INSECTICIDES (incl. Fungicides, Herbicides, Nematicides, Larvicides, etc.)

NPARR 2(2), 2011-202, **Repellent activity of catmint, *Nepeta cataria*, and iridoid nepetalactone isomers against Afro-tropical mosquitoes, ixodid ticks and red poultry mites**

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. [Michael A. Birkett*, Ahmed Hassanali, Solveig Hoglund, Jan Pettersson and John A. Pickett (Biological Chemistry Department, Rothamsted Research, Harpenden, Hertfordshire AL5 2JQ, UK), *Phytochemistry,* 2011, 72(1), 109-114].

NPARR 2(2), 2011-203, **Antifeedant and larvicidal activities of Rhein isolated from the flowers of *Cassia fistula* L.**

Antifeedant and larvicidal activities of rhein (1, 8-dihydroxyanthraquinone-3-carboxylic acid) isolated from the ethyl acetate extract of *Cassia fistula* flower were studied against lepidopteron pests *Spodoptera litura* and *Helicoverpa armigera*. Significant antifeedant activity was observed against *H. armigera* (76.13%) at 1000 ppm concentration. Rhein exhibited larvicidal activity against *H. armigera* (67.5), *S. litura* (36.25%) and the LC_{50} values was 606.50 ppm for *H. armigera* and 1192.55 ppm for *S. litura*. The survived

larvae produced malformed adults [V. Duraipandiyan, S. Ignacimuthu*and M. Gabriel Paulraj (Entomology Research Institute, Loyola College, Nungambakkam, Chennai 600034, India), *Saudi Journal of Biological Sciences*, 2011, 18(2), 129-133].

NPARR 2(2), 2011-204, **Gaseous emissions from soil biodisinfestation by animal manure on a greenhouse pepper crop**

Soil solarisation together with the application of animal manure has been described as an alternative process for control of *Phytophthora capsici* root rot in pepper crops. A mixture of fresh sheep manure and dry chicken litter (SCM) and a semi-composted mixture of horse manure and chicken litter (HCM) were applied at 5.1 kg m^{-2} (dry weight) under plastic sheets to reduce *Phytophthora* inoculum survival rate and disease incidence. Non-solarised (C) and solarised (S) soils were used as control treatments. Mean NH_3 concentration increased in SCM during biodisinfestation process (14.8 mg NH_3 m^{-3}) compared with HCM (9.1 mg NH_3 m^{-3}), accounted for the higher organic N content and potential N mineralisation. The higher NH_3 concentration in SCM could have contributed to reduce the inoculum survival rate (30.6% and 75.0% in SCM and HCM plots, respectively). Inoculum survival rate was not reduced in S (94.4%) as temperature was below 33 °C throughout the experimental period. After biodisinfestation treatment, N_2O and CO_2 emissions tended to be higher in SCM, despite high spatial variability. Cumulative N_2O emissions were 1.31 and 0.42 g N_2O-N m^{-2} in SCM and HCM after 43 days. The larger N application and organic N mineralisation rate on fresh manure amended soils might have contributed to higher N_2O emissions during and after soil biodisinfestation by denitrification and nitrification, respectively. Cumulative CO_2 emission averaged 211.0 and 159.9 g CO_2-C m^{-2} in SCM and HCM, respectively. The soluble organic C, more abundant in fresh manure, might have favoured soil respiration in SCM. Disease incidence decreased in SCM and HCM plots (disease incidence, 2%–8%) in relation to solarised soils (42%) after 4 months. Microbial suppressiveness might have contributed to minimise *Phytophthora* disease incidence in SCM and HCM plots. Pepper fruit yield increased with manure amendment in SCM and HCM, which averaged 4.6 and 4.3 kg m^{-2}, respectively. Further research will be necessary to guarantee an effective *Phytophthora* biodisinfestation by fitting manure N and organic matter applications, improving crop yield and reducing greenhouse gas pollution [H. Arriaga*, M. Núñez-Zofio, S. Larregla and P. Merino (NEIKER-Tecnalia, Dept. Ecotechnologies, Basque Institute for Agricultural Research and Development, 48160 Derio, Bizkaia, Spain), *Crop Protection*, 2011, 30(4), 412-419].

NPARR 2(2), 2011-205, **Use of farming and agro-industrial wastes as versatile barriers in reducing pesticide leaching through soil columns**

Increased interest has been recently focused on assessing the influence of the addition of organic wastes related to movement of pesticides in soils of low organic matter (OM) content. This study reports the effect of two different amendments, animal manure (composted sheep manure) and agro-industrial waste (spent coffee grounds) on the mobility of 10 pesticides commonly used for pepper protection on a clay-loam soil (OM = 0.22%). The tested compounds were azoxystrobin, cyprodinil, fludioxonil, hexaconazole, kresoxim-methyl, pyrimethanil, tebuconazole, and triadimenol (fungicides), pirimicarb (insecticide), and propyzamide (herbicide). Breakthrough curves were obtained from disturbed soil columns. Cumulative curves obtained from unamended soil show a leaching of all pesticides although in different proportions (12–65% of the total mass of compound applied), showing triadimenol and pirimicarb the higher leachability. Significant correlation ($r = 0.93$, $p < 0.01$) was found between the observed and bibliographical values of GUS index. The addition of the amendments used drastically reduced the movement of the studied pesticides. Only two pesticides were found in leachates from amended soils, pyrimethanil (<1%) for both, and pirimicarb (44%) in the soil amended with spent coffee grounds. A decrease in pesticide leaching was observed with the increase in dissolved organic matter (DOM) of leachates. The results obtained point to the interest in the use of organic wastes in reducing the pollution of groundwater by pesticide drainage [J. Fenoll, E. Ruiz, P. Flores, N. Vela, P. Hellín and S. Navarro*(Departamento de Química Agrícola, Geología y Edafología, Facultad de Química, Universidad de Murcia, Campus Universitario de Espinardo, 30100 Murcia, Spain), *Journal of Hazardous Materials,* Volume 187, Issues 1-3, 15 March 2011, Pages 206-212.