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# Evaluation of sticky traps to manage eucalyptus gall wasp, *Leptocybe invasa* Fisher & La Salle (*Hymenoptera: Eulophidae*)

N. KAVITHA KUMARI, A. S. VASTRAD, K. BASAVANA GOUD, SHASHIDHAR VIRAKTAMATH AND P. U. KRISHNARAJ

Department of Agricultural Entomology
University of Agricultural Sciences, Dharwad 580 005, India
Email : vastrad_v@yahoo.com

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**Abstract:** The recent outbreak of the invasive gall wasp, *Leptocybe invasa* Fisher & La Salle has threatened the productivity of the existing eucalyptus plantations and has become a constraint in the expansion of the plantations throughout India. In the present study among the different coloured sticky traps evaluated, yellow trap was most effective in trapping the pest (146.83/trap) followed by green (67.33), white (66.33), blue (49.08) and red (48.92) which were on par with each other. The results indicated that yellow sticky traps can be used both for monitoring the pest in general and mass trapping it in nursery and under protected cultivation. Among the three sticky materials used with or without eucalyptus oil, insect gum with and without oil trapped 192.00 and 169.25 wasps respectively followed by petroleum jelly with oil (122.25/trap). Automobile grease (with or without eucalyptus oil) trapped the lowest number of wasps (54.25 to 56.25/trap). Among the different shapes evaluated, flat trap with glue on both sides (176.53/trap) was significantly superior to all other traps evaluated followed by sphere trap (92.27/trap), flat trap glued only on one side (75.07/trap) and cuboid trap (67.33/trap).

**Key words :** Eucalyptus, gall wasp, *Leptocybe invasa,* sticky traps

## Introduction

Completely unknown anywhere in the world until 2000, eucalyptus gall wasp, *L. invasa* has shown incredible natural dispersal ability throughout areas where it has been introduced. The pest causes galls on the midribs, petioles and stems of new shoots of *Eucalyptus*. Heavy infestation leads to deformed leaves, shoots and reduction in growth. Adult female size ranges from 1.1 to 1.4 mm. The adult wasps lay eggs inside the tender leaves and stem. The larvae on hatching out of the eggs remains in a cavity formed within the plant tissues and feed on the plant and the injury to tissues results in formation of galls. The pest attack was observed in nurseries, coppice shoots and young plantations. The affected seedlings show stunted growth and become unsuitable for planting (Mendel *et al.*, 2004). On heavily attacked young trees the canopy hangs due to the weight of gall (http//www.fao.pdf). The practice of raising nursery for planting new areas coupled with coppicing provides large amounts of young leaf and shoot material ideal for *L. invasa* attack. This favors large population build-up and consequent higher levels of damage.

It was first noticed in India during 2001 (Anonymous, 2007) the insect attack has assumed greater significance since its spread in many parts of the country. Currently the insect attack has assumed greater significance since it has spread to other parts of the country. If the problem is unattended it may become severe in all the eucalyptus growing areas. Even after a decade of its existence no effective control measures exist to manage *L. invasa* menace. The need for monitoring the spread of the newly introduced pest has been frequently emphasized. Hence the studies were initiated to evaluate sticky traps to monitor and manage *L. invasa.*

## Material and methods

The present study was conducted at Kulwalli plantation belonging to West Coast Paper Mills Ltd., Dandeli during 2008-09. Different coloured traps were prepared by wrapping the coloured PVC sheet around card board sheets measuring 10.5" X 7.5". The PVC sheets were then coated with insect gum. Three traps of each color was installed two inch above the crop canopy in an area of 3X3 $m^2$ with four replications. The observations on the wasp trapped were made at three days interval. Six treatments consisting of insect gum, petroleum jelly and grease (with and without eucalyptus oil) were evaluated. Eucalyptus oil (5 ml) was mixed with sticky materials before being applied on yellow cards (10.5"x 7.5"). The observations on the wasps trapped were recorded at weekly intervals for a month. Different shapes viz. sphere, rectangular cuboid, cylindrical, rectangle with single sided glue and both sided glue were installed just above the crop canopy in nursery and main field. Sphere, cuboid, cylindrical traps were prepared from plastic containers painted yellow. The observations on the wasps trapped were recorded at weekly intervals. Treatments were replicated five times. The data were transformed and the means were differentiated by DMRT.

