Delay of Onset of Oviposition in Pullets Promoted by 6-Methoxybenzoxazolinone

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ABSTRACT Single Comb White Leghorn pullets were used to determine the effects of 6-methoxy-2-benzoxazolinone (6–MBOA) and photoperiod on sexual maturity and egg production. Pullets were maintained on a constant 11L:13D photoperiod until 18 weeks of age and then were divided into two light-controlled chambers. Half the pullets in each chamber received a standard layer mash and the other half received the same diet supplemented with 6-MBOA (MB). Over the ensuing 21 days, the photoperiods were increased to 15L:9D in one chamber and 12L:12D in the other. Consumption of MB resulted in delayed sexual maturity and lower average egg production of those pullets when compared with pullets in the 15L:9D chamber. No significant difference between MB and C pullets was noted in the 12L:12D chamber. These results are similar to those obtained with pinealectomized quail and chickens.

(*Key words:* 6-methoxybenzoxazolinone, photoperiod, egg production, pullets)

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INTRODUCTION

Photoperiod influences sexual maturation of domestic fowl. Recently, a nonestrogenic cyclic carbamate, 6-methoxy-2-benzoxazolinone (6-MBOA), isolated from corn, wheat, rye, and other grasses, was found to promote an increase in the ovarian/body weight ratio and a proliferation of large antral follicles in treated rodents (Sanders *et al.*, 1981). Incorporation of this compound at .02 to .1 mg/g in the diet of nonbreeding montane meadow voles (*Microtus montanus*) resulted in a rapid commitment in males and females to reproduce (Berger *et al.*, 1981). We studied the effect of 6-MBOA on the sexual maturity and laying performance of Single Comb White Leghorn (SCWL) pullets.

MATERIALS AND METHODS

Dekalb DK pullets were reared on a standard developer mash and an 11 hr light:13 hr dark (11L:13D) photoperiod (0700 to 1800 hr). At 18 weeks of age, 112 pullets were randomly allotted to a 2 × 2 factorial experimental design with diet and lighting regimens as the variables. Pullets were placed in wire-floor batteries with 69 × 34-cm pens. There were 7 replicates of 4 pullets each assigned to each diet within each lighting regimen. The developer diet was offered until 20 weeks of age when the diet was changed to a standard layer mash. No additions were made to the control (C) diet and .05 g pf 6-MBOA/kg diet was added to prepare experimental diets (MB) used from 18 to 26 weeks. The 6-MBOA used was synthesized according to Nachman (1982).

The photoperiod in one chamber was increased to 15L:9D (0500 to 2000 hr) by two 15-min incremental increases 6 days each week (long). Incremental increases were added alternately to the beginning and end of the photoperiod. The photoperiod in the other chamber was increased to 12L:12D (0630 to 1830 hr) by two 15-min incremental increases weekly for 2 consecutive weeks (short). Light

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intensity was 25 lx. Chamber temperatures ranged from 27 to 31 C daily and relative humidity was approximately 67%. Feed and water were provided *ad libitum*.

Data were examined statistically by the analysis of variance (Steel and Torrie, 1960). Duncan's (1955) multiple range test was used to determine significant differences among means. All statements of significance refer to the 5% level of probability.

RESULTS AND DISCUSSION

The MB diet caused a significant delay in the onset of oviposition among pullets in the long photoperiod (Table 1) and a significantly lower percent hen-day egg production during Weeks 22 through 24 compared to the CON diet (Table 2). Significantly lower average production was noted over the first 5 weeks of lay as well. No significant difference between the C and MB diets in either the age of onset of lay or percent hen-day egg production was observed in the short photoperiod. Furthermore, the decrease in egg production noted in the MB × long photoperiod interaction was only transient, and no differences between treatments were detected by the 25th and 26th weeks (Table 2). Similarly, age at 50% egg production was not affected by MB diet (Table 1).

Thus, in contrast to the stimulatory action of 6-MBOA on the sexual maturation and activity of voles (Berger *et al.*, 1981), 6-MBOA in the diet of maturing pullets caused a 6-day photoperiod-dependent delay in sexual maturation and a transient reduction in hen-day egg production. These results parallel those obtained in Japanese quail, *Coturnix coturnix japonica* (Sayler and Wolfson, 1967, 1968; McFarland *et al.*, 1966), and young hens (Harrison, 1968) subjected to pinealectomy. Specifically, yolk deposition was delayed in pinealectomized juvenile hens (Harrison, 1968), and pinealectomy in juvenile female Japanese quail under stimulatory photoperiods retarded maturation of the ovary and oviduct and, hence, delayed onset of oviposition by approximately 5 to 10 days (Saylor and Wolfson, 1968). However, ovarian maturation was not delayed in young female quail under a non-stimulatory photoperiod.

