University of Nebraska - Lincoln
DigitalCommons@University of Nebraska - Lincoln

Transactions of the Nebraska Academy of Sciences and Affiliated Societies

Nebraska Academy of Sciences

1-1-1980

Observations on the Life Cycle of Spurge Hawkmoth

J. R. Forwood
Kansas State University

M. K. McCarty
U.S.D.A.

Follow this and additional works at: http://digitalcommons.unl.edu/tnas

Part of the Life Sciences Commons

Forwood, J. R. and McCarty, M. K., "Observations on the Life Cycle of Spurge Hawkmoth" (1980). *Transactions of the Nebraska Academy of Sciences and Affiliated Societies.* Paper 279.
http://digitalcommons.unl.edu/tnas/279

This Article is brought to you for free and open access by the Nebraska Academy of Sciences at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Transactions of the Nebraska Academy of Sciences and Affiliated Societies by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

1980. *Transactions of the Nebraska Academy of Sciences,* VIII:31-34

OBSERVATIONS ON THE LIFE CYCLE OF SPURGE HAWKMOTH*

J. R. Forwood† and M. K. McCarty

Agricultural Research, Science and Education Administration
United States Department of Agriculture
Lincoln, Nebraska 68583

Certain aspects of the life cycle of the spurge hawkmoth, *Hyles euphorbiae* L. (Sphingidae), were studied to evaluate it as a possible biological control agent for leafy spurge (*Euphorbia esula* L.) in Nebraska. There are five phases in the life cycle of this insect: egg, larva, prepupa, pupa, and adult. It is a foliage-feeding insect and consumes about 18 g fresh weight of leafy spurge during its larval life. About 80% of the leafy spurge consumption is by the fifth instar. A generation may be completed in a period of 42 to 72 days. The spurge hawkmoth overwinters as a pupa, emerges as the adult in spring, and begins egg laying about the time leafy spurge begins to bloom.

† † †

INTRODUCTION

In some areas of the United States, biological control shows possibilities of becoming an economical and effective tool for control of weeds. Efforts in Oregon to control tansy ragwort (*Senecio jacobaea* L.) with the cinnabar moth (*Tyria jacobaeae* L.) are resulting in a 25% to 30% forage increase on land where the weed has been brought under control (Kingsley, 1976). Investigations by Surles, Kok, and Pienkowski (1974) using the musk thistle weevil (*Rhinocyllus conicus* Froelich) as a biological control agent on musk thistle (*Carduus nutans* L.) showed successful insect establishment and high plant and head infestation. Kok and Surles (1975) reported a decrease in musk thistle plant density and viable seed and buds per plant due to the weevil. Hodgson and Rees (1976) reported establishment of the musk thistle weevil in Montana and a decrease in seed production of primary flowers.

Outstanding successes in biological control of insect pests and weeds have been obtained in more than 60 countries, in all parts of the world, with more than 200 successful biological control programs (Doutt, 1964). When effective, the natural enemies of weeds can offer advantages such as economy and selectivity toward the target weed. In some cases, biological control may be the only answer to a weed problem in an inaccessible area.

The spurge hawkmoth is a native of southern and central Europe, northern India, and central Asia. Harris and Alex (1971) reported that it has been imported into the United States and Canada to study its potential as a biological control agent for leafy spurge and cypress spurge (*E. cyparissias* L.).

Leafy spurge was introduced into Nebraska in the early 1920s (Jeffery and Robison, 1969). It now infests 20,000 ha. to 40,000 ha. of meadows, rangeland, roadsides, and cropland (Nebraska Department of Agriculture, private communication). Leafy spurge is a highly competitive weed because of its ability to reproduce by seeds and rhizomes. It is considered a noxious weed in Nebraska.

Several studies were undertaken to determine the effectiveness of the spurge hawkmoth as a biological control agent for leafy spurge in Nebraska. Some of these studies involved the life cycle of the insect and its feeding behavior.

METHODS AND MATERIALS

Laboratory studies were conducted to determine consumption of leafy spurge and growth of the spurge hawkmoth larvae. These studies paralleled a study by New (1971) involving consumption of cypress spurge by the spurge hawkmoth in Canada.

Twenty-one larvae reared from eggs in a growth chamber were used. The larvae were kept in the growth chamber during the experiment. Growth chamber temperature was kept at

*Contribution from cooperative investigations of the Nebraska Agricultural Experiment Station and the United States Department of Agriculture, Science and Education Administration, Agricultural Research. Published with the approval of the Director as paper number 5628, Journal Series, Nebraska Agricultural Experiment Station.

† Present address: Agronomy Department, Kansas State University, Manhattan, Kansas 66507.

