

A New Model of Polystyrene Foam for Renesting Leafcutting Bees (*Megachile* spp.: *Megachilidae*, *Hymenoptera*)

S. M. Kamel, T. A. Abu Hashesh, M. A. Osman and M. A. Shebl

Dept. of Plant Protection, Faculty of Agriculture, Suez Canal University, 41522, Ismailia, Egypt

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Abstract: Leafcutting bees are considered as a main pollinator of alfalfa world wide. Preliminary observation revealed the importance of *Megachile* spp. in pollination of alfalfa at Ismailia. Many natural nests of *Megachile* spp. were found in mud walls in Tel el Kebir (30°33' 30"N, 31°56' 13"E) about 50 kilometers west of Ismailia on the delta of the Nile River in Egypt. The new foam model has a good advantage for conserving these bees. The model contain 50 foam pieces each piece 50 cm length, 12 cm width and 2 cm thickness. In each piece of foam were 26 holes, the hole was 10 cm depth and 6 mm diameter. However, most natural nests were under high risk because the concrete houses moved very fast to replace the mud houses in that area. The percentages of nesting were reaching with using the new model 32.04 % for new foam in 2005 and 48.3 % for new foam in 2006.

Keywords: Leafcutting bees, *Megachile uniformis*, *Megachile* spp., Artificial nests

INTRODUCTION

Leafcutting bees are gregarious species and readily nests in man-made paper, wooden or plastic tubes. Alfalfa seed yields increased, and from some fields more than 1000kg/ha of seeds was obtained as a result of leafcutting bees pollination (Hobbs, 1965). Some of the nesting materials were better suited for propagation of leaf cutter bees than other materials such as pine and fir plywood, and the polymers, Styrofoam and polystyrene, produced a greater percentage of cocoons than those in soda straws, k₂ particle board, aluminum or corrugated paper (Richard *et al* 1978). In France, they found that grooved boards of pine produced better than the two African woods, Entandrophragma and Terminalia (Richards 1978). Among all hole diameters (5, 6, 7, 8 mm), *Osmia lignaria* Propinqua females produced a very high ratio of male/female progeny (5.3 :1) suggesting that they were un mated (Tepedino and Torchio 1989). There are two distinct types of nesting material are in use today wood and polystyrene (also referred to as styrofoam or plastic). Each has advantages and disadvantages. In general, wood is expensive, heavy, and difficult to handle and assemble. It is also very durable, long lasting, attractive to bees and will usually produce mould free cells because of its ability to absorb and dissipate moisture from the leaf pieces-polystyrene is relatively inexpensive and easy to handle, but it is less attractive to bees, more conducive to the growth of mould, and is much more easily damaged by mice and cell removal (Petrowski 1991). Nesting material should be provided at a rate of about 1½ tunnels per female bee (Petrowski 1991). Several nest materials are available for use in the loose-cell system, including various polystyrene and paper nests. Filled polystyrene and rolled paper nests are better heat insulators than filled wooden nests. Paper nests probably show the highest temperatures because of the arrangement of the holes. Only a thin wall of paper separates each hole in a paper nest, resulting in densely packed larvae (Peterson *et al.*1994). Shelters built on trailers with wheels are popular because they can be moved to and from the field easily, and can also be

moved to other late-blooming fields as the season progresses. The opening to the bee shelters is oriented south to southeast to take advantage of early morning sun for rapid warming and to provide shade during the hot afternoon hours (Peterson *et al.* 1992). Nesting activities of *Megachile uniformis* (A.) first appeared just shortly after the emergence of females i.e. during mating period and continued to the end of the activity season. The emergency of bees was started on April 10 in the two season 2001-2003 (females activity was from April 10 to June 6) The female usually hovers around the nests to select suitable nesting site for herself. After selecting the nest, she started cleaning it before inhabiting it (Shoukry *et al.* 2004). The aim of this work is to evaluate a new model of polystyrene foam for renesting leafcutting bees, *Megachile* spp.

MATERIAL AND METHODS

Artificial nesting of *Megachile* spp.

The artificial foam nests were distributed in the natural nest of leafcutting bees. The bees are easily managed and renesting in straws, wooden boards and styrofoam nesting blocks. The foam nest were put front of the natural nest two weeks after emerging the females. The natural nests were scattered in different villages around El Tel Elkebbber. These villages were Tel Elkebbber, El Kssasin and El Balwa (30 to 40 km far from Ismailia).

