Establishment and Spread of Released *Typhlodromus pyri* Predator Mites in Apple Orchard Blocks of Different Tree Size: 1999 and Final Results

Ronald Prokopy, Starker Wright ,and Jonathan Black
Department of Entomology, University of Massachusetts

Jan Nyrop, Karen Wentworth, and Carol Hering
Department of Entomology, Cornell University, NYSAES, Geneva, New York

As discussed by Nyrop in the Winter 1999 issue of *Fruit Notes*, the predatory mite *Typhlodromus pyri* can be highly effective in providing season-long suppression of pest European red mites in commercial apple orchards. Unfortunately, *T. pyri* has been found present (in numbers large enough to be detected) in fewer than 10% of Massachusetts orchards sampled since 1978. In contrast, the predatory mite *Amblyseius fallacis* has been found present in readily detectable numbers in about 90% of Massachusetts apple orchards sampled since 1978. However, *A. fallacis* is less capable than *T. pyri* of enduring cold winter temperatures, withstanding low relative humidities, and surviving periods of short supply of pest mites as food.

In 1997, we initiated a program of introducing *T. pyri* into eight commercial apple orchards in Massachusetts in which it was not previously detected. Two of our aims were to (1) chart the rate at which *T. pyri* spread from trees on which they were released to other trees in the same orchard blocks, as affected by tree size and planting density, and (2) determine the impact of *T. pyri* on pest mite populations. Our study was intended to extend over a period of 3 years. In the Fall 1997 and Winter 1999 issues of *Fruit Notes*, we reported, respectively, on our findings from 1997 (the first year) and 1998 (the second year). Here, we report on our findings from 1999 (the third year) and our final conclusions.

Materials & Methods

As indicated in the Fall 1997 issue of *Fruit Notes,* our experiment was conducted in six blocks of apple trees in each of eight commercial orchards. Of the six blocks per orchard, two each contained trees on M.9, M.26, or M.7 rootstock, designated as small, medium-size, or large trees. One block of each pair received first-level IPM practices, wherein growers applied insecticides and fungicides of their own choosing and timing of application, which extended from April through August. The other block of each pair received third-level IPM practices, wherein the initial intent was that no pesticides known to cause a moderate or high level of harm to *T. pyri* were to be used. These included synthetic pyrethroid insecticides (at any time) and EBDC fungicides (after mid-June). In addition, after mid-June, no insecticide of any type was to be used, and captan or benomyl were the only fungicides to be used. There was no restriction on type of miticide allowable for use in third-level blocks, except for Carzol, which was not used. Each block was comprised of 49 trees (seven rows of seven trees per row) and of the cultivars McIntosh, Empire, or Cortland. Third-level IPM is similar to second-level IPM in its focus on using biologically-based pest-management practices, but it embraces integration with horticultural concerns (such as tree size) as an added component.

T. pyri were released onto the center tree of each third-level IPM block in May of 1997, in the manner described in the Fall 1997 issue of *Fruit Notes*. No *T. pyri* were released in first-level IPM blocks. Three times during the summer of 1997 and four times during the summer of each of 1998 and 1999 in each of the 48 blocks, we sampled 25 leaves from the center tree, 15 leaves from each of the two outer-most trees in the center row, and 15 leaves each from the center tree in each of the two outermost rows. The leaves were sent by overnight mail to Geneva, New York for the identification and counting of pest and predatory mites. In all, more than 12,000 leaves were sampled in 1997 and more than 16,000 in each of 1998 and 1999.

Results

Results on establishment and spread of *T. pyri* for all 3 years (1997, 1998, and 1999) are presented in Figs. 1, 2, and 3. The data show good establishment of *T. pyri* in 1997

