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The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(10): 2073-2077

www.thepharmajournal.com
Received: 02-08-2022
Accepted: 06-09-2022

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Feasibility of different traps for trapping of stingless bee colony from its natural habitat

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Abstract
The present investigation was conducted with five treatments and four replications in randomized block design. The different treatments viz., T1-Wooden square trap @ 20x20x15 cm^3, T2-PVC pipe trap @ Two chamber 20x18x12 cm^3, T3-Wooden rectangular trap @ 34x11x11 cm^3, T4-Earthen pot @ ½ litre capacity and T5-Bamboo trap @ 35x7.5 cm^2 were designed. Surveyed the stingless bee colonies in electric pipe, plumbing pipe, live and dead tree trunk, crevices in window, door, wall etc and installed the treatments traps in natural habitat of bee colonies by coupling of PVC pipe @ 5 inch long with 25mm diameter. The generated data indicated that the treatments T2-PVC pipe trap @ Two chamber 20x18x12 cm^3 and T5-Bamboo trap @ 35x7.5 cm^2 were found equally effective recorded 100 per cent trapping of stingless bee colony and queen (0.87 nos./trap) from its natural habitat, and was significantly superior over rest of the treatments. The maximum honey cells (15.1 nos.), pollen cells (21.6 nos.) and brood cells (398.5 nos.) were recorded in T2-PVC pipe trap @ Two chamber 20x18x12 cm^3 and it was followed by T5-Bamboo trap @ 35x7.5 cm^2 which 11.6, 18.7 and 347 nos., respectively which found significantly superior over T4-Earthen pot @ ½ litre capacity, T1-Wooden square trap @ 20x20x15 cm^3 and T3-Wooden rectangular trap @ 34x11x11 cm^3.

Keywords: Capturing, colony, hive, honey bees, natural habitat, stingless bees, trapping

Introduction
Bees are truly a diverse group of insects placed under order hymenoptera, including 20,092 valid species organised under 7 families (Michener, 2007) [10]. Out of which, stingless bees are known to be the smallest honey producing bees. Stingless bees are eusocial insects like *Apis* honey bees and have an organized system of caste division (Roopa *et al*., 2015) [13]. Stingless bees are small in size and can be distinguished from other corbiculate Apinae, not only because of the absence of sting but also attributed by reduced forewing venation and the presence of the jugal lobe in hindwing (Michener, 2013) [11]. Stingless bees are also known as 'dammer/dammar bees' as they collect 'dammer', which is a resin from dipterocarp trees. The most important activity of stingless bees in terms of benefits to human and nature is the pollination that they outperform in natural vegetation as well as crops especially from compositae, cruciferae and leguminosae family, Beekeeping of stingless bees is less popular or concentrated in certain region as they produce only about 200 to 500 gm honey per season according to their colony strength (Rahman *et al*., 2015) [12].
Apiculture is a sector with great scope of earning returns but it had been remained in dark. Though, the honey bees yield a delicious honey, there is always a fear to untrained person of honey bee attack while rearing them. But fortunately, there are some honey bees which do not bite and they are known as 'Stingless bees'. They are playing roll in pollinating crops like mango, cashew, coconut, vegetables etc in Konkan region, living in permanent colonies by nesting in old walls, logs, crevices and such other concealed places. It is very difficult to capture colony from its natural habitat. Hence, present investigation was carried out for trapping of stingless bee from its natural habitat.

Materials and Methods
The present investigation entitled, "Feasibility of different traps for trapping of stingless bee colony from its natural habitat" was conducted at Regional Coconut Research Station, Bhatye during *Rabi* and *Summer*, 2021-2022 with five treatments and four replications in randomized block design. Treatments wise different sized hives/traps viz., T1-Wooden square trap @ 20x20x15 cm^3, T2-PVC pipe trap @ Two chamber 20x18x12 cm^3, T3-Wooden rectangular trap @ 34x11x11 cm^3, T4-Earthen pot @ ½ litre capacity and T5-Bamboo hive/trap @ 35x7.5

cm^2 were designed. Surveyed the stingless bee colonies in the jurisdiction of Dr. BSKKV, Dapoli and installed the different treatments wise traps in natural habitat of bee colonies by taking PVC pipe @ 5 inch long with 25mm diameter. One end of pipe was fixed at upper on back side of hive/trap and other end was inserted in natural habitat of bee colony. Small 5 mm hole was made at lower on front side of hive/trap. All the crakes and crevices on natural habitat of bees were plugged with Plaster of Paris and M-Seal material. Experimental observations on bee colony present/absent, nos. of brood cells, honey pots, pollen pots and queen present/absent were recorded at four months after imposition of treatments. The generated data were subjected for statistical analysis.