Thus, pinealectomy in quail and hens reported in the literature and in 6-MBOA in this paper with SCWL pullets cause a transient photoperiod-dependent delay in the onset of oviposition of similar duration. This comparison suggests that the mode of action of 6-MBOA in these experiments may involve the pineal gland.

Melatonin and related pineal indoleamines are considered major agents of pineal expression (Sayler and Wolfson, 1968; Ralph *et al.*, 1974). The reproductive effects of exogenous melatonin are quite marked in mammalian systems and can vary according to the mode of administration. Melatonin applied *via* implants to hamsters can duplicate the effects of the removal of the pineal gland, i.e., causing a "functional pinealectomy" (Nir *et al.*, 1978). Similarly, Homma *et al.* (1967) found that melatonin implants in young Japanese quail under a stimulatory photoperiod decreased gonadal weights which, in effect, mimicked the retardation of ovarian and oviducal maturation rates reported by Saylor and Wolfson (1968) in

TABLE 1. *The effect of 6-methoxy-2-benzoxazolinone (MB) supplement in diet and photoperiod on age of onset of oviposition and age at 50% production*

Treatment[1]	N	Onset of lay	Age at 50% production
		(days)	
C × long	28	153 ± 4[a,2]	160 ± 4[a]
C × short	28	155 ± 5[a]	160 ± 4[a]
MB × long	28	159 ± 6[b]	163 ± 7[a]
MB × short	28	157 ± 4[ab]	162 ± 5[a]

[a,b]In the same column, values with dissimilar superscripts differ significantly ($P \leq .05$).

[1] 1Treatments were control (CON) or MB-supplemented diets fed under long or short photoperiods.

[2] Mean ± SD.

TABLE 2. *The effect of photoperiod and 6-methoxy-2-benzoxazolinone (MB) supplement in diet on weekly hen-day egg production*

Treatment[1]	Week 21	Week 22	Week 23	Week 24	Week 25	Week 26	Mean, weeks 21–25
C × long	17.0 ± 11.9[a2]	38.1 ± 16.7[a]	55.1 ± 9.5[a]	62.9 ± 12.2[a]	73.2 ± 11.6[a]	66.0 ± 12.4[a]	49.3 ± 4.7[a]
C × short	16.3 ± 17.8[a]	32.0 ± 12.2[a]	59.2 ± 10.6[a]	64.0 ± 12.5[a]	72.5 ± 11.2[a]	65.6 ± 13.3[a]	48.9 ± 8.7[a]
MB × long	8.2 ± 8.1[a]	23.1 ± 23.1[b]	38.1 ± 16.7[b]	53.7 ± 4.5[b]	70.1 ± 8.1[a]	64.0 ± 6.7[a]	38.6 ± 8.7[b]
MB × short	8.8 ± 10.1[a]	25.2 ± 14.9[ab]	55.1 ± 17.7[a]	64.4 ± 12.4[a]	70.1 ± 11.9[a]	65.3 ± 13.4[a]	44.6 ± 12.3[a]

[a,b]In the same column, values with dissimilar superscripts differ significantly ($P \leq .05$).

[1]N per treatment is same as in Table 1. Treatments were control (C) or MB-supplemented diets fed under long or short photoperiods.

[2]Mean ± SD.

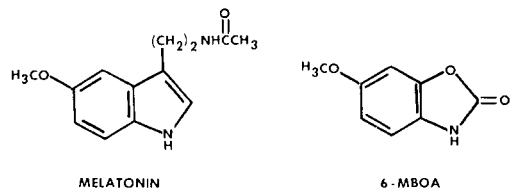

FIG. 1. Structures of melatonin and 6-methoxy-2-benzoxazolinone (6-MBOA).

immature pinealectomized females of the same species. The similarity of structures of 6-MBOA and melatonin (Fig. 1) further suggests that the former may function as a mimic of melatonin or related pineal indoleamines in pullets.

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