Rearing Method of Horn Fly Larvae with Freeze-dried Bovine Dung (Diptera : Muscidae)*

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Abstract

Freeze-dried bovine dung reconstituted with water was tested for rearing of horn fly larvea in the laboratory. The moisture content in the diet suitable for the larval and pupal development ranged from 80 to 85%. The larval density suitable for the development was 10 per 10g of the diet. The horn fly larvae could be reared satisfactorily with freeze-dried bovine dung in the laboratory.

Introduction

In many insects including muscid flies, artificial diets have been developed for continuous rearing in the laboratory without natural diets (cf SINGH, 1977). In the house fly, *Musca domestica*, and the stable fly, *Stomoxys calcitrans*, various artificial diets for the larvae have been developed and used for mass rearing in the laboratory (BASEN, 1947; HOUSE and BARLOW, 1958; MONROE, 1962; ASHRAFI, 1964; BAILEY et al., 1975), while in the horn fly, *Haematobia irritans*, several attempts to devlop artificial diets for complete rearing of the larvae in the laboratory have failed (DEPNER, 1962; HARRIS, et al., 1967; ESHLE et al., 1973). So fresh bovine dung is always required for the larval rearing of the horn fly. Although this material is the natural diet for larval devlopment, its use in the laboratory had certain disadvantages such as the neccesity of maintaining animals, contamination of other insects and pathogenic bacteria, and need of storage in a refrigerator. The use of a dry medium that could be reconstituted with water when used would eliminate these problems.

In this study, an attempt was made to rear the horn fly larvae in the laboratory by the use of freeze-dried instead of fresh bovine dung.

Materials and Methods

Insects used

Horn fly eggs were obtained according to the way reported by KURAMOCHI (1985).

Bovine dung

Fresh bovine dung just after excretion was collected from the pasture of the Obihiro University of Agriculture and Veterinary Medicine where 40 holsteins were grazed. Fresh

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bovine dung, which was contaminated by no insects and was approximately 85% in moisture content, was used for examinations. A part of the dung was freeze-dried by the freeze dryer (LABCONCO® Freeze Dryer 18). The dried materials were reconstituted with water (70, 75, 80, 85 or 90% moisture content) just before the start of examinations.

Insect rearing methods

The eggs were seeded on 10g of each larval diet (fresh bovine dung or freeze-dried dung with water) in plastic petri dishes (9cm in diameter and 1.5cm in height). Larvae were reared in an incubator adjusted at 25±2C, 70% RH and continuous light. Pupae were collected from diets 10 days after egg seeding and weighed. About 50 pupae were placed together in a plastic cup (9cm in diameter and 5cm in height) under the same condition as the case of the larvae. Newly emerged adult flies were reared under the same conditions as reported by KURAMOCHI (1985) and fed with bovine blood containing acid citrate dextrose and antibiotic.

Results and Discussion

Table 1 shows the effect of moisture content in diets on the larval development of the horn fly. The hatching rate of the eggs was 96% on the average and there were no significant different in moisture content ($P=0.01$). Pupation rate of the larvae reared with diets containing moisture of 75, 80 and 85% was 94, 98, and 97%, respectively. Pupation rate of the larvae however, reared with the diet containing 90 % moisture, was 38% and this value was significantly lower than those of the former values ($P=0.01$). Futhermore, no pupae were obtained from the dung with 70% moisture content. From these results, it was comfirmed that suitable moisture content in diets for the larval development of the horn fly ranged from 75 to 85%. This result is similar to the results reported by HAMMER (1942), GREER and BUTLER (1973) and PALMER and BAY (1982). On the other hand, when the larvae were reared on natural fresh dung (approximately 85% moisture content), the pupation rate was 55%, significantly lower than that of the dried dung (85% moisture). This difference might be because the natural dung contains much pathogenic bacteria, as the pathogenic (anaerobic) bacteria in the dung decreases by freeze-drying (NAKANO, personal comunication). Mean weight to the pupae from the larvae on the dried dung of 75% moisture content was 4.13 mg, significantly lighter than those of the pupae from the larvae reared on other dried dungs. Emergence rate of the pupae from the larvae reared on the dung with 90% moisture

Table 1. Effects of moisture content in diets on the larval and pupal development of the horn fly.

Moisture content in diets (%)	No. of eggs seeded	No. of eggs hatched	No. of larvae pupated	Mean weight of pupae (mg) (Mean±SD)	No. of pupae emerged	Mean days from egg to adult	
						Male	Female
90	100	96	36	5.73±0.47	20	16.8	15.6
85	100	96	93	6.08±0.58	91	14.9	14.5
80	100	95	93	6.14±0.62	91	15.4	14.9
75	100	97	91	4.13±0.89	83	15.9	15.5
70	100	95	0	.....	0	.....	.....
Naturaldung (85% moisture)	100	97	55	5.61±0.62	51	15.9	15.1

Table 2. Effects of moisture content in larval diets on the mortality and reproductive ability of the adult horn fly.

Moisture content in larval diets (%)	Mean survival day		Maximum survival day		Mean number on eggs oviposited by a female
	Male	Female	Male	Female	
90	13.4	14.1	39	33	43.8
85	15.3	18.1	27	32	46.3
80	14.2	16.6	27	39	45.8
75	9.8	12.6	31	33	27.9
Natural fresh dung	14.3	18.1	35	41	46.8

Table 3. Effect of larval density in diet on the development of horn fly larvae and pupae reared on 85% moisture content of freeo-dried bovine dung.

