	0	0	0.0	6.50	0	0

[1]Includes application costs.
[2]Yield units measured in pounds of lint.
[3]Does not include costs of Bt transgenic cotton; foliar insecticides only.
[4]Grower costs of Boll Weevil Eradication Program (BWEP). All cotton produced in Georgia is required to participate in BWEP. The annual per acre assessment for participation was $2.75 per acre during 2006.
[5]Some acreage not treated due to Bt cotton insect resistance management programs.

Field Corn Insects

G. Buntin and J. All

Corn was planted on 280,000 acres and harvested from 225,000 acres in 2006. Yields averaged 112 bushels per acre, and the average price was $2.80 per bushel. About 40,000 acres of corn was harvested for silage with an average yield of 17 tons per acre.

Soil insects as a group were the number one insect pest of field corn in Georgia. Historically about 25-30% of acreage was treated with a conventional at-planting insecticide for soil insect control. In 2006 the neonicotinoid seed treatment, Poncho 250, was used on about 50% of the acreage, replacing some of the conventional at-planting insecticides. This seed treatment cost about $6.50 per acre compared with $12 per acre for conventional treatments. Fall armyworm populations were large later in the season which damaged late-planted corn. Generally, corn earworm numbers were moderate and mainly damaged late-planted corn. Stink bugs populations were very low in 2006 with little damage occurring. Chinch bugs damage seedling stand and infested field during grain fill in some areas. Cereal leaf beetles defoliated some whorl-stage corn mostly along field edges, which rarely reduced grain yield.

Estimated Losses and Control Costs in 2006

Rank	Insect	Cost of Control	Damage	Total
1	Soil insects[1]	$728,000	$ 439,000	$1,167,000
2	Fall armyworm	90,000	526,000	616,000
3	Corn earworm	0	219,000	219,000
4	Stink bugs	28,000	105,000	133,000
5	Chinch bugs	34,000	140,000	174,000
6	Cereal leaf beetle	56,000	0	56,000
	Total	***$936,000***	***$1,429,000***	***$2,365,000***

[1]Includes wireworms, southern corn rootworm, western corn rootworm, lesser cornstalk borer, billbugs, sugarcane beetles and white grubs.

Information Pertaining to Control of Major Field Corn Insect Pests in Georgia in 2006

Insect	No. Acres Needing Control	No. Acres Treated	No. of Acres Applic.	Avg. Cost Per Unit Treated[1]	Yield Loss on Units Treated	Yield Loss on Units Untreated
Soil insects[2]	56,000	112,000	1	6.00	0	157,000
Fall armyworm	28,000	11,000	1	8.00	0	188,000
Corn earworm	14,000	0	1	--	0	78,000
Stink bugs	8,000	6,000	1	5.00	36,000	38,000
Chinch bugs	11,000	6,000	1	6.00	0	50,000
Cereal leaf beetle	2,000	11,000	1	5.00	0	0

[1]Application cost not included; corn earworm control not feasible in field corn.
[2]Includes wireworms, southern corn rootworm, western corn rootworm, lesser cornstalk borer, billbugs, sugarcane beetles and white grubs.

Grain Sorghum Insects

D. Buntin and J. All

A total of 40,000 acres of grain sorghum was planted in 2006 with 26,000 acres being harvested for grain and 11,000 acres being harvested for silage. Grain yields averaged 45 bushels per acre with an average price of $2.52 per bushel. Dry conditions resulted in grain sorghum being planted late which reduced yield potential, but average commodity price was higher than in recent years.

Chinch bug and sorghum midge were the most important insect pests of grain sorghum in Georgia in 2006. Sorghum midge caused losses mainly in late-planted sorghum. Swarming birds also eat grain especially along field margins and in smaller fields. Head worms, including corn earworm, sorghum webworm and fall armyworm, in grain heads are managed together, but populations were moderate in 2006. Stink bug populations were very small and did not cause much damage during grain fill in 2006. Soil insects, mostly lesser cornstalk borer at planting, caused sporadic damage in some fields.

Estimated Losses and Control Costs in 2006

Rank	Insect	Cost of Control	Damage	Total
1	Chinch bug	$15,000	$ 42,000	$ 57,000
2	Sorghum midge	13,000	15,000	28,000
3	Bird damage[2]	0	29,000	29,000
4	Head worms[1] and stink bugs	6,000	6,000	12,000
5	Soil insects	12,000	8,000	20,000
	Total	***$46,000***	***$100,000***	***$146,000***

[1]Includes corn earworm, sorghum webworm and fall armyworm.

Information Pertaining to Control of Major Grain Sorghum Insect Pests in Georgia in 2006

Insect	No. Acres Needing Control	No. Acres Treated	No. of Acres Applic.	Avg. Cost Per Unit Treated[1]	Yield Loss on Units Treated	Yield Loss on Units Untreated
Chinch bugs	5,500	1,850	1	8.00	0	17,000
Sorghum midge	3,900	2,600	1	5.00	0	6,000
Bird damage[2]	2,600	0	–[2]	–[2]	0	12,000
Head worms and stink bugs	2,080	1,040	1	6.00	0	3,000
Soil insects	2,960	1,480	1	8.00	0	3,000

[1]Application cost not included.
[2]Not legal to control birds with pests.

Household and Structural Insects

D. Suiter and B. Forschler

Georgia is the second most populated state in the Southeast. During the 1990s it was the fastest growing state east of Colorado and the sixth fastest growing state in the U.S. As of 2005, 12 of the 100 fastest growing counties in the U.S. were in Georgia—only Florida had more (14). During the 1990s, Georgia's population grew by 1.7 million (26.4% increase) to 8.2 million. The Atlanta metropolitan statistical area (MSA) grew by 1.1 million, accounting for 68% of the state's growth. Half of Georgia's residents currently live in the Atlanta MSA, and by 2010 the Atlanta area is projected to have grown by another 687,000. From 2005 to 2006 Georgia was the fourth-fastest growing state in the U.S. During that one year period, 231,388 people moved into the state, bringing Georgia's population to 9,363,941. From 2000 to 2006, Georgia's population grew by about 1.2 million; during the same period, only Arizona and Nevada grew faster! Urbanization often leads to problems directly associated with insects and other pests. A 2003 University of Georgia Survey Research Center poll of 500 Georgians found that:

- 26% of respondents had hired a pest control company in the past two years to treat for termites. The response was statistically independent of whether the respondent was a Georgia native or not, age, ethnicity, gender, and marital status, but was dependent upon education, income, whether the respondent lived in a MSA or not, and whether the respondent rented or owned their home.
- 36% of respondents had hired a pest control company in the past two years to treat for pests other than termites. The response was statistically independent of whether the respondent was a Georgia native or not, age, ethnicity, gender, income, and whether the respondent rented or owned their home, but was dependent upon marital status, education, and whether the respondent lived in a MSA or not.

A 2005 nationwide survey indicated that pest management firms in the U.S. amassed an estimated $6.76 billion in revenue from residential (general insect control and termites) and commercial services, representing a 4% increase over 2004. Because some pest species are a problem anywhere that food is manufactured, prepared, cooked, served, or stored, commercial businesses serviced by pest management firms often include restaurants, service stations, schools, daycares, hospitals, grocery stores, nursing homes, food processing and manufacturing plants, food storage facilities and warehouses, etc.

Each year, over 1,000 pest management firms in Georgia serve the diverse needs of Georgia homeowners and businesses. In 2006, for instance, 1,229 pest management firms in Georgia employed 7,868 licensed individuals (2,058 certified operators and 5,810 technicians), excluding secretaries and other office personnel; 75 new pest management firms were started in Georgia in 2006. The Georgia Department of Agriculture (GDA) regulates Georgia's 1,200+ termite and pest control businesses. Each year the GDA inspects (at consumer request) approximately 3,000 treatments performed by pest management professionals to ensure that Georgia consumers receive treatments that meet established state standards and provide protection for attack by termites.

The total dollar value (i.e., revenues and expenditures) associated with pests and their control and prevention comes from a wide variety of sources—not just service fees garnered by pest management firms. For instance, in addition to the service fees paid by Georgians to pest management firms to control and prevent pests of homes, homeowners also spend untold dollars to repair damage to homes caused by pests and to pay for expenses related to the treatment of medical conditions that are a direct result of bites, stings, or allergies caused by some pests found in and around the home. Fire ants, yellow jackets, wasps, hornets, and some stinging caterpillars and biting spiders are annually responsible for a number of human deaths, emergency room visits, and hospitalizations. Financial costs associated with these events are unknown, but probably significant. Furthermore, house dust mites and German cockroaches are common causes of asthma in inner city children. Cockroach allergies are reportedly the #1 reason for emergency room visits by inner city children. Many arthropods create real anxieties, known as entomophobias, in an unknown number of individuals. Some entomophobias are extreme, resulting in a mental state known as Delusory Parasitosis (DP), wherein delusions of insect infestation of the body dominate one's thoughts and actions to the detriment of living a normal life. Cases involving DP sometimes require professional medical (e.g., for treatment of infected sores caused by excessive scratching, or in some cases self-mutilation, caused by the patient's need to 'remove the bugs' from the skin) and psychological care. The costs of both forms of care are unknown. Finally, many industries and businesses peripheral to the pest management industry (e.g., pesticide product manufacturers, equipment manufacturers, insurers, regulators, product distributors, professional organizations and associations, etc.) add thousands of jobs and generate tens of millions of dollars in revenue for their U.S. and Georgia-based companies.

<u>2006 Topics Important Nationally and Regionally</u>

- The Evolution of the Bed Bug Problem: Insecticide Resistance, Liability, Bed Bug Spread (nationally), Lack of Reliable Control Options
- Regulatory Issues and Pest Management in Schools (GA)
- The Evolution of Green Pest Control Services (both nationally and in GA)
- Borate-Based Pre-Treats (regionally and in GA)
- Formosan Termites (regionally and in GA)
- Softening Termite Control Market: lack of termite swarms and a weak housing market
- Price of Gas: in an industry that is driving-intensive.