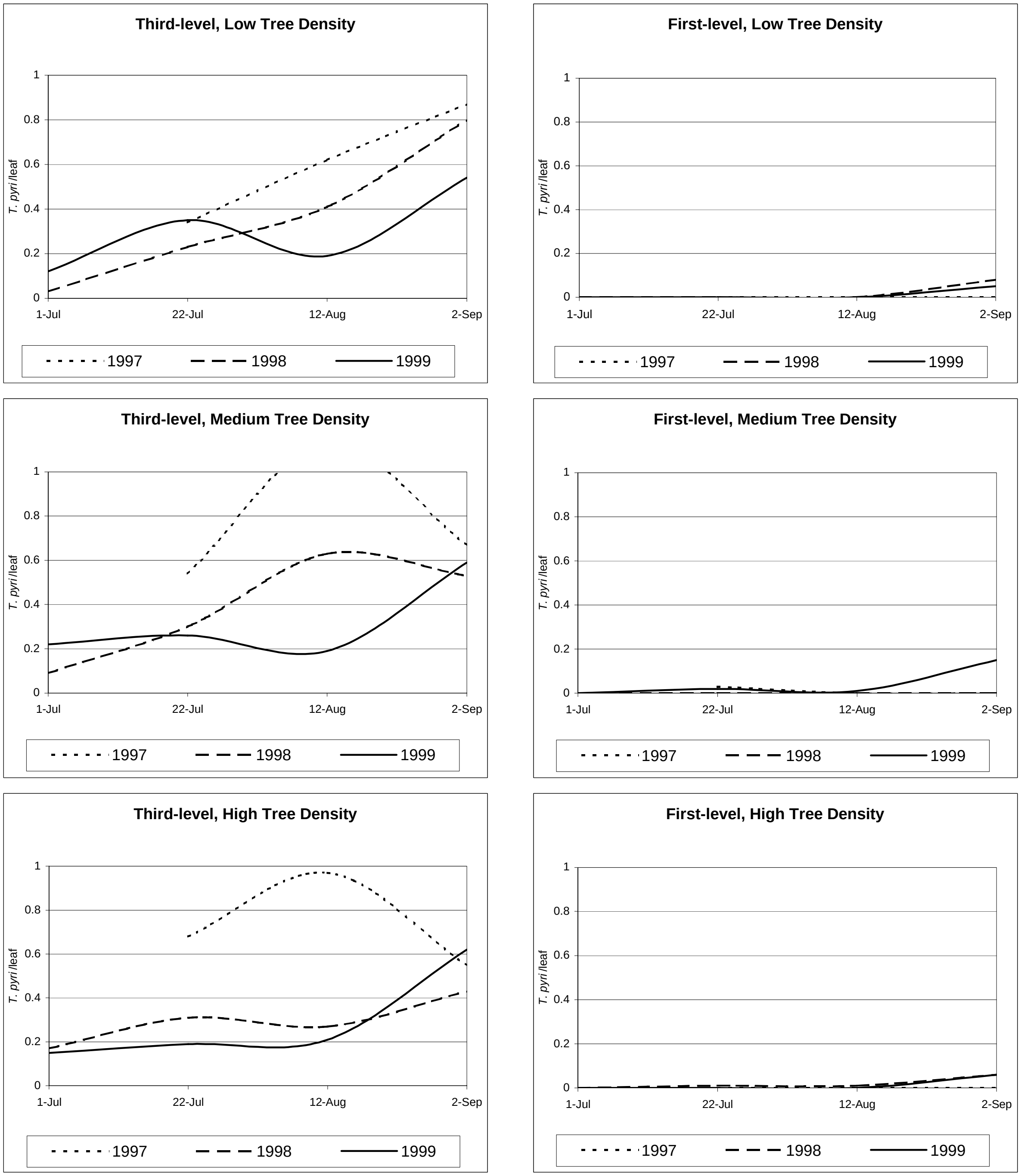

Figure 1. In 1997, 1998, and 1999, abundance to *T. pyri* mite predators on center trees of third-level IPM blocks (in which *T. pyri* were released on center trees in mid-May 1997) and center trees of first-level IPM blocks (in which no releases of *T. pyri* were made).

