Design and test of a single-pulse, single-polarization harmonic radar for the tracking of the Asian yellow-legged hornet and future developments

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The yellow-legged Asian hornet is an invasive species of "Vespa", indigenous of the South-East Asia but recently spreading in Southern Europe. Because of its exponential diffusion and its serious threat to the local honey bee colonies
(and to humans as well), restraint measures are currently under investigation. We developed and tested an harmonic radar capable of tracking the flying trajectory of these insects, once equipped with a small transponder, in their natural environment. Several hornets were captured close to a small cluster of honey bee hives, tagged with different transponders and then released in order to follow the flight towards their nest. On field testing proved an initial maximum detection range of about 125 m in a hilly and woody area. A number of detections were clearly recorded and preferential directions of flight were identified. The system herein described is intended as a first low-cost harmonic radar; it proved the capability to track the hornets while flying and it permitted to test the tagging techniques. The designed system has three major advantages over 23 conventional harmonic radars. Firstly and most importantly, it adopts advanced processing techniques to suppress clutter and to improve target detection. Secondly, it allows radar operations in complex environments, generally hilly and rich of vegetation. Finally, it can continuously track tagged insects (24/7) and in any meteorological condition, providing an effective tool in order to locate the nests of the yellow-legged Asian hornet. To improve the detection and the range of operation of the harmonic radar, several upgrades have been identified during this work and are under development.

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PROGRAM & ABSTRACTS