<u>Non-Termite Pests: Ants are King!</u> In 2006, a nationwide survey (Pest Control Technology [PCT] magazine) of 378 pest control companies asked the following questions:

- *Which ONE of these services represented your company's largest growth market in 2006*? As in previous years, ant control was the fastest growing segment of pest management services—reported by 29% of companies as their best growth area in 2006. Responses for other segments of business growth were 21% for termites; 16% perimeter pest control; 8% IPM; 4% for lawn care, bed bug control, and rodent control; 3% for wildlife management, flying insects, and others; and 1-2% for fleas, fumigation, birds, and mosquitoes.
- *Which of the following services does your company offer*? 90% of the 378 companies offered ant control services, more than any other type of service offered. The response for other categories included 89% rodent control; 86% perimeter pest control; 84% flea control; 66% IPM; 65% termite control; 57% flying insect control; 56% bed bug control;

30% bird control; 24% mosquito control; 23% vertebrate/wildlife control; 16% lawn care; 15% moisture control; 11% fumigation; and 7% other.

- Ants were overwhelmingly considered the most difficult pest to control. When asked *What pest is proving to be the hardest to control in your market*? 45% of responding companies answered "ants", followed by 16% for bed begs; 12% fleas; 9% cockroaches; 6% other; 5% or less for rodents, birds, and wildlife. Notably, just 2% of the 378 companies responding to the survey indicated that termites were their most difficult pest to control!
- In summary, ants and their control are a very important component of pest control. In 2006, ant control services were the greatest segment of business growth. Although 90% of companies offer ant control services, ants were considered the most difficult pest to control—even more difficult than termites.

In the same 2003 UGA Survey Research Center poll of 500 Georgians mentioned above, 33% of respondents had been troubled by an ant infestation in their home in the past two years. The response was statistically independent of whether the respondent was a Georgia native or not, age, gender, marital status, income, education, whether the respondent rented or owned their home, and whether the respondent lived in a MSA or not. The response was, however, dependent upon ethnicity. In Georgia, the most important group of non-termite pests are the ants—Argentine ants (known to Georgians as 'sugar ants'), fire ants, carpenter ants, and odorous house ants.

Other pests important in Georgia include cockroaches (German, Asian, smokybrown, American), flies (houseflies, moth flies, fruit flies), biting and stinging pests (spiders, fleas, ticks, yellow jackets, hornets, bees, stinging caterpillars, mosquitoes), pantry and fabric pests (Indianmeal moths, cowpea weevils, drugstore and cigarette beetles, and carpet beetles), and various occasional invaders (millipedes, earwigs, centipedes, crickets, camel crickets, ground beetles, pillbugs and sowbugs, and springtails).

Wood-Destroying Organisms. Subterranean termites are the most economically important structural insect pest encountered by Georgia homeowners. In Georgia, subterranean termites account for tens of millions of dollars in pest control industry revenue and homeowner expenditures to repair termite-damaged homes. In the same PCT survey noted above of 378 companies, termite control services represented the #2 growth market for pest control companies in 2006 (ants were #1); 21% of responding companies answered "termites" (compared to 29% for "ants") when asked the question *Which ONE of these services represented your company's largest growth market in 2006*? Furthermore, 65% of the 378 companies surveyed offered termite control services, compared to 90% who offer ant control services. Termites were not considered that difficult to control. When asked the question *What pest is proving to be the hardest to control in your market*, just 2% of responding companies answered "termites", while 45% of responding companies answered "ants". Bed bugs, fleas, cockroaches, and rodents were considered more difficult to control than were termites. In 2006, 28% of companies that offer subterranean termite control services use both baits and liquid termiticides; 42% use only liquids; 22% use wood treatments and soil treatments combined; and just 3% use only baits. Drywood termites are less important, and largely a regional pest along Georgia's coastline and in south Georgia. Other, less important, wood-destroying insect pests encountered by the structural pest

control industry include powderpost beetles, old house borers, carpenter ants, and carpenter bees. Wood-rotting fungi, associated with persistently wet wood, is responsible for unknown costs related to control and damage repair (i.e., mainly wood replacement). Collectively, though, drywood termites and all wood-infesting beetles likely account for a fraction of the economic impact of either subterranean termites or wood-rotting fungi.

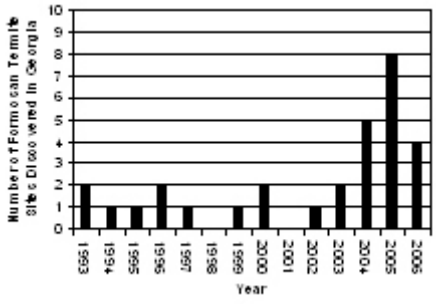
The *Formosan subterranean termite* (FST) is a unique species of subterranean termite that deserves special mention because of its potential negative impact on Georgians. It is native to China, was accidentally introduced into the southern U.S. by maritime traffic over 50 years ago, and has since been found in nine southern states. From 1993 to 2006, 30 infestations have been identified in Georgia (**see graph below**). Four sites were found in 2006 alone. Additional, undiscovered sites certainly exist throughout the state.

The FST is the most destructive termite pest in the U.S., and arguably the world. It can cause extensive structural damage. In extreme cases, damage can even be catastrophic. A homeowner in Marietta, GA sustained, by his own estimate, $200,000 in Formosan termite damage (see quote below); we can cite several other damage estimates of homes in Georgia in the $10,000-$70,000 range. Prior to hurricane Katrina, the FST was annually responsible for an estimated $100 million in damage to homes and businesses in the New Orleans area.

In the U.S., the Formosan termite is most commonly spread by movement of termite-infested railroad crossties. As railroad companies replace crossties, some of the used ones are sold and re-used to build retaining walls and other landscape features around homes and businesses. Some of the used crossties are infested with Formosan termites. The termites survive transport and become established in previously un-infested areas when the crossties are installed. Unfortunately, movement of termite-infested crossties into un-infested, growing communities will likely continue for the foreseeable future.

"If you add in demolition associated costs to the costs of labor and replacement, I think $200,000 is a fair estimate… just to "get back" what was already there in a 1970s brick ranch. This has become a life-changing event".

---This is a 2003 email quote from a Marietta, GA homeowner regarding out-of-pocket costs directly associated with a Formosan termite infestation of his home.



Since 1993, 30 Formosan termite sites have been discovered in Georgia, including four in 2006.

Livestock and Poultry Insects

N. Hinkle

Estimates of Losses and Control Costs

Rank	Insect	Cost of Control	Damage	Total
1	Darkling beetles	$4,516,000	$7,548,000	$12,064,000
2	House flies	2,827,000	2,819,000	5,646,000
3	Horn flies	1,738,000	1,711,200	3,449,200
4	Stable flies	1,254,000	1,453,000	2,707,000
5	Northern fowl mites	453,000	1,361,000	1,814,000
6	Lice	441,000	485,000	926,000
7	Grubs and Bots	320,000	163,000	483,000
8	Horse flies	60,000	170,000	230,000
	Total	***$11,609,000***	***$15,710,200***	***$27,319,200***

Estimates of Losses and Control Costs for Each Group of Livestock and Associated Pests in Georgia in 2006.

Insect	Control Cost	Damage	Total
Beef Cattle			
Horn fly	$1,720,000	$1,650,000	$3,370,000
Lice	201,000	352,000	553,000
Stable fly	157,000	356,000	513,000
Grubs	127,000	66,000	193,000
Subtotal	***$2,205,000***	***$2,424,000***	***$4,629,000***

Insect	Control Cost	Damage	Total
Dairy Cattle			
Horn fly	$18,000	$61,200	$79,200
Lice	27,000	55,000	82,000
Stable fly	99,000	997,000	1,096,000
Grubs	94,000	12,000	106,000
Horse fly	187,000	950,000	1,137,000
Subtotal	***$425,000***	***$2,075,200***	***$2,500,200***
Horses			
Lice	$74,000	$10,000	$84,000
Stable fly	998,000	100,000	1,098,000
House fly	800,000	78,000	878,000
Horse fly	60,000	170,000	230,000
Bots	99,000	85,000	184,000
Subtotal	***$2,031,000***	***$443,000***	***$2,474,000***
Poultry (Layers)			
Lice	$22,000	$20,000	$42,000
House fly	380,000	299,000	679,000
Darkling beetle	47,000	94,000	141,000
Mites	153,000	362,000	515,000
Subtotal	***$602,000***	***$775,000***	***$1,377,000***
Poultry (Breeders)			
Lice	$39,000	$16,000	$55,000
House fly	440,000	590,000	1,030,000
Darkling beetle	42,000	230,000	272,000
Mites	300,000	999,000	1,299,000
Subtotal	***$821,000***	***$1,835,000***	***$2,656,000***
Poultry (Broilers)			
House fly	$1,020,000	$902,000	$1,922,000
Darkling beetle	4,427,000	7,224,000	11,651,000
Subtotal	***$5,447,000***	***$8,126,000***	***$13,573,000***
Grand Total	***$23,140,000***	***$31,388,400***	***$54,528,400***

Ornamental, Lawn and Turf Insects

R. Oetting, W. Hudson and K. Braman

The ornamentals, lawn, and turf section covers estimates for both the production and maintenance industries. The economic impact is inflated more by the maintenance industry than production industry. The use of pesticides by homeowners and professional pest control operators for control of pests around public areas (schools, industrial sites, hotels and motels, financial institutions, hospitals, municipal and private parks, shopping centers, higher education institutions, churches, cemeteries, golf courses) contribute to determining the costs of control and damage.

Ornamental production of floricultural crops is primarily under greenhouse culture and has spring and fall pest problems. Field production has been on a decline and there are only a few commercial field production operations left. There is a substantial amount of outdoor production of bedding plants near greenhouses as part of the overall production. Populations of whiteflies, including the resistant Q-strain of *Bemesia tobacci*, were down slightly but costs of treatment were up due to the more costly materials used by many growers. Mealybugs and spider mites were generally manageable. Leafminers were serious pests for those few growers who had them; they were essentially uncontrollable where the problem is longstanding.