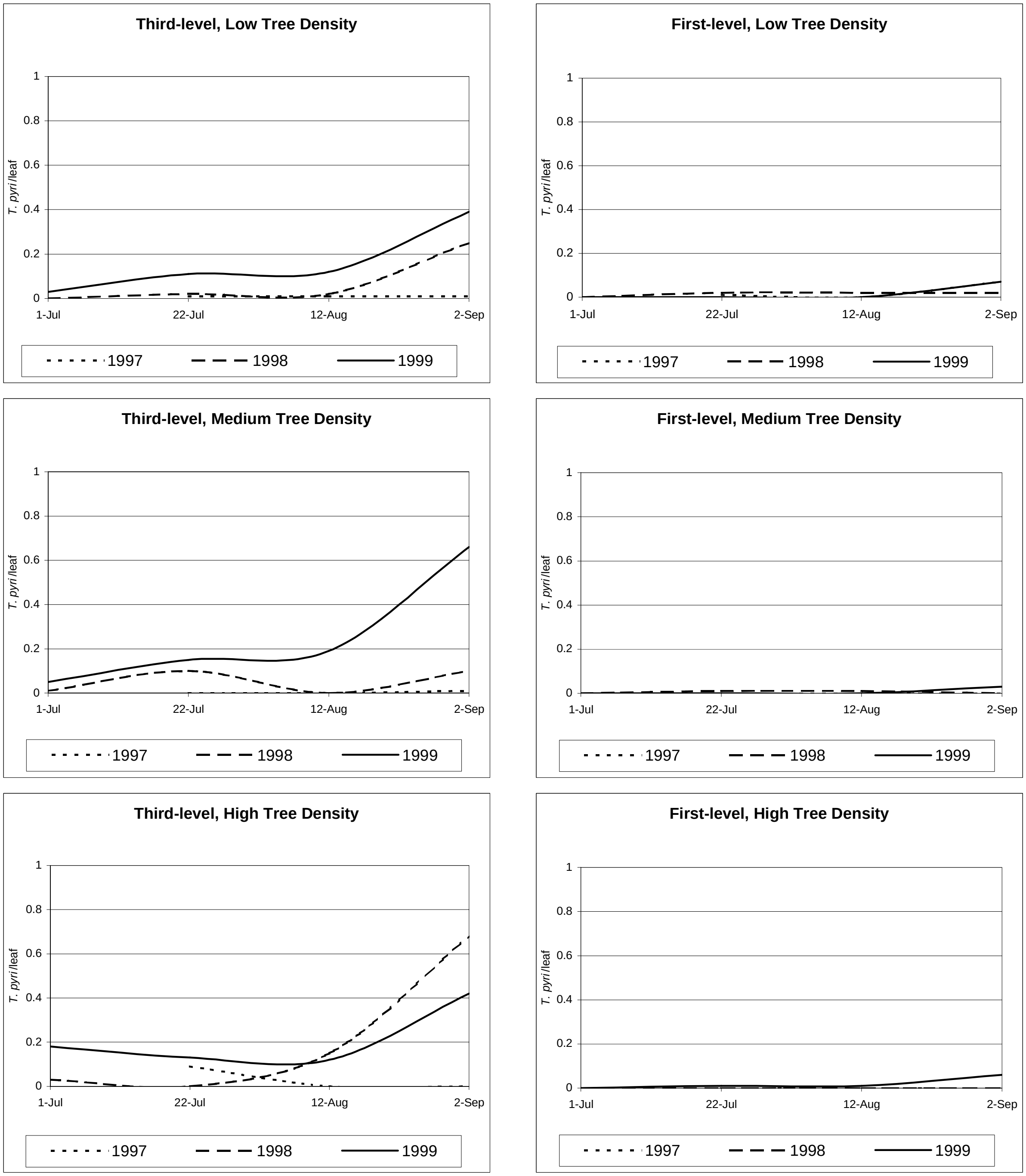

Figure 2. In 1997, 1998, and 1999, abundance to *T. pyri* mite predators on outer trees of center row of third-level IPM blocks (in which *T. pyri* were released on center trees in mid-May 1997) and outer trees of center row of first-level IPM blocks (in which no releases of *T. pyri* were made).

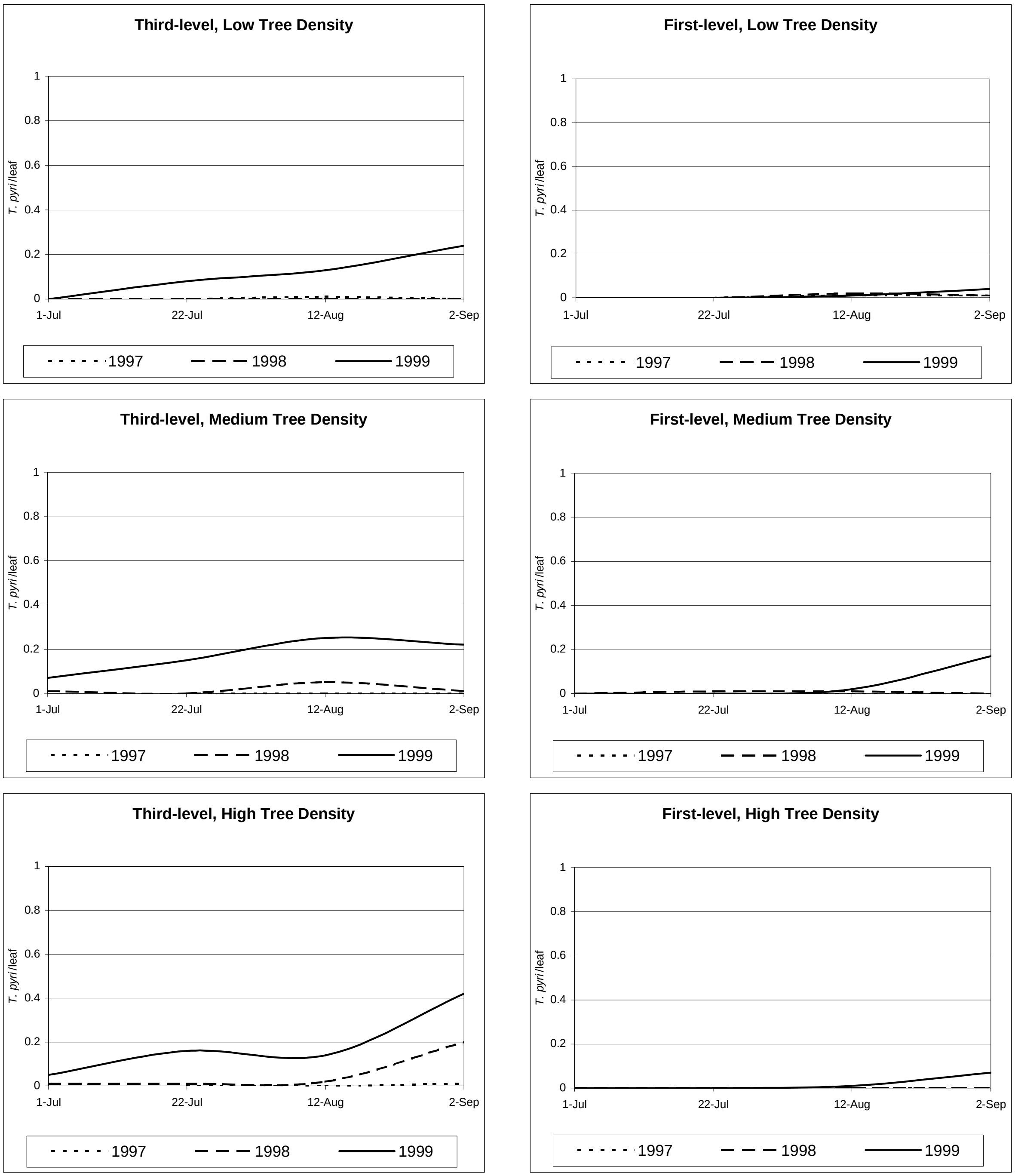

Figure 3. In 1997, 1998, and 1999, abundance to *T. pyri* mite predators on center trees of outer rows of third-level IPM blocks (in which *T. pyri* were released on center trees in mid-May 1997) and center trees of outer rows of first-level IPM blocks (in which no releases of *T. pyri* were made).

