NPAG DATA: *TECIA SOLANIVORA*

CENTRAL AMERICAN POTATO TUBERMOTH

A POTENTIAL THREAT TO AMERICAN POTATO GROWERS

Draft - April 6, 2000

TAXONOMY:

Phylum: Arthropoda
Class: Insecta
Order: Lepidoptera
Family: Gelechiidae

Full Name: *Tecia solanivora* Povolny
Synonyms: *Scrobipalpopsis solanivora* Povolny

Common Name: Central American potato tuberworm (Zhang, 1994)
Guatemalan potato moth (B. N. I., 1998)
Polilla guatemalteca (Gomez, 2000)

DETECTION DATA:

Initial Detection and Description (in Costa Rica):

Location: ?
Date: ?1973
Host: *?Solanum tuberosum* (Potato)
Collector: ?
Identifier: D. Povolny,
?
Iden. Date: ?197# (The source for this data is Povolny, 1973.)

Detection(s) in the US:

No report of a detection in the US was found. (*See* Pertinent Points.)

QUARANTINES:

This tuberworm apparently originated in Guatemala and was introduced to Costa Rica in 1970 in a shipment of potatoes. It expanded throughout the potato-growing region in Costa Rica and caused major amounts of damage (Raman, 1988). Ramen (1988) stated that it is of great importance that strict quarantine regulations be followed to further prevent the spread of this pest. (*See* Damage Where Established.)

The ability of this pest to live in infested tubers indicates an ability to move long distances in tubers used as seed potatoes.

LIFE HISTORY:

The life cycle of the Central American potato tubermoth involves complete metamorphosis:

Egg → Larva (caterpillar) → Pupa → Adult (moth)

At 10°C, the Central American potato tuberworm is able to produce 2 generations per year; at 25°C, 10 generations per year (Notz, 1996).

The Central American potato tuberworm mainly infests the tubers (Gomez, 2000).

Table 1: Incubation Temperature and the Duration in Days for the Different Stages at Different Temperatures (Notz, 1996)

Stage	Temperature°C (°F)				
	10°C (50°F)	15°C (59°F)	20°C (68°F)	25°C (77°F)	30°C (86°F)
Egg	c26.05	c22.02	c10.00	c5.89	c5.00
Larvae	c56.58	c41.30	c20.56	c13.26	-
Prepupa	c23.54	c10.64	c4.65	c4.00	-
Pupa	c91.18	c47.96	c17.56	c13.98	-
Egg-Adult	c197.35	c121.92	c52.77	c37.13	-
Number of Generations per Year	2	3	7	10	

Adult: The adult moths measure up to 12 mm in length and have well-defined wing patterns. Sexual dimorphism is apparent both in size and coloration. As a rule, males are smaller than females, deep brown in color, and marked with a wing pattern of two stigmata but mostly without strong longitudinal markings. Female are visibly larger than males in most cases, brighter brown in color, and marked with a wing pattern of three stigmata and longitudinal markings (Lal & Prasad, 1989).

Most activity is during the night when temperatures are above 11°C. During the day the adult rest and hide beneath leaves, clumps of eath, and/or weeds (Gomez, 2000).

The greatest capture of moths in pheromone traps was from flowering to harvest, which is the period when the tuber form and fill. Further, the least favorable period was the rainy period. The areas with the greatest damage were the most dry: Potrero Cerrado, Tierra Blanca, Llano Grande, and others (Gomez, 2000).

Reproduction: The females deposit the eggs at dusk, laying them singularly or in groups, in the soil near the base of the plant. Conditions are favorable for ovipositing when the temperature is between 11°C and 29°C and relative humidity is greater than 30%. This range demonstrates the capacity of the moth to adapt to different ambient conditions (Gomez, 2000).

After the synthesis of the sex pheromone in 1982, monitoring of the Central American potato tuberworm was possible in Costa Rica (Raman, 1984).

The sex pheromone is available from Pherobank which has the following website:

http://www.ipo.dlo.nl/Ipowww/dps/phero/sexphero.html

Ecology: In study conducted in the Norte de Cartago in Costa Rica, the populations of the Central American potato tubermoth and the common potato tubermoth, *Phthorimaea operculella*, where similar in proportion. In the areas more than 2,500 meters above sea level, the Central American potato tubermoth predominated (Gomez, 2000).

Damage was always greater in the borders of plots. This was particularly true if weed hosts, such as *zorrillo* and *ruibardo*, were present.

This pest is capable of adopting to different ecological areas. It is significant that this pest is able to disperse from high-altitude zones where it actually is concentrated to low-altitude zones where the temperature averages about 25°C (Notz, 1996).