Approximately 24% of Georgia homeowners purchase lawn care and landscape maintenance services (Jordan et al., 1999) and the Atlanta Metro Area is consistently one of the largest lawn care markets in the United States. The number of landscape installation and maintenance firms in Georgia exceeded 2,300 and provided employment for over 42,000 individuals. The majority of these firms (63%) serviced at least 100 acres of lawns and landscapes, and it is estimated that all firms together serviced approximately 225,000 landscape acres.

In 2006, the major insect problems on woody ornamentals, both in home landscapes and commercial landscape maintenance, included various species of scale insects, mealybugs, mites, aphids, whiteflies, various caterpillars, foliage feeding beetles, borers, and lace bugs. Scale problems, in particular, have become much more manageable with the introduction over the last few years of new insecticides with excellent efficacy on these pests. This has reduced the damage associated with scales and mealybugs, but the costs have dropped more slowly as these materials are relatively expensive.

The turf industry in Georgia, including production, sales, installation and maintenance, is estimated to be worth over $1.6 billion annually. There are currently 445 golf courses in operation in the state, with more under construction or in planning. There are over 750 football fields, thousands of acres of turf on school grounds (public and private), and more than 25,000 acres of turf in parks. In total, there are almost 2 million acres of turf grass in the state. The Atlanta metro area has been the strongest housing market and largest lawn care market in the country. Continued demand for quality sod has fueled an expansion of the state's sod production industry to over 38,000 acres, more than double the acreage in 1998.

Although mole crickets are found only in the coastal plain region, they are so destructive and difficult to control that a significant proportion of the losses and control costs due to insects statewide are due to these pests. The damage done by mole crickets in well managed turf has been dropping over the last few seasons, as newer insecticides have become widely available. These materials are expensive but very effective and once mole crickets are controlled in a given area, they may take several seasons to build back up to destructive population levels. White grubs and billbugs in zoysiagrass production continue to cause significant losses, although white grubs are also more manageable with newer insecticides.

Private units considered in preparing the loss estimates for 2006.

Households	3,006,000
Floriculture (18.4 million ft^2)	1,025
Nurseries (3,600 acres containers)	1,285
Nurseries (5,825 acres field)	1,800
Sod farms (38,000 acres)	100

Estimates of Losses and Control Costs

Insect	Cost of Control	Damage	Total
Ornamentals			
Scale insects & mealybugs	$25,500,000	$20,000,000	$45,500,000
Mites	24,750,000	22,300,000	47,050,000
Aphids	8,370,000	2,000,000	10,370,000
Whiteflies	9,000,000	4,235,000	13,235,000
Thrips	7,745,000	7,500,000	15,245,000
Caterpillars[1]	1,850,000	1,300,000	3,150,000
Slugs and snails	2,000,000	850,000	2,850,000

Insect	Cost of Control	Damage	Total
Beetles[2]	1,650,000	2,700,000	4,350,000
Lace bugs	1,750,000	300,000	2,050,000
Spittle bugs	400,000	90,000	490,000
Miscellaneous[3]	5,465,000	2,850,000	8,315,000
Subtotal	***$88,480,000***	***$64,125,000***	***$152,605,000***
Lawns and Turf			
Mole crickets	$ 11,855,000	$3,000,000	$14,855,000
Caterpillars[4]	3,600,000	2,300,000	5,900,000
White grubs	3,350,000	1,850,000	5,200,000
Cinch bugs	1,150,000	1,500,000	2,650,000
Spittle bugs	900,000	1,710,000	2,610,000
Miscellaneous[5]	2,835,000	2,835,000	5,670,000
Subtotal	***$23,690,000***	***$13,195,000***	***$36,885,000***
Grand Total	***$112,170,000***	***$77,320,000***	***$189,490,000***

[1]Primarily bagworm, cutworms, corn earworms, loopers, azalea caterpillars, tent caterpillars, webworms, and leaf rollers.
[2]Primarily leaf beetles, Japanese weevils, Fuller Rose weevils, Japanese beetles, whitefringed beetles, and borers.
[3]Includes grasshoppers, fungus gnats, millipedes, sowbugs, psocids, springtails, ants, earwigs, and leafminers.
[4]Sodwebworms, armyworms, cutworms.
[5]Ants (fire ants are included in a separate report), billbugs, leafhoppers, bermudagrass mites and stunt mites.

Pasture and Forage Insects

W. Hudson, D. Buntin and W. Gardner

Acreages of forage and pasture crops have declined in recent years to about 1.3 million acres of grass pastures and over 650,000 acres of grass hay pastures in 2006. Although losses per acre generally are low and treatment thresholds are large, this extensive acreage produces large combined losses for forage and pasture insects in Georgia. Losses are greater for hay than pastures because hay crops have greater yield potential and market value.

The number one pest of perennial grass forages, primarily bermudagrass, was mole crickets. Mole crickets damaged grass pastures in southern Georgia, especially in the Flatwoods region, sometimes requiring replanting. Introduction of two natural enemies, the nematode parasite *Steinernema scapterisci*, and the wasp, *Larra bicolor*, have reduced the impact of mole crickets significantly over the last couple of years, a trend that should continue. The white grub complex, mostly *Phyllophaga* spp., *Cyclocephala* sp. and Green June beetle larvae, caused damage in some fields. Dry conditions in spring and summer reduced yields some and fall armyworm damage was extensive in many areas. The striped grassworm, *Mocis latipes*, was unusually abundant in 2006, generally in mixed populations with armyworms, adding to the caterpillar damage. Spittlebug damage to permanent grasses was sporadic, but chinch bug damage to millet and sorghum planted as forage was sometimes extensive.

Alfalfa acreage in Georgia was about 30,000 acres in 2006. The alfalfa weevil was the number one pest of alfalfa with many fields being treated to control this insect.

Estimated Losses and Control Costs in 2006

Rank	Insect	Cost of Control	Damage	Total
GRASS HAY PASTURES				
1	Mole crickets	$ 0	$2,437,500	$2,437,500
2	White grubs	400,000	910,000	1,310,000
3	Fall armyworm	70,000	87,750	157,750
4	Spittlebug/chinch bug	35,000	43,875	78,875
5	Leafhoppers/planthoppers	0	16,250	16,250
	Subtotal	***$505,000***	***$3,495,375***	***$4,000,375***
GRASS PASTURES				
1	Mole crickets	$ 0	$1,100,000	$1,100,000
2	White grubs	750,000	473,000	1,223,000
3	Fall armyworm	245,000	123,750	368,750
4	Spittlebug/chinch bug	84,000	39,435	123,435
5	Leafhoppers/planthoppers	70,000	24,750	94,750
	Subtotal	***1,149,000***	***$1,760,935***	***$2,909,935***
ALFALFA				
1	Alfalfa weevil	$98,000	$249,000	$347,600
2	Potato leafhopper	0	36,000	36,000
	Subtotal	***$98,000***	***$285,000***	***$383,000***
	Total	***$1,247,000***	***$2,045,935***	***$3,292,935***

Information Pertaining to Control of Major Pasture and Forage Insect Pests in Georgia in 2006.

Insect	No. Acres Needing Control	No. Acres Treated	No. of Acres Applic.	Avg. Cost Per Unit Treated[1]	Ton Loss on Units Treated	Tons Loss on Units Untreated
GRASS HAY PASTURES						
Mole crickets	100,000			N/A	0	37,500
White grubs	60,000	40,000	1	10.00	4,000	10,000
Fall armyworm	25,000	10,000	1	7.00	250	1,100
Spittlebug	10,000	5,000	1	7.00	50	625
Leafhoppers/ plantbugs	2,000	0	0	N/A		250
GRASS PASTURES						
Mole crickets	75,00	0		12.00	0	37,500
White grubs	100,000	75,000	1	10.00	3,000	5,600
Fall armyworm	75,000	35,000	1	7.00	350	1,900
Spittlebug	24,000	12,000	1	7.00	140	577
Hoppers	20,000	10,000	1	7.00	75	375
ALFALFA HAY						
Alfalfa weevil	15,000	14,000	1	7.00	1,120	800
Potato leafhopper	1,500	0	0	N/A	0	300

NOTE: Hay crops consisted of 650,000 acres of grasses (hybrid bermudagrass 75%; tall fescue 20%; and other grasses 5%), with an average yield of 1.8 tons per acre. Alfalfa acreage was 30,000 acres with an average yield of 3.5 tons per acre. Grass and clover hay were valued at $65 per ton and alfalfa hay was worth $130 per ton. Permanent pasture consisted of 500,000 acres of bahiagrass and 800,000 acres of fescue, fescue/clover mixtures and fescue/common bermudagrass. Average yield was estimated at 0.75 ton per acre with a value of $55 per ton. An additional 400,000 acres of temporary pasture (mostly small grains and sorghum) was grazed. There were 150,000 acres of sorghum and millet silage harvested. Silage and temporary pasture crops were included as pasture grasses.

[1] Application cost not included.

Peanut Insects

D. Adams

In 2006, peanut yields averaged 2780 lbs/A on 575,000 harvested acres. Total production was 1.60 billion pounds. Prices received by farmers averaged $0.175per pound.

Lesser cornstalk borer (LCB) was the most costly pest in damage losses topping 24 million dollars. The granulate cutworm caused insignificant yield losses, but cost of control was high due to insecticide resistance, extreme heat and population resurgence in many fields. Some fields had 3 applications of insecticide for granulate cutworms. Burrowing bugs continue developing as a major pest in no-till peanuts, especially in non-irrigated fields. Because of these cultural practices, it is difficult to put a soil insecticide in contact with the target.

