Biological Forum – An International Journal **15(8): 263-266(2023)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Domestication, Proliferation and Hive Modelling of Feral Stingless Bee (*Tetragonula iridipennis* Smith) Colonies

B. Saai Vignesh[1*], B. Anujaa[2], K. Suresh[3], R. Elamparithi[4], S. Selvakumar[5] and R. Ramesh Kumar[6]

[1]Ph.D. Scholar, Department of Agricultural Entomology, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai (Tamil Nadu), India.

[2]Ph.D. Scholar, Department of Agricultural Entomology, Faculty of Agriculture, Annamalai University, Chidambaram (Tamil Nadu), India.

[3]Indian Council of Agricultural Research – Krishi Vigyan Kendra, Tamil Nadu Agricultural University, Madurai (Tamil Nadu), India.

[4]Ph.D. Scholar, Department of Seed Science and Technology, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai (Tamil Nadu), India.

[5]Ph.D. Scholar, Department of Agronomy, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai (Tamil Nadu), India.

[6]Ph.D. Scholar, Department of Plant Pathology, Agricultural College and Research Institute, Tamil Nadu Agricultural University, Madurai (Tamil Nadu), India.

(Corresponding author: B. Saai Vignesh)*

(Received: 04 June 2023; Revised: 24 June 2023; Accepted: 23 July 2023; Published: 15 August 2023)
(Published by Research Trend)

ABSTRACT: *Tetragonula iridipennis* Smith is the most abundant stingless bee in India. Tetragonula-keeping (Meliponiculture) for colony and honey makes it profitable because of weedy propagation in stingless bees. For the rearing of stingless bees, seven hive models (wooden box, rectangular wooden box, bamboo logs, PVC hive, mud pot, coconut shell) with different dimensions were chosen. Out of seven, the bamboo logs with a 30cm length and cavity diameter of 6.5 – 7.5 cm showed better brood development, less pest and diseases and also easy honey extraction. The standard brood transfer method of colony capturing is easy to follow in abandoned house walls, iron pipes, etc. Feral colonies present in the undisturbed habitat like living houses, wells, etc., are transferred by eduction method with substratum like plastic bottles, mud pots and coconut shells with plastic tubes as temporary hive setups. Furtherance of colony transfer happens in coconut shells with better colony development and speedy separation within two months interval. The count of stingless bee colonies is reducing due to lack of nesting habitat as the traditional human living habits (mud house, huts, etc.) are depleting. Its quite challenging to transfer the colony from feral nest to the domesticating hive. In this study, different hive models were used to transfer and domesticate the feral colonies with minimal duration which will help the beekeepers and researchers in domestication.

Keywords: *Tetragonula*, colony separation, eduction, hive models.

INTRODUCTION

Beekeeping with stingless bees is called Meliponiculture, which has been practiced for many centuries in various parts of Latin America, where these bees are considered as very valuable domestic species. Meliponiculture has been managed at varying levels by traditional societies throughout the equatorial range of stingless bees. Currently, it is most widely practiced in Neotropical realms, including Asia, with many species (Chuttong *et al*., 2016). Stingless bees easily adjust to beekeeping, that normally collect honey or pollinate crops (Kumar 2012; Vijayakumar *et al.,* 2013). They are generalists in their habits and their efficient pollination on the tropical flora is remarkable. Meliponiculture increased as products such as honey, bee pollen, and propolis have gained economic value (Fadhilah and Rizkika 2015).

One of the most primitive honeybees in India is Asiatic stingless bee *Trigona* (*Tetragonula)* iridipennis (Lindauer, 1956) and are highly eusocial and corbiculate, showing tropical and southern subtropical distribution with a distinguished character of reduction and weakness of wing venation and presence of the penicillum. Some species have clusters of as many as 80,000 individuals and others less than 100. Worker bees possess weak or vestigial stingers hence the term "stingless" is used to designate the species. Some species have defence mechanism as biting and spitting attack that causes irritation (Rahman *et al*., 2015). They differ from *Apis* species in biology and foraging behaviour. The process of feeding the larvae in stingless bees is very different from that of the *Apis*.

Stingless bees are small (few mm in length) and resident species which nest among old walls, dead trees, tree cavities, nests in the ground, crevices of culverts, among orchid roots, in empty tanks, boxes, etc. Nests are primarily found inside the forest cover (Brown and Albrecht 2001).

