

# The Changes of Damage Rate by Peach Pyralid Moth, *Dichocrocis punctiferalis* (Lepidoptera: Pyralidae) in Chestnut Orchards from 1995 to 2010 Year

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## 밤나무림에서 1995-2010년의 복숭아명나방의 피해율 변화

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**ABSTRACT:** The damage rates of peach pyralid moth (*Dichocrocis punctiferalis*), which damages the chestnut fruits, were investigated annually from 1995 to 2010 according to year, region, and maturity. The damage rate by *D. punctiferalis* was the highest (34.5%) in 1998 and was the lowest (17.9%) in 2000. The pattern of the damage rate showed a repeating three-year cycle. There was a negative correlation (-0.6261\*) between rainfall and damage rate. There was a positive correlation (0.5826\*) between temperature and damage rate. The average damage rate of all surveyed regions was 22.2%. Of the surveyed areas, Hapcheon had the highest at 27% and Hamyang had the lowest at 15.0%. The damage rate of chestnut fruit depending on the maturity was 26.1% in an early maturing cultivar (Dantaek), and 19.3% and 21.1% in a late maturing cultivar (Eungi) and a medium maturing cultivar (Chukpa), respectively.

**Key words:** Chestnut tree *Dichocrocis punctiferalis*, Damage rate, Dantaek, Chukpa, Eungi

**초 록:** 밤나무 재배지에서 밤의 종실에 발생하여 알밤을 가해하는 복숭아명나방(*Dichocrocis punctiferalis*)을 선정된 조사지역에서 1995년부터 2010년까지 16년 동안 년도별, 지역별, 숙기별로 조사한 결과는 다음과 같다. 년도별 피해율은 1998년이 34.5%로 가장 높았고, 2000년이 17.9%로 가장 낮았다. 년도별 피해율의 패턴은 3년의 반복 주기로 변화되었다. 복숭아명나방의 피해율과 강우량과는 부의 상관(-0.6261\*)이었고, 온도의 상관은 정의 상관(0.5826\*)이었다. 조사 지역의 전체 평균 피해율은 22.2%이었고, 조사지역 중에서 합천지역이 27.0%로 가장 높았고, 함양지역이 15.0%로 가장 낮았다. 밤나무 성숙기별 피해율은 조생종인 단택품종이 26.1%로 피해율이 가장 높았고, 중생종과 만생종인 축파, 은기품종의 피해율이 각각 19.3%, 21.1%로 같은 수준이었다.

**검색어:** 밤나무 복숭아명나방, 피해율, 단택, 축파, 은기

The peach pyralid moth, *Dichocrocis punctiferalis*, reduces the income of farms and is persistent in chestnut fruits production. Therefore, we analyzed the change of damage rate caused by peach pyralid moth for 16 years.

The peach pyralid moth causes severe damage to chestnut, peach, apple, persimmon, and apricot in Korea and Japan (Choi, 1998; Konno *et al.*, 1981). The peach pyralid moth has been found in Korea, Japan, China, India, and Australia in areas

where chestnuts are cultivated (Needlay *et al.*, 1983). The host plants of this insect pest belong to 44 species in 17 families (Shinkaji, 1969). In Korea, the peach pyralid moth is trivoltine in chestnut orchards and the 2nd generation caused the most serious damage to chestnut orchards (Choi *et al.*, 2004; 2006). Analysis of damage rate can be useful for chestnut fruit insect pest control. These patterns will help predict peach pyralid moth damage rate and provide a solution for insect pest control. Chestnut farms have suffered considerable losses annually from the peach pyralid moth. Its damage rate reduces the productivity, corresponding to about four billion wons (Forest, 2010).

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This study was carried out to investigate damage rate from 1995 to 2010 in chestnut orchards. The purpose of this study is to provide useful guidelines for management and cultivation of chestnut orchards to effectively control peach pyralid moth in chestnut orchards.

## Materials and Methods

This study was conducted in areas where chestnut trees are cultivated and where the peach pyralid moth, *D. punctiferalis*, damages the fruits. The surveyed areas were chestnut orchards in 6 counties and 12 myeon (Table 1) located in Kyeongsangnam-do province. The area of each orchard was 5 ha in all survey sites. Kyeongsangnam-do province is one of the major chestnut fruit producing districts and is responsible for about 50% of the domestic total output (Forest, 2010). The chestnut trees in survey sites were 20-years old and there were 200 trees per ha.