Estimates of Losses and Control Costs

Rank	Insect	Cost of Control	Damage	Total
1	Lesser Cornstalk Borer	$8,000,000	$5,118,750	$13,118,750
2	Thrips	4,940,000	218,750	5,118,750
3	Granular Cutworm	4,830,000	43,750	4,873,750
4	Spidermites	1,360,000	743,750	2,103,750
5	Burrowing Bug	400,000	139,125	539,125
6	3-Cornered Alfalfa Hopper	468,750	0	468,750
	Total	***$19,998,750***	***$6,264,125***	***$26,262,875***

Information Pertaining to Control of Major Peanut Insect Pests in Georgia in 2006.

Insect	No. Acres Needing Control	No. Units Treated	No. of Unit Applic.	Avg. Cost per Unit Treated[1]	Yield Loss on Units Treated[2] (Avg/A)	Yield Loss on Units Untreated[2] (Avg/A)
Lesser Cornstalk Borer	225,000	400,000	1	20.00	24,750,000 (110)	4,500,000 (500)
Thrips[3]	480,000	520,000	1	9.50	0	1,250,000 (250)
Granulate Cutworm	230,000	300,000	1.85	12.00	0	250,000 (125)
Spidermites	85,000	85,000	1	16.00	4,250,000 (50)	0
Burrowing Bugs	8,000	20,000	1	20.00	720,000 (90)	75,000 (150)
3-Cornered alfalfa hopper	70,000	75,000	1	6.25	0	0

[1]Includes application costs.
[2]Yield units measured in pounds.
[3]Losses due to Tomato Spotted Wilt Virus (TSWV) are not included.

Pecan Insects

W. Hudson and J. Dutcher

Extreme drought in late-season 2005, coupled with an extremely dry spring, stressed trees and reduced the crop in what was already an "off" year to just 42 million lbs. Prices were strong, so overall value of the crop was $66 million, about 2/3 of 2005 value.

Pecan nut casebearer control costs were higher in 2006 than in recent years. The emergence of moths began earlier than usual by as much as 2 - 3 weeks, and moths were active for a longer time. Some areas experienced two peaks of flight and egg-laying activity. For some of the major production areas, a single insecticide application was not sufficient even if timing was right for the first part of the casebearer flight. Damage to newly-set nuts was as high as 60% in some orchards. The trees proved flexible in responding to such early damage, and effect on yield was no larger than normal, but control costs were up significantly. Aphid and mite populations, and damage and control costs associated with these pests, were down slightly from 2005.

Estimate of Losses and Control Costs

Rank	Insect	Cost of Control	Damage	Total
1	Pecan weevil	$4,050,000	$2,471,299	$6,521,229
2	Black pecan aphids	1,999,500	1,797,991	3,797,491
3	Mites[3]	1,800,000	210,527	2,010,527
4	Hickory shuckworm	650,000	283,092	933,092
5	Yellow aphids[1,2]	600,000	92,231	692,231
6	Pecan nut casebearer	520,000	0	520,000
7	Spittlebugs	50,000	0	50,000
8	Kernel feeding hemipterans	45,000	276,500	321,500
9	Others[4]	120,000	102,068	222,068
	Total	***$9,834,500***	***$5,233,638***	***$15,068,138***

[1]"Yellow aphids" include the yellow pecan aphid and the blackmargined aphid.
[2]The cost of control of yellow aphids includes $60 per acre for application of aldicarb or imidacloprid and $10 per acre for foliar sprays.
[3]"Mites" refers primarily to the pecan leaf scorch mite.
[4]"Others" include the pecan bud moth, casebearers, leaf miners, fall webworm, phylloxeras, walnut caterpillar, boring insects, *Prionus* spp., hickory nut curculio, and hickory shoot curculio.

Information Pertaining to Control of Major Pecan Insect Pests in Georgia in 2006.

Insect	No. Units Needing Control	No. Units Treated	No. of Unit Applic.[1]	Avg. Cost Per Units Treated	Yield Loss on Units Treated[2]	Yield Loss on Units Untreated[3]
Pecan weevil	113,000	90,000	3.0	$15.00	285,768	1,278,301
Black pecan aphids	75,000	100,000	1.5	13.33	822,150	315,819
Hickory shuckworm	75,000	50,000	2.0	6.50	56,700	122,472
Yellow pecan aphids[4]	25,000	40,000	1.5	10.00	31,300	27,074
Mites[5]	10,000	60,000	1.5	20.00	104,895	28,350
Pecan nut casebearer	75,000	80,000	1.0	6.50	0	0
Spittlebugs	0	5,000	1.0	10.00	0	0
Kernel feeding hemipterans[6]	10,000	5,000	1.	9.00	115,000	60,000
Others[7]	20,000	10,000	1.0	12.00	26,400	38,200

[1]Some applications control more than one pest and the number of applications indicated were not made in all orchards.
[2]Excluding application costs.
[3]Yield units measured in pounds.
[4]"Yellow aphids" include the yellow pecan aphid and the black-margined aphid.
[5]"Mites" refers primarily to the pecan leaf scorch mite.
[6]"kernel feeding hemipteran" include the southern green stink bug, the brown stink bug, the leaf-footed bug and others
[7]"Others" include the pecan bud moth, pecan leaf casebearer, leaf miners, fall webworm, walnut caterpillar, phylloxeras, boring insects, *Prionus* spp., hickory nut curculio, and hickory shoot curculio.

Public Health and Recreational Area Insects

E. Gray

In 2006, mosquitoes were the most important and expensive public health pests. Mosquito control and surveillance continued to receive more emphasis as a result of WNV awareness; however support from the Centers for Disease Control for viral testing has begun to decline. Likewise, funding at most of the state's mosquito control programs has stabilized as interest in WNV subsided. Coastal areas with continued population growth continue to increase support for organized mosquito control. Surveillance for all types of mosquito borne encephalitis has been greatly expanded and the Georgia Department of Human Resources continues to provide leadership in this area. However, decreased CDC funding has begun restricting how many and what type of mosquitoes and birds were tested.

In 2006, there were 9 confirmed human cases of West Nile virus causing 1 death. Mosquito surveillance continues to indicate that the Southern House mosquito, *Culex quinquefasciatus* appears to be our primary vector of WNV in Georgia. This species prefers to breed in polluted waters contaminated with organic matter and is often found in the storm drains in cities and towns. Most areas with significant storm drain systems continue to treat these areas extensively with mosquito larvicides.

In general, mosquito numbers were normal throughout most of the season. Limited hurricane activity did not produce any significant flooding events. Only one case of eastern equine encephalitis was reported in both 2006 as well as 2005. Similarly, only one case of LaCrosse encephalitis was reported in both 2006 and 2005. No St. Louis encephalitis was reported during either of these seasons. Imported malaria continues to be relatively common with 88 cases being reported in 2006 and 50 cases in 2005. Another significant international disease that is imported into Georgia is Dengue. In 2006 one case was observed with five cases occurring in 2005.

Houseflies also continue to be significant pests with the primary concerns being garbage management and exclusion aspects. Ticks, primarily lone star ticks, American dog ticks and blacklegged ticks were present in many sections of the state. Their bite and their ability to serve as vectors of Lyme disease and Rocky Mountain Spotted Fever (RMSF) made them important public health arthropods. There were 7 cases of Lyme disease in 2006, down from 10 cases in 2005 and 13 cases in 2004. There were 10 cases in 2003 and the 5 cases in 2002. Rocky Mountain Spotted Fever continues to be the most common tick borne disease in the state with 48 cases in 2006, down from the 83 cases in 2005 and 73 cases reported in 2004 and 65 cases reported in 2003. The Georgia Department of Human Resources, Epidemiology and Prevention Branch has completed an extensive tick attachment survey that will shed additional light on our tick/host/disease situation in Georgia. Results should be available in 2007. (Data on vector borne disease provided by the Office of Epidemiology and Prevention Branch, Georgia Department of Human Resources).

Estimates of Losses and Control Costs

Rank	Insect	Cost of Control
1	Mosquitoes	$126,965,513
2	Flies (non-biting)	58,250,234
3	Others[1]	20,837,352
4	Ticks and Chiggers	7,244,712
5	Headlice	6,534,552

6	Yellow Jackets	5,581,771
	Total	***$225,414,134***

Summary of Insect Control and Losses Estimates

Insect	Item	Cost
Flies	window screens	$ 6,78,639
	screened doors	18,857,330
	aerosol sprays	10,560,105
	garbage removal	18,857,330
	garbage dumpsters	188,515
	garbage cans	188,733
	fly swatters	1,112,528
	Subtotal	***$58,250,234***
Mosquitoes	window screens	$ 6,788,639
	screened doors	18,857,330
	aerosol sprays	10,560,105
	repellents	5,949,059
	abatement programs	9,201,947
	heartworm prevention & treatment	74,290,000
	hospitalization	352,000
	doctor fees	464,459
	druggist fees	46,515
	Subtotal	***$126,965,513***
Other	window screens	$ 2,545,740
	screened doors	7,071,499
	aerosol sprays	3,060,039
	repellents	5,940,059
	doctor fees	1,131,440
	druggist fees	188,575
	Subtotal	***$20,837,352***
Head Lice	doctor fees	$2,658,123
	druggist fees	3,876,429
	Subtotal	***$6,534,552***

Insect	Item	Cost
Ticks and Chiggers	repellents	$5,091,479
	doctor fees	22,000
	druggist fees	5,500
	hospitalization	220,000
	acaracides (residential)	1,885,733
	acaracides (organizations)	
	Subtotal	***7,244,712***
Yellow Jackets	window screens	$ 848,580
	screened doors	2,357,166
	aerosol sprays	1,320,013
	doctor fees	905,152
	druggist fees	150,860
	Subtotal	***$5,581,771***
	TOTAL	***$225,414,134***

Cost of Control Estimates

Mosquitoes - 40%, Flies - 40%, Eye gnats - 5%
Yellow Jackets - 5%, Others[1,2] - 10%

1. Window screens - 10 screens/residence
x $12.00/screen = $120/residence
x 3,771,466[3] residences = 452,575,920.
20 year life/screen = $22,628,796/year
x 75% who have window screens — *$16,971,597*