MATERIAL AND METHODS

Surveys were conducted in different districts of Tamil Nadu for capturing natural colonies (Table 1) in places like old mud or stone walls, mud brick walls, live or dead tree trunk, termitorium, bamboo logs, palm trees, electrical pipes and water pipes. Feral nests were identified by guard bees and based on the foraging activity (to and fro movement) of worker bees at the nest entrance.

The standard brood transfer method was followed here to capture the colony by breaking the nest substratum to transfer an equal quantity of brood and storage pots along with or without the queen bee into the hive and placed near the mother colony to settle down the bees in the hive. This was done in the late evening to prevent the loss of foragers and worker bees (Devanesan *et al*., 2009). Colonies in temples, homes and electric pipes could not be transferred without breaking the substratum. For this, Eduction method was followed by connecting one end of the plastic tube (flexible and transparent) in the natural colony and with the other end in the hive. Care was taken to have another entrance hole for bees foraging activity (Vijayakumar *et al*., 2013).

Table 1: Collection sites of feral *Tetragonula* colonies.

Sr. No.	Location	Collection site	Geographical position	No. of colonies domesticated
1.	Mettur (Salem)	Kunjandiyur	11°48′14″N 77° 51′28″E	5
2.	Pennagaram (Dharmapuri)	Anumandhapuram	12°19′04″N 78° 06′48″E	7
3.	Morappur (Dharmapuri)	Dhodamapatti	12°03′22″N 78° 29′56″E	13
4.	Vridhachalam (Cuddalore)	Aanandhakudi	11°27′44″N 79°19′57″E	15
5.	Vanoor (Pondicherry)	Aurobindo Ashram	12°00′42″N 79°44′30″E	2

Hiving of *T. iridipenis* in various hive models, as given below, was attempted to assess their suitability for easy rearing, conservation and domestication. Wooden box, Bamboo logs, Wood logs, Rectangular wooden box, PVC hive, Mud pot, Coconut shell. For colony division or splitting, bees were collected in plastic water bottle with cut end covered with muslin cloth for aeration, from the hive with more population (mother colony) and equal amount of early and later stage brood pots with storage pots were transferred to new hive to make daughter colony. Then bees were released from the bottle and equally distributed to both colonies (Klumpp, 2007; Palial *et al*., 2019).

RESULTS AND DISCUSSIONS

Different bee-hive models were evaluated for their easiness in handling, domestication and management of stingless bees. Hive models that were suitable for colony growth, less or free pest and disease and easy honey extraction were observed and listed in Table 2. Among the seven hives, wooden boxes (27 × 22 × 14cm) and rectangular boxes (30 × 15 × 15cm) showed better brood development, easy honey extraction using syringe, but fungal growth occurred during rainy days. Wooden logs and PVC hives showed poor brood development, more pest incidence especially by solitary bees and fungal growth and honey extraction was also tedious (Fig. 1). Out of seven hive models, the mud pot and coconut shell were suitable for easy domestication and even showed better colony growth, but honey extraction was tedious (Fig. 2). In the present study, the colony domestication in bamboo logs with 30cm length and cavity diameter of 6.5 – 7.5 cm showed better brood development, less pest and diseases and also easy honey extraction. Honey extraction done either by scooping with spoon or squeezing or using syringe, yielded pure honey without hive material contamination and no honey wastage during extraction in bamboo hive. These findings are in accordance with Raakheee and Devanesan (1999); Kumar *et al*. (2012) who reported that from the bamboo hives, tribes removed the honey storage pots and crushed in a white cloth, filtered and then bottled.

Eduction method. It took several months for separating the colony from its natural nest to the hive without damaging the substratum using the plastic tube. By using various length of plastic tubes and hives, the duration of colony separation varied. The process of colony transfer and development at monthly interval was observed and listed in Table 3.

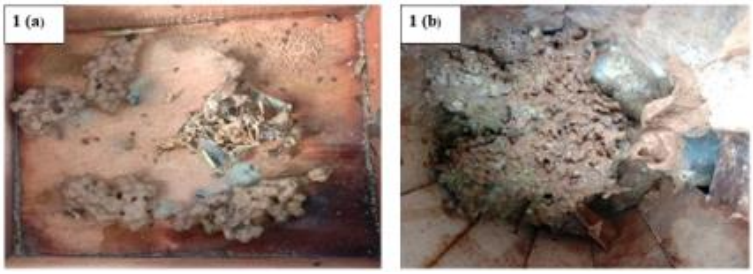

Fig. 1 (a) Wooden box, PVC hive, (b) Colony absconded due to fungal growth in hives.

