A Method for 'Hiving' Solitary Bees and Wasps

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Transparent trapnests are stacked in conspicuous colored hive bodies of Langstroth dimensions that stand on platforms on greased poles. This conveniently concentrates woodnesting bees and wasps for regular observation and eventual selection. The method is primarily intended for scientists and educators, but may also suit beekeepers or fruit growers interested in developing new pollination or organic farming services.

1. Introduction Very few species of solitary bees or wasps have been farmed [1,2]. As these beneficial insects amount to very many species, which are adapted to most environments, a few occurring even in the inner cities, this failure leaves an enormous renewable resource untapped ---in a world where underexploited resources are rare. For example, there are about 660 species of solitary bees in Eastern North America, and at least two major obstacles to studying them. (1) A serious difficulty for most people is giving an insect a useful and accurate name. The few experts who classify and identify to the species level have high work loads. Fortunately, it is quite practical to use the *nest architectures* as an interim classification until expert help is really needed ---because the nest construction immediately suggests the subfamily, genus or subgenus. Table 1 shows the nest constructions and names of the bees and wasps that I have trapnested in my area. In midwinter, for example, when I count up the annual yields of grubs (prepupae) for the different species, I can refer to so many 'leaf bee', 'resin bee', or 'resin wasp' grubs without needing to have captured and identified the mother insect in the summer, or alternatively having to wait three weeks to 'force' a sample of the grubs to hatch into adults. (2) A more serious problem is that current methods of collecting these insects are suited to laboratory study, but not to frequent easy observation in the field, because the usual nesting materials (drilled sticks and straws) are opaque and placed in many locations. This inconvenience discourages wider scientific study, education, and public awareness. The present method places many transparent nests in conspicuous hives in a few locations where they can be repeatedly inspected and studied throughout the year. It is hoped that this approach will encourage more people to observe these beneficial insects, and help in the selection of candidate species for innovative methods of mass rearing. Conservation, education

Constructions (+Provisions)	Families	Subfamilies	Genera	Common Names
BEES				
Cellophane	**COLLETIDAE**		*Hyleus*	Masked bees
Felt	**MEGACHILIDAE**		*Anthidium*	Carder bees
Leaf	**MEGACHILIDAE**		*Megachile*	Leafcutter bees
Mastic/Mud	**MEGACHILIDAE**		*Osmia*	Spring orchard bees
Resin	**MEGACHILIDAE**		*Megachile*	
WASPS				
Mud cup+spider	**POMPILIDAE**		*Auplopus*	Spider wasps
Mud+beetle grubs	**VESPIDAE**	Eumeninae	*Symmorphus*	Potter wasps
Mud+caterpillars	**VESPIDAE**	Eumeninae	*Ancistrocerus, Monobia*	Potter wasps
Mud+spiders	**SPHECIDAE**	Trypoxyloninae	*Trypoxylon*	Mud daubers
Resin+aphids	**SPHECIDAE**	Pemphredoninae	*Passoloecus*	Aphid wasps

Table 1: Nest constructions and provisions link to the taxonomy, providing a pragmatic alternative to the Latin names for the beekeeper, fruit grower, educator or naturalist, and an initial working classification for the scientist. Bore width provides an additional classifier.

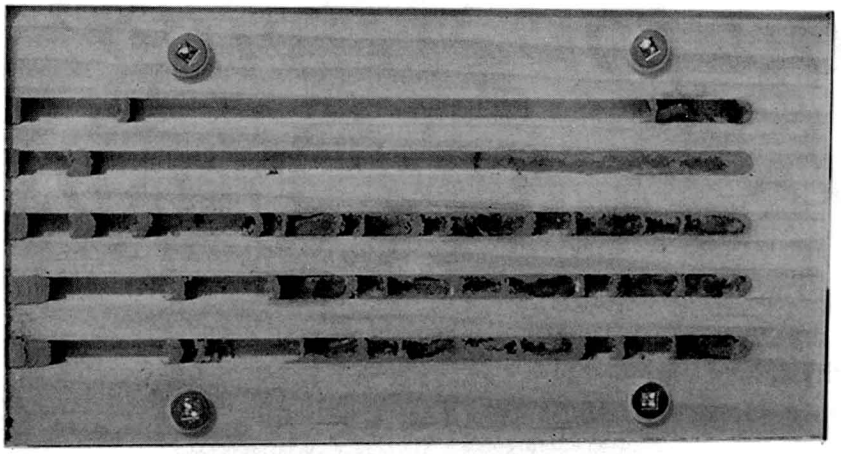

Fig. 1 An observation nest block in mid summer with 3.2 mm bores partitioned into cells by mud walls. Some cells are empty, others contain pale watery Potter Wasp larvae that have just consumed their provisions and not yet hardened for the winter freeze.

and agriculture will then be better served.