2. Screened doors - 2 screened doors/residence
x $125/screened door = $250/residence
x 3,771,466 residences = 942,866,500.
15 year life span/screened door = 62,857,767/
year x 75% who have screened doors — *$47,143,325*

3. Aerosol sprays - 2-15 oz. aerosol insecticide
spray can/residence. $3.50/can x 2 can x 3,771,466
residences = 26,400,262 — *$26,400,262*

Subtotal — ***$90,515,184***

Mosquitoes - 35%, Ticks and Chiggers - 30%,
Eye gnats - 25%, Others[1] - 10%

4. Repellents - 1 pump spray/aerosol can/residence.
$4.50/can x 1 x 3,771,466 residences = $16,971,597 — *$16,971,597*

Mosquitoes - 100%

5. Mosquito Abatement Program

(a) Twelve major programs (Bibb, Camden, Chatham, Clayton, Cobb, DeKalb, Dougherty, Fulton Glynn, Liberty, Muscogee and Richmond Counties) *$6,269,211*

(b) About 128 county/city programs @ approximately $22,912/ program *$2,932,736*

6.	Doctor fees - 88 imported malaria cases $400[5]/case x 88 cases = $35,200	*$35,200*
7.	Hospitalization - $4,000[5]/case x 88 cases = $352,000	*$352,000*
8.	Druggist Fees - $100[5]/case x 88 = $8,800	*$8,800*
8a.	West Nile Encephalitis - average inpatient medical costs[7] = $17,219/case x 9 cases = $154,971	*$154,971*
8b.	LaCrosse Encephalitis - average impatient medical costs[8] = $48,000/case x 1 cases = $48,000	*$48,000*
8c.	Heartworm prevention in pets	*$60,000,000*
8d.	Treating pets with heartworm	*$14,290,000*
	Subtotal	***$84,053,918***

Flies - 100%

9.	Garbage removal - $50/residence/year x 3,771,466 residences = $188,573,300 x 10% (portion attributed to insect control) = $18,857,330/year	*$18,857,330*
10.	Garbage disposal units (dumpsters - county, commercial and industrial) - $500/unit; 1 unit/100 residences. 37,715 units x $500 x 10% (portion attributed to insect control) = $1,885,750. 10 year life span/ unit = $188,575	*$188,575*
11.	Garbage cans (residential) - 2/residence = $15/can x 2 x 3,771,466 residences = $113,143,980 x 10% (portion attributed to insect control) = $11,314,398. 6 year life span/can = $1,885,733	*$1,885,733*
12.	Fly swatters - 1 fly swatter/residence $0.59/fly swatter x 1 x 3,771,466/2 residences = $1,112,582	*$1,112,582*
	Subtotal	***$22,044,220***

Ticks and Chiggers - 100%

13.	Acaracides (residential) - of 3,771,466 residences, estimated 5% purchase $10.00 acaracide for tick control in yards	*$1,885,733*
14.	Acaracides (public and private organizations)	*$20,000*
15.	Doctor fees - 48 RMSF cases and 7 Lyme case $400[5]/case x 55 cases = $34,400	*$22,000*

16. Hospitalization - $4,000[5]/case x 55 cases
= $344,000 *$220,000*

17.	Druggist fees - $100[6]/case x 55 cases = $8,600	*$5,500*
	Subtotal	***$2,153,233***

Yellow jackets - 40%, Others[1] - 49%, Eye gnats - 1%, Mosquitoes - 10%

18.	Doctor fees (bites and stings) 1 visit/100 residences at $60/visit = 37,715 residences x $60/visit = $2,262,880	*$2,262,880*
19.	Druggist fees - 1 visit/100 residences at $10/visit = 37,715 residences x $10 = $328,170	*$37,715*
	Subtotal	***$2,640,030***

Head lice - 100%

20.	Doctor fees - 3% of 1,476,735[6] school children in ages 5-17 = 44,302 x $60/visit = $2,658,123	*$2,658,123*
21.	Druggist fees - pediculicides for head lice - $17.50/pediculicide x 1,476,735[6] school children in ages 5-17 15% estimated infestation = $3,876,429	*$3,876,429*
	Subtotal	***$6,534,552***

[1]"Others include eye gnats, spiders, biting flies, bees and other stinging insects (other than yellow jackets).
[2]Estimated percent importance insect has to control.
[3]Estimate of number households, US Census Bureau.
[4]Based on survey for mosquito control programs by Cooperative Extension Service 2005.
[5]Based on New York State Department of Health report of over $4,000 hospital cost/care of Lyme disease reported by CDC, Lyme Disease Surveillance, Volume 4, Number 2, March 1993.
[6]Based on 2000 Georgia County Guide, Cooperative Extension Service
[7]CDC National WNV Conference 2003
[8]Public Health Confronts the Mosquito: Developing Sustainable State and Local Mosquito Control Programs, A Project of the Association of State and Local Territorial Health Officials, 2005.

Small Grain Insects

D. Buntin and J. All

Winter small grain crops in Georgia include wheat, rye, oats and barley. Planted acreage of wheat was 230,000 but harvested acreage was 120,000 in 2006, which was a 14% reduction from 2005 and a 48% reduction from 2003. Yields averaged 49 bushels per acre with an average price of $3.70 per bushel. A total of 230,000 acres of rye and 70,000 acres of oats were planted. Rye was harvested for grain from 26,000 acres with an average yield of 26 bushels per acre and a price of $4.00 per bushel. Oats were harvested for grain from 30,000 acres with an average yield of 53 bushels per acre and a price of $1.90 per bushel. Barley acreage is very limited in Georgia.

The 2005/2006 has wet soil conditions in fall of 2005 which limited planting of small grains, but dry conditions at harvest aided in timely harvest. Cost estimates and damage are mostly for the wheat crop. Hessian fly caused losses in some susceptible varieties in southern Georgia. Large aphid infestations caused transmission of barley yellow dwarf virus in some fields but BYD levels were low in most areas. Cereal leaf beetle populations continue to spread in the upper coastal plain region. Hessian fly is not a problem on rye or oats, and rye is not severely affected by barley yellow dwarf. Stink bug populations were low in 2006 but some fields were treated to prevent movement of these insects to adjacent crops. However, stink bug numbers almost always are too low to cause significant direct damage to wheat. Soil insects including wireworms and lesser cornstalk borer damage seedling stands. Numbers of other insects such as armyworms were low in 2006.

Estimated Losses and Control Costs in 2006

Rank	Insect	Cost of Control	Damage	Total
1	Aphids	$ 30,000	$109,000	$139,000
2	Hessian fly	25,000	98,000	123,000
3	Cereal leaf beetle	24,000	70,000	94,000
4	Soil insects	19,000	11,000	30,000
5	Stink bugs	12,000	0	12,000
	Total	***$110,000***	***$288,000***	***$398,000***

Information Pertaining to Control of Major Small Grain Insect Pests in Georgia in 2006

Insect	No. Acres Needing Control	No. Acres Treated	No. Acres Applic.	Avg. Cost Per Unit Treated[1]	Yield Loss on Units Treated	Yield Loss on Units Untreated
Aphids	12,000	6,000	1	6.00	6,000	23,000
Hessian fly	10,000	6,000	1	7.00	0	26,000
Cereal leaf beetle	12,000	7,400	1	5.00	0	19,000
Soil insects	2,400	1,200	1	8.00	0	3,000
Stink bugs	0	24,00	1	6.00	0	0

[1]Application cost not included.

Soybean Insects

P.M. Roberts and R.M. McPherson

Soybeans were harvested from 140,000 acres during 2006 with an average yield of 25 bushels per acre. The average price received was $6.00 per bushel, making the value of the 2006 soybean crop in Georgia worth $21 million (NASS, http:/www.nass.usda.gov). The 2006 production year was plagued with dry weather during June and July. Favorable conditions during late summer and fall allowed for an average crop to be produced. As a whole insect problems in soybean were limited.

Stink bugs were the primary insect pest of soybeans during 2006, however control costs and losses were significantly lower that during recent years. Total control costs and losses associated with stink bugs totaled $660,000 or about $5 per acre. The most common stink bug species observed included the southern green, brown, and green stink bugs. *Thyanta* spp. and *Euschistus* spp. were also occasionally observed. Populations were generally light to moderate with some isolated areas experiencing high infestations.

Velvetbean caterpillar and soybean loopers were the primary foliage feeding insects observed and were the number two and three ranked insect pests in terms of control costs and losses ($352,250 and $167,400 respectively). As with stink bugs foliage feeding insect pest infestations were light to moderate. Corn earworm populations were generally low on soybeans throughout the state.

Additional soybean insect pests observed throughout the stateincluded whiteflies, grasshoppers, threecornered alfalfa hoppers, whitefringed beetles, cucumber beetles, spider mites, lesser cornstalk borer, and Mexican bean beetles, Japanese beetles, and soybean aphids in north Georgia. Soybean aphid continues to be monitored and detected in Georgia soybeans, but to date has not been an economic problem.

Recommended insecticides provided good control for all major soybean pests when the appropriate rate was applied at the appropriate time.

Estimates of Losses and Control Costs for Soybean Insect pests in 2006

Rank	Insect	Cost of Control	Damage	Total
1	Stink bugs[1]	$504,000	$156,000	$660,000
2	Velvetbean caterpillar	271,250	81,000	352,250
3	Soybean looper	147,000	20,400	167,400
4	Other[2]	25,500	39,600	65,100
5	Corn earworm	8,750	6,900	15,650
	Total	***$956,500***	***$303,900***	***$1,260,400***

Information Pertaining to Control of Major Soybean Insect Pests in Georgia in 2006

Insect	No. Acres Needing Control	No. Acres Treated	No. of Acre Appl.	Ave. Cost Per Unit Treated[1]	Yield Loss on Units Treated[2]	Yield Loss on Units Untreated[2]
Stink bugs[3]	60,000	56,000	1.0	$9.00	14,000	12,000
Velvetbean caterpillar	40,000	35,000	1.0	7.75	3,500	10,000
Soybean looper	15,000	14,000	1.0	10.50	1,400	2,000
Other[4]	5,000	3,000	1.0	8.50	600	6,000
Corn earworm	1,500	1,000	1.0	8.75	150	1,000

[1]Includes application costs.
[2]Yield units measured in bushels.
[3]Includes the southern green, green and brown stink bugs.
[4]Others include threecornered alfalfa hoppers, whiteflies, grasshoppers, whitefringed beetles, spider mites, Japanese beetles, Mexican bean beetles, lesser cornstalk borers, cucumber beetles, and soybean aphids.

