Including the square root of mean annual rainfall as the 15th discriminant variable improves the performance of the discriminant function compared to the exclusively morphological approach: 92.4 % of the determinations had *a-posteriori*-probabilities of p > 0.95, and the LOOCV test probabilities of the holotypes of *C. atalanta* and *C. nuda* were 0.998 and 1.000, respectively.

Habitat selection

Clear differences between *C. atalanta* and *C. nuda* regarding the macroclimatic zonation were determined above, but the sparse information provided by the labels and the documentation of collections do not allow a differentiation of habitat selection. Both species seem to occur along a wide gradient from natural to urban habitats, in fully open as well as in woodland sites. *Cardiocondyla nuda* was reported from a coastal dune, coastal grasslands, a pasture, human settlements, moist soils along river and lake sites, *Eucalyptus* savannah and true rain forest. *Cardiocondyla atalanta* was found in *Eucalyptus* and *Acacia-Eucalyptus* savannah, in open grassland, parkland and road sides in cities. It remains unclear whether this species really avoids inner parts of intact rain forest. Its occurrence on two coral sea island sites (Chilcott Island group, leg. H. Heatwole), about 370 km away from the Australian continent, seems exceptional and raises questions. Zoogeographic considerations would decidedly point to *C. nuda*, but all six investigated workers are clearly determined as *C. atalanta* with *a-posteriori*-probabilities of 0.995, 0.998, 0.999, 0.999, 0.999, and 1.000. Passive aerial transport of mated flying gynes from the continent in eastern directions and over such a long distance seems rather unlikely because the main wind directions in east Australia are southeast to northeast. If this case does not represent an error by confusion of locality labels (probably not), I assume a human introduction with soil material from Australia.

Diagnostic characters of *C. atalanta* and simpler approaches to determination

Complex NUMOBAT systems such as those presented above are powerful solutions to difficult identification problems and are indispensable for fundamental taxonomic research that aims to recognise true biodiversity. Practitioners such as ecologists, however, who are confronted with very large sample numbers and a wealth of species belonging to very different genera, can hardly use such methods.

Is a simpler method for recognising *C. atalanta* available? A search for subjectively perceptible characters failed in practice. A researcher could have the superficial impression that *C. atalanta* has a weaker sculpture, a lighter colour, a smaller propodeal lobe and the postpetiole in dorsal view with a less concave anterior margin and more rounded sides, but the intraspecific variability is so large that these characters are almost invalid discriminators. Moreover, the differential characters CL/CW, PEW/CS and SP/CS, proposed by SEIFERT (2003) based on only two available *C. atalanta* workers, only weakly contribute to species discrimination, as the current investigation of much larger material showed.

Table 2 compares morphometric data of both species. Both the correlation with the canonical vector and the significance level in a t-test on independent samples indicate PLG/CS, sqPDG, SL/CS and PoOc/CL to be the best discriminators. Gastral pubescence length, scape length and postocular distance are significantly smaller in *C. atalanta* while gastral pubescence density is larger than in *C. nuda*. However, character overlap is considerable. For the most discriminative characters, the following percentage of specimens is found outside the overlap range: PLG/CS 87.9 %, sqPDG 43.9 %, SL/CS 6.8 %, PoOC/CL 14.4 %.

Tab. 2: Morphometric data of worker individuals of *Cardiocondyla nuda* and *C. atalanta* given as arithmetic mean ± standard deviation [minimum, maximum], their correlation with the canonical discriminant vector and their t-value and significance level in a t-test of independent samples. Data are arranged with falling discriminatory power.

	C. nuda **(n = 84)**	***C. atalanta*** **(n = 48)**	**canonical correlation**	**t-value** **p**
PLG/CS [%]	6.24 ± 0.41 [5.48, 7.31]	5.07 ± 0.39 [4.34, 5.71]	0.707	16.106 0.000
sqPDG	3.75 ± 0.21 [3.30, 4.33]	4.26 ± 0.27 [3.73, 4.81]	-0.541	12.336 0.000
SL/CS	0.796 ± 0.021 [0.757 ,0.839]	0.776 ± 0.019 [0.745 ,0.829]	0.239	5.404 0.000
PoOc/CL	0.470 ± 0.009 [0.453, 0.498]	0.463 ± 0.006 [0.452, 0.477]	0.219	4.996 0.000
dFOV	15.9 ± 1.0 [13.1, 18.0]	15.2 ± 1.2 [13.2, 17.7]	0.163	3.718 0.000
PEW/CS	0.288 ± 0.013 [0.254, 0.321]	0.295 ± 0.016 [0.259, 0.338]	-0.123	2.797 0.006
PPW/CS	0.512 ± 0.023 [0.474, 0.564]	0.521 ± 0.017 [0.471, 0.560]	-0.106	2.415 0.017
CS	461 ± 22 [422, 526]	471 ± 28 [413, 549]	-0.099	2.268 0.025
CL/CW	1.220 ± 0.022 [1.170, 1.307]	1.212 ± 0.021 [1.157, 1.256]	0.082	1.872 0.063
SP/CS	0.123 ± 0.014 [0.095, 0.157]	0.119 ± 0.010 [0.096, 0.142]	0.068	1.709 0.090
EYE	0.232 ± 0.006 [0.221, 0.247]	0.233 ± 0.006 [0.223, 0.246]	-0.056	1.285 0.201
PPH/CS	0.352 ± 0.019 [0.315, 0.395]	0.353 ± 0.014 [0.329 ,0.380]	-0.009	0.210 0.834
MGr/CS [%]	1.32 ± 0.46 [0.2, 2.6]	1.34 ± 0.58 [0.2, 2.9]	-0.006	0.141 0.888
PEH/CS	0.351 ± 0.016 [0.321, 0.390]	0.350 ± 0.016 [0.322, 0.388]	0.005	0.123 0.903

PLG offers the best approach to a rather simple species recognition. I recommend collecting nest samples and then carefully measuring mean PLG in three workers. Not considering geographic variability, a random combination of the 48 *C. atalanta* and 84 *C. nuda* workers to hypothetic homospecific nest samples of three workers yielded a full separation in 1804 samples:

C. atalanta: PLG 23.82 ± 0.83 [21.6, 25.7] µm (n = 656)
C. nuda: PLG 28.77 ± 1.17 [25.9, 32.1] µm (n = 1148).

Random combination of two workers to hypothetic nest samples predicts 6.9 % of the samples to be within the interspecific overlap range, while this ratio increases to 18.2 % in individual workers.