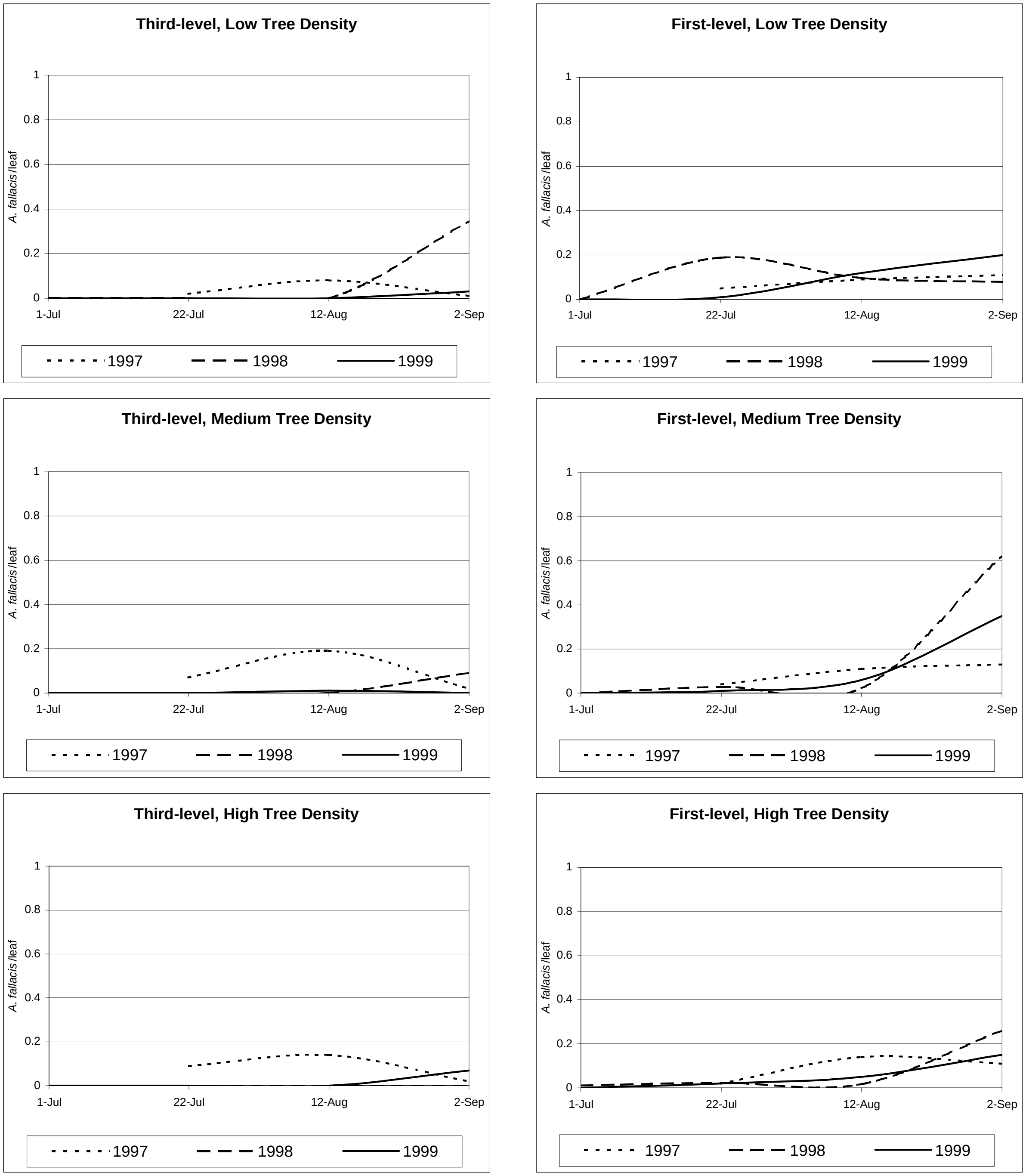

Figure 4. In 1997, 1998, and 1999, abundance to *A. fallacis* mite predators on center trees of third-level IPM blocks (in which *T. pyri* were released on center trees in mid-May 1997) and center trees of first-level IPM blocks (in which no releases of *T. pyri* were made).

