

Analysis of illicit Heroin with HPLC -DAD

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Aims

During 2003, 2004, and 2005, a total of 650 illicit heroin samples were quantitatively analyzed (Heroin range 0.7 – 69 % free base) in our special testing laboratory. In order to establish a database for chemical profiling and sample comparison, the content of heroin, 6-acetylmorphine, acetylcodeine, noscapine, papaverine, paracetamol and caffeine were determined

Background

Opium cultivation in Afghanistan has hit record levels -- up by more than 40 percent from 2005 -- despite hundreds of millions in counternarcotics money. A Western anti-narcotics official in Kabul said about 150,000 hectares of opium poppy was cultivated this growing season -- up from 104,000 hectares in 2005 -- citing their preliminary crop projections. The previous highest recorded figure was 131,000 hectares in 2004, according to the U.N. Office on Drugs and Crime [1]. Opium cultivation has surged since the ouster of the Taliban in late 2001. The former regime enforced an effective ban on poppy growing by threatening to jail farmers -- virtually eradicating the crop in 2000, see Fig 1 [2]. The Heroin seized on the illicit Swiss drug market derives mainly from opium produced in Afghanistan (SWA Heroin).

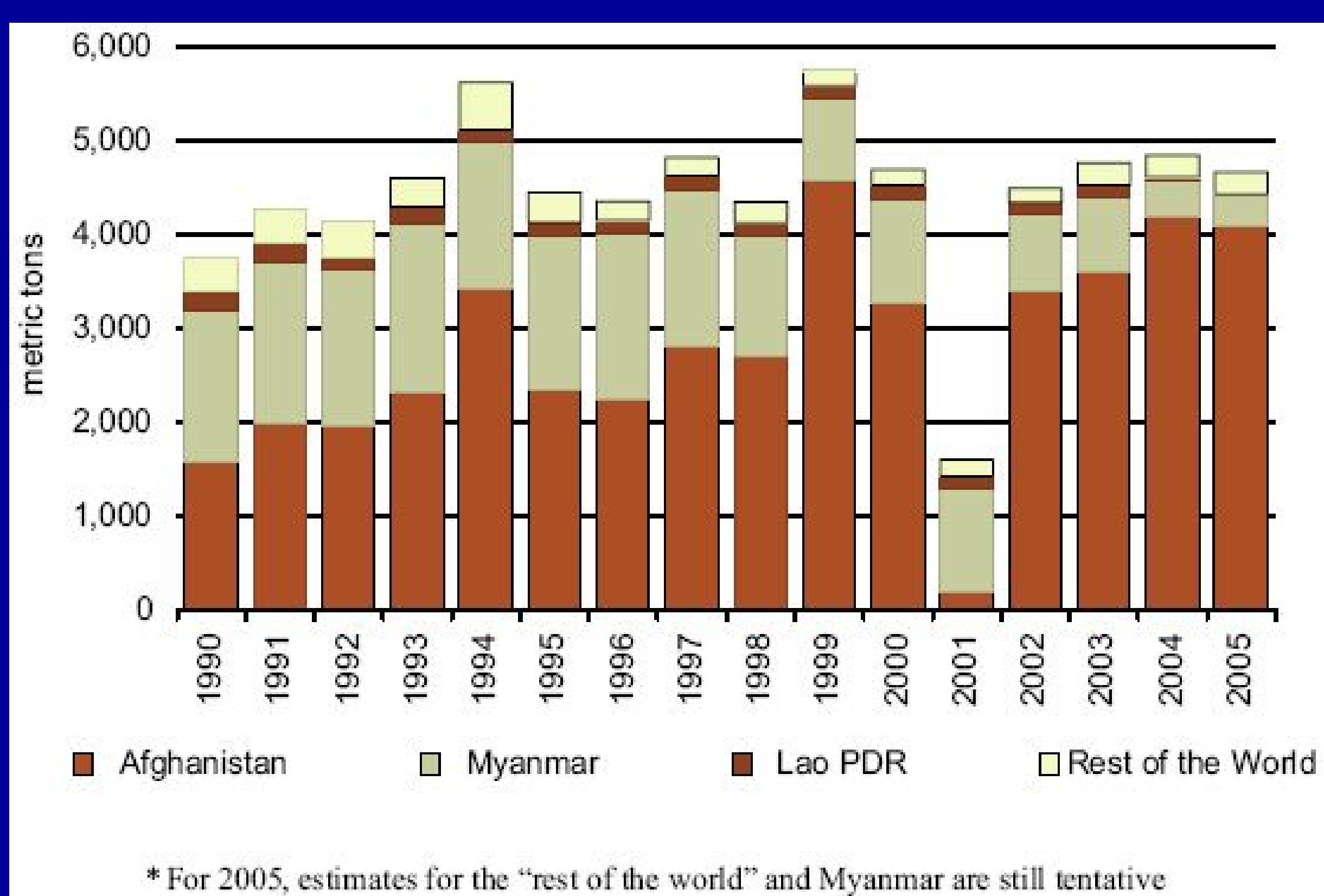