Conservation. Global population and land clearance are large and extensive and still rapidly increasing, with 16-23% of Earth's land surface already completely converted for human use [3]. In the North America and European countryside, agricultural and urban expansion stress the populations of natural pollinators, and curtail geographic ranges [4]. Adverse practices include tilling huge areas of land and planting with a single crop, without preserving undisturbed soil and vegetation as hedgerows, sanctuaries or woodlots, and excessive pesticide usage. Within the cities old gardens provide refuges that are not entirely safe from redevelopment, 'weeding' out the wildflowers, tidying away the dead wood (before it has a chance to get nicely lively), planting low nectar-secreting ornamentals, etc. The rapidity and extent of the changes in environment and lifestyle in the last 50 years warn that we may need widespread methods for propagating beneficial insects soon, perhaps within 20 years.

Education. People are increasingly isolated from what is left of 'Nature' by urban work and urban leisure. There is a fear of insects, especially of bees and wasps. Adult solitary bees and wasps only sting if the female is pinched with the fingers or trapped in one's shirt [5]. This docility makes this group ideal for biological education, and for displays promoting beekeeping, fruit growing and integrated pest management.

Farming and apiculture. Honey bees are good pollinators, available in mass, with valued products. But beekeepers are narrowly focused on costs, efficiency and honey ---when managing a clients' beneficial insects offers the possibility of supplementary revenue [6]. It is certainly possible that the demand for honey bee pollination services may soon outstrip supply, but orchards in richly diverse countryside nearly always do well. In principle, beekeepers (or for that matter fruit growers, market gardeners or landscape services) with a modest knowledge of beneficial insects could charge fees for advice and maintenance of trapnests in favorable natural areas. The beekeepers would not forego honey, as honey bees out-compete other bees [4]. Of course, this rather implies that beekeepers' and fruit growers' groups will be prepared to promote the idea of a connected wide-ranging network of refuges for native pollinators.[4]

Extant methods. The great majority of solitary bees and wasps nest in the ground and, apart from the Alkali Bee *Nomia*, there are no methods for getting them to nest where desired [1,2]. Fortunately, some species nest in wood. Trapnesting exploits the tendency of female wood-nesting bees and wasps to partition artificial tunnels by a series of transverse walls into a linear series of *cells*, within which they store food and lay eggs, just as they do in beetle burrows or similar cavities. Trapnests are really more handling tools than traps because the females are free to come and go, as are the offspring when they mature. The sequence of cells in a tunnel or *bore* are separated by transverse walls constructed by the mother insect from a wide variety of family-specific or genus group-specific materials, such as mud, resin, secreted cellophane, felt (made from plant hairs), leafcuttings, masticated leaves (mastic), wood chippings, sand, gravel, etc (Table 1). Krombein's rather dry book is the classic summary of a large body of work using drilled sticks that are then split and taped together again [7]. Targetting infested roofs, bushes or trees with many small bundles of sticks, or drilled blocks fitted with paper straws, can be very effective and a lot of fun. But the approach is inherently labor intensive and, as observation and inspection are difficult, the nests are usually taken back to the laboratory for dissection, observation and sacrifice.

2. The new method[8] Features of my method echo Krombein, Western Canadian

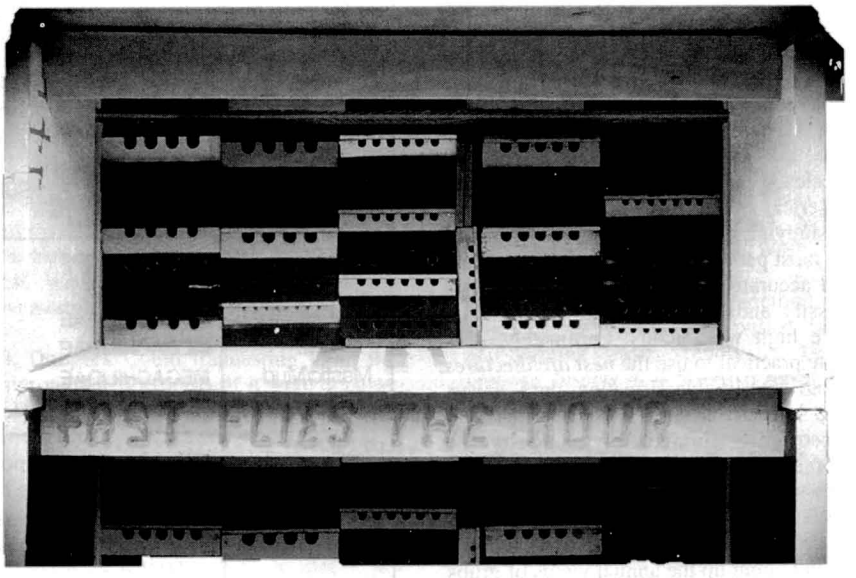

Fig. 2 The entrances, or atria, of a pair of hives to show the painted fronts of the nest blocks. The top hive is fully shown and it can be seen that there is little space left for bats. Both hives sport removable notched crossbars introduced in 1998 to solve problems that proved imaginary (as hives have never warped or toppled). The lower bar carries a motto ("Fast flies the hour").