

Pollination of *Barringtonia racemosa* (Lecythidaceae) by Moths on Iriomote Island, Japan

Norio TANAKA*

田中法生* : 西表島におけるサガリバナ (サガリバナ科) のガによる送粉

Barringtonia J.R. Forst. et G. Forst. (Lecythidaceae) is a genus of 56 species that is widely distributed in the tropics from eastern Africa to northern Australia. *Barringtonia racemosa* (L.) Spreng. occurs in Mozambique, Madagascar, India, Sri Lanka, Indochina, Malaysia, New Guinea, northern Australia, Taiwan, Southern China, the Philippines, Melanesia, Micronesia, and Japan (the south of Amami-Oshima Island) (Setoguchi 1999, Chantaranonthai 1995, Hatsushima and Nakajima 1979).

Records of pollinators of *Barringtonia* are sparse. Start and Marshall (1976) reported that the flowers of *Barringtonia* sp. were pollinated by the Mariana fruit bat, *Pteropus mariannus* Desmarest (Pteropidae) in West Malaysia. Marshall (1983) described *B. racemosa* in Malaysia as a bat-pollinated tree. It is thought that *B. acutangula* displays “shaving brush”-type floral characteristics, and is most probably bat-pollinated (Armstrong 1979, Faegri and van der Pijl 1966, Baker and Harris 1957, Baker 1961, 1969). In Japan, bat-pollinated plants have not been reported (Kato 1999). Although Kato (1999) suggested that *B. racemosa* may be pollinated by bats in Japan, the pollinators of this species in Japan have not been observed to date. In this paper, I report the pollinators of *B. racemosa* on Iriomote Island, Japan.

Study Site and Methods

Pollination of *B. racemosa* was observed in a riparian zone, 600 m southwest of the mouth of Male River, Funaura, Iriomote Island, Okinawa Prefecture, Japan, for six nights between 11 July and 16 July 2003. Iriomote Island is located at the tip of southwestern Japan. Observations were mainly carried out on 20 trees in an area of 150 m² between 7 p.m. and 11 p.m., and between 6 a.m. and 8 a.m.

Results and Discussion

During the observation period, the flowers of *B. racemosa* emitted a strong scent and produced a fair amount of nectar. Four species representing four families of moths were recorded visiting and sucking nectar from the flowers of *B. racemosa*: *Asota heliconia riukiwana* Rothschild (Noctuidae) (Fig. 1A); *Erasmia pulchella fritzei* Jordan (Zygaenidae) (Fig. 1B); *Milionia basalis pyreri* Druce (Geometridae); and *Nevrina procopia* (Stoll) (Crambidae) (Fig. 1C). *E. pulchella fritzei* visited twice during the observation period, while the other species were seen only once. These moths sucked nectar for several minutes while moving from flower to flower within an inflorescence by crawling and/or by fluttering (Fig. 1). At this time, their wings and body touched the anthers and stigmas of the flowers. Although the observation

*Tsukuba Botanical Garden, National Science Museum, Tsukuba, 305-0005. 国立科学博物館 筑波研究資料センター 筑波実験植物園.