Tobacco Insects

R.M. McPherson

Tobacco was harvested from 16,000 acres in 2006, about the same as the 2005 harvest. Georgia's average yield was 1900 pounds per acre. The average price received in 2006 was $147.00 per cwt, making the value of the crop $44.7 million.

The tobacco budworm was the number one insect pest on flue-cured tobacco in Georgia, with total losses exceeding $0.7 million due to control costs and damage. This was down some from 2005, when this pest caused over $1.0 million in losses. More of the losses in 2006 were due to damage rather than to costs of control.

Thrips were the second most economically damaging pest, costing Georgia producers over $0.5 million. All of these reported losses were due to control costs. However, over $4.9 million were reported lost due to tomato spotted wilt virus, a disease that is vectored by certain thrips species. Tobacco hornworms were the third most economically damaging pest, costing Georgia growers over $0.4 million.

Wireworms and mole crickets were the fourth and fifth most damaging tobacco pests, totaling nearly $0.3 and $0.2 million, respectively. All other pests accounted for $102,000 in losses in 2006. These other pests were primarily splitworms, aphids, flea beetles, armyworms, cutworms, grasshoppers, and cucumber beetles.

Estimate of Losses and Control Costs for Tobacco Insect pests in 2006.

Rank	Insect	Cost of Control	Damage	Total
1	Tobacco budworms	$ 310,000	$429,000	$ 739,000
2	Thrips	504,000	0[1]	504,000
3	Tobacco hornworms	113,000	335,000	448,000
4	Wireworms	224,000	56,000	280,000
5	Mole crickets	128,000	28,000	156,000
6	Other pests[2]	29,000	73,000	102,000
	Total	$1,308,000	$921,000	$2,229,000

[1]Does not include losses due to spotted wilt virus ($4.95 million in 2006).
[2]Other include splitworms, aphids, flea beetles, grasshoppers, cutworms, cucumber beetles, and armyworms.

*Georgia Farm Report Vol 06 (11).

Information Pertaining to Control of Major Tobacco Insect Pests in Georgia in 2006

Insect	No. Acres Needing Control	No. Acres Treated	No. of Acre Appl.	Ave. Cost Per Unit Treated[1]	Yield Loss on Units Treated[2]	Yield Loss on Units Untreated[2]
Tobacco budworms	12,000	12,800	1.94	$12.50	291,840	0
Thrips	14,400	14,400	1.0	35.00	0	0
Tobacco hornworms	10,400	9,600	1.0	11.75	182,000	45,600
Wireworms	8,000	8,000	1.0	28.00	38,000	0
Mole crickets	4,000	4,000	1.0	32.00	19,000	0
Others[3]	3,200	2,400	1.0	12.00	11,400	38,000

[1]Includes application costs.
[2]Field units measured in pounds.
[3]Others include splitworms, aphids, flea beetles, cutworms, armyworms, cucumber beetles, and grasshoppers.

Vegetable Insects

A. Sparks

Specific crop estimates in this report are provided for those vegetable crops with an estimated farm gate value in Georgia of more 10 million dollars. These major vegetable crops were planted on a estimated 159,900 acres, with a total value in excess of $ 763.8 million. The estimated insecticide costs and losses due to insects exceeded $ 58.3 million, or approximately 7.6 % of the total value of these crops. Extrapolation of this estimate to all vegetables produced in Georgia (total value of $ 828 million) estimates total losses at approximately $ 63 million in 2006. This is a conservative estimate as it does not include costs associated with insecticide application or costs associated with non-insecticidal controls, such as use of reflective mulches.

Insect pest management in vegetables in Georgia is very dynamic because of the diversity of crops and multiple, overlapping growing seasons for many of these crops. Pest pressure and management requirements in a single crop with distinct spring and fall seasons can vary greatly between seasons as well as with location within the state. The estimates reported have been adjusted to reflect seasonal distribution of specific crops, differences in pest pressure between seasons, and estimated costs of the most common insecticides used for specific pests. Thus, for a pest that requires a single treatment on 100% of the fall acreage of a crop with only 10% of the acreage in the fall, a total of 0.1 applications is shown. Specific insecticide cost estimates varied from $4.00 to $5 per acre per application for pyrethroid insecticides to $50 to $60 per acre for soil applied neonicotinoid insecticides and some acaricides. Estimated yield losses include direct losses, losses associated with lack of marketability (aesthetic damage), and losses associated with diseases specifically vectored by insects (mostly viruses which would not occur without the insect vectors). Overall, these costs and loss estimates are not intended to reflect specific crop production in a given season, but reflect overall impact for the 2006 calendar year.

Over 30 % of the estimated losses in 2006 were contributed to viral diseases vectored by insects. Further, this value does not include the potential impact of recently discovered viruses in onions as some debate still exists as to the actual cause of the problems that have occurred in the onion crop the last few years. As in the past, the majority of direct insect losses were largely attributed to Lepidopteran insects including defoliators in cole crops, fruit feeders in beans and fruiting vegetables, the caterpillar complex in sweet corn, and pickleworm in cucurbit vegetables. Of note in 2006, the diamondback moth was difficult to control in the Spring, resulting in some fields with complete losses, but populations unexplainably disappeared in the fall. Whiteflies reached exceptionally high densities in some areas in the fall and were difficult to control, even with insecticides previously highly efficacious against this pest. The potential for insecticide resistance in whitefly will require careful monitoring in 2007.

Estimated acreage, average yields and total value of the top commercial vegetable crops[1] in Georgia, 2006.

	Crop	Acreage Planted	Total Value of Yield
1	Onions	14,900	$ 132,029,000
2	Watermelons	23,900	111,060,000
3	Bell Pepper	5,900	77,057,000
4	Cantaloupe	5,400	60,085,000
5	Tomato	6,100	56,641,000
6	Sweet corn	21,800	55,317,000
7	Snap Beans	22,900	48,792,000
8	Squash (Yellow and Zucchini)	9,800	44,841,000
9	Cucumbers	11,100	43,948,000
10	Cabbage	9,800	31,752,000
11	Collard greens	7,500	22,858,000
12	Turnip Greens	7,100	22,331,000
13	Carrots	2,800	22,095,000
14	Mustard greens	3,600	14,439,000
15	Southern Peas	6,000	10,611,000
16	Eggplant	1,300	10,010,000
Total		159,900	$ 763,866,000
Other vegetables[2]		10,300	64,280,000
Total all vegetables		170,200	$ 828,146,000

[1] Table includes only those specific vegetables with an estimated value greater than 10 million dollars.

[2]Other vegetable crops with a value in excess of one million dollars include: hot peppers (9.7 million), lima beans (5.8), spinach (2.8), kale (2.7), sweet potatoes (2.5), green onions (2.3), pumpkins (2.2), okra (1.8), banana peppers (1.7), Irish potatoes (1.4), winter squash (1.1).

Estimates of Insect Control Costs and Losses for Georgia Vegetables, 2006.

Crop[1]	Insect	Insecticide Costs[2] ($)	Yield Losses ($)	Total Losses ($)
Snap Beans (1.85 insecticide applications per season) [6 % yield loss]				
	Whitefly (0.3)	123,500	1,951,700	2,075,200
	Pod feeders (1)	91,500	731,900	823,400
	Lesser cornstalk borer (0.1)	13,700	125,000	138,700
	Thrips (0.2)	18,300	120,000	138,300
	ECB Program (0.25)	22,800	(<0.05%)	22,800
	Crop totals	269,800	2,928,600	3,198,400
Cabbage (8.25 insecticide applications per season) [12 % yield loss]				
	Leps. (DBM, loopers)(7)	1,234,800	3,175,200	4,410,000
	Whitefly (1)	392,000	635,000	1,027,000
	Aphids (0.25)	12,000	(<0.05%)	12,000
	Crop totals	1,638,800	3,810,200	5,449,000
Collard greens (8.15 insecticide applications per season) [8 % yield loss]				
	Leps. (DBM, loopers) (7)	1,312,500	1,600,000	2,912,500
	Whitefly (1)	187,500	228,600	416,100
	Aphids (0.15)	4,500	(<0.05%)	4,500
	Crop totals	1,504,500	1,828,600	3,333,100
Mustard greens (2.7 insecticide applications per season) [3.5 % yield loss]				
	Leps. (DBM, loopers) (2.5)	225,000	433,200	658,200
	Aphids (0.15)	2,400	72,200	74,600
	Yellow-margined leaf beetle (0.05)	900	(<0.05%)	900
	Crop totals	228,300	505,400	733,700

Crop[1]	Insect	Insecticide Costs[2] ($)	Yield Losses ($)	Total Losses ($)
Turnip greens (2.7 insecticide applications per season) [3.5 % yield loss]				
	Leps. (DBM, loopers) (2.5)	443,750	669,900	1,113,600
	Aphids (0.15)	4,700	111,600	116,300
	Yellow-margined leaf beetle (0.05)	1,600	(<0.05%)	1,600
	Crop totals	450,000	781,500	1,231,500
Carrots (1.5 insecticide applications per season) [4 % yield loss]				
	Soil insects & aphids (1.0)	84,000	883,800	967,800
	Leps. & aphids (0.5)	6,300	(<0.05%)	6,300
	Crop totals	90,300	883,800	974,100
Sweet corn (16 insecticide applications per season) [3 % yield loss]				
	CEW/FAW/ECB (16) (include ECB Program)	1,569,600	1,659,500	3,229,100
	Crop totals	1,569,600	1,659,500	3,229,100
Cucumbers (4.25 insecticide applications per season) [5.25 % yield loss]				
	Pickleworm, melonworm (3)	149,600	1,318,500	1,468,100
	Whitefly (0.75)	249,800	879,000	1,128,800
	Cucumber beetles (0.5)	25,000	109,900	134,900
	Crop totals	424,400	2,307,400	2,731,800
Cantaloupe (3.5 insecticide application per season) [3.5 % yield loss]				
	Pickleworm (3)	72,900	1,802,500	1,875,400
	Cucumber beetles, other pests (0.5)	12,200	300,400	312,600
	Crop totals	85,100	2,102,900	2,188,000