DISTRIBUTION:

South America:	Columbia (Raman, 1988)
	Equador (www.jatunsacha.org)
	Venezuela (Notz, 1996; Raman, 1988)
Central America:	Costa Rica (Ramen, 1988; introduced in 1970)
	Guatemala (Notz, 1996; Raman, 1988)
	Hondoras (Notz, 1996)
	Central America (Hill, 1994; Zhang, 1994)

HOSTS:

Beta vulgaris	Beet, *beterraga*	Gomez, 2000
Lycopersicon esculentum	Tomato, *tomate*	Gomez, 2000
Nicotiana tabacum	Tobacco, *tabaco*	Gomez, 2000
S. melongena	Eggplant, *berenjena*	Gomez, 2000
S. tuberosum	Potato	Zhang, 1994

The existence of several host plants in the Family Solanaceae is to be expected; the existance of host plants beyond the Family Solanaceae is surprising.

DAMAGE WHERE ESTABLISHED:

In *Agricultural Entomology*, Hill (1994) refers to this pest as "a major pest of potato tubers." In earlier books, Hill did *not* mention this pest. In *Agricultural Pests of Temperate Regions and Their Control*, Hill (1987) did *not* list this pest among either the "Major Pests" or "Minor Pests" of potato. In *Agricultural Pests of the Tropics and Their Control*, Hill (1975) did *not* list this pest among the "Major Pests" or "Minor Pests" of potato.

Potatoes in Costa Rica: In 1970, this potato tuber moth was introduced to Costa Rica. It dispersed through the potato-growing regions of Costa Rica. mainly in elevations between1,300 to 2,300 meters. In 1972, the loss was about 20% to 40% of the potato in an area of 2,000 hectares, corresonding to a value of about $900,000 (Raman, 1988).

Potatoes in Columbia: This potato tubermoth is a major pest in Boyaca Department, Columbia, where CIP (International Potato Center) and its partner institutions are promoting the use of sex pheromones, manual collection, and baculovirus for control (B. N. I., 1998). In Columbia in the ten years prior to 1998, damage was widespread and losses were substancial. In 1997 on potatoes both in the field and in storage, producers lost about $70,000,000 (US dollars) (Motreno *et al*., 1998).

Other Solanaceous Plants: No estimates of damage were found.

METHODS OF CONTROL:

Chemical Control: For potato plants in the field, several insecticides are effective against another potato tubermoth. The usual method of chemical control involves insecticidal sprays applied to the crop at two-week intervals after the first leaf miners are observed (Hill, 1987; Misra & Agrawal, 1988).

Because excessive use of insecticides in Columbia produced a more resistant, hard-to-control pest, CIP (International Potato Center) is developing an intergrated pest management system (Dr. Lagnaoui, 08Feb00 e-mail).

For other potato tubermoths attaching potatoes in storage, the pyrethroid insecticide deltametrine (Decis) appears to be effective (Ewell *et al*., 1990). However, the use of an insecticide applied directly onto stored potatoes will probably not be feasible.

For another tubermoth, fumigation of stored potatoes is effective (Hill, 1987).

Biological Control: In Columbia, CIP and its partner institutions are promoting the use of sex pheromones, manual collection, and baculovirus for control (B. N. I., 1998)

Cultural Control: Crop hygiene is useful in reducing populations of other potato moths (Hill, 1987).

Temperatures under 8°C may be used as a method of control, because this pest is not able to survive or reproduce (Notz, 1996).

Resistance: The major cultivars in Costa Rica had no differences in susceptibility (Gomez, 2000). To control this pest, CIP will test transgenic (Bt-transformed) potato varities (Dr. Lagnaoui, 08Feb00 e-mail).

Mass Trapping: Catches of certain potato tubermoths in high numbers of moths indicate that mass trapping may be used to control populations. Catches in storehouses dropped considerably after the first couple of days.

PERTINENT POINTS:

Presence in North America: A literature search found no record of this pest in the United States. Zhang (1994) reports that this pest occurs in Central America, but not in the United States. A check of databases on web found no record in the United States: ?

- Essig Museum http://www.mip.berkeley.edu/essig/holdings/lepwebsi.htm
- Harvard's Museum http://mcz-28168.oeb.harvard.edu/FMpro

Damage to Native Plants: This pest may be able to adapt to native solanaceous plants with significant damage as a result.

The Central American potato tubermoth was able to adapt to potatoes in Central America, then in Columbia and Venzuela; this indicates an ability to adapt. Based on the amount of damage caused in certain regions, the adaption was succesful.

Ecological Information: This pest may *not* be able to withstand low temperatures. A low-temperature tolerance will limit its ability to adapt to the United States. The coolest place where it is established is ?Caracas,Venezuela (?).