## Results and discussion

The number of adult wasp trapped three days after installation of trap ranged from 13.92 to 57.08/trap (Fig 1). On sixth day yellow sticky trap caught the highest number of wasps (57.84/trap) which was on par with green (34.92/trap) and white (37.58/trap) traps. On ninth and subsequent days of observations, yellow trap was significantly superior over other colours. Ninth and subsequent days of observations revealed a general decline in the number of wasps trapped. Drastic

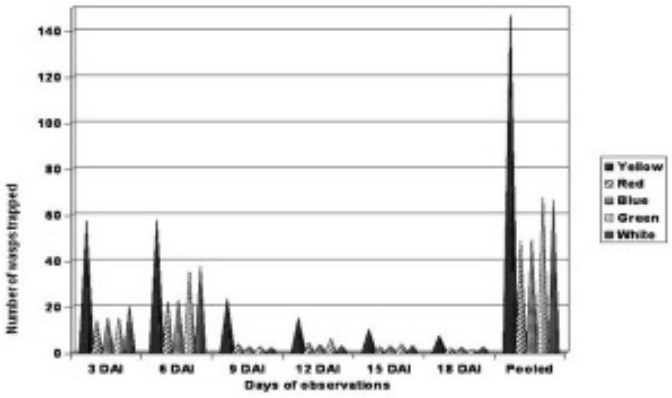


Fig. 1. Evaluation of sticky traps against eucalyptus gall wasp, Leptocybe invasa during August 2008 at Dandeli

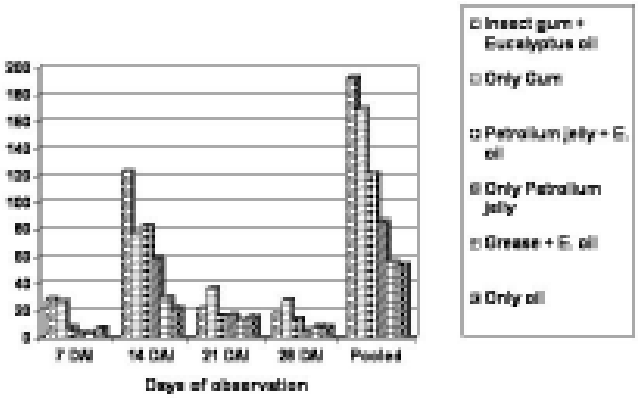


Fig. 2. Efficacy of sticky materials in trapping eucalyptus gall wasps November 2008 at Kulawalli

reduction in the number of adults trapped on 18th day after installation was noticed in all colours (1.16 to 7.16 adults/trap) due to heavy rains received during 9th and subsequent days of observations. The pooled data indicated that yellow sticky trap was the most effective in trapping significantly highest number of wasps (146.83/trap), whereas the adults attracted to other colours ranged from 48.92 to 67.33 and were on par with each other.

Among the different coloured sticky traps evaluated, yellow sticky trap was found effective by trapping the highest number of wasps which is in line with David and Boyd (2008) who reported that yellow trap was most effective against *Gynaikothrips uzieli* Zimmermann. Protasov *et al*. (2007) reported that green sticky plates were effective in trapping *Ophelimus muskelli* (Ashmead). The efficacy of yellow sticky traps in attracting various insects both under protected cultivation as well as open field has been reported by various authors (Durairaj *et al*., 2006; Ramegowda *et al*., 2007; Affandi *et al*., 2008). Thus Yellow sticky traps can be used both for monitoring of the pest in general as well as mass trapping of the wasps to reduce the infestation both in nursery and under protected cultivation.

The number of wasps trapped in different treatments on seventh day, ranged from 4.25 to 28.50 (wasps/trap). Insect gum with or without eucalyptus oil was equally effective in trapping adults (28.50 and 27.25 wasps/trap respectively) which was significantly superior to all other treatments (Fig 2). On 14th day, number of gall wasps trapped varied from 22.50 to 123.50 wasps/ trap. Insect gum with oil trapped the highest number of wasps (123.50) followed by insect gum without oil (77.00/trap), petroleum jelly with (83.00/trap) and without oil (58.25/trap) whereas it was least in grease with oil (30.00/trap) and without oil (22.50/trap). On 21st day significantly higher number of wasps was trapped in insect gum without oil (36.75/ trap) followed by with oil (21.75/trap) and the lowest trap catches were observed in grease and petroleum jelly with oil and without oil. Similar trend was noticed on 28th day of observation. The pooled data revealed that insect gum with oil (192.00/trap) and with out oil (169.25) were effective in trapping the wasps followed by petroleum jelly with oil (122.25/trap). Automobile grease (with or without eucalyptus oil) trapped the lowest number of wasps (54.25 to 56.25/trap). The results indicated the superiority of insect gum in attracting gall wasp. However, the addition of eucalyptus oil enhanced the trap catches in petroleum jelly and grease.

The use of host odour and chemical attractants has been reported to improve the efficiency of traps (Heath *et al*., 1997). Among all the treatments, addition of eucalyptus oil numerically enhanced the trap catches than without oil. Insect gum with eucalyptus oil trapped maximum number of wasps (192/trap) which was equally effective gum without oil (169.25/ trap) and petroleum jelly with oil (122.25/trap). Automobile grease (with or without eucalyptus oil) trapped the lowest number of wasps (54.25 to 56.25). The results indicated the superiority of insect gum with eucalyptus oil in attracting gall wasp. Insect gum was most effective in trapping the wasps while eucalyptus oil enhanced the trap catches in petroleum jelly and grease. While insect gum has been extensively used for trapping (Rodrigues, 2002), alternatives such as vinyl chloride (Anonymous, *et al*., 1988), 5% polybutane (Anonymous, 1990) and grease (Protosav *et al*., 2007) have also been successfully tried.

