Trichogramma

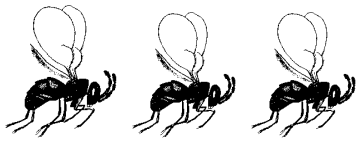
Lepidoteran egg parasites

PO Box 1555, Ventura, CA 93002
800-248-2847 * 805-643-5407 * fax 805-643-6267
questions orderdesk@rinconvitova.com
orders orderdesk@rinconvitova.com
www.rinconvitova.com

BENEFITS OF BIOCONTROL

Biological control with beneficial insects makes dollars and sense, even in chemically sprayed fields. Growers using Rincon-Vitova's Trichogramma and other beneficials (all natural, none genetically engineered) to augment indigenous natural enemies can expect to improve profits by reducing or eliminating pesticide use. Residue problems, costs of sprays, scheduling sprays around irrigations and when workers are not present, health and safety liability risks, even insurance costs, may be reduced when beneficial insects assume more pest management chores.

In many cases, crop yield and quality improve as previously unrecognized adverse pesticide effects on plant physiology disappear. Resistance problems, and outbreaks of secondary pests like spider mites, whiteflies and leafminers are avoided. There are also public relations and marketing benefits from using this "green", environmentally-friendly alternative to conventional chemical control.



MICRO-MARVELS

Trichogramma destroy eggs of over 200 pest moth species (cutworms, fruitworms, leaf worms, leafrollers, loopers, armyworms, borers etc.), preventing ravenous worms (caterpillars) from hatching out and devouring crops. These pale yellow micro-wasps, 1/100 inch long, smaller than a pinhead, drill through moth eggs to deposit 1-3 of their own eggs; moth egg size, and hence how many of their own eggs to lay, is calculated by timing walks across moth egg surfaces.

Trichogramma larvae eat out the insides of pest eggs, pupate, and cut an exit hole in moth eggshells for winged adults to squeeze through. Males emerge first, wait for females, and immediately mate. The life cycle from egg to adult is completed in 7 to 10 days (longer in cool weather). This short life cycle allows as many as 30 generations per season, and rapid population increase. Hence, early season releases produce large populations positioned to fight pest invasions.

MANY SPECIES & BIOTYPES

Rincon-Vitova Insectaries began raising Trichogramma in 1960, and currently distributes Trichogramma species and strains (biotypes) adapted to various crop and caterpillar (worm) pests. A phone call will help us match your pest with the best available Trichogramma species or biotype.

Trichogramma pretiosum is our all purpose warm weather species, recommended for field, row and vegetable crops, as well as vineyards and selected trees.

Trichogramma platneri, a western U.S. native, is recommended for western trees. The avocado strain of T. platneri has garnered rave reviews. We also rear a codling moth strain of T. platneri for western apple, pear and walnut growers.

Trichogramma minutum is best for eastern states, where it is native, overwinters, and colonizes all tiers of trees. T. minutum fights spruce budworm, codling moth (eastern orchards only), and has parasitized up to 90% of corn earworm eggs in the southeast. Optimum temperature is 65-85º F.; low temperatures and rain reduce effectiveness.

Trichogrammatoidea bactrae, recently imported from Australia to fight pink bollworm, has a wide host range, including tomato pinworm, potato tuber moth, Oriental fruit moth, navel orangeworm, peach twig borer, and diamondback moth.