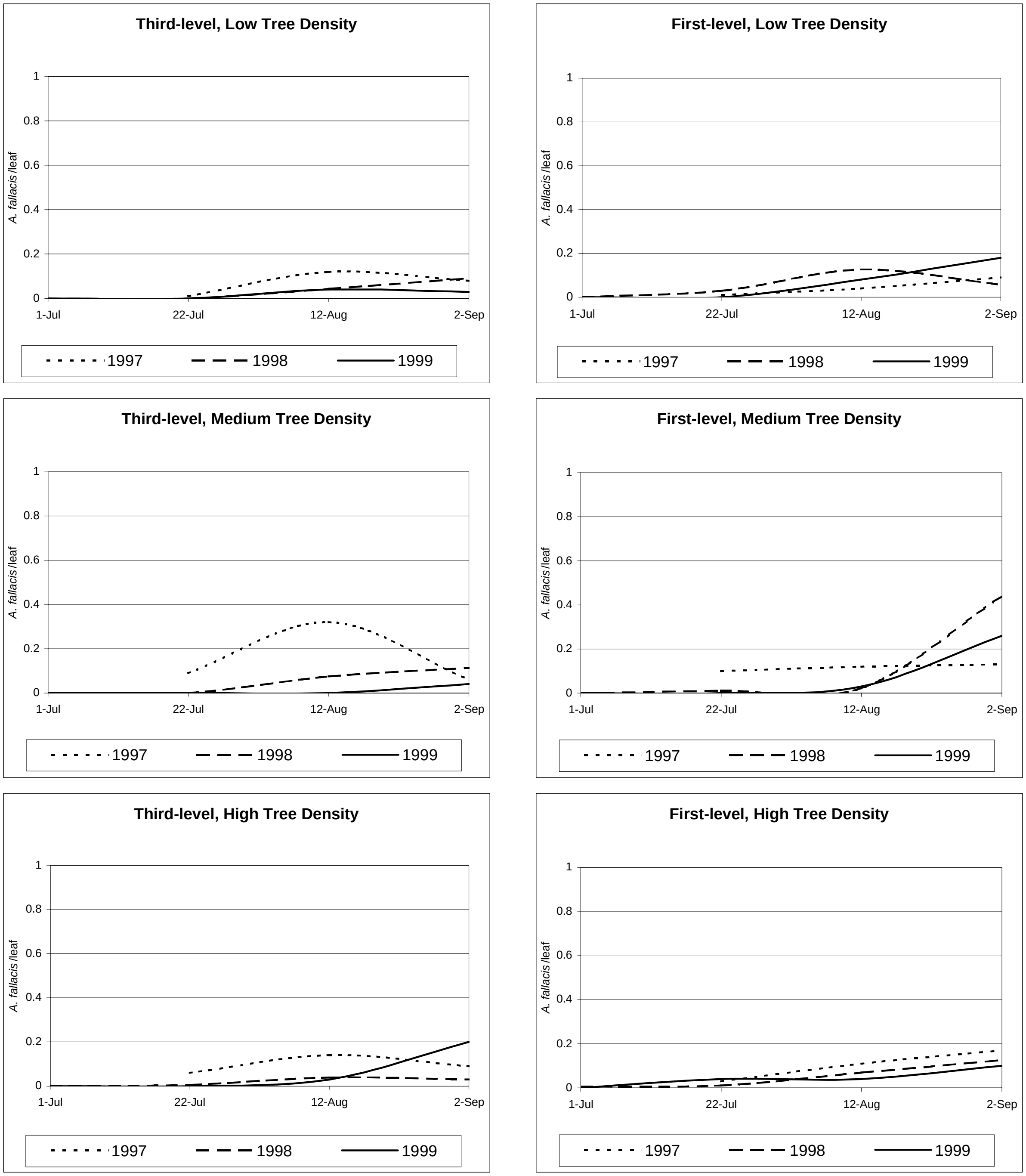

Figure 5. In 1997, 1998, and 1999, abundance to *A. fallacis* mite predators on outer trees of center row of third-level IPM blocks (in which *T. pyri* were released on center trees in mid-May 1997) and outer trees of center row of first-level IPM blocks (in which no releases of *T. pyri* were made).

