N O T E

Factors Influencing Color Changes in *Hierodula patellifera* (Mantodea: Mantidae)[1]

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Color polymorphism occurs among members of the family Mantodea (Ramsay 1990, Fauna of New Zealand 19, 96 pp.). Roberts (1937, Ann. Entomol. Soc. Am. 30: 96–109) reported that *Stagmomantis limbata* Hahn adult males are usually green but the females are divided about equally between green and brown phases. *Mantis religiosa* L. can often be found with different colorations: grass-green and brown and from yellow-ochre to brown-sepia (Battiston and Fontana 2010, B. Insectol. 63: 85–89). Coloration may be either genetically controlled or influenced by environmental factors (Okay 1953, B. Entomol. Res. 44: 299–315) and background (James 1944, Can. Entomol. 76: 113–116). *Hierodula patellifera* (Serville) is found in Japan, Hawaii, and Southeast Asia, and its body is green or brownish-purple (Perez 2005, Physiol. Entomol. 30: 42–47). Little attention has been paid to color changes in *H. patellifera*. Herein is reported a preliminary study focusing on color polymorphism in *H. patellifera*.

Four oothecae were collected in longan (*Dimocarpus longan* Lour.) and litchi (*Litchi chinensis* Sonn.) orchards (N 19°30.444′, E 109°29.780′) in 2011. Neonate *H. patellifera* were reared in separate transparent plastic cups (upper diameter 65.8 mm, bottom diameter 49.0 mm, height 71.8 mm) with a cover of white gauze. Upon reaching the 5th stadium, nymphs were placed individually in larger transparent plastic cups (upper diameter 83.0 mm, bottom diameter 57.5 mm, height 157.0 mm) until adults emerged. They were fed daily on a successive diet of artificial formula (Wang et al. 2014, China Plant Prot. 34: 5–8) and a variety of insects collected in the field, such as *Uroleucon formosanum* (Takahashi), *Dysmicoccus boninsis* (Kuwana), *Tenebrio molitor* L., and *Brontispa longissima* (Gestro), depending on

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developmental stage. All rearing was at 80 ± 3% relative humidity, 28 ± 1°C, and on a photoperiod of 12:12 (L:D).

A high mortality rate of 1st instars occurred presumably because of their smaller size and apparent weaker composition compared with other stages (Wang et al. 2014, China Plant Prot. 34: 5–8). Therefore, our observations of color changes were performed with adults because a portion of young mantids died before reaching maturity. Of 173 adults (86 females and 87 males), two body color polymorphisms were seen in the 3rd and 4th instars. We found that nymphs which hatched from the same oothecae could change from green to brown; however, the brown color form was rarer than the green. This phenomenon is also found in *Miomantis caffra* Saussure (Ramsay 1990) and *M. religiosa* (Okay 1953). The sex ratio of brown females to brown males was approximately 1:6.3 and the sex ratio of the green adults was 1.2:1. The percentage of brown adult mantids in the total population was 11.6% and the number of brown female and brown male adults accounted for 3.5% and 19.5% of the total number of females and the total number of males, respectively. The head width of green females and males averaged 9.38 ± 0.05 mm and 7.64 ± 0.05 mm (mean ± SE), respectively. The average head width of brown females and males was 8.83 ± 0.39 mm and 7.26 ± 0.26 mm, respectively. Body length of green adults was 6.06 ± 0.09 cm (female) and 5.19 ± 0.06 cm (male). Body length of brown females and males was 5.78 ± 0.32 cm and 5.11 ± 0.18 cm, respectively. In general, for the same sex, the green adults were larger in size than the brown adults. Otherwise, the brown females were larger than the brown males.

Litchi and longan are evergreen subtropical fruit trees in Hainan Province, China. It is suggested that the color changes in *H. patellifera* might not be related to the changing of the season. Based on our observation, we also totally agree with Battiston and Fontana (2010, B. Insectol. 63: 85–89) that partial color changes are not linked to the substrate or the molting process in artificial conditions. On the other hand, *H. patellifera* always stayed on the leaves and showed much-more aggressive behavior against some animals (Wang pers. obs.), although we speculated that the brown mantids were easily detected and eaten by natural predators in the orchards, as their coloration was visibly different. Thus, this color change in *H. patellifera* is not due to the color of the plant cover (James 1944, Can. Entomol. 76: 113–116), environmental factors (i.e., humidity, air temperature, and light intensity) (Battiston and Fontana 2010), or protective coloration manner (Di Cesnola 1904, Biometrika 3: 58–59). Questions remain as to the factors that influence color changes in *H. patellifera* hatching from the same oothecae.

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