The survey of the peach pyralid moth damage rate was carried out from 1995 to 2010. To investigate damage rate, the number of chestnut fruits were 500EA was repeated three times. Chestnut fruits collected random at chestnut orchards fall. Damage rates were calculated as percentage of damaged fruits of the collected chestnut fruits. They were also calculated according to area and by cultivar.

Data were analyzed by one-way analysis of variance (ANOVA) to determine the significance of damage rate change. ANOVA were executed using in SAS (SAS Institute, 2001). Means were compared by Turkey's test.

## Results and Discussion

### Change of annual damage rate

The highest damage rate was 34.5% in 1998 and the lowest damage rate was 17.9% in 2000. The damage rate of peach pyralid moth changed on a three-year cycle. The damage rate was higher in 1995, then gradually decreased until 1997. The highest damage rate was in 1998, after which it slowly decreased again. The damage rate was higher in 2001 and 2004 (Table 2). Knowledge of the three-year cycle could be valuable data in the cultivation and management of the chestnut.

Based on the surveyed results, we analyzed correlation using emergence time, rainfall, and temperature (KMA, 2010). A negative correlation (-0.6261<sup>\*</sup>) was observed between damage rate and rainfall. These results indicate that damage rate is affected by rainfall from late July to late August concentrated 2nd generation of peach pyralid moth. Annual rainfall was 544mm, which is less than in a normal year. In contrast, rainfall in 2000 was higher than in a normal year and the damage rate was much lower compared to those of other years. These results agreed with Choi (1997), who reported that the emergence of peach pyralid moth has a close relationship with rainfall at emergence time. In addition, there was a positive correlation (0.5826<sup>\*</sup>) between damage rate and temperature. These results agreed with previous reports that emergence of imagoes is closely related to temperature (Jacob, 1981; Shinkaji and Oho, 1970; Choi, 1998).

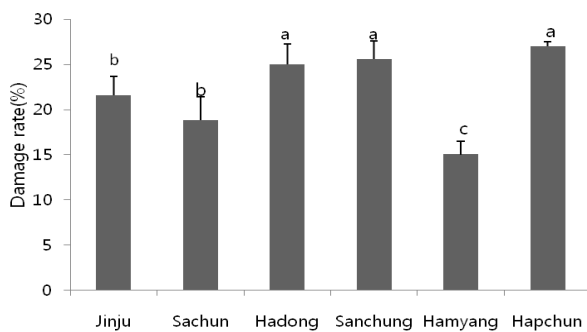
**Table 1.** Survey sites of *Dichocrocis punctiferalis* in chestnut orchards

County	Survey sites(coordinate)
Jinju city	Micheon-myeon Obang(N35°58'58" E128°05'01") Ibansung-myeon Dacheon(N35°08'58" E128°19'03")
Sacheon city	Gonmeong-myeon Sansa(N35°05'47" E127°56'20") Gonyang-myeon Jyojang(N35°04'20" E127°51'31")
Hadong-gun	Bookcheon-myeon Banghowa(N35°05'58" E127°20'39") Yangbo-myeon Gamdagn(N35°04'47" E127°49'33")
Sancheong-gun	Sinan-myeon Hajong(N35°20'12" E127°52'33") Sindung-myeon More(N35°23'43" E127°58'41")
Hamyang-gun	Soodong-myeon Howsan(N35°30'47" E127°48'27") Hamyang-myeon Jukgok(N35°31'42" E127°40'12")
Hanpcheon-gun	Gahoe-myeon Oewesa(N35°01'14" E128°58'31") Samga-myeon Yonghung(N35°25'16" E128°04'35")

**Table 2.** Damage rate of *Dichocrocis punctiferalis* by year in chestnut orchards

Year	Damage rate (%)	Precipitation (mm)*	Temperature (°C)*
1995	23.3±4.7	485.1	155.7
1996	20.8±4.1	599.3	147.6
1997	16.9±3.0	852.2	157.8
1998	34.5±6.3	544.2	166.1
1999	19.2±3.4	1102.4	164.5
2000	17.9±2.7	988.0	160.8
2001	27.0±5.5	727.2	165.9
2002	18.9±3.0	1141.8	158.0
2003	17.6±2.5	1038.6	153.0
2004	29.0±6.1	821.0	165.6
2005	25.0±4.7	684.4	163.8
2006	20.1±3.7	1006.1	157.5
2007	22.8±4.2	806.7	168.9
2008	24.3±5.0	531.6	167.6
2009	24.6±5.0	346.8	170.1
2010	21.1±3.6	752.0	155.9
Correlation coefficient		r=-0.6261	r=0.5826

Note \* Precipitation and temperature afford data to JinJu meteorological observatory data.