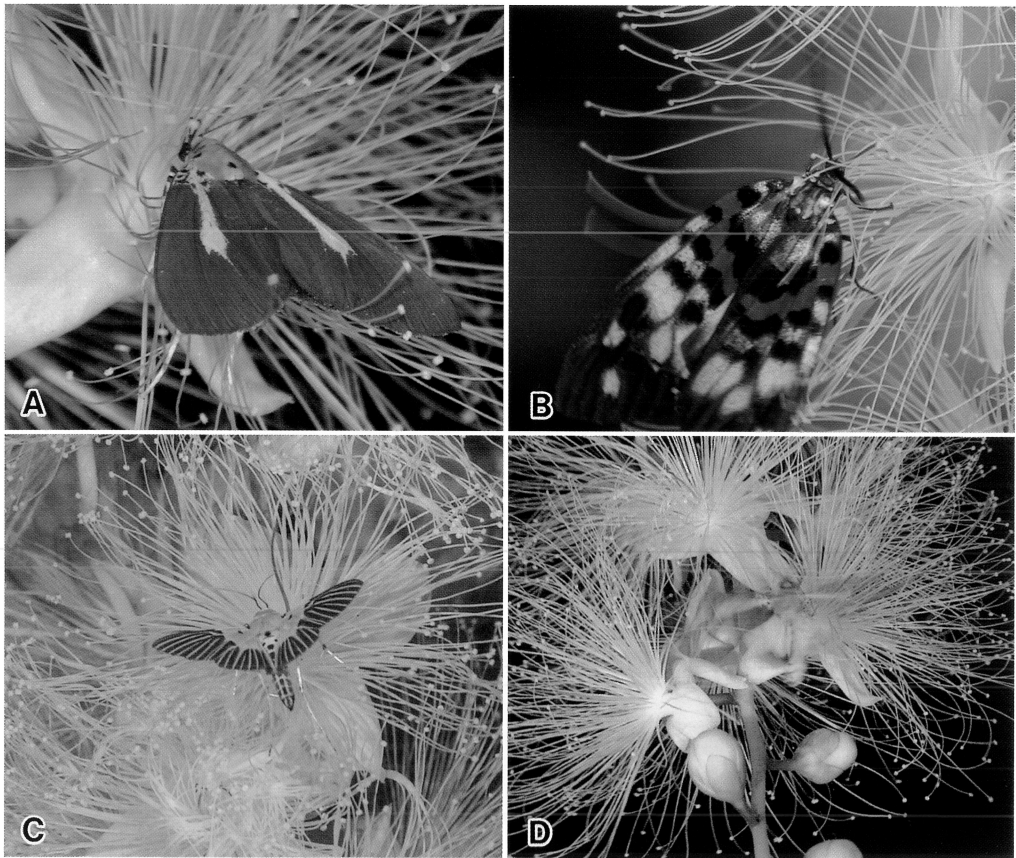


Fig. 1. Moths visiting *Barringtonia racemosa*. **A.** *Asota heliconia riukuana* sucking nectar from flowers. **B.** *Erasmia pulchella fritzei* sucking nectar from flowers. **C.** *Nevrina procopia* crawling on a flower. **D.** *A. heliconia riukuana* fluttering on a flower.

time was relatively limited in this study, *B. racemosa* is probably pollinated by these moths, because fruits grew out of several inflorescences, and flowers in which the stigma protrudes from an androecium are thought to prevent automatic self-pollination.

Barringtonia racemosa has generally been considered to be bat-pollinated. In this observation, however, no bats were observed visiting the flowers. Three species of bat (Chiroptera) are distributed across Iriomote Island (Environment Agency of Japan 2002): *Phinolophus pumilus* Andersen (Phinolophidae), *Hipposideros turpis* Bangs (Hipposideridae), and *Miniopterus fuscus* Bonhote (Vespertilionidae). *Pteropus mariannus* is the only recorded pollinator of *Barringtonia* (Start and Marshall 1976). Although three species of *Pteropus* have been recorded in Japan, none is found on Iriomote Island. In the Old World, flower-visiting bats are restricted to the Pteropidae (Kato 1999, Proctor *et al.* 1996). The only genus of Japanese Pteropidae is *Pteropus*. Therefore, bat pollination on Iriomote Island is very unlikely.

In Japan, the areas of distribution of *B. racemosa* and *Pteropus* species overlap only on Okinawa Island. However, *Pteropus loochoensis* Gray, an endemic species to the island, is thought to have become extinct (Environment Agency of Japan 2002). *B. racemosa* may have been pollinated by these bats when they were still distributed across Okinawa Island.

Table 1. The floral syndrome of moth-pollination and bat-pollination based on Proctor *et al.* (1996), Kato (1993) and Wyatt (1983)

floral character	moth	bat
flowering time	night	night
shape	narrow-deep	brush-like, bell-shaped or scuttle shaped
scent	strong or semi-strong	strong, often fruity, sour, musty
nectar	semi-large quantity of dilute nectar	large quantity of dilute nectar

The floral characteristics of bat-pollinated and moth-pollinated species are very similar (Proctor *et al.* 1996, Kato 1993, Wyatt 1983; Table 1). Iriomote Island lies at the northern end of the range of *B. racemosa*, out of the distribution of the Pteropidae, the flower-visiting bat family of the Old World. It is probable that *B. racemosa* was able to become established on Iriomote Island by being pollinated by moths instead of bats.