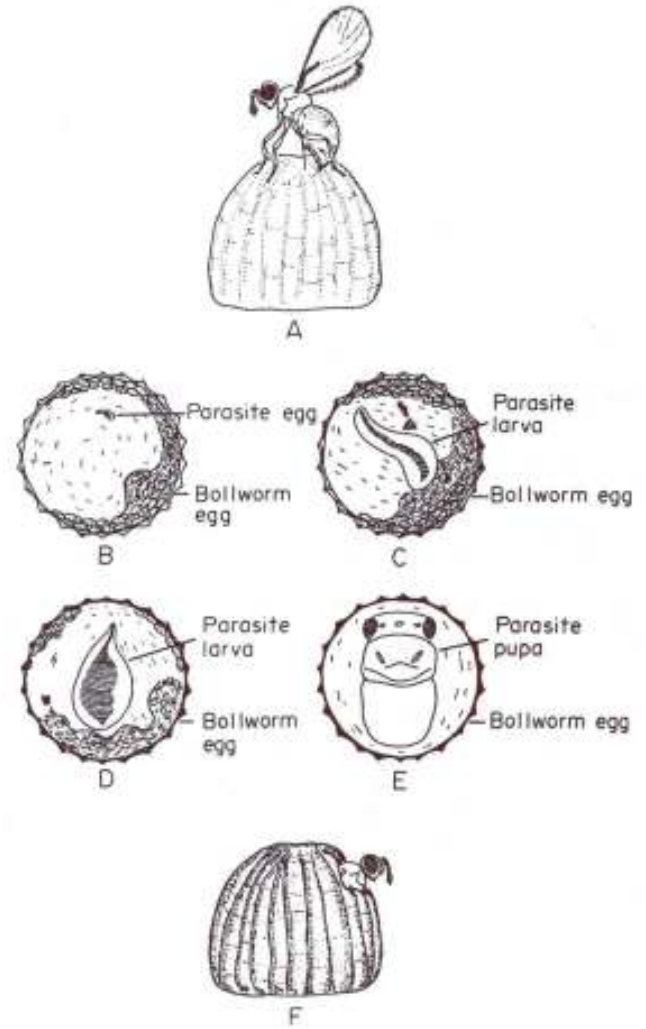
From time to time, and on special demand, Rincon-Vitova Insectaries offers other Trichogramma species and biotypes to customers on account.

Trichogramma card with 100,000 parasitized eggs, can be cut into 30 tabs, each with a hook for hanging. Card is 4 X 11 inch, each tab is ¾ X 2 inch.

RELEASE BASICS

Trichogramma are shipped (as pupae ready to emerge as adults) inside parasitized grain moth eggs, usually glued to perforated cards. There are approximately 120,000 Trichogramma per card. Each card can be broken into 30 squares with about 4,000 parasites -- this permits even distribution in fields and orchards. Loose eggs can be divided into paper cups; there are approximately 20,000 eggs in a cubic centimeter.

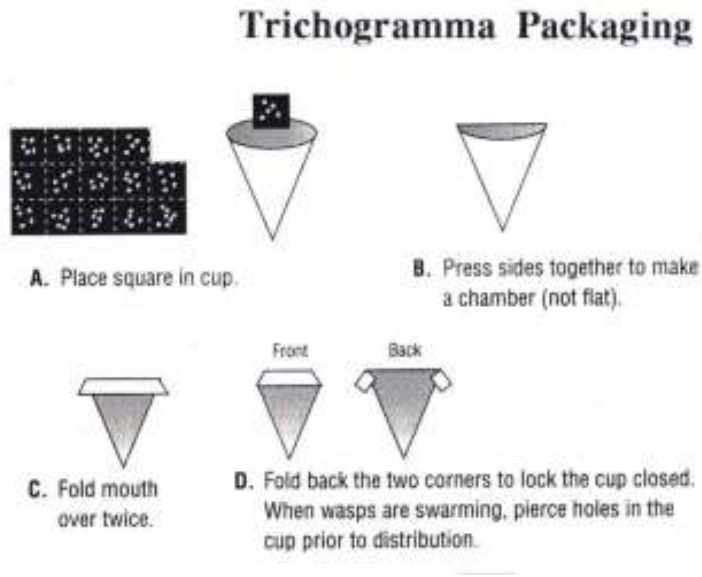
Trichogramma wasps emerge from cards in two to five days, depending on temperature, which should ideally be 80º to 90º F. Emergence can be delayed by holding parasitized moth eggs at cooler temperatures (not less than 40o F). Emerging wasps are usually seen in the morning. To maximize pest fighting time, don't delay release after adult wasps emerge. Keep Trichogramma cards in the shade, out of the hot sun.