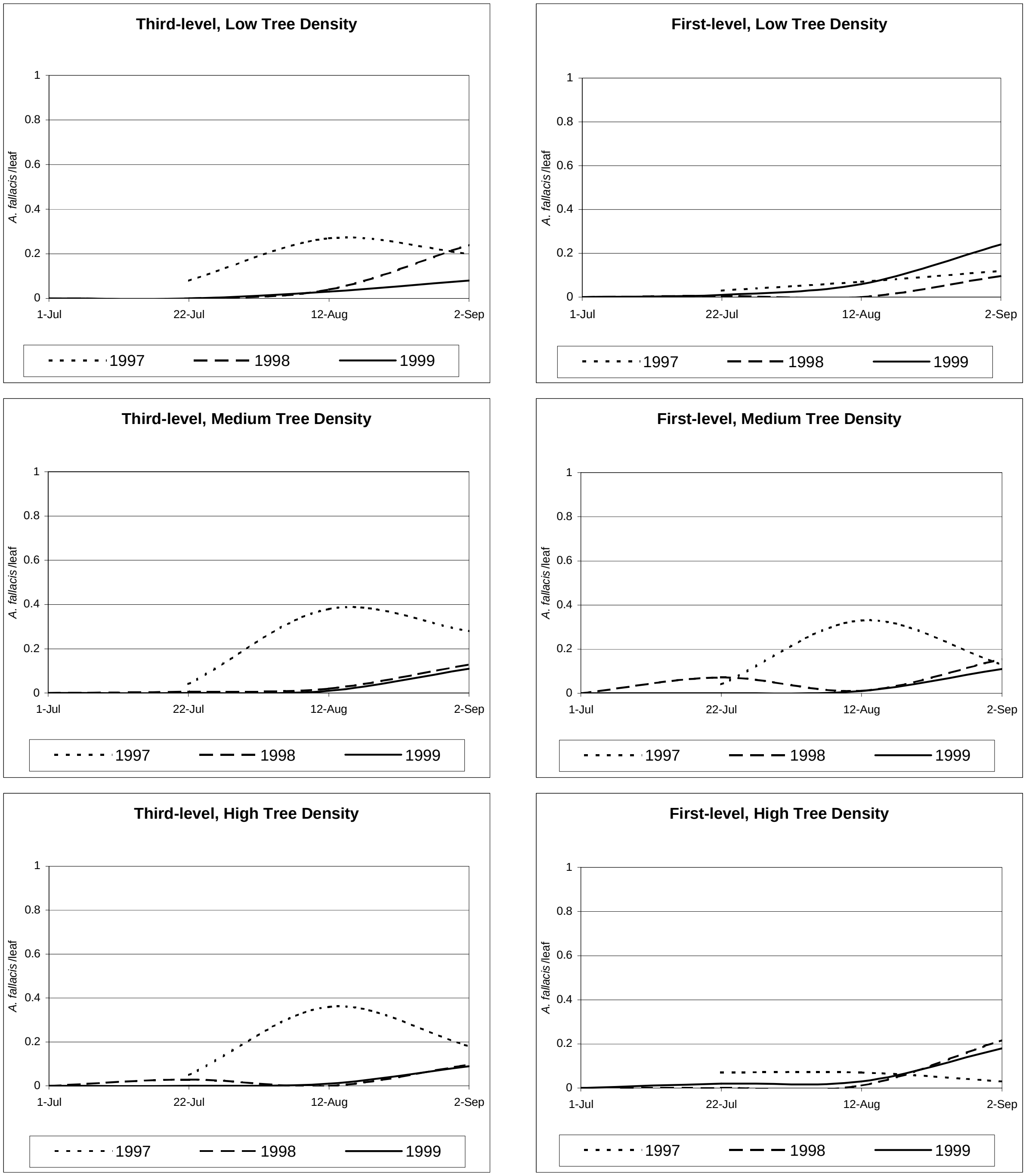

Figure 6. In 1997, 1998, and 1999, abundance to *A. fallacis* mite predators on center trees of outer rows of third-level IPM blocks (in which *T. pyri* were released on center trees in mid-May 1997) and center trees of outer rows of first-level IPM blocks (in which no releases of *T. pyri* were made).

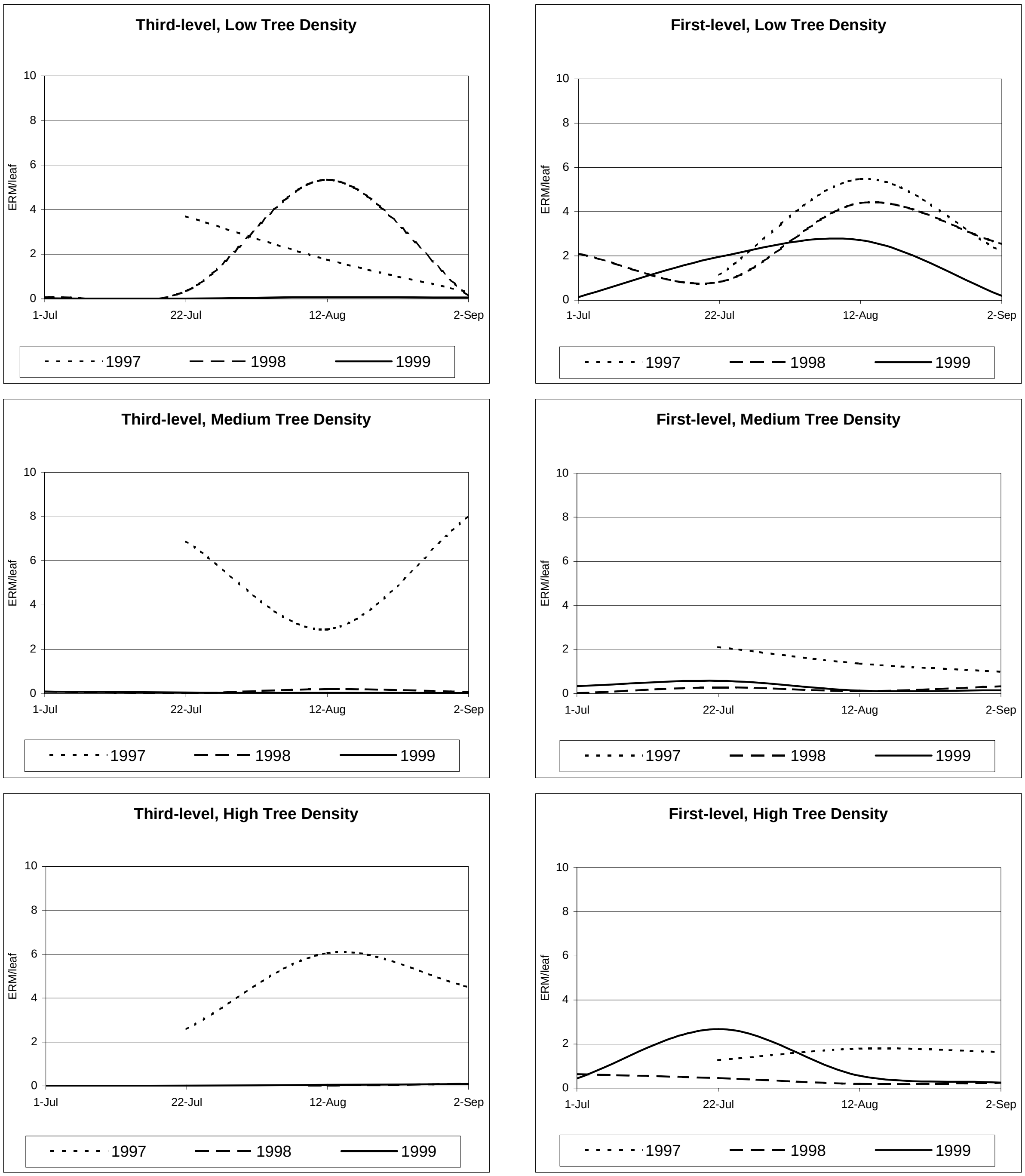

Figure 7. In 1997, 1998, and 1999, abundance to European red mites (ERM) on center trees of third-level IPM blocks (in which *T. pyri* were released on center trees in mid-May 1997) and center trees of first-level IPM blocks (in which no releases of *T. pyri* were made).

