

Notes on hibernation of a Lesser yellow-jacket wasp,
Parapolybia varia (Fabricius, 1787) (Hymenoptera: Vespidae)
in Vietnam, with comments on its nest

О сезонной диапаузе осы *Parapolybia varia* (Fabricius, 1787)
(Hymenoptera: Vespidae) в условиях Вьетнама с замечаниями
по конструкции и размещению гнёзд

Phong Huy Pham
Фонг Фам

Institute of Ecology and Biological Resources, Vietnam Academy of Science and Technology, Hoang Quoc Viet Road 18, Hanoi Vietnam. E-mail: phong.wasp@gmail.com, phongpham82@iebr.ac.vn.

Институт экологии и биологических ресурсов, Вьетнамская Академия наук и технологии, Хоанг Куок Вьет-роуд 18, Ханой Вьетнам.

Key words: aggregation, bamboo stem, hibernation, *Parapolybia varia*, Vietnam.

Ключевые слова: агрегация, стебли бамбука, зимняя спячка, *Parapolybia varia*, Вьетнам.

Abstract. Hibernation of a Lesser yellow-jacket, *Parapolybia varia* (F.), was studied from mid December 2015 to early April 2016 in Nghia Do, Cau Giay, Hanoi. Hibernaculum was into a bamboo stem put under the palm leaf-tiled roof of a desert house. Hibernant time ranged from 101 to 111 days. An aggregation of 135 individuals of the species found at the hibernaculum. Association of these multi-individuals aims to defend the colony and is a common feature of *P. varia*. Comments on the nest of *P. varia* are also presented.

Резюме. Изучена сезонная диапауза осы *Parapolybia varia* (F.) в условиях Вьетнама, наблюдавшаяся в период с середины декабря 2015 года до начала апреля 2016 в парке Нгия До, расположенном в районе Кау Гиай города Ханоя. Диапауза длилась в течение 101-111 дней и происходила в побегах бамбука, размещённых под крышей пустынного домика, покрытого пальмовыми листьями; здесь были обнаружены скопления 135 особей ос. Подобные скопления характерны для *P. varia* и необходимы для сохранения колонии. В работе обсуждаются особенности конструкции и размещения гнёзд *P. varia* в условиях природы Вьетнама.

Introduction

The genus *Parapolybia*, containing five species [Kojima, Carpenter, 1997], is a small group of the Old World Polistinae and thought to form a natural group together with other Old World polistine genera except for *Polistes*, by sharing a meconium extracting behavior [Jeanne, 1980]. Of those, three species *P. indica*, *P. varia*, and *P. nodosa* are recorded for Vietnam by Pham, Li [2015].

Information existing on biology of *P. varia* is poor and fragmentary, and nothing is known about the hibernation of the species. Nest architecture of *P. varia* is mentioned by Yamane [1984]: Nest is without an outer envelope and there are two types of the nest;

the first type it is called the single-combed nest having a slender and vertical comb supported by a single petiole, with less than a thousand cells. The second type it is called the multiple-combed nest having approximately 10 vertical combs containing 2000–3000 cells. With nesting habit as the second type it suggests that this is a possible relationship with colony defense. Also author, in 1985, studied on social relations among females in pre- and post-emergence colonies of *P. varia*. Following this, most colonies of *P. varia* are found by multiple females. In the pre-emergence period the top-ranking female dominated all others like a despot, and after the emergence of workers the subordinate associates gradually disappeared and colonies become monogynous (one egg-layer or queen per colony). Barthélémy [2009] showed briefly on nest construction and habitat of *P. varia* as follows: The nest is un-protected and has one sided and asymmetrical paper comb construction with eccentric pedicel. Cells are unspecialized. The nest material is composed of masticated plant fiber and secretions. It is commonly found in shaded areas with dense vegetation fixed to a variety of supports. In this present study hibernant observations add hence new information about its biology. Hibernaculum, hibernant time and behaviour of *P. varia* are presented and discussed along with comments on its nest.