Trichogramma Life Cycle: A) female ovipositing a moth egg; B) parasite egg inside host egg; C) developing larvae; E) pupa; F) adult wasp emerging from host egg. (From van den Bosch & Hagen, 1966).

To increase mating prior to release, incubate parasitized moth eggs in a gallon jar, paper bag, paper wedge cup or other closed container. This can be done by cutting cards (along perforations) into 30 squares, and placing squares in a paper wedge cup according to the diagram. Fold the mouth of the cup closed (folding over twice), and fold back the two corners like dog ears.

Anytime after Trichogramma adults begin emerging and swarming, cups can be set out. Cups can be opened and placed in plants, or punctured with a knife, creating an exit hole on each side while protecting remaining unhatched eggs from predators and moisture. Punctured cups can be broadcast on and around plants or vines, set in branches or stapled to leaves. Large incubation containers can be opened at randomly spaced rows or trees; allow containers to remain open longer at pest "hot spots," so more parasites emerge where pests are concentrated.



Since Trichogramma attack freshly deposited moth eggs, the time to release Trichogramma is when moths are flying and laying eggs. Begin releases as early in the season as field and row crops provide shade for the parasites, e.g. when tomatoes are 12-28 inches high. It is better to start releases early than too late, as Trichogramma populations have the potential to grow geometrically each 7-10 days, and a long headstart on pests is more likely to tip the ecological balance in favor of biological control. A few minor pest situations must be tolerated to obtain a natural enemy complex that controls major pest problems.

MONITORING

Monitoring biological control (e.g. a pest:beneficial ratio) reduces spray bills, as economic treatment thresholds can be adjusted upwards to account for natural enemies. Trichogramma parasitism of moth eggs can be monitored by placing cards of fresh moth eggs in fields or by two-minute timed egg searches of plants. Fresh moth eggs are usually white or a pale shade of yellow or orange. Moth eggs parasitized by Trichogramma darken to black within 48 hours. The ratio of black (contains pupating Trichogramma) to white (unparasitized) eggs is a measure of Trichogramma parasitism.

RELEASE RATES

The question of how many Trichogramma to release is complicated by numerous variables, like pest density, release dates, single vs. multiple releases, cultural practices, pesticides, pruning, alternate hosts, weather, type and growth stage of the crop. More Trichogramma are needed in heavily sprayed agro-ecosystems, than in areas where minimal pesticide use allows natural enemies to multiply and migrate from crop to crop.

Trichogramma releases increase moth egg parasitism on cabbage, tomatoes, bell peppers, collards, soybeans etc. from 0-20% in no release plots to 50-85%. Trichogramma alone can parasitize 80-96% of Heliothis (cotton bollworm, tobacco budworm, tomato fruitworm), alfalfa caterpillar, cabbage worm and other pest eggs (Lindgren, 1969). USDA models theorize that 12,000 to 50,000 Trichogramma per acre should be released per generation of pest to achieve the 80% egg parasitization level necessary to keep worms below economic levels (Ridgway et al., 1981).

Trichogramma are not intended to be used as pesticides. Rincon-Vitova beneficials should be integrated into IPM programs and sustainable farming systems to augment and strengthen the indigenous natural enemey complex. Indigenous predators like pirate bugs, big-eyed bugs, damsel bugs, rove beetles, ground beetles, Collops beetles, lady beetles and spiders can add 45% moth egg destruction to the 50% obtained with egg parasites. Thus, total natural enemy destruction of moth eggs before caterpillars hatch out can exceed 95%. Few pesticides can match the 95+ percent pest egg destruction potential of the natural enemy complex -- indeed, pests are prolific egg layers to insure that a few individuals survive to perpetuate the species in this tough bug-eats-bug natural environment.

ROW & FIELD CROPS

One of our most popular strategies is initially releasing small numbers of beneficials (as early in the season as possible) to colonize young plants, and following up with weekly releases to insure long-term establishment.