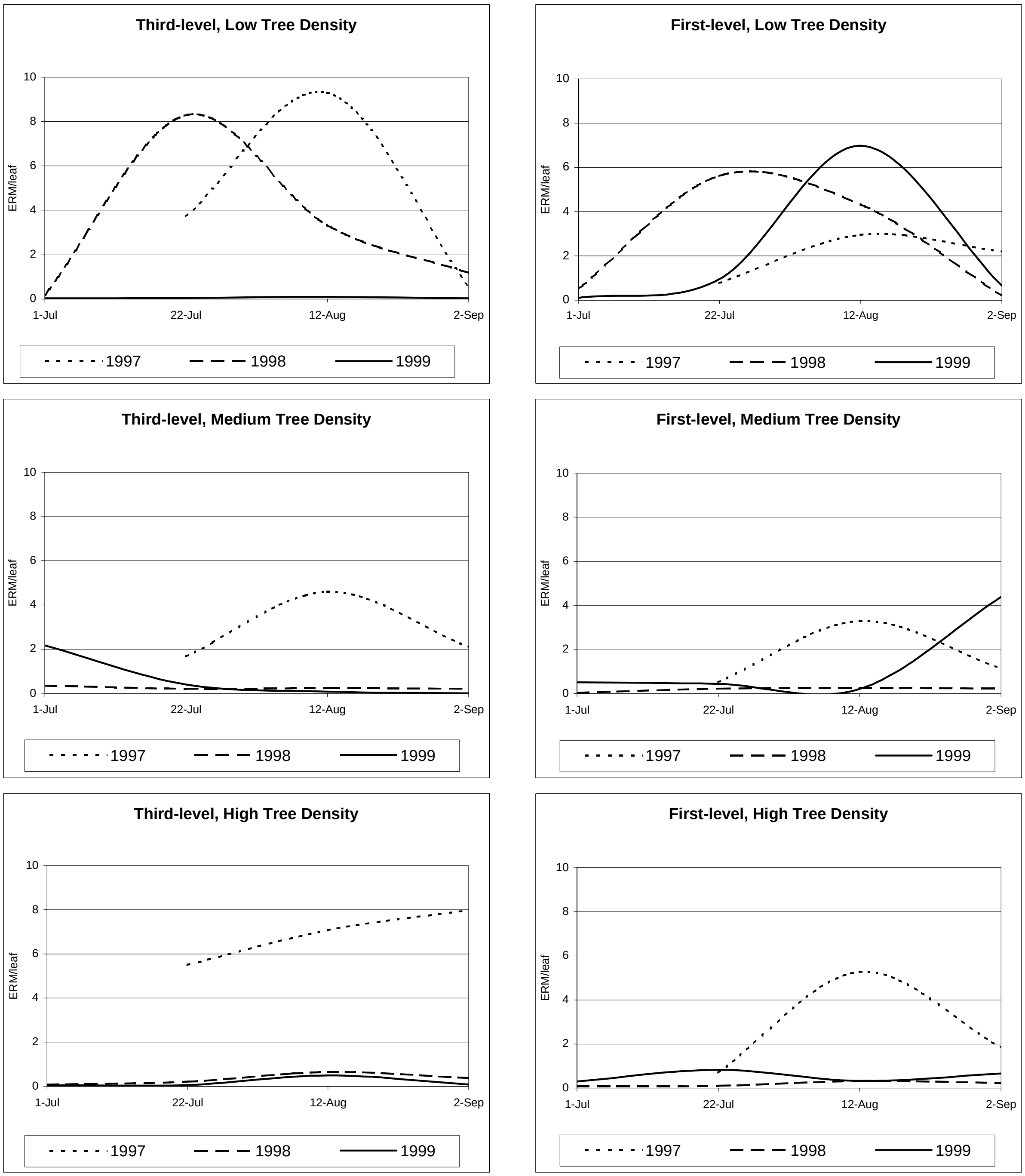

Figure 8. In 1997, 1998, and 1999, abundance to European red mites (ERM) on outer trees of center row of third-level IPM blocks (in which *T. pyri* were released on center trees in mid-May 1997) and outer trees of center row of first-level IPM blocks (in which no releases of *T. pyri* were made).