Results and Discussion

Surveyed the stingless bee colonies in the jurisdiction of Dr. DRBSKKV, Dapoli and observed its natural habitat (Table 1) in under electric, plumbing, electric meter board, live and dead tree trunk, crevices in window, wall, doors at different locations. The present investigations are somewhat similar with the findings of Danaraddi *et al.*, (2009) [9]. Suriawanto *et al.* (2017) [14] found the nesting sites of stingless bees in stone, bricks wall, wooden wall, bamboo and iron cavities.

The data presented in Table 2 revealed that the treatments T2-PVC pipe trap @ Two chamber 20x18x12 cm^3 and T5-Bamboo trap @ 35x7.5 cm^2 were found equally effective for trapping of maximum queen (0.75 nos.) was significantly superior over T1-Wooden square trap @ 20x20x15 cm^3 and T3-Wooden rectangular trap @ 34x11x11 cm^3. It was found on par with T4-Earthen pot @ ½ litre capacity (0.25 nos.). Heard (1988) [2] constructed stingless bee rearing boxes measured 28×21 cm and its height were 21 cm and concluded that it is important to manufacture a durable box because colony cannot be easily relocate to another box if the old one deteriotes. The maximum honey cells (0.75 nos.) were equally recorded in T2-PVC pipe trap @ Two chamber 20x18x12 cm^3 and T5-Bamboo trap @ 35x7.5 cm^2 It was followed by T4-Earthen pot @ ½ litre capacity (0.25 nos.) of honey cells. The treatment T2-PVC pipe trap @ Two chamber 20x18x12 cm^3 was recorded maximum pollen cells (22 nos.) was at par with T5-Bamboo trap @ 35x7.5 cm^2 (19.7 nos.) and found significantly superior over T4-Earthen pot @ ½ litre capacity (6 nos.), T1-Wooden square trap @ 20x20x15 cm^3 (4.50 nos.) and T3-Wooden rectangular trap @ 34x11x11 cm^3 (4 nos.). The maximum brood cells was observed in T2-PVC pipe trap @ Two chamber 20x18x12 cm^3 (412 nos.). It was significantly superior over T4-Earthen pot @ ½ litre capacity (2.38 nos.), T1-Wooden square trap @ 20x20x15 cm^3 and T3-Wooden rectangular trap @ 34x11x11 cm^3 and was at par with T5-Bamboo trap @ 35x7.5 cm^2 (327 nos.).

The data presented in Table 3 revealed that the treatments T2-PVC pipe trap @ Two chamber 20x18x12 cm^3 and T5-Bamboo trap @ 35x7.5 cm^2 were found equally effective for trapping of maximum queen (1.0 nos.) were significantly superior over T3-Wooden rectangular trap @ 34x11x11 cm^3 and T4-Earthen pot @ ½ litre capacity which recorded (0.25 nos.) was at par with T1-Wooden square trap @ 20x20x15 cm^3 (0.50 nos.). Sommeijer (1999) [3]. developed UTOB hive assembled with two compartments (brood chamber and honey chamber) resting on a wooden bottom tray that is surrounded by a rim (2 cm high). The maximum honey cells (29.5 nos.) were recorded in T2-PVC pipe trap @ Two chamber 20x18x12 cm^3 was followed by T5-Bamboo trap @ 35x7.5 cm^2 (22.5 nos.). The others treatments also recorded honey cells in descending orders viz., T3-Wooden rectangular trap @ 34x11x11 cm^3 (11.7 nos.), T4-Earthen pot @ ½ litre capacity was recorded (8.25 nos.) and T1-Wooden square trap @ 20x20x15 cm^3 (4.25 nos.) of honey cells. The treatment T2-PVC pipe trap @ Two chamber 20x18x12 cm^3 was recorded maximum pollen cells (21.2 nos.), T5-Bamboo trap @ 35x7.5 cm^2 (17.7 nos.), T1-Wooden square trap @ 20x20x15 cm^3 (8.75 nos.), T4-Earthen pot @ ½ litre capacity (8.25 nos.) and T3-Wooden rectangular trap @ 34x11x11 cm^3 (7.75 nos.). The maximum brood cells was observed in T2-PVC pipe trap @ Two chamber 20x18x12 cm^3 (385 nos.) which found significantly superior over T1-Wooden square trap @ 20x20x15 cm^3 (117.5 nos.), T4-Earthen pot @ ½ litre capacity (77.5 nos.) and T3-Wooden rectangular trap @ 34x11x11 cm^3 (60 nos.) was at par with T5-Bamboo trap @ 35x7.5 cm^2 (366.2 nos.). Colony establishment after the gyne emergence and egg laying of new queen takes 40, 107, 20, 54 and 43 days for their establishment from the date of division by Mounika *et al*. (2019) [4].