Materials and Methods

Observations on hibernation of *P. varia* took place at a desert house in Nghia Do, Cau Giay, Hanoi (21°02'877" N, 105°47'967" S, altitude 9 m) with the frequency of 1–2 weeks per time. Within early five days the frequency was of 1 time per day. The study site is a desert area waiting for the city planning and develop-

ment. Because this desert house was cancelled for the construction aim, on 9 March 2016, the hibernaculum of *P. varia* was moved to a safe place in which it was put into a net cage with 20×20×100 cm in dimension (Fig. 9, 12). Plug of the entrance was made of a piece of white spongy with a small hole to facilitate the activities of *P. varia* (Fig. 11). This cage was hung under an iron roof at the ninth floor of Institute of Ecology and Biological Resources (IEBR) (Fig. 12). During this time observation was carried out daily.

Three specimens of the species were collected for identification. These specimens were pinned and deposited at IEBR, Vietnam Academy of Science and Technology (VAST), Hanoi, Vietnam.

The species name was obtained based on publications by Barthélémy [2009] and van der Vecht [1966]. All actions of individuals were minutely written, and pictures were taken by a digital camera Canon SD3500 IS.

Results and Discussion

Hibernaculum. *P. varia* overwintered in a bamboo stem placed under the palm leaf-tiled roof of a desert house. This bamboo, 6.8 cm in the diameter, was chiseled through two sides to make a hole and one other smaller bamboo with the diameter of 2.5 cm was put into this hole. Therefore the entrance of the hibernaculum was gaps made between the corner of the hole and the smaller bamboo (Fig. 2, 3). The hibernaculum was about 2.4 m from the ground. It is very surprised that the hibernaculum of *P. varia* is also that of the cockroach, *Periplaneta sp.*, because nine young cockroaches found at the bottom of the bamboo stem (Fig. 8, 14). It is very difficult to explain this because neither any report has recorded the cockroach prey of *P. varia* or of vespid wasps in general, nor the cockroach was paralyzed by the sting of *P. varia*. In other words, no observations on symbiosis were recorded between two these species. Maybe it is only a coincidence of the hibernaculum.

Hibernant time. Individuals of *P. varia* were found on 14 December 2015 perching on the outer of a bamboo stem at the desert house as mentioned above. Because on 8 December a collection trip also took, this shows that these wasps aggregate at this site within from 9 to 14 December. On 16 December, all wasps moved into the bamboo stem. The beginning and end day that individuals left the hibernaculum were on 25 March and 4 April 2016 respectively (Fig. 7, 8), hence the duration of the hibernation of *P. varia* was from 101 to 111 days.

Hibernant behaviour. An aggregation of 135 individuals found at the hibernant site (Fig. 1, 10). This amount suggests two cases as follows: the first case these individuals are from one nest only. If so, this nest has a magnificent size because during collection trips of 5 years from 2010 to 2015 no nests with over 100 individuals were found in Hanoi, Vietnam. Hence this nest is a particular case. The other case these individuals are from more other *P. varia* nests. Barthélémy [2009] recorded that *P. varia* can be found in associa-

tion with other *Parapolybia* species, particularly with *P. varia*. This species has also a regional varying degree in nest initiation strategy, pleometrotic in Southern Taiwan, haplometrotic in North-Central Taiwan and Japan. Yamane [1985] also stated that most colonies of *P. varia* are found by multiple females. Hence the second case is more high possibility than the first case because of association among other *P. varia* species. Association of multi-individuals is to defend the colony before natural enemies such as predators. This is also reported in Yamane's papers [1984, 1985]. The hibernation with a lot of individuals is also reported to *Polistes olivaceus* in Pham's papers [2014, 2015]. This may be a highly usual method among the Polistinae in general and the association among other *P. varia* species is a common feature of *P. varia*.

Before moving into the bamboo stem, all wasps perched on the outer of the hibernaculum with antennae and legs outstretched and wings held flat on the dorsum (Fig. 1). This shows that either they are exploring the hibernant site or they are arranging the colony in the second case as mentioned above. In days with favourable weather condition, sunshine and temperature over 25 °C, such as on 4, 14, and 17 January, 29 February, 7, 8, 19 March, some wasps left the hibernaculum to take food and water (Fig. 2, 3, 5, 6). This is to supply more energy to their body. Before leaving the hibernaculum *P. varia* crawled to the entrance hole, stopped here about 30–40 seconds to view and it used its antennae to probe the safeness. With more 30 hours and 30 minutes of observation, no more two wasps left the hibernaculum at the same time that one by one only. In days with adverse weather condition, rain or cloudiness and temperature under 20 °C, such as on 22, 27 January, 3, 14, and 21 February, 3, 10, 11 March, all were inactive and no wasps were found at the entrance hole (Fig. 4).