Egg number per 10 g of diet	No. of replications	Mean rate of eggs hatched (%)	Mean rate of pupation from hatched larvae (%)	Mean weight of pupae (mg) (Mean±SD)	Mean rate of emergence from		Mean days from egg to adult	
					pupa	egg	Male	Female
5	10	94	84	6.22±0.41	91	72	13.8	13.3
10	10	96	96	6.00±0.64	99	91	14.6	14.2
15	10	95	90	5.49±0.80	96	75	15.3	14.7
20	8	93	88	5.01±0.39	98	80	15.4	14.8
30	10	97	84	4.56±0.59	88	72	15.5	14.6

was 58%, significantly lower as compared with other dried dungs. These phenomenon might be explained as follows; when the larvae were reared on dried dung of 90% moisture content, approximately 45% of the pupae were malformed: tanning in the puparium was incomplete, namely, high moisture content in diets might partly inhibit the puparium formation.

Moisture content in diets had no effects on the adult longevity and reproduction, except the case of the diet of 75% moisture content where the longevity of the adult and number of the eggs oviposited by a female were low (Table 2). This phenomena might be because the light weight (small size) bodies of the adults originated from the diet of 75% moisture content as compared with those of adults which originated from other high moisture content diets.

Table 3 shows the effect of density on the larval and pupal development of the horn fly. Number of the larvae per 10g of diet suitable for development was 10. Pupal weight became lighter in proportion to the increase of larval density.

Freeze-dried bovine dung, which was reconstituted with water to a moisture content of 80 or 85%, is very useful for rearing the horn fly larvae; freeze-dried bovine dung can be used in place of fresh natural bovine dung or artificial diets.

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References

ASHRAFI, S. H. (1964): The cultivation and nutritional requirements of *Stomoxys calcitrans*. *Bull. WHO*, 31: 519–520.

BAILEY, D. L., T. L. WHITFIELD and G. C. LABRECQUE (1975): Laboratory biology and techniques for mass producing of the stable fly, *Stomoxys calcitrans* (L.) (Diptera: Muscidae). *J. Med. Entomol.*, 12: 189–193.

BASDEN, E. B. (1947): Breeding the housefly *Musca domestica* (L.) in the laboratory. I. Introduction and technique. *Bull. ent. Res.*, 37: 381–387.

DEPNER, K. R. (1962): Continuous propagation of the horn fly, *Haematobia irritans* (L.) (Diptera: Muscidae). *Can. Ent.*, 94: 893–895.

ESHLE, J. L., C. D. SCHMIDT and J. J. MATTER (1973): Horn, fly: Preliminary evaluation of media for rearing larvae. *Ann. Entomol. Soc. Am.*, 66: 352–354.

GREER, N. I. and J. F. BUTLER (1973): Comparison of horn fly development in manure of five animal species. *Florida Entomol.*, 56: 197–199.

HAMMER, O. (1942): Biological and ecological investigation of flies associated with pasturing cattle and their excrement. *Vidensk Medd. Dansk. ntruf. For. Kobenhaven*, 105: 141–393.

HARRIS, R. L., E. D. FRAZAR and P. D. GROSSMAN (1967): Artificial media for rearing larvae of horn flies. *J. Econ. Entomol.*, 60: 891–892.

HOUSE, H. L. and J. S. BARLOW (1958): Vitamin requirements of the house fly, *Musca damestica* L. (Diptera: Muscidae) *Ann. Entomol. Soc. Am.*, 51: 299–302.

KURAMOCHI, K. (1985): Studies on the reproductive biology of the horn fly, *Haematobia irritans* (L.) (Diptera: Muscidae). II. Effect of temperature on the ovarian development and blood meal volume of the fly reared in the laboratory. *Appl. Ent. Zool.*, 20: 264–270.

MONROE, R. E. (1962): A method for rearing house fly larvae aseptically on a synthetic medium. *Ann. Entomol. Soc. Am.* 55: 140.

PALMER, W. A. and D. E. BAY (1982): Moisture content of the dung pat as a factor in the survival of larval stages of the horn fly, *Haematobia irritans* (L.). *Prot. Ecol.*, 4: 353–359.

SINGH, P. (1977): *Artificial diets for insects, mites and spiders*. IFI/Plenum Data Company, New York, pp. 594.

凍結乾燥牛糞を用いたノサシバエ幼虫の室内飼育

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摘　　要

ノサシバエ幼虫は野外においては新鮮な牛糞のみに生息し，またこの幼虫の完全な人工飼料は開発されていない。それゆえノサシバエ幼虫の室内飼育を行なう場合，常に新鮮な牛糞を用いなければならず，それゆえきわめて不都合な点が多い。そこで新鮮な牛糞を凍結乾燥し，それを再び水でもどしたものを用いてノサシバエ幼虫の室内飼育を試みた。凍結乾燥牛糞を水分含量が80%または85%になるように水でもどしたものを用いて幼虫飼育を行なったところ，幼虫の蛹化率，蛹の羽化率ともきわめて高く，牛糞そのものを用いたときよりも良い結果が得られた。一方水分含量を90%以上にした場合，蛹化率，羽化率とも低い水準であり，奇形蛹の出現率が高かった。また水分含量が75%のときは，蛹化率，羽化率とも高かったが，得られた成虫の生存率および繁殖能力が低かった。水分含量を70%にした場合には，ノサシバエ幼虫は全く蛹になることができなかった。餌10g当りの幼虫数を10頭にした場合，蛹化率，羽化率とも最も良い結果が得られた。

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