Crop[1]	Insect	Insecticide Costs[2] ($)	Yield Losses ($)	Total Losses ($)
Watermelons (1.1 insecticide application per season) [2.25 % yield loss]				
	'Rindworms' (0.75)	80,700	2,221,200	2,301,900
	Cucumber beetles, Aphids (0.25)	26,900	277,600	304,500
	Spider mites (0.1)	95,600	(<0.05%)	95,600
	Crop totals	203,200	2,498,800	2,702,000
Squash (6.25 insecticide applications per season) [16.5 % yield loss]				
	Whitefly (2)	808,000	4,599,900	5,407,900
	Aphids/mosaic viruses (2)	80,800	2,300,000	2,380,800
	Pickleworm, melonworm (2)	90,900	1,379,000	1,469,900
	Cucumber beetles, others (0.25)	10,100	(<0.05%)	10,100
	* Losses associated with transmission of mosaic viruses in late spring and fall crops.			
	Crop totals	989,800	8,278,900	9,268,700
Eggplant (8 insecticide applications per season) [4.0 % yield loss]				
	Plant bugs (3.0)	15,600	200,200	215,800
	Spider mites (2.0)	104,000	50,000	154,000
	Leps. (BAW, CEW) (2.0)	31,200	100,100	131,300
	Thrips (1.0)	6,500	49,000	55,500
	Crop totals	157,300	399,300	556,600
Onions (6.25 insecticide applications per season) [1.5 % yield loss]				
	Thrips (6)*	402,300	1,980,400	2,382,700
	Seedcorn maggot (0.25)	16,700	(<0.05%)	16,700
	* Suspected vectoring of bulb rots and viruses is not considered and impact is most likely underestimated.			
	Crop totals	419,000	1,980,400	2,399,400

Crop[1]	Insect	Insecticide Costs[2] ($)	Yield Losses ($)	Total Losses ($)
Bell Pepper (8.75 insecticide applications per season) [11.25 % yield loss]				
	Thrips/TSWV (3.0)	79,600	7,705,700	7,785,300
	Leps. (Includes ECB Program) (5.0)	354,000	770,000	1,124,000
	Whitefly (0.5)	53,100	192,600	245,700
	Pepper weevil (0.25)	6,600	(<0.05%)	6,600
	* Losses associated with vectoring of Tomato Spotted Wilt Virus			
	Crop totals	493,300	8,668,300	9,161,600
Tomato (9.75 insecticide applications per season) [16.6% yield loss]				
	Thrips/TSWV (1 soil, 4 foliar)	488,000	6,796,900	7,284,900
	Leps. (CEW, others) (3.0)	219,600	1,130,000	1,349,600
	Whitefly (1.0)	183,000	1,132,800	1,315,800
	Spider mites, Leafminer, others (0.5)	122,000	283,203	405,200
	Stink bugs (0.25)	6,800	56,600	63,400
	* Losses associated with vectoring of Tomato Spotted Wilt Virus			
	Crop totals	1,019,400	9,399,500	10,418,900
Southern Pea (4.75 insecticide applications per season) [6.0 % yield loss]				
	Cowpea curculio (3.5)	94,500	451,000	545,500
	Leps. (BAW, etc.) (0.5)	24,700	106,100	130,800
	Stink bugs, aphids (0.25)	6,800	53,000	59,800
	Thrips (0.5)	13,500	26,500	40,000
	Crop totals	139,500	636,600	776,100
Totals		$ 9,682,300	$48,669,700	$ 58,352,000

[1]Numbers in () after each crop or pest indicate the estimated average number of insecticide applications on that crop or for the specific pest. These estimates are adjusted for differences in pest pressure in fall and spring crops and estimated acreage of each crop in the fall and spring. Thus, estimates are not intended to reflect specific crop production in a given season, but reflect overall impact for 2005. Similarly, numbers in [] reflect overall estimated yield losses adjusted for spring and fall pest pressure and acreage.

[2]Values represent estimated costs of insecticides only. Values are adjusted for estimated costs of the most commonly used insecticides and rates for the specific pests, which range from $4.50 per acre to $50.00 per acre. Application costs are not included as these costs can be shared with fungicide applications and multiple insecticides can be applied in a single application. Thus, these values represent a conservative estimate of insect control costs.

Summary of Losses Resulting from Insect Damage and Control Costs in Georgia in 2006 by Commodity or Other Category.

Commodity	Control	Damage	Total Losses
Cotton	70,538,047	27,936,500	98,474,547
Field Corn	936,000	1,429,000	2,365,000
Grain Sorghum	46,000	100,000	146,000
Lawn and Turf	23,690,000	13,195,000	36,885,000
Livestock and Poultry	11,609,000	15,710,200	27,319,200
Ornamentals	88,480,000	64,125,000	152,605,000
Pasture and Forages	1,247,000	2,045,935	3,292,935
Peanuts	19,998,750	6,264,125	26,262,875
Pecans	9,834,500	5,233,638	15,068,138
Public Health and Recreational Areas	225,414,134	0	225,414,134
Small Grains	110,000	288,000	398,000
Soybeans	956,500	303,900	1,260,400
Tobacco	1,308,000	921,000	2,229,000
Vegetables	9,682,300	48,669,700	58,352,000
Total	***$463,850,231***	***$186,221,998***	***$650,072,229***

Scientific Names or Other Taxonomic Classifications of the Insect Species or Insect Complexed for Which Economic Loss Estimates Have Been Made In Georgia

Insect or Insect Complex	Scientific Name or Other Taxonomic Classification
Alfalfa weevil	*Hypera postica* (Gyllenhal)
Almond moth	*Ephestia cautella* (Walker)
Ambrosia beetles	various species of Scolytidae
Angoumois grain moth	*Sitotroga cerealella* (Olivier)
Anobiid beetle	Anobiidae
Aphids	various species of Aphididae
Apple aphid	*Aphis pomi* DeGeer
Arctiid larvae	various species of Arctiidae
Armyworm	*Pseudaletia unipuncta* (Haworth)
Azalea caterpillar	*Datana major* (Grote & Robinson)
Bagworm	*Thyridopteryx ephemeraeformis* (Haworth)
Bahiagrass borer	*Derobrachus brevicollis* (Audinet-Serville)
Bandedwinged whitefly	*Trialeurodes abutilonea* (Haldeman)
Bees	various species of Hymenoptera
Beet armyworm	*Spodoptera exigua* (Hubner)
Billbug	various species of Curculionidae
Bird cherry-oat aphid	*Rhopalosiphum padi* (Linnaeus)
Biting midge	primarily *Culiocoides* species
Blackmargined aphid	*Monellia caryella* (Fitch)
Black pecan aphid	*Melanocallis caryaefoliae* (Davis)
Black turpentine beetle	*Dendroctonus terebrans* (Olivier)
Blister beetles	species of Meloidae
Blueberry gall midge	*Dasineura oxycoccana*
Blueberry maggot	*Rhagoletis mendax* Curran
Boll weevil	*Anthonomus grandis grandis* Boheman
Bollworm	*Helicoverpa [=Heliothis] zea (*Boddie)
Bollworms	*Heliothis virescens* and *Helicoverpa zea*
Borers (on ornamentals)	various species of Coleoptera and Lepidoptera
Bots	various species of Oestridae
Brown stink bug	*Euschistus servus* (Say)
Cabbage aphid	Brevicoryne brassicae (Linnaeus)

Insect or Insect Complex	Scientific Name or Other Taxonomic Classification
Cabbage looper	*Trichoplusia ni* (Hubner)
Cabbage seedpod weevil	*Ceutorhynchus*assimilis (Paykull)
Cabbageworms	mostly *Pieris rapae* (Linnaeus) and *Plutella xylostella* (Linnaeus)
Cadelle	Tenebroides mauritanicus *(Linnaeus)*
Carpet beetles	various species of Dermestidae
Carpenter ants	*Camponotus* spp.
Carpenter bees	*Xylocopa virginica* (Linnaeus)
Carpenterworm	*Prionoxystus robiniae* (Peck)
Cattle grub	*Hypoderma lineatum* (Villers)
Chinch bug	*Blissus leucopterus leucopterus* (Say)
Cigarette beetle	*Lasioderma serricorne* (Fabricuis)
Clothes moth	primarily *Tinea pellionella* L. and *Tineola bisseliella* (Hummel)
Cockroaches	various species of Blattelidae
Codling moth	*Cydia pomonella* (Linnaeus)
Colorado potato beetle	*Leptinotarsa decemlineata* (Say)
Coneworms	*Dioryctria*spp.
Corn earworm	*Helicoverpa [=Heliothis] zea* (Boddie)
Corn leaf aphid	*Rhopalosiphum maidis* (Fitch)
Corn rootworm	*Diabrotica undecimpunctata howardi* (Barber)
Cotton aphid	*Aphis gossypii* Glover
Cowpea curculio	*Chalcodermus aeneus* Boheman
Cranberry fruitworm	*Acrobasis vaccinii* Riley
Cutworms	primarily *Feltia subterranea* (Fabricius)
Darkling beetle complex	various species of Tenebrionidae
Diamondback moth	*Plutella xylostella* (Linnaeus)
Disease vectors (on corn)	various species of Aphididae and Cicadellidae
Dogwood borer	*Synanthedon scitula* (Harris)
Earwigs	various species of Dermaptera
Eastern tent caterpillar	*Malacosoma americanum* (Fabricius)
English grain aphid	*Sitobion avenae* (Fabricius)
European corn borer	*Ostrinia nubilalis* (Hubner)
European red mite	*Panonychus ulmi* (Koch)