Fifty to 80 percent parasitism of eggs of key pests like Heliothis or Helicoverpa (i.e. tobacco budworm, cotton bollworm, tomato fruitworm, corn earworm) have been reported with release rates of 25,000 to 100,000 Trichogramma per acre when there are 25,000 Heliothis eggs per acre. High rates of egg parasitism are almost always followed by drastic reductions in worm (caterpillar) populations.

Ridgway (1981) reported the following commercial suggestion for cotton, which can also be a guide for other crops: "Control of Heliothis on cotton. For light infestations of Heliothis eggs, 10,000 Trichogramma per acre per week should be released beginning when squares are one-half grown and continuing through the fruiting season, or for about eight to ten weeks. For heavy infestations of Heliothis eggs, a minimum of 30,000 Trichogramma per acre should be released biweekly, or more frequently if necessary, thoughout the fruiting season."

Another commercial suggestion reported by Ridgway (1981) for cole crops: "Control of cabbage loopers on cabbage. For light infestations early in the season, 25,000 Trichogramma should be released twice a week. For medium and heavy infestations, 50,000 and 100,000 Trichogramma, respectively, should be released twice each week." Reports from former Soviet republics indicate that 20,000 Trichogramma per acre, or 1 parasite per 20 pest eggs, produces 90-100% parasitization of cabbage worm eggs. Combining Trichogramma with larval and pupal parasites, predators (e.g. green lacewings), and BT is another option.

In processing tomatoes, Ridgway (1981) cited 8 seasons of work by Oatman et al. at the University of California, Riverside, that "showed that biological control of the three key pests (tomato fruitworm, cabbage looper, tomato hornworm) on early plantings could be achieved by releasing a total of 200,000 to 300,000 parasites per acre. They further suggested that, for maximum success, releases should be made twice weekly from June through August, or until harvest." USDA studies (Agric. Res., April 1981) recommend 50,000 to 70,000 Trichogramma per acre per release over the growing season. Rincon-Vitova clients report control of low to moderate tomato fruitworm infestations with 100,000 to 300,000 Trichogramma pretiosum per acre (15,000 wasps per acre twice weekly for 10 weeks) when releases are started early in the season and pesticide interference is avoided.

Another approach is aiming for a ratio of 1 parasite per 10-20 pest eggs to boost parasitization into the 90-100% range. This requires monitoring fields, and timing releases with pest egg laying. Former Soviet republics claim that 6-8,000 Trichogramma per acre produce 68% cutworm parasitism on wheat and sugar beets. Extra releases and higher numbers of Trichogramma are released if cutworm eggs are more numerous than usual -- up to 3 releases of 12,500 Trichogramma per acre are used when there are 30 cutworm eggs per square meter, with the aim being a 1:10 ratio of parasites to pest eggs.

An effective ecological approach used at Rincon-Vitova takes advantage of natural migrations of beneficials to adjacent and downwind fields. For example, sunflower borders integrated biological control into a 10,000 acre processing tomato and canteloupe cooperative where a thousand farmers each had an 8-10 acre tomato field plagued by sweetpotato whitefly and tomato fruitworms. Two plantings of sunflowers 60 and 30 days prior to tomatoes acted as field insectaries, producing natural enemies that moved over to tomatoes with early sweetpotato whiteflies, and provided control. Pesticide spraying, which had been continuous, was reduced to spot treatments, with Rincon-Vitova's Trichogramma

(sensitive to insecticides) and lacewings providing excellent control of fruitworms. Corn and alfalfa borders and interplants have also succeeded. Unsprayed sorghum, grains, oil seed Brassicas, vegetables, cover crops, wild flowers, and red-root pigweed (Amaranthus retroflexus) can also increase Trichogramma parasitism of moth eggs in neighboring and later season crops.

AVOCADOS

Inoculating orchards with Trichogramma platneri provides an alternative to pesticides for control of omnivorous loopers and Western leafrollers. In field tests, T. platneri produced 60% parasitism of omnivorous looper eggs and 80% parasitism of Western leafroller eggs.