The observations made after seven days showed that flat (both sided) trapped significantly higher number of wasps (454.40 wasps/trap) followed by flat (single sided) trap (176.20/ trap), sphere (233.20/trap) and cuboid (158.00/trap). On 14th day, sphere (8.00/trap), flat trap glued on one side (6.00/trap), cuboid (5.20) and flat trap glued on both sides (3.80/trap) trapped significantly higher number of wasps and least trapping was observed in cylinder (1.60/trap). On 21$^{st}$ day of observation cuboid (22.60/trap), sphere (27.20/trap) and flat glued at one side (24.00/trap) were on par followed by flat both sided (8.40/ trap) and cylinder (10.20/trap). On 28$^{th}$ day, flat both sided (32.40/ trap) and single sided (27.40/trap) were equally effective in trapping the wasps and significantly superior over cuboid (15.20/ trap), sphere (16.80) and cylinder (15.80/trap). Pooled data showed that flat trap with glue on both sides (176.53/trap) was superior to all other trap shape followed by sphere (92.27/trap), flat glued only on one side (75.07/trap) and cuboid (67.33/trap) (Table 1).

Table 1. Evaluation of different shaped yellow sticky traps in nursery and main field

| Sl. No. | Shapes | Surface Area (cm2) | Number of adult wasps trapped | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Nursery | | | | | Main field | | | |
| | | | 7th day | 14th Day | 21st Day | 28th Day | Pooled | 14th Day | 21st Day | 28th Day | Pooled |
| 1 | Cuboid | 947.00 (12.58) | 158.40 cd (5.70) | 33.10 bc (9.98) | 98.70 a (7.14) | 50.00 ab (7.75)a | 59.10 (2.49) | 5.20 ab (4.85) | 22.60 a (3.97) | 15.20 b (827) | 67.33 bc |
| 2 | Sphere | 1073.00 (15.58) | 233.20 b (7.34) | 52.90 a (5.63) | 30.7 b (5.78) | 32.40 b (6.22) | 37.73 b (3.00) | 8.00 a (5.30) | 27.20 a (4.15) | 16.80 b (9.66) | 92.27 b |
| 3 | Cylindrical | 414.85 (10.35) | 106.80 d (4.97) | 23.70 c (5.70) | 31.5 b (6.07) | 35.80 b (5.60) | 30.33 b (1.61) | 1.60 c (3.28) | 10.20 b (4.03) | 15.8 b (7.34) | 52.93 c |
| 4 | Flat both sided | 1260.00 (21.23) | 454.40 a (6.45) | 40.60 ab (6.51) | 41.40 b (8.55) | 72.10 a (7.58) | 56.40 a (2.19) | 3.80 bc (3.05) | 8.40 b (5.72) | 32.4 a (13.32) | 176.53 a |
| 5 | Flat single sided | 630.00 (13.29) | 176.20 bc (5.60) | 30.40 bc (4.94) | 23.4 b (5.48) | 29.00 b (5.17) | 25.73 b (2.65) | 6.00 ab (4.98) | 24.00 a (5.21) | 27.4 ab (8.72) | 75.07 bc |
| | SEm ± | -- | 0.78 | 0.42 | 0.83 | 0.63 | 0.40 | 0.19 | 0.21 | 0.40 | 047 |
| | CD @ 5% | -- | 2.34 | 1.27 | 2.48 | 1.89 | 1.20 | 0.59 | 0.64 | 1.20 | 1.41 |

Figures in the parentheses are $\sqrt{x+1}$ transformed values

Means followed by the same superscripts do not differ significantly by DMRT (0.05)

In the main field, on 14th day of observation, sphere (52.90/trap) and flat trap with gum on both sides (40.60/trap) trapped significantly higher number of wasps followed by cuboid trap (33.10/trap) and flat single sided trap (30.40/trap). The cylinder trap caught least number of wasps (23.70/trap). On 21st day of observation, cuboid trapped significantly higher number of wasps (98.70/trap) followed by others which recorded 23.40 (flat single sided) to 41.40 (flat both sided) wasps per trap. Cuboid trap (50.00/trap) and both sided flat sticky trap (72.10/trap) were equally effective in trapping the wasps followed by sphere (32.40/trap), cylinder (35.80/trap) and single sided flat traps (29.00/trap) on 28th day of observation. Pooled data revealed that among all the treatments, cuboid and both sided flat traps were significantly superior over others by trapping 59.10 and 56.40 wasps respectively followed by sphere (37.73), flat single sided (30.33) and cylinder (25.75) (Table 1).

Flat trap with glue on both sides (1260 $cm^2$) trapped significantly higher number of wasps per trap followed by other traps, the surface areas of which ranged from 415 (cylindrical trap) to 1073 $cm^2$ (sphere trap) indicating the direct relationship between the surface area and number of trap catches which corroborates well with the reports of Robacker and Heath (2001). Thus the flat rectangular yellow sticky trap can be used both for monitoring and mass trapping of the eucalyptus gall wasp.

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