The pooled data of both *Rabi* and *Summer* season depicted in Table 4 revealed that the treatments T2-PVC pipe trap @ Two chamber 20x18x12 cm^3 and T5-Bamboo trap @ 35x7.5 cm^2 were found equally effective for trapping of maximum queen (0.87 nos.) which were significantly superior over T1-Wooden square trap @ 20x20x15 cm^3 (0.25 nos.), T4-Earthen pot @ ½ litre capacity (0.25 nos.) and T3-Wooden rectangular trap @ 34x11x11 cm^3 (0.12 nos.). Oliveria *et al.* (2012) [6]. used two different types of trap-nests (plastic and cardboard) of four different sizes (0.5, 1.0, 2.0, and 3.0 L) and found most swarms chose the largest container (3 L) in springtime (October–December). The maximum honey cells (15.1 nos.) were recorded in T2-PVC pipe trap @ Two chamber 20x18x12 cm^3 and it was followed by T5-Bamboo trap @ 35x7.5 cm^2 (11.6 nos.). The others treatments also recorded honey cells in descending order viz., T3-Wooden rectangular trap @ 34x11x11 cm^3 (5.85 nos.), T4-Earthen pot @ ½ litre capacity (4.25 nos.) and T1-Wooden square trap @ 20x20x15 cm^3 (2.12 nos.). The treatment T2-PVC pipe trap @ Two chamber 20x18x12 cm^3 was recorded maximum pollen cells (21.6 nos.) and found at par with T5-Bamboo trap @ 35x7.5 cm^2 (18.7 nos.) which was significantly superior over T4-Earthen pot @ ½ litre capacity (7.12 nos.), T1-Wooden square trap @ 20x20x15 cm^3 (6.62 nos.) and T3-Wooden rectangular trap @ 34x11x11 cm^3 (5.87 nos.). The maximum brood cells was observed in T2-PVC pipe trap @ Two chamber 20x18x12 cm^3 (398.5 nos.). It was on par with T5-Bamboo trap @ 35x7.5 cm^2 (346.6 nos.) which found significantly superior over T4-Earthen pot @ ½ litre capacity (39.9 nos.), T1-Wooden square trap @ 20x20x15 cm^3 (58.7 nos.) and T3-Wooden rectangular trap @ 34x11x11 cm^3 (30 nos.). Palial *et al.* (2019) [7]. studied modern hives for domestication of stingless bee having length of the box varied from 25 to 32 cm, width from 18 to 26 cm and height from 20 -64 cm.

The T2-PVC pipe trap @ Two chamber 20x18x12 cm^3 and T5-Bamboo trap @ 35x7.5 cm^2 were found equally effective recorded 100 per cent trapping of stingless bee colony from its natural habitat during *Rabi* and *Summer* season in Konkan region. Suitable hive with two chamber diameter 13x13x13 cm^3 for brood chamber and 40x13x7 cm^3 for honey chamber with wide space of 2.5 cm was given to connect each other by Ali (2016) [1]. However, others treatments viz., T1-Wooden square trap @ 20x20x15 cm^3, T3-Wooden rectangular trap @ 34x11x11 cm^3 and T4-Earthen pot @ ½ litre capacity were

recorded only 50 per cent trapping of stingless bees colony (Fig. 1). Mythri *et al.* (2018) [5] an attempt was made to find out success rate of 86.66 per cent was found in case of parallel method with the presence of queen cells.