Plastic bottles with 30cm tube length attached to colony in mud wall showed entrance tube formation at first month followed by cerumen pillar construction at second month and failure of colony splitting due to making new entrance on the substratum on third month. Plastic bottle with tube length of 60cm showed entrance tube formation at first month followed by failure of colony splitting due to heat intolerance was observed, some bees even died and remaining bees made a new entrance on substratum on second month. Pot with 30cm plastic tube attached to a nest present in pillar showed entrance tube formation, brood development and successful colony split with certain population at first, second and third month respectively. Pot with 60 cm tube length showed entrance tube formation, cerumen pillar construction and brood development at first, second and third month respectively.

Coconut shell hive with minimum cavity area was directly attached to the nest on mud wall resulted in better colony development and speedy separation within two months. (Fig. 3). These findings are contradictory to the findings of Vijayakumar *et al.* (2013) who reported that duration of colony splitting using wooden hive takes five months to one year depending on the floral rewards (Table 3). This contradiction might be due to the minimum cavity area of hive (coconut shell) and shortest tube (travel distance) length of 30 cm from nest entrance to hive and further the experiment was conducted during honey flow season.

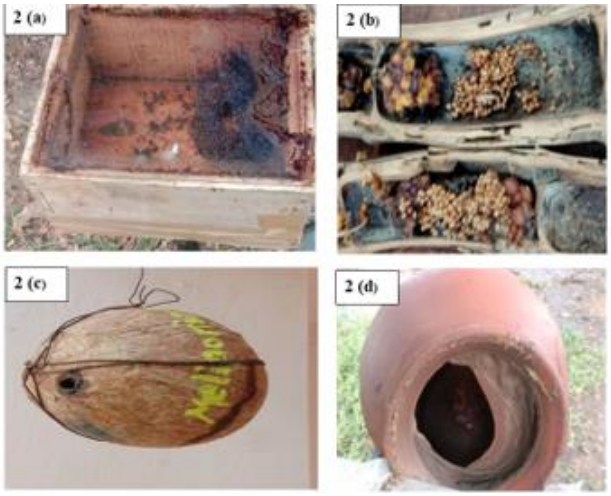

Fig. 2. Different hive models for stingless bee (a) Wooden box hive, (b) Bamboo hive, (c) Coconut shell hive, (d) Mud pot hive.

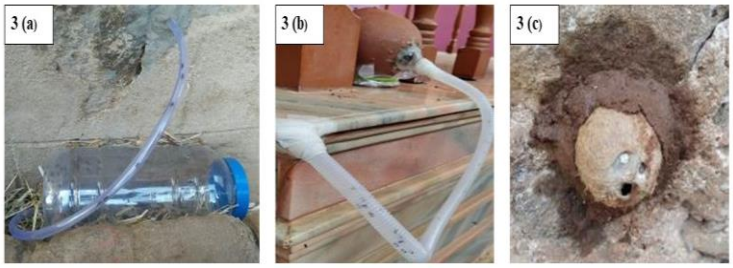

Fig. 3. Colony separation using eduction method (a) using plastic bottles with plastic tube, (b) mud pot with plastic tube and (c) coconut shell on substratum.

Table 2: Handling easiness of various Hive models of *Tetragonula.*

Sr. No.	Hive models	Measurements (cm)			Domestication and colony splitting		Management		
		(L)	(B)	(H)	Easy	Hard	Brood development	Pest and disease incidence	Honey extraction
1.	Wooden box	27	22	14	√	-	High	Fungal attack	Easy
2.	Rectangular wooden box	30	15	15	√	-	High	-	Easy
3.	Bamboo logs	60	6.5 – 7.5 (Dia)		√	-	High	-	Easy
4.	Wooden logs	140	3 – 4.5 (Dia)		-	√	Low	Solitary bees	Hard
5.	PVC Hive	-			√	√	Low	Solitary bees and fungal attack	Hard
6.	Mud pot	-			√	√	High	Paper wasp	Hard
7.	Coconut shell	-			√	-	High	-	Easy

Table 3: Efficacy of various temporary hives in colony separation using eduction method.