Acknowledgements

I would like to thank Tokushiro Takaso for providing study site, Yohei Suzuki for helping field observation, Keiko Yasuda and Fumio Sakuma for identification of moths.

Summary

I observed pollinators of *Barringtonia racemosa* on Iriomote Island, Japan. Four species representing four families of moths were recorded visiting and sucking nectar from flowers: *Asota heliconia riukiwana*, *Erasmia pulchella fritzei*, *Milionia basalis pyreri*, and *Nevrina procopia*. Although *B. racemosa* is generally considered to be bat-pollinated, no bats were observed visiting the flowers. *B. racemosa* was probably able to become established on Iriomote Island, which lies at the northern end of its distribution and out of the range of the flower-visiting bat family Pteropidae, by being pollinated by moths instead of bats.

摘 要

西表島におけるサガリバナ（サガリバナ科）の送粉者を観察した。シロスジヒトリモドキ、シロシタサツマニシキ、キオビエダシャク、ハグルマノメイガの4種のガが訪花し、吸蜜するのが確認された。サガリバナはコウモリ媒と考えられているが訪花するコウモリ類は見られなかった。西表島はサガリバナの分布の北端域に位置し、訪花行動をするコウモリのグループであるオオコウモリ科の分布域から外れていることから、コウモリの代わりにガに送粉されることによって、西表島のサガリバナは定着を可能にしていると考えられた。

References

- Armstrong, J.A., 1979. Biotic pollination on mechanisms in the Australian flora - a review. *N.Z. J. Bot.* **17**: 467-508.
 Baker, H.G. and B.J. Harris., 1957. The pollination of *Parkia* by bats and its attendant evolutionary problems. *Evolution* **11**: 449-460.
 ———, 1961. The adaptation of flowering plants to nocturnal and crepuscular pollinators. *Quarterly Rev. Biol.* **36**: 64-73.
 ———, 1969. Two cases of bat pollination in Central America. *Revista de Biological Tropical* **17**: 187-197.

- Chantaranothai, P., 1995. *Barringtonia* (Lecythidaceae) in Thailand. *Kew Bull.* **50**: 677-694.
- Environment Agency of Japan, 2002. Threatened Wildlife of Japan - Red Data Book 2nd ed.- volume 1. Mammals.
- Faegri, K. and van der Pijl, 1966. *The Principles of Pollination Ecology*. Pergamon Press, London. pp. 248.
- Hatsushima, S. and K. Nakajima, 1979. *Flowers of the Ryukyu Islands*. Kodansha Ltd., Tokyo.
- Kato, M., 1993. Emergence of pollinators and evolution of bees. *In*: Inoue, T. and M. Kato (eds.), *Animals Attracted by Flowers*, Heibonsha Ltd., Tokyo. pp. 33-78 (in Japanese).
- , 1999. Symbiosis of Plants and Animals at Night. *In*: Ohara, M. (ed.), *Natural History of Flowers*, Hokkaido Univ. Press, Sapporo. pp. 74-88 (in Japanese).
- Marshall, A.G., 1983. Bats, flowers and fruit: evolutionary relationships in the Old World. *Biol. J. Linn. Soc.* **20**: 115-135.
- Proctor, M., P. Yeo and A. Lack., 1996. *The Natural History of Pollination*, Harper Collins Pub., London. pp. 479.
- Setoguchi, H., 1999. Lecythidaceae. *In*: Iwatsuki, K., D.E. Boufford and H. Ohba (eds.), *Flora of Japan*. Vol. IIc. Kodansha Ltd., Tokyo. p. 216.
- Start, A.N. and A.G. Marshall, 1976. Nectarivorous bats as pollinators of trees in West Malaysia. *In*: Burley, J. and B.T. Styles (eds.), *Variation, Breeding and Conservation of Tropical Forest Trees*, Academic Press, London. pp. 141-150.
- Wyatt, R., 1983. Pollinator plant interactions and the evolution of breeding systems. *In*: Real, L. (ed.), *Pollination Biology*, Academic Press, New York. pp. 51-96.