Table 1: Natural habitat /nests of stingless bees in Konkan region of Maharashtra

Sr. No.	Natural habitat/nest of stingless bees	Sr. No.	Natural habitat/nest of stingless bees
1	Electric pipe	7	Cracks of doors
2	Plumbing pipe	8	Dead tree trunk
3	Electric meter board	9	Bricks wall
4	Live tree trunk	10	Cracks of drainage wall
5	Crevices of window	11	Stone wall
6	Cracks of house wall	12	Cavities of iron pipe

Table 2: Trapping of stingless bee colony from its natural habitat in artificial trap during *Rabi*, 2021

Tr. No.	Treatments details	Queen	Honey cell	Pollen cell	Brood cell
T1	Wooden square trap @ 20x20x15 cm^3	0.0 (0.71)	0.0 (0.71)	4.50 (1.61)	0.0 (0.71)
T2	PVC pipe trap @ Two chamber 20x18x12 cm^3	0.75 (1.10)	0.75 (1.10)	22.0 (4.70)	412 (19.9)
T3	Wooden rectangular trap @ 34x11x11 cm^3	0.0 (0.71)	0.0 (0.71)	4.0 (1.55)	0.0 (0.71)
T4	Earthen pot @ ½litre capacity	0.25 (0.84)	0.25 (0.84)	6.0 (2.12)	2.38 (4.39)
T5	Bamboo hive/trap @ 35x7.5 cm^2	0.75 (1.10)	0.75 (1.10)	19.7 (4.44)	327 (15.8)
SE±		0.09	0.78	0.66	2.66
CD@5%		0.30	2.40	2.05	8.22

(Figures are parenthesis are square root ($\sqrt{x}$ +0.5) transformed values)

Table 3: Trapping of stingless bee colony from its natural habitat in artificial trap during *Summer*, 2022

Tr. No.	Treatments details	Queen	Honey cell	Pollen cell	Brood cell
T1	Wooden square trap @ 20x20x15 cm^3	0.50 (0.97)	4.25 (2.04)	8.75 (2.77)	117.5 (7.97)
T2	PVC pipe trap @ Two chamber 20x18x12 cm^3	1.00 (1.22)	29.5 (5.37)	21.2 (4.60)	385 (19.5)
T3	Wooden rectangular trap @ 34x11x11 cm^3	0.25 (0.84)	11.7 (2.80)	7.75 (2.33)	60.0 (4.41)
T4	Earthen pot @ ½litre capacity	0.25 (0.84)	8.25 (2.41)	8.25 (2.41)	77.5 (4.94)
T5	Bamboo hive/trap @ 35x7.5 cm^2	1.00 (1.22)	22.5 (4.75)	17.7 (4.22)	366.2 (19.0)
SE±		0.10	0.86	0.76	3.32
CD@5%		0.33	2.67	2.35	10.2

(Figures are parenthesis are square root ($\sqrt{x}$ +0.5) transformed values)

Table 4: Pooled mean of trapping of stingless bee colony from its natural habitat in artificial trap during 2021-22

Tr. No.	Treatments details	Queen	Honey cell	Pollen cell	Brood cell
T1	Wooden square trap @ 20x20x15 cm^3	0.25 (0.84)	2.12 (1.37)	6.62 (2.19)	58.7 (4.34)
T2	PVC pipe trap @ Two chamber 20x18x12 cm^3	0.87 (1.16)	15.1 (3.23)	21.6 (4.65)	398.5 (19.7)
T3	Wooden rectangular trap @ 34x11x11 cm^3	0.12 (0.77)	5.85 (1.75)	5.87 (1.94)	30.0 (2.56)
T4	Earthen pot @ ½litre capacity	0.25 (0.84)	4.25 (1.62)	7.12 (2.26)	39.9 (4.66)
T5	Bamboo hive/trap @ 35x7.5 cm^2	0.87 (1.16)	11.6 (2.92)	18.7 (4.33)	346.6 (17.4)
SE±		0.09	0.82	0.71	2.99
CD@5%		0.31	2.53	2.20	9.21

(Figures are parenthesis are square root ($\sqrt{x}$ +0.5) transformed values)