Sr. No.	Substratum of feral nest	Temporary hive	Tube length (from feral nest to hive) (cm)		Duration of colony separation and development			
					1st month	2nd month	3rd month	Success Rate
1.	Mud wall	Plastic bottles with plastic tube	L1	30	Entrance tube formation	Cerumen pillars constructed	Make new entrance on substratum	x
			L2	60	Entrance tube formation	Bees died due to heat and make new entrance on substratum	-	x
2.	Pillars	Pot with plastic tube	L1	30	Entrance tube formation	Brood development	Colony split with minimum bees	√
			L2	60	Entrance tube formation	Cerumen pillars constructed	Brood development	√
3.	Mud wall	Coconut shell	Directly attatched to nest		Guard bees at entrance and Cerumen pillars constructed	Brood development	Colony well developed	√

CONCLUSIONS

The aforementioned strategies were effective in the domestication of colonies, appropriate conservation, and ensuring the survival of *Tetragonula* colonies. Among the various techniques, wooden boxes performed well in terms of brood development, easy honey harvesting, and pest and disease resistance. The rate of domestication was good when colonies relocated from pillars to pots with plastic bottles, and it was even better when colonies were transferred from wall to coconut shell.

FUTURE SCOPE

Stingless bees serve as intermediaries for biocultural conservation and agroecological education, forming an intricate relationship between humans and also key pollinators. These strategies and structures can be utilized to conserve them from the depleting habitat and to improve pollination as well as to investigate them.

Author contribution: BSV performed the collection and domestication of feral colonies and observation on behavioural studies; drafting the manuscript. BA performed the manuscript drafting.RE, SSK and RRK helped in colony collection. Hence, the authors equally contributed towards the experiments. The authors read and approved the final manuscript.

Acknowledgement. Authors thank the localite's who helped for capturing the feral colonies from the districts which provides major support for this study.

Conflict of Interest. None.

REFERENCES

Brown, J. C., and Albrecht, C. (2001). The effect of tropical deforestation on stingless bees of the genus Melipona (Insecta: Hymenoptera: Apidae: Meliponini) in central Rondonia, Brazil. *Journal of Biogeography*, *28*(5), 623-634.

Chuttong, B., Chanbang, Y., Sringarm, K., and Burgett, M. (2016). Physicochemical profiles of stingless bee (Apidae: Meliponini) honey from South east Asia (Thailand). *Food Chemistry*, *192*, 149-155.

Devanesan, S., Shailaja, K. K., and Premila, K. S. (2009). Status paper on stingless bees. *All India co-ordinated research project on honey bees and pollinators. ICAR, New Delhi*, *80*.

Fadhilah, R. and Rizkika, K. (2015). Profit of stingless bee. PT.Trubus Swadaya, Jakarta. www.trubus-online.co.id. [Indonesian]

Klumpp, J. D. (2007). *Australian stingless bees: a guide to sugarbag beekeeping*. Earthling Enterprises.

Kumar, M. S., Singh, A. J. A., and Alagumuthu, G. (2012). Traditional beekeeping of stingless bee (*Trigona* sp) by Kani tribes of Western Ghats, Tamil Nadu, India. Indian *Journal of Traditional Knowledge*, *11* (2), 342-345.

Lindauer, M. (1956). Über die Verständigung bei indischen Bienen. *Zeitschrift für vergleichende Physiologie*, *38*, 521-557.

Palial, S., Manohar. M.R. and Dhole, R. (2019). Recent Developments in the Domiciliatin of stingless bees. *Popular Kheti*, *7*(3).

Raakheee, M. and Devanesan, S. (1999). Dammer bee, Trigona iridipennis Samith (Apidae: Melipomninas) in Kerala. *Insect Environ*ment, *5*(2), 79.

Rahman, A., Das, P.K., Rajkumari, P., Saikia, J. and Sharmah, D. (2015). Stingless bees (Hymenoptera: Apidae: Meloponini): Diverstiy and Distribution in India. *International Journal of Science and Research*, *4*(1), 77-81.

Vijayakumar, K., Muthuraman, M., and Jayaraj, R. (2013). Propagating Trigona iridipennis colonies (Apidae: Meliponini) by eduction method. *Scholars Academic Journal of Biosciences*, *1*(1), 1-3.

How to cite this article: B. Saai Vignesh, B. Anujaa, K. Suresh, R. Elamparithi, S. Selvakumar and R. Ramesh Kumar (2023). Domestication, Proliferation and Hive Modelling of Feral Stingless Bee (*Tetragonula iridipennis* Smith) Colonies. *Biological Forum – An International Journal*, *15*(8): 263-266.