24 C ± 2 C and relative humidity was maintained at about 50%. Sixteen-hour days and eight-hour nights were used.

Larvae were confined individually to separate nine-dram, plastic containers in the growth chamber until reaching the fourth instar at which time they were placed in separate one-half pint, cardboard, ice cream containers under the conditions described above. Larvae were given known amounts of fresh spurge daily and weighed daily. Spurge was provided in amounts that insured that the larvae did not consume all of the food before the next feeding. Weighing was done at approximately 0800. At this time, the weight of all uneaten foliage was subtracted from the calculated dry weight of the total fed on a particular day. Dry weight of fresh foliage was determined by taking samples from the feeding material and drying for 24 hours at 66 C. Fresh material was adjusted to dry weight on this basis. Material not consumed was also converted to dry weight. Fecal material, moisture, and molted skin were removed each day at feeding time.

As measurements were taken each day, it was possible to note the number of days each larva spent as a particular instar by skin color changes of the larvae and molted skin in the containers. These observations were recorded with the consumption data for each larva. From this it was possible to compare progress of the larvae through the five instars with data from New (1971) in Canada where the larvae were fed cypress spurge.

RESULTS AND DISCUSSION

Each larva consumed an average of 17.05 g fresh weight (3.37 g dry weight) of leafy spurge during the larval lifetime (Table I). New (1971) reported consumption of cypress spurge

TABLE I. Mean leafy spurge consumption, larval weights, and days within stadia of spurge hawkmoth.

	Instars				
	I	II	III	IV	V
			SPURGE		
Mean Consumption (g)/instar	0.0092 ±0.00034	0.0345 ±0.0027	0.2770 ±0.015	2.4190 ±0.12	14.3060 ±0.22
Accumulated Consumption (g)/instar	0.0092	0.0437	0.3207	2.7397	17.0457
			LARVA		
Mean weight (g)/instar	0.0015 ±0.0001	0.0048 ±0.0006	0.0406 ±0.006	0.4259 ±0.045	2.7826 ±0.113
Accumulated weight (g)/instar	0.0015	0.0063	0.0469	0.4728	3.2554
Mean days/stadium	1.4	2.9	3.8	4.8	5.5

by the larvae to be 2.8 g dry weight. It was found that 82% of the total leafy spurge consumed was used by fifth instars compared to 87% recorded by New. In some cases it was found that fifth instar larvae would consume two times their own weight in fresh leafy spurge daily. It is apparent that the fifth instar larvae are very important as far as defoliation of the weed is concerned.

Data from Lincoln are similar to those from New (1971) concerning the length of the stadia (with the possible exception of those of the first and last instars) and the total length of the larval period. It can be concluded from both studies that the five instars are usually produced in two to three weeks.

If estimates of the amount of leafy spurge in a particular location were made, the number of larvae required to defoliate the leafy spurge stand could also be estimated. The degree of stress one defoliation would put on the plant is not known. It would also occur at a period near maturity when the plant is least susceptible to damage from defoliation. This plant also recovers after the heat of summer and makes fall growth to recover vigor. By itself the spurge hawkmoth would not likely be a viable biological control agent but would be valuable to provide additional stress in combination with other agents. Search for other agents of control is in progress.

REFERENCES

Doutt, R. L. 1964. The historical development of biological control. *In* P. DeBach (ed.), *Biological control of insect pests and weeds.* New York, Reinhold Publishing Corporation: 21-42.

Harris, P., and J. Alex. 1971. *Euphorbia esula* L., Leafy spurge and *E. cyparissias* L. Cypress spurge (Euphorbiaceae). Biological control programmes against insects and weeds in Canada 1959-1968. *Technical Communication Number 4,* Commonwealth Institute of Biological Control: 83-88.

Hodgson, J. M., and N. Rees. 1976. Dispersal of *Rhinocyllus conicus* for biocontrol of musk thistle. *Weed Science,* 24:59-62.

Jeffery, L. S., and L. R. Robison. 1969. Know and control leafy spurge in Nebraska. *Cooperative Extension Service, University of Nebraska, Extension Circular,* 69-186: 8 p.

Kingsley, K. K. 1976. Controlling tansy ragwort. *Oregon State University Extension Service Review,* 47(1):16-17.

Kok, L. T., and W. W. Surles. 1975. Successful biocontrol of musk thistle by an introduced weevil, *Rhinocyllus conicus. Environmental Entomologist,* 4(6):1025-1027.

New, T. R. 1971. The consumption of *Euphorbia cyparissias* (Euphorbiaceae) by larvae of *Celerio euphorbiae* (Lepidoptera: Sphingidae). *Canadian Entomologist,* 103: 59-66.

Surles, W. W., L. T. Kok, and R. L. Pienkowski. 1974. *Rhinocyllus conicus* establishment for biocontrol of thistles in Virginia. *Weed Science*, 22:1-3.