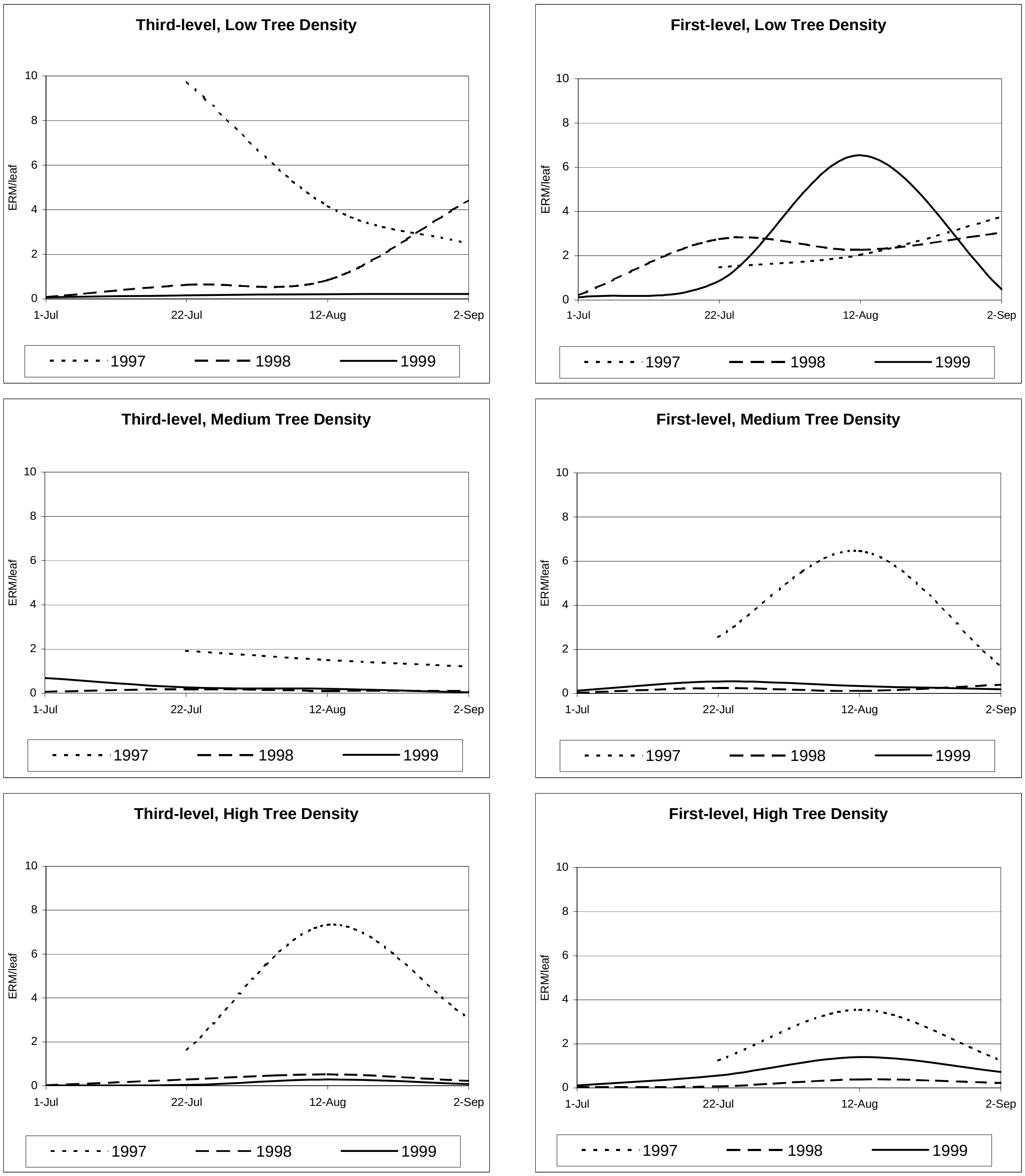

Figure 9. In 1997, 1998, and 1999, abundance to European red mites (ERM) on center trees of outer rows of third-level IPM blocks (in which *T. pyri* were released on center trees in mid-May 1997) and center trees of outer rows of first-level IPM blocks (in which no releases of *T. pyri* were made).

on the trees on which they were released, and this establishment was maintained at about the same level during 1998 and 1999 (Fig. 1). Higher numbers of *T. pyri* during 1997 in medium and high-density tree plots were probably due to the higher abundance of European red mite prey. There was very little spread of *T. pyri* in 1997 to the most distant trees up and down the row in which they were released, some up and down row spread (especially in blocks of small trees) by 1998, and excellent up and down row spread in blocks of all tree sizes by 1999 (Fig. 2). There was no detectable spread whatsoever of *T. pyri* in 1997 to the most distant trees across row from which they were released, very slight across-row spread in 1998 (and only in blocks of small trees), and considerable across-row spread in 1999 (especially in blocks of small trees) (Fig. 3). *T. pyri* were essentially absent in 1997 and 1998 from blocks in which they were not released but were detectable in several such blocks (albeit in very low numbers) by 1999, suggesting some spread of *T. pyri* by 1999 beyond the confines of blocks in which they were released (Figs. 1, 2, 3).

Data on presence of *A. fallacis* mite predators (Figs. 4, 5, 6) show a general trend from 1997 to 1998 and 1999 toward lesser abundance in blocks where *T. pyri* were released, compared with blocks where no *T. pyri* were released. There was no apparent influence of tree size or location of sample site within blocks on abundance of *A. fallacis*.

Data on abundance of European red mites (Figs. 7, 8, 9) show little suppressive effect of *T. pyri* in 1997. In 1998, *T. pyri* strongly suppressed European red mites in the small and medium sized trees into which the predators were released. During the same year there was moderate suppression of European red mites throughout the third-level IPM plots of medium and small trees. By 1999 *T. pyri* strongly suppressed European red mites throughout all the third-level IPM plots.

Conclusions

This 3-year study of movement of released *T. pyri* among trees in blocks of different tree sizes (perhaps the only one of its kind) shows that by the third year after release, *T. pyri* can spread effectively as far as three trees away up and down rows and three trees away across rows, with spread fastest and greatest in blocks of small tree size. Also, by the third year after release, *T. pyri* is able to very effectively suppress pest mites in parts of blocks where it has become firmly established. Our findings argue strongly in favor of releasing *T. pyri* for biocontrol of European red mites in apple orchards and suggest that releases be made no further apart than every sixth tree in high-density plantings or every third tree in low-density plantings for rapid establishment throughout an orchard.

Acknowledgments

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