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Dormancy Period of Pawpaw (*Asimina triloba* (L.) Dunal) Trees in Miyazaki Prefecture, Japan

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INTRODUCTION

Pawpaw is a small, deciduous fruit tree species in the family Annonaceae that is native to eastern North America. Among the members of the family Annonaceae, only the genus *Asimina* is found in the temperate zone. Temperate fruit tree species enter a dormant state during the winter. This endogenous dormancy breaks after exposure to low temperatures for a specific period of time. Since the dormancy period of Pawpaw in southern Kyushu of japan is unknown, we collected Pawpaw branches over time and estimated the dormancy period using a stem cutting method.

MATERIALS AND METHODS

Three grafted 10-year-old 'Rebecca Gold' Pawpaw trees being cultivated in open fields in Nichinan, Miyazaki Prefecture, Japan were sampled. To investigate Pawpaw dormancy period, same year living branches were collected approximately every 2 weeks from October 20, 2016 to March 10, 2017 and from August 7, 2017 to March 8, 2018 and subjected to stem cutting. At each sampling, a single medium-length branch (ca. 15 cm) growing at a nearly horizontal angle was collected from each tree. Each branch was stripped, leaving approximately five buds, and cut under water before being immediately inserted into floral foam. The floral foam was placed in a 100-mL beaker and soaked in tap water to ensure sufficient moisture content. The branch and beaker were sealed in a 0.04-mm-thick plastic bag to maintain a humidity of 90% or greater. These beakers were then placed in growth chambers

maintained at 25°C under a regime of 10 h light (7 am to 5 pm) and 14 h dark (5 pm to 7 am), and the number of days required for budding, defined as the number of days required for any of the buds on each branch to reach 3 mm in length, was observed. To estimate the temperature and cumulative time required to break dormancy, the soil temperature of the orchard was monitored hourly using a thermo recorder equipped with a data logger (Ondotori Jr. TR-52, T&D Corporation, Japan). For air temperature data, weather data from the Japan Meteorological Agency station at Aburatsu in Nichinan, Miyazaki Prefecture, were used. The cumulative temperature (°C・days) required to break dormancy was defined as the sum of the difference between the reference temperature (2, 5, 7.2, or 10°C) and the daily mean air temperature during the period of deepest dormancy each year.

RESULTS AND DISCUSSION

The results of our 2-year investigation of the depth of dormancy using a stem-cutting method indicate that Pawpaw dormancy is relatively shallow from August to September, with 20 days or less being required for budding (Figure 1). Starting in early October, the number of days required for budding increases gradually, reaching from 46 to 60 days or more by early January when dormancy is deepest. The number of days required for budding began to decrease gradually in early February 2016 and in mid-January 2017. In both years, dormancy was broken completely by early March, at which point the mean air and soil temperatures were both 10°C.

The cumulative number of times not greater than each reference temperature (*i.e.*, 2, 5, 7.2, and 10°C) for the period between entering deep dormancy and breaking dormancy (October 5, 2016 to March 10, 2017 and October 5, 2017 to March 8, 2018) was 58, 282, 604, and 1214 h, respectively, in 2016 and 131, 492, 902, and 1563 h in 2017 (Table 1). Although cumulative temperature decreased with decreasing reference temperature, further investigation is warranted.

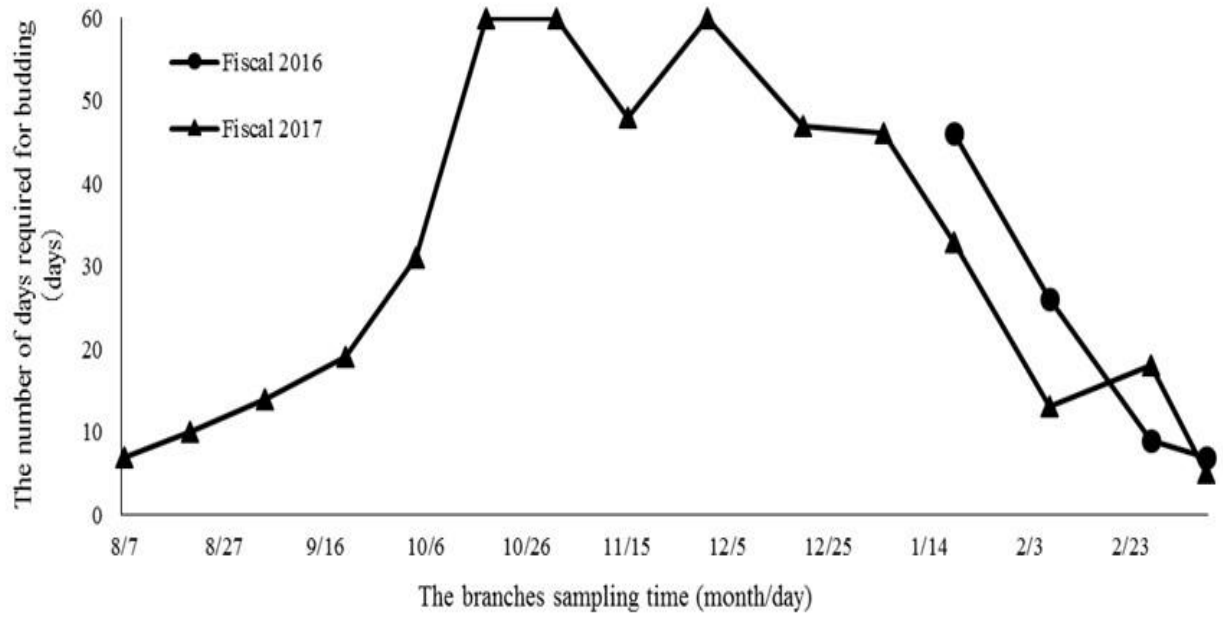

Figure 1. Seasonal change in the degree of Pawpaw bud dormancy.

Table 1. Cumulative time encountered less the reference temperature until the dormancy break.

Fiscal	Cumulative time	Reference temperature			
		2℃	5℃	7.2℃	10℃
2016	16.10.5～17.3.10	58[Z]	282	604	1214
2017	17.10.5～18.3.5	131	492	902	1563

[Z]The cumulative time is the time when it encountered less the reference temperature until the time when bud break started to take place within 10 days from the time when it took more than 20 days to bud.