"These rates of parasitism should be obtained by releasing 200,000-250,000 parasites per acre for the year," wrote University of California IPM specialist Dr. Phil Phillips (1984). "This total amount released per acre should be divided into at least four release sites per acre and releases at each location should be made over a period of 6 to 8 weeks following the peak of the spring flight. This can be accomplished starting in early to mid-March with releases every other week of approximately 12,500 parasites per each of the 4 release sites per acre over the 6-8 week release period through early May...Releases of parasites after the flight peaks occurring in June-July and September-October may also prove beneficial, but probably not as effective as releases in the spring. Not only have the pest populations increased considerably by these later season flights, but the daytime temperatures have increased to a point more deleterious to the insectary-reared parasites."

CODLING MOTH

In the 1920s, Prof Harry Smith of the University of California, Riverside, urged Stanley Flanders to develop techniques for mass-rearing Trichogramma because it was "the most adaptable egg parasite with which to attempt the biological control of the codling moth." In 1927, Flanders released insectary-reared Trichogramma in orchards, and wrote that the "increase in parasitism from less than 1 percent to 50 percent occurred in a period of three weeks." Mass rearing of Trichogramma promptly spread to the Soviet Union, and then around the world before coming back to the U.S.

As early as 1930 (Hilgardia, V.4,N.16), Flanders touted ecological farming methods to maximize Trichogramma's pest-fighting power: "Clean cultivation, by reducing the number and variety of the food plants of the hosts of Trichogramma, acts as a check on the natural abundance of the latter. In southern California there is a noticeable difference between the degree of parasitism of the codling moth in orchards and on fruit trees in dooryard situations where food plants of moths are present throughout the year. Properly managed cover crops may aid parasitism under orchard conditions. Trichogramma may be of value in maintaining pest populations below the economic zero."

As adults, Trichogramma feed on insect eggs, nectar, pollen and honeydew. Trichogramma live several times longer and destroy more pests when supplied with nectar plants (e.g. between rows, borders). These refugia (safe havens that are never sprayed) grow large populations of beneficials that migrate into trees.

Soviet studies reveal that Trichogramma minutum parasitism of codling moth is highest in release trees. Though there is some T. minutum movement with the prevailing wind, downwind from release points, the parasite tends to remain on crowns of release trees, leading to the recommendation that "Trichogramma should be released in the morning hours in the lower tiers of the crown of EACH fruit-bearing tree."

In single release Soviet studies, there was 6-28% parasitism with 2,000 Trichogramma per tree. "With 500 and 1,000 eggs of codling moth per tree and a ratio of parasites to host of 10:1 and 5:1 the rate of parasitism was 30 to 39%." Achieving 70-96% Trichogramma parasitism required releasing either 10,000 or 20,000 Trichogramma per tree. Studies in various climatic zones "revealed that when the pest population is low the release of fewer Trichogramma, done once in the first days of oviposition, yield a low rate of parasitism -- a little more than 10%. Only with the appearance of the progeny of the released Trichogramma, i.e., 10 to 20 days later, does the rate of parasitism rise to 30 to 40%, gradually increasing to 70 to 90%" (Zhilyaeva et. al., in Pristavko ed. 1981).

LAST WORDS

Best results are seen 3 to 5 years after the start of beneficial insect releases. The first year of transition from pesticides to greater reliance upon biological control is the most difficult. Each year of ecological farming, background levels of indigenous natural enemies helping insectary-reared beneficials increases. Trichogramma are very sensitive to pesticides; growers will do best with an IPM practitioner or PCA who can devise strategies to mitigate chemical impacts.

A quality control specialist works to insure that the best possible product is sent out. Nevertheless, sometimes shipments of fragile insects can arrive injured or otherwise not meet expectations. As we stand behind all product shipped, please feel free to contact us should you ever feel that there is a problem or that a replacement may be necessary.