During the time of dismantlement of bamboos of the desert house and transference of the bamboo stem back to the laboratory, no wasps left the hibernaculum although there were many strong touches to this bamboo. In bamboo stem, wasps perched on each other (Fig. 10) suggesting that this may be to keep the warm each other. During hibernant time energy in wasps' body was drained, attacks by stings of *P. varia* was hence unavailable (Fig. 13). Or in other words *P. varia* hardly attacked any activities moving and coming near its hibernaculum. The attacking behaviour of *P. varia* at this time is absolutely different from that at the time building its nest. At that time while activities move and come near its nest it will be quick to spot, locate and attack all those.

Remarks. With surveyed results during a period of 5 years from 2010 to 2015 in North Vietnam (11 provinces and cities), *P. varia* has both pleometrotic and haplometrotic nest initiation strategy. Its nest is often built on the back of leaves or on leaf pedicles of mango (*Mangifera indica*) (4 nests), longan (*Dimocarpus longan*) (3 nests), litchi (*Litchi chinensis*) (4 nests); on



Figs 1–14. Hibernation of *Parapolybia varia* in Vietnam. 1 — Aggregation of *Parapolybia varia* individuals before removing into the hibernaculum on 14 December, 2015; 2, 3 — wasps perching on the entrance hole of the hibernaculum on 4 and 17 January, 2016 (Sunshine, Temperature $> +25^{\circ}\text{C}$); 4 — wasps absence at the entrance hole on 22 January, 2016 (rain or cloudiness and temperature $< +20^{\circ}\text{C}$); 5, 6 — wasps leaving the hibernaculum to take water and food on 29 February and 19 March, 2016; 7, 8 — wasps leaving the hibernaculum to construct new nests on 4 April, 2016; 9 — hibernaculum (in bamboo stem) of *P. varia* transferred to the laboratory; 10 — *varia* individuals lying dormant in the bamboo stem; 11 — entrance plug made of a piece of white spongy with a small hole; 12 — the bamboo stem put in a net cage hung under an iron roof; 13 — attack by the sting of *P. varia* unavailable after the hibernant time; 14 — the cockroaches, *Periplaneta* sp., found in the same hibernaculum of *P. varia*.

Рис. 1–14. Сезонная диапауза осы *Parapolybia varia* в условиях Вьетнама. 1 — скопление особей *Parapolybia varia* (F.) 14 декабря 2015 г. перед переходом в диапаузу; 2, 3 — скопление ос у входа в гнездо в период диапаузы 4 и 17 января 2016 в хорошую погоду (яркое солнце, температура выше $+25$ – 25°C); 4 — отсутствие ос у входа 22 января 2016 при неблагоприятной погоде (дождь или высокая облачность при температуре ниже $+20^{\circ}\text{C}$); 5, 6 — осы покидают гнездо для потребления воды и пищи 29 февраля и 19 марта 2016 г.; 7, 8 — осы покидают гнездо 4 апреля 2016 г. для строительства новых гнезд; 9 — гнездо *P. varia*, обустроенное в бамбуковом побеге, перемещено в лабораторные условия; 10 — особи *P. varia* в состоянии диапаузы внутри бамбукового побега; 11 — заглушка входного отверстия, выполненная из пористого материала с маленькой дырочкой; 12 — бамбуковые побеги с гнездами ос в сетчатой сумке, подвешенной под металлической крышей; 13 — оса после выхода из диапаузы не способна жалить; 14 — таракан *Periplaneta* sp., обнаруженный в гнезде *P. varia*.

small branches of peach (*Prunus persia*) (2 nests) or in bushes (6 nests). With small nests (11 nests), *P. varia* builds a comb under 300 cells, about 15–20 cm long and 10–15 cm wide. With large nests (8 nests), it builds a

comb over 400 cells, to 30 cm long. For two special nests, the comb is expended and bent two sides then these two sides reach together to make a tubular comb. These nests can contain hundreds of individuals. In

Hanoi area, nests of *P. varia* with over 100 individuals have not yet, to date, found because this is an urban area with a lot of human activities and limit food sources. Therefore *P. varia* varies nest strategy in order to adapt to living environment condition.

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