Two models of foam were used for the artificial nest, so the first one was 50 cm length, 12 cm width and 2 cm thickness. In each piece of foam were 26 holes, the hole was 10 cm depth, and 6 mm diameter. After sticking the foam pieces above each other, holes were creating in this block and the shelter was performed. Straws of paper tubes 10 cm in length and 5.2 mm internal diameter, one tube was putted in every hole Fig.1, Fig. 2 Fig. 3, and Fig. 4. The second model was 50 cm length, 10 cm width and 2 cm thickness. In each piece of foam were 34 holes, the hole was 10 cm depth, and 7 mm diameter. The advantage of the second model, that the second model has more holes in the same area of foam. All foam nests were painted by

black color for imitation of the natural nests. By the second week of June every year artificial foam nests were collected from the field and transferred to the

experimental farm to be ready for the bee emerging in the next year. Each foam nests, the completed nest tubes were counted in the season 2005 and 2006.

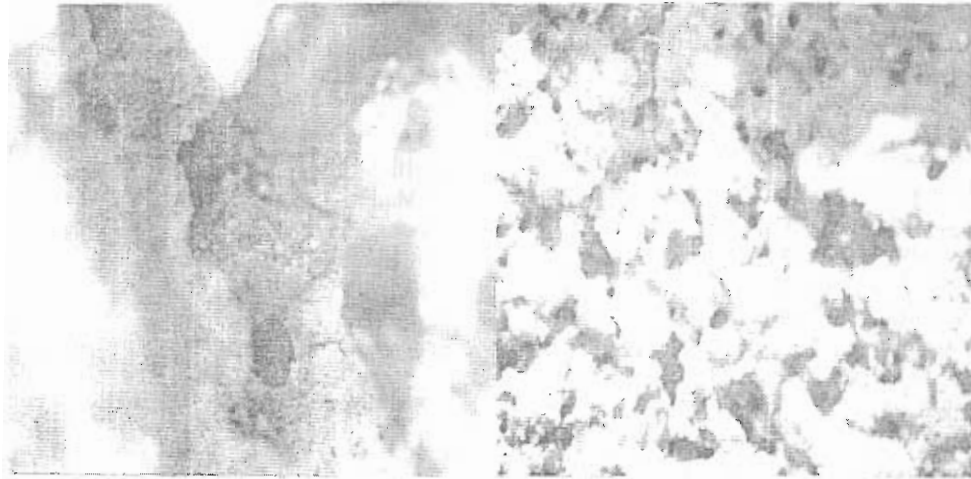


Fig. (1): Show the natural nests of leafcutting bees *Megachile* spp