Insect or Insect Complex	Scientific Name or Other Taxonomic Classification
Eye gnats	*Hippelates*spp.
Face fly	*Musca autumnalis* De Geer
Fall armyworm	*Spodoptera frugiperda* (J.E. Smith)
Fall webworm	*Hyphantria cunea* (Drury)
False chinch bug	*Nysius raphanus* Howard
Field crickets	*Gryllus*spp.
Fire Ants	*Solenopsis*spp.
Flat grain beetle	*Cryptolestes pusillus* (Schnherr)
Flea beetles	various species of Alticinae
Fleas	various species of Siphonaptera
Forbes scale	*Quadraspidiotus forbesi* (Johnson)
Forest tent caterpillar	*Malacosoma disstria* Hubner
Fuller rose beetle	*Asynonychus godmani* Crotch
Fungus beetles	various species of Tenebrionidae
Fungus gnats	various species of Mycetophilidae and Sciaridae
German cockroach	*Blattella germanica* (Linnaeus)
Granulate cutworm	*Agrotis subterranea* (Fabricius)
Grape root borer	*Vitacea polistiformis* (Harris)
Grasshoppers	various species of Orthoptera
Green cloverworm	*Plathypena scabra* (Fabricius)
Green fruitworm	*Lithophane antennata* (Walker)
Green June beetle	*Cotinis nitida* (Linnaeus)
Green peach aphid	*Myzus persicae* (Sulzer)
Greenbug	*Schizaphis graminum* (Rondani)
Grub (cattle)	*Hypoderma lineatum* (Villers)
Gypsy moth	*Lymantria dispar* (Linnaeus)
Hessian fly	*Mayetiola destructor* (Say)
Hickory nut curculio	*Conotrachelus hickoriae* (Schoof)
Hickory shoot curculios	*Conotrachelus*spp.
Hickory shuckworm	*Cydia caryana* (Fitch)
Honey bees	*Apis mellifera* (Linnaeus)
Honey bee (tracheal) mite	*Acarapis woodi* (Rennie)
Horn fly	*Haematobia irritans* (Linnaeus)

Insect or Insect Complex	Scientific Name or Other Taxonomic Classification
Horse flies	various species of Tabanidae
House fly	*Musca domestica* Linnaeus
Imported cabbageworm	*Pieris rapae* (Linnaeus)
Indian mealmoth	*Plodia interpunctella* (Hubner)
Ips beetles	*Ips avulsus, I. grandicolis, I. calligraphis* and *I. pini*
Iris borer	*Macronoctua onusta* Grote
Japanese beetle	*Popillia japonica* Newman
Lace bugs	various species of Tingidae
Leafminers	various species of Coleoptera, Diptera and Lepidoptera
Leaf rollers	various species of Lepidoptera
Leaffooted bugs	various species of Coreidae
Leafhoppers	various species of Cicadellidae
Lesser appleworm	*Grapholitha prunivora* (Walsh)
Lesser cornstalk borer	*Elasmopalpus lignosellus* (Zeller)
Lesser peachtree borer	*Synanthedon pictipes* (Grote & Robinson)
Lice (on livestock)	various species of Anoplura and Mellophaga
Lyctid beetles	Lyctidae
Magnolia borer	Euzophera magnolialis Capps
May beetles	various species of Scarabaeidae
Mealworms	*Tenebrio*spp. and *Alphitobius* spp.
Mealybugs	various species of Pseudococcidae
Mexican bean beetle	*Epilachna varivestis* Mulsant
Millipedes	various species of Diplopoda
Mites (on livestock)	various species of Acari
Mites (on plants)	various species of Acari
Mole crickets	primarily *Scapteriscus* spp.
Mosquitoes	various species of Culicidae
Moth flies	Psychodidae
Nantucket pine tip moth	*Rhyacionia frustrana* (Comstock)
Northern fowl mite	*Ornithonyssus sylviarum* (Canestrini & Fanzago)
Oak skeletonizer	*Bucculatri ainsliella* Murtfeldt
Old house borer	*Hylotrupes bajulus* (Linnaeus)
Onion maggot	*Delia antiqua* (Meigen)

Insect or Insect Complex	Scientific Name or Other Taxonomic Classification
Oriental fruit moth	*Grapholita molesta* (Busck)
Pales weevil	*Hylobius pales* (Herbst)
Pea aphid	*Acyrthosiphon pisum* (Harris)
Peachtree borer	*Synanthedon exitiosa* (Say)
Pecan bud moth	*Gretchena bolliana* (Slingerland)
Pecan leaf casebearer	*Acrobasis juglandis* (LeBaron)
Pecan leaf phylloxera	*Phylloxera notabilis* Pergande
Pecan spittlebug	*Clastoptera achatina* Germar
Pecan weevil	*Curculio caryae* (Horn)
Pepper weevil	*Anthonomus eugenii* Cano
Pickleworm	*Diaphania nitidalis* (Stoll)
Pitch-eating weevil	*Pachylobius picivorus* (Germar)
Pitch pine tip moth	*Rhyacionia rigidana* (Fernald)
Plant bugs	various species of Miridae
Planthoppers	various species of Delphacidae and Fulgoridae
Plum curculio	*Conotrachelus nenuphar* (Herbst)
Powderpost beetles	various species of Lyctidae
Prionus borers	*Prionus*spp.
Psocids	various species of Psocoptera
Red flour beetle	*Tribolium castaneum* (Herbst)
Red imported fire ant	*Solenopsis invicta* Buren
Redbanded leafroller	*Argyrotaenia velutinana* (Walker)
Rice weevil	*Sitophilus oryzae* (Linnaeus)
Rosy apple aphid	*Dysaphis plantaginea* (Passerini)
San Jose scale	*Quadraspidiotus perniciosus* (Comstock)
Sawflies	various species of Symphyta
Sawtoothed grain beetle	*Oryzaephilus surinamensis* (Linnaeus)
Scale insects	various species of Homoptera
Seed bugs	*Nysius*spp.
Seedcorn maggot	*Delia platura* (Meigen)
Seedworms	*Cydia*spp.
Shield bugs	various species of Scutelleridae
Shothole borers	species of Scolytidae

Insect or Insect Complex	Scientific Name or Other Taxonomic Classification
Silverfish	*Lepisma saccharina* Linnaeus
Slugs	various species of Stylommatophora
Smokybrown cockroach	*Periplaneta fuliginosa* (Serville)
Snails	various species of Stylommatophora
Sod webworms	*Crambus*spp.
Sorghum midge	*Contarinia sorghicola* (Coquillett)
Sorghum webworm	*Nola sorghiella* (Riley)
Southern corn rootworm	*Diabrotica undecimpunctata horwardi* Barber
Southern green stink bug	*Nezara viridula* (L.)
Southern pine beetle	*Dendroctonus frontalis* Zimmerman
Sowbugs	various species of Isopoda
Soybean looper	*Pseudoplusia includens* (Walker)
Spiders	Araneida
Spider mites	*Tetranychus*spp.
Spittlebugs (on ornamentals)	various species of Cercopidae
Spotted tentiform leafminer	*Phyllonorycter blancardella* (Fabricius)
Springtails	various species of Collembola
Squash vine borer	*Melittia cucurbitae* (Harris)
Stable fly	*Stomoxys calcitrans* (Linnaeus)
Stink bugs	various species of Pentatomidae
Sugarcane beetle	Eutheola *humilis rugiceps* (LeConte)
Sugarcane borer	*Diatraea saccharalis* (F.)
Sweetpotato whitefly	*Bemisia tabaci* (Grennadius)
Tarnished plant bug	*Lygus lineolaris* (Palisot de Beauvois)
Termite (eastern subterranean)	*Recticulitermes flavipes* (Kollar)
Threecornered alfalfa hopper	*Spissistilus festinus* (Say)
Thrips	various species of Thripidae
Ticks	various species of Argasidae and Ixodidae
Tip moths	primarily *Dioryctria* spp. and *Rhyacionia* spp.
Tobacco aphid	*Myzus nicotianae* Blackman
Tobacco budworm	*Heliothis virescnes* (F.)
Tobacco hornworm	*Manduca sexta* (L.)
Tobacco splitworm	*Phthorimaea operculella* (Zeller)

Insect or Insect Complex	Scientific Name or Other Taxonomic Classification
Tomato fruitworm	*Helicoverpa [=Heliothis] zea* (Boddie)
Tufted apple budmoth	*Platynota idaeusalis* (Walker)
Turkey chigger	*Neoschoengastia americana* (Hirst)
Turnip aphid	*Lipaphis erysimi* (Kaltenbach)
Twolined spittlebug	*Prosapia bicincta* (Say)
Twospotted spider mite	*Tetranychus urticae* Koch
Varroa mite	*Varroa jacobsoni* Oudemans
Vectors (of corn diseases)	various species of Aphididae and Cicadellidae
Velvetbean caterpillar	*Anticarsia gemmatialis* Hubner
Walnut caterpillar	*Datana integerrima* Grote & Robinson
Wasps	various species of Hymenoptera
Webbing coneworm	*Dioryctria disclusia* Heinrich
Western flower thrips	*Frankliniella occidentalis* (Pergande)
White grubs	various species of Scarabaeidae
White peach scale	*Pseudaulacapis pentagona* (Targioni-Tozzetti)
Whiteflies	various species of Aleyrodidae
Whitefringed beetle	*Graphognathus*spp.
Wireworms	various species of Elateridae
Wooly apple aphid	*Eriosoma lanigerum* (Hausmann)
Yellow jackets	*Vespula*spp.
Yellow pecan aphids	primarily *Monelliopsis pecanis* (Bissell)
Yellow sugarcane aphid	*Sipha flava* (Forbes)
Yellownecked caterpillar	*Datana ministra* (Drury)
Yellowmargined leaf beetle	*Microtheca ochroloma* Stal

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