The climatic information below comes from *The Times Books World Weather Guide*:

Table 2: Climatic Data for Caracas, Venezuela

Month	Temperature °F				Precipitation
	Highest Recorded	Aver. Daily Max.	Aver. Daily Min.	Lowest Recorded	Monthly Average
January	83	75	56	47	0.9
February	88	77	56	46	0.4
March	91	79	58	45	0.6
April	89	81	60	51	1.3
May	89	80	62	52	3.1
June	86	78	62	53	4.0
July	84	78	61	52	4.3
August	86	79	61	53	4.3
September	85	80	61	53	4.2
October	86	79	61	54	4.3
November	84	77	60	51	3.7
December	83	78	58	47	1.8

REFERENCES:

Biocontrol News and Information (B. N. I.). 1998. Teaching Success in Andean Communities. *Biocontrol News and Information* Vol. 19, No. 3, September 1998. Online document available at the following website: http://pest.cabweb.org/bni/bni19-3/train.html

Busck, A. 1939. Restriction of the Genus *Gelechia* (Lepidoptera: Gellechiidae) with descriptions of new genera. *Proceedings of United States Museum* Vol. 86, No. 3064.

CIP (International Potato Center). 1980. CIP Annual Report 1980. Pages 39-49.

Condor, J. A. 1973. *Lista de Insectos y Otros Animales Daninos a la Agricultura en elPeru*. Manual No. 38. Estatacion Experimental Agricola de la Molina. Ministerio de Agricultura, Peru.

Ewell, P., Fano, H., Raman, K., Alcazar, J., Palacios, and Carhuamaca, J. 1990. *Farmer Mamagement of Potato Insect Pests in Peru.* Report of an Interdisciplinary Research Project in Selected Regions of the Highlands and Coast. CIP (International Potato Center).

Fan, X. and Maggiorani, A. 1995. Uso de nematodos entomopatogenos como una altrnativa para control de polilla, *Tecia solanivora*, Venezuela (resumenes). En VIII Congreso Latinoamericano de Fitopatologia, 22-26 Octubre 1995, Merida, Venezuela. Page 45. (Requested)

Hill, D. 1987. *Agricultural Insect Pests of Temperate Regions and Their Control.* Cambridge University Press, New York.

Hill, D. 1975. *Agricultural Insect Pests of the Tropics and Their Control*. Cambridge University Press, New York.

Hodges, R. W. and Becker, V. O. 1990. Nomenclature of some Neotropical Gelechiidae (Lepidoptera). *Proc. Entomol. Soc. Wash.* 92(1):76-85.

Lal, L. and Krishna Prasad, K. S. 1987. Bionomics and management strategies of potato tuberworm. *Pesticides* 23(7):53-57.

Misra, S. S. and Agrawal, H. O. 1988. Potato pests in India and their control. *Tropical Pest Management* 34(2):199-209.

Moreno, B., Castillo, G., Bejarano, E., Fajardo, V., and Suarez,M. 1998. Biological activity of fifteen crude extracts from native plants against larvae of *Tecia solanivora* (Lepidoptera: Gelichiidae). Fifteen Annual Meeting of the International; Society of Chemical Ecology. Ithaca, NY. Page 19.

Nesbitt, B., Beevor, A., Cork, A., Hall, D., Murillo, R., and Leal, H. 1985. Identification of components of the female sex pheromone of the potato tubermoth, *Scrobipalpopsis solanivora*. *Entomol. Exp. Appl.* 38:81-85. (Requested)

Notz, A. 1996. Influencia de la temperature sobre la biologica de *Tecia solanivora* Povolny (Lepidoptera: Gelechiidae) criadas en tuberculos de papa *Solanum tuberosum* L. *Bol. Entomol. Venez. N. S*. 11(1):49-54.

Povolny, D. 1973. *Scrobipalpopsis solanivora* sp. n. a new pest of potato (*Solanum tuberosum*) from Central America. *Acta Universitalis Agriculture, Facultas Agronomica (Czechoslovakia)* 21(1):133-146. (Requested)

Radcliffe, E. B. 1982. Insect pests of potato. *Ann. Rev. Entomol.* 27:173-204.

Raman, K. V. 1988. Integrated insect pest management for potatoes in developing countries. *CIP Cicular* 16(1):1-8.

Raman, K. V. 1984. Progress in pheromone utilization and other novel control practices. *Report of the XXII (i. e. XXVII) Planning Conference on Integrated Pest Management*. June4-8, 1984. Lima, Peru. Pages 217-233.

Torres, F., Notz, A., and Valencia, L. 1997. Ciclo de vida y otros aspectos de la biologia de la popilla de la papa, *Tecia solanivora* Povolny (Lepidoptera: Gelechiidae). *Bol. Entomol. Venez. N. S.* 12(2):165-203. (Requested)

Winters, P. and Fano, H. 1997. *The Economics of Biological Control in Peruvian Potato Production*. International Potato Center (CIP), Working Paper No. 1997-7.

Zhang, Bin-Cheng. 1994. *Index of Economically Important Lepidoptera*. CAB International, Wallingford, UK.