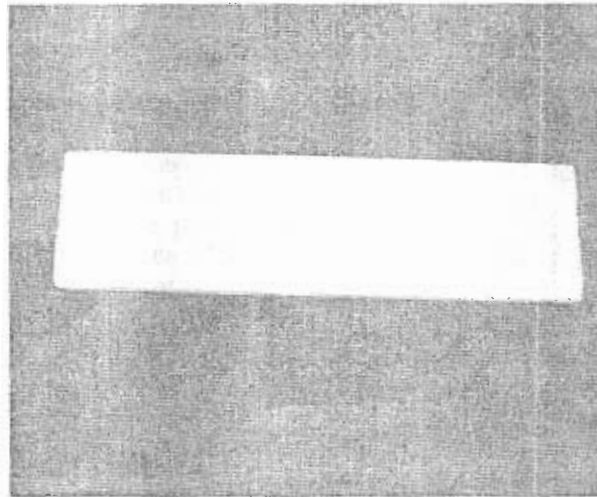


Fig. (2): Show the foam piece

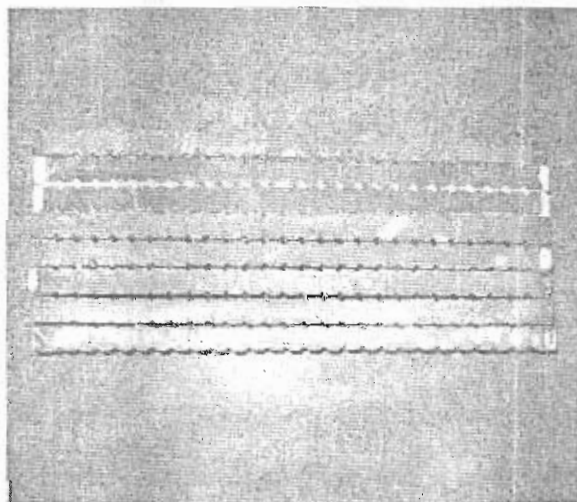


Fig. (3): Show the new model of foam used for nesting leafcutting bees

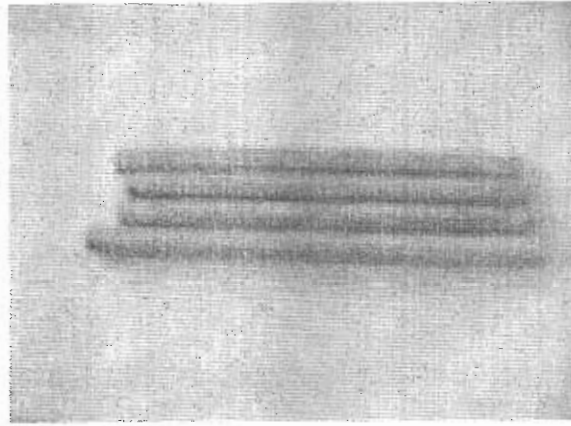


Fig. (4): Show the paper tubes used for nesting leafcutting bees

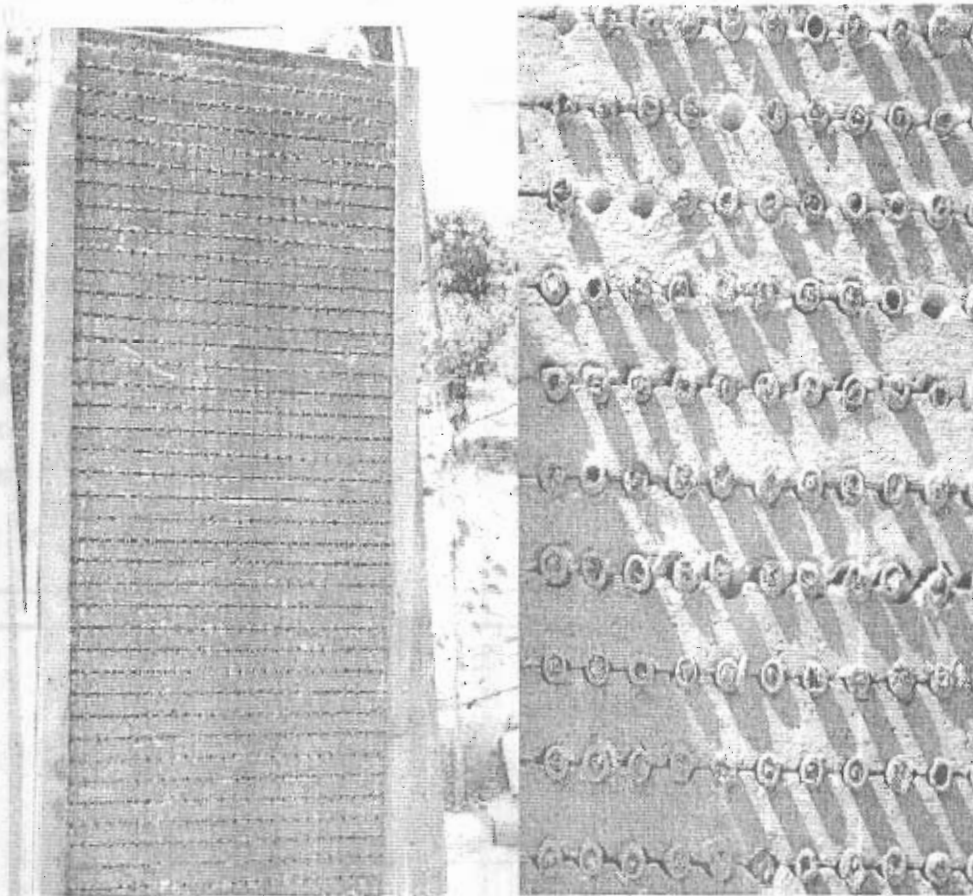


Fig. (5): Show the artificial nests with leafcutting bees (*Megachile* spp.)

RESULTS AND DISCUSSION

Results in table (1) showed that when using the new foam nests, the minimum number of empty tubes were 2880 tubes which contain 396 nesting tubes but the maximum total number of tubes were 3233 empty tubes which contain 1660 nesting tubes in 2005. The minimum number of empty tubes were 2400 tubes which contain 372 nesting tubes (shelters number 10, 12 and 15) but the maximum number of tubes were 6300 empty tubes (shelter number 6) which contain 6084 nesting tubes in 2006.

In 2005, 9 shelters had been used, the number of nesting tubes were (438, 396, 1660, 680, 1391, 1285, 1175, 1165 and 420) (Fig. No.6). The average nesting percentage was 32.04 %. The result shows that the new model is better than the old polystyrene nests.

In 2006, 15 shelters had been used, the number of nesting tubes were (1481, 1584, 2301, 1062, 1464, 6084, 1287, 391, 804, 1331, 2859, 372, 1200, 3460, and 1326) (Fig. No.7). The average nesting percentage was 48.3 %.

From the previous data it was clear that the percentage of nesting were rising every year , 20.67 %

old foam 2005, 32.04 % new foam 2005 and 48.3 % new foam 2006. The increasing of the number may be due to new model of polystyrene foam which has been used with advantage for attracting the bees to reneat. These results are in agreement with those; (Richards

1978), (Tepedino and Torchio 1989), (Peterson *et al.*, 1994), and (Shoukry *et al.*, 2004), they mentioned that polystyrene and rolled paper nests were the best materials for leafcutting bees artificial nesting.

Table (1): Numbers of the total empty new and completed nest tubes of *Megachile* spp. at the end of season 2005 and 2006

Number of Shelters	2005		2006	
	Total empty used tubes	Total Completed used tubes	Total empty used tubes	Total Completed used tubes
1	3060	438	4200	1481
2	3233	396	4200	1584
3	2880	1660	4500	2301
4	3102	680	4200	1062
5	2880	1391	4500	1464
6	2880	1285	6300	6084
7	3000	1175	3600	1287
8	2940	1165	3600	391
9	2880	420	2700	804
10	-	-	2400	1331
11	-	-	3600	2859
12	-	-	3400	372
13	-	-	3600	1200
14	-	-	3600	3460
15	-	-	2400	1326
Maximum	3233	1660	6300	6084
Minimum	2880	396	2400	372
Mean	2983	956	3720	1800
Average nesting percentage	$956/2983 = 32.04\%$		$1800/3720 = 48.3\%$	

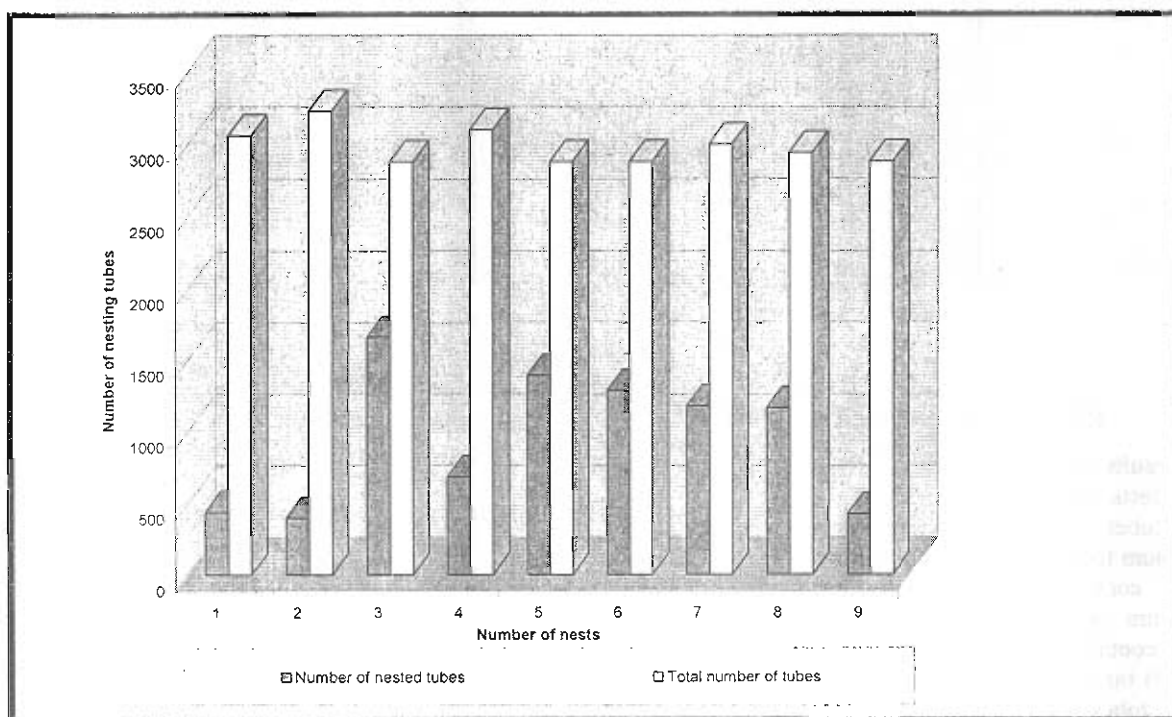


Fig.(6): The number of all nest tubes of *Megachile* in the new model in 2005.