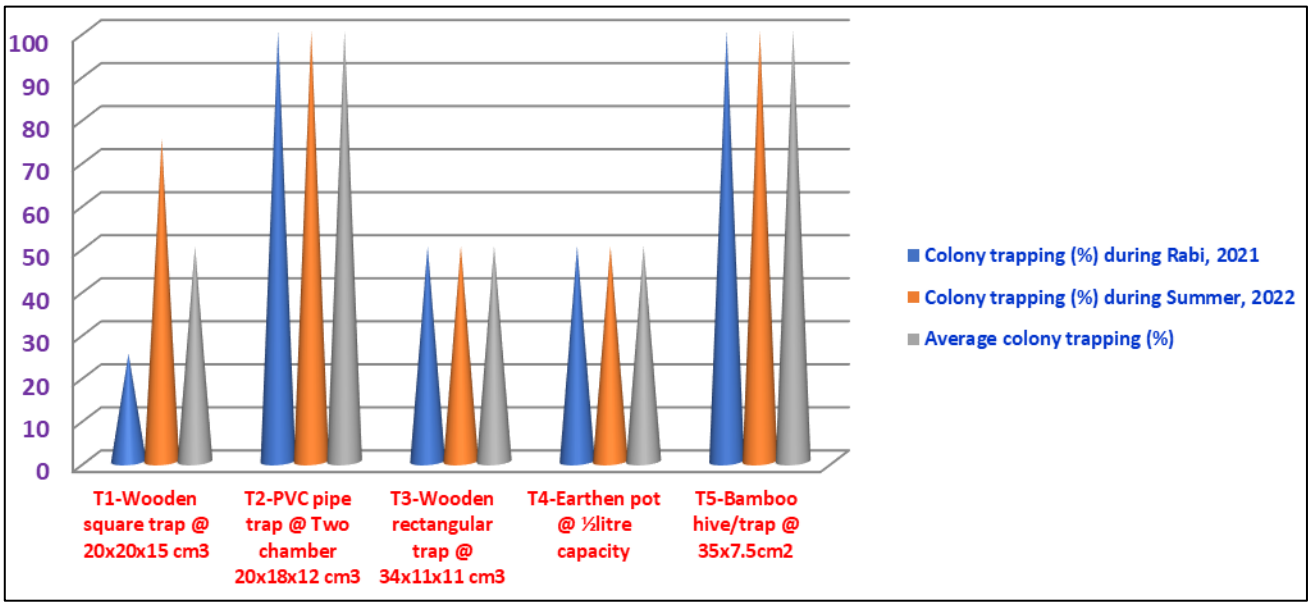

Fig 1: Per cent trapping of stingless bee colony from its natural habitat in artificial trap during 2021-22

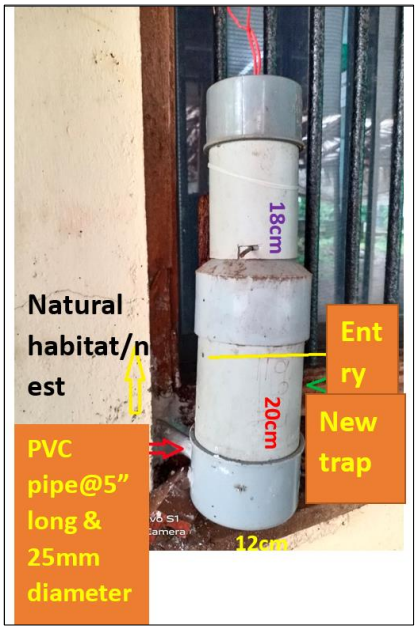

Plate 1: T2- PVC pipe trap @ Two chamber 20x18x12 cm3

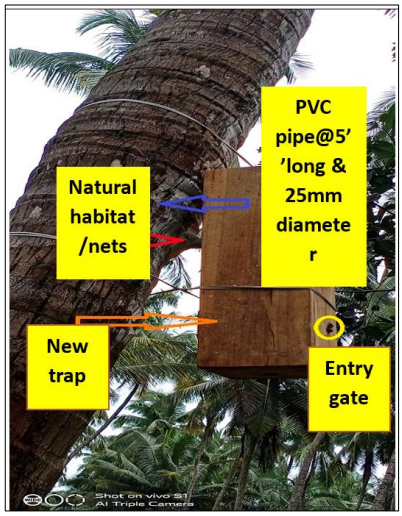

Plate 2: T3- Wooden rectangular trap @ 34x11x11 cm3

Plate 3: Stingless bee colony trapped in PVC pipe trap

Plate 4: Stingless bee colony trapped in Bamboo trap

Conclusion

The T2-PVC pipe trap @ Two chamber 20x18x12 and T5-Bamboo trap @ 35x7.5 cm^2 were found equally effective recorded 100 per cent trapping of stingless bee colony from its natural habitat with maximum queen trapping, honey,

pollen and brood cells development in *Rabi* and *Summer* season.

Acknowledgement
The authors are thankful to Dept. of Entomology, Dr. BSKKV, Dapoli (Palms) for providing funds, technical help and timely guidance for conduct of experiment.

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