**Fig. 1.** Damage rates of *Dichocrocis punctiferalis* by site in chestnut orchards. Different letters above error bar indicates significant differences at 5% level as measured by a Turkey test.

### Changes of damage rates in some regions

We investigated the damage rates in chestnut fruits by peach pyralid moth in 6 experimental fields (Table 1). In chestnut tree-growing areas, 500 samples were collected three times per year from 1995 to 2010 and investigated for damage by peach pyralid moth. The average damage rate in all chestnut orchards was 22.2%. Hapcheon had the highest damage at 27.0%,

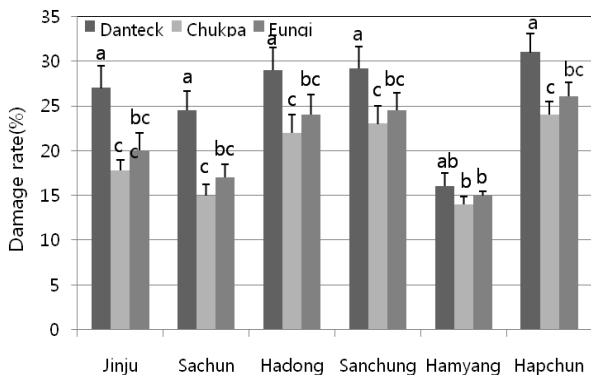
followed by Sancheong (25.6%) and Hadong (25.0%). The damage rate in Jinju and Sacheon were 21.6% and 18.8%, respectively. Hamyang had the lowest damage at 15.0%. These results were similar to previous studies (Kang *et al.*, 1978; Choi, 1993) where an annual loss by peach pyralid moth of 400 ~ 600 millions at 20% to 30% was reported. It is likely that the similar damage rates are related to timely insect pest control. Aerial pesticide spraying and self-crown spraying at one time emergence peaks of peach pyralid moth were carried out at chestnut fruit harvest at the request of local farmers in Sacheon and Hamyang. The controlled area had significantly lower damage rates than the uncontrolled areas. These results were reported that the control of chestnut insect pests were controlled most effectively by a combination of aerial spraying and self-crown spraying control methods (Lee *et al.* 1997).

Therefore, the highest damage rate by peach pyralid moth occurred in areas in which insect pests were not controlled in a timely manner. Therefore, it is highly recommended that control is conducted in a timely manner using helicopters at the time of highest emergence of the peach fruit moth.

### Change of damage rate depending on maturing cultivar

The damage rates by peach pyralid moth were investigated in different chestnut varieties planted in six experimental chestnut fruit-growing regions (Table 1).

Three varieties of chestnut fruits were collected in Dantaek, Chukpa, and Eungi. Collections occurred three times, 500 fruits per variety were collected each time, and the damage rates by peach pyralid moth were examined (Fig 2). The damage rate of the early maturing cultivar, Dantaek, was the highest at an average of 26.1% in 6 experimental fields. The damage rate of the medium maturing cultivar, Chukpa, was an average of 19.3%. The damage rate of the late maturing cultivar, Eungi, was an average of 21.1%. The damage rates of the medium maturing cultivar (Chukpa) and the late maturing cultivar (Eungi) were lower than the early maturing cultivar (Dantaek). This result suggest that the damage rate of the medium maturing variety (Chukpa) and the late flowering cultivar (Eungi) is less than the early maturing cultivar (Dantaek) because hatching of peach pyralid moth does not occur well at the highest emergence peak of peach pyralid moth due to its late maturity.



**Fig. 2.** Damage rate of *Dichocrosis punctiferalis* on different chestnut cultivars. Different letters above error bar indicates significant differences at 5% level as measured by a Turkey test.

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