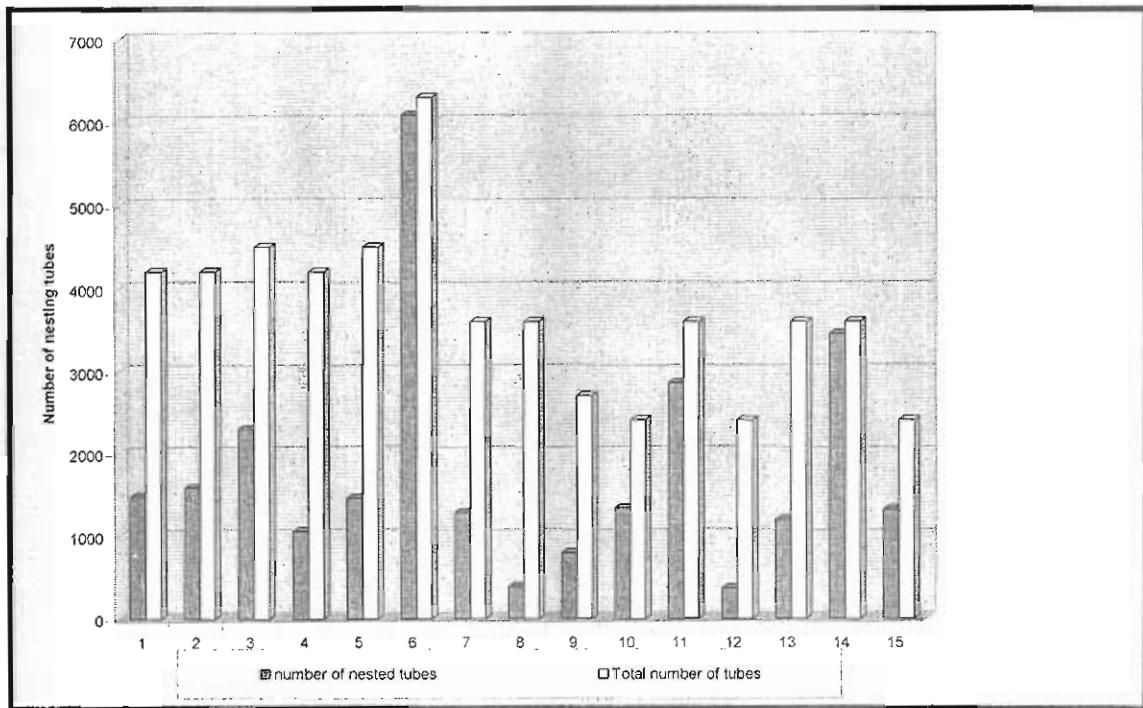


Fig. (7): The number of all nest tubes of *Megachile* in the new model in 2006.

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نموذج جديد من الفوم البولي ستيرين لإعادة تعشيش النحل القاطع للأوراق (*Megachile* spp.: *Megachilidae*, *Hymenoptera*)

سليمان كامل - طلعت ابو حشيش - محمد عبد النعيم - محمد شبل
قسم وقاية النبات- كلية الزراعة- جامعة قناة السويس- ٤١٥٢٢- الإسماعيلية- مصر

يعتبر النحل القاطع للأوراق من الملقحات الرئيسية للبرسيم الحجازي في العالم. الملاحظات السابقة دلت على أهمية نحل الميكاكيل في تلقيح البرسيم الحجازي في محافظة الإسماعيلية. تم اكتشاف العديد من الأعشاش الطبيعية لنحل الميكاكيل في الحواظ الطينية بمدينة التل الكبير علي بعد ٥٠ كيلو متر من محافظة الإسماعيلية. تواجه الأعشاش الطبيعية خطراً كبيراً حيث يتم هدمها واستبدالها ببيوت جديدة من الاسمنت، النموذج الجديد من الأعشاش الصناعية له العيد من المزايا، يتكون من عدة قطع من الفوم كل قطعة بطول ٥٠ سم، عرض ١٢ سم، سمك ٢ سم تحتوي على عدد ثقب من ٢٦ الي ٣٤ ثقب، يتم لصق القطع مع بعضها البعض ثم طلائها باللون الأسود حيث تنقل كمصائد تجذب النحل القاطع للأوراق خلال موسم النشاط الطبيعي للحشرة في الفترة من ابريل و مايو حيث بعد ذلك تنقل للحقل التجريبي في يونيو حيث تخرج الحشرات في العام التالي. هذا وقد بلغت نسبة التعشيش عند استخدام الفوم الجديد الي ٣٢,٠٤ % في الموسم ٢٠٠٥ وزادت الي ٤٨,٣ % في الموسم ٢٠٠٦.