The repellent activity of the essential oil of the catmint plant, *Nepeta cataria* (Lamiaceae), and the main iridoid compounds (4a*S*,7*S*,7a*R*) and (4a*S*,7*S*,7a*S*)-nepetalactone, was assessed against (i) major Afro-tropical pathogen vector mosquitoes, i.e. the malaria mosquito, *Anopheles gambiae* s.s. and the Southern house mosquito, *Culex quinquefasciatus*, using a World Health Organisation (WHO)-approved topical application bioassay (ii) the brown ear tick, *Rhipicephalus appendiculatus*, using a climbing repellency assay, and (iii) the red poultry mite, *Dermanyssus gallinae*, using field trapping experiments. Gas chromatography (GC) and coupled GC–mass spectrometry (GC–MS) analysis of two *N. cataria* chemotypes (A and B) used in the repellency assays showed that (4a*S*,7*S*,7a*R*) and (4a*S*,7*S*,7a*S*)-nepetalactone were present in different proportions, with one of the oils (from chemotype A) being dominated by the (4a*S*,7*S*,7a*R*) isomer (91.95% by GC), and the other oil (from chemotype B) containing the two (4a*S*,7*S*,7a*R*) and (4a*S*,7*S*,7a*S*) isomers in 16.98% and 69.83% (by GC), respectively. The sesquiterpene hydrocarbon (*E*)-(1*R*,9*S*)-caryophyllene was identified as the only other major component in the oils (8.05% and 13.19% by GC, respectively). Using the topical application bioassay, the oils showed high repellent activity (chemotype A RD_{50} = 0.081 mg cm^{-2} and chemotype B RD_{50} = 0.091 mg cm^{-2}) for *An. gambiae* comparable with the synthetic repellent DEET (RD_{50} = 0.12 mg cm^{-2}), whilst for *Cx. quinquefasciatus*, lower repellent activity was recorded (chemotype A RD_{50} = 0.34 mg cm^{-2} and chemotype B RD_{50} = 0.074 mg cm^{-2}). Further repellency testing against *An. gambiae* using the purified (4a*S*,7*S*,7a*R*) and (4a*S*,7*S*,7a*S*)-nepetalactone isomers revealed overall lower repellent activity, compared to the chemotype A and B oils. Testing of binary mixtures of the (4a*S*,7*S*,7a*R*) and (4a*S*,7*S*,7a*S*) isomers across a range of ratios, but all at the same overall dose (0.1 mg), revealed not only a synergistic effect between the two, but also a surprising ratio-dependent effect, with lower activity for the pure isomers and equivalent or near-equivalent mixtures, but higher activity for non-equivalent ratios. Furthermore, a binary mixture of (4a*S*,7*S*,7a*R*) and (4a*S*,7*S*,7a*S*) isomers, in a ratio equivalent to that found in chemotype B oil, was less repellent than the oil itself, when tested at two doses equivalent to 0.1 and 0.01 mg chemotype B oil. The three-component blend including (*E*)-(1*R*,9*S*)-caryophyllene at the level found in chemotype B oil had the same activity as chemotype B oil. In a tick climbing repellency assay using *R. appendiculatus*, the oils showed high repellent activity comparable with data for other repellent essential oils (chemotype A RD_{50} = 0.005 mg and chemotype B RD_{50} = 0.0012 mg). In field trapping assays with *D. gallinae*, addition of the chemotype A and B oils, and a combination of the two, to traps pre-conditioned with *D. gallinae*, all resulted in a significant reduction of *D. gallinae* trap capture. In summary, these data suggest that although the nepetalactone isomers have the potential to be used in human and livestock protection against major pathogen vectors, intact, i.e. unfractionated, *Nepeta* spp. oils offer potentially greater protection, due to the presence of both nepetalactone isomers and other components such as (*E*)-(1*R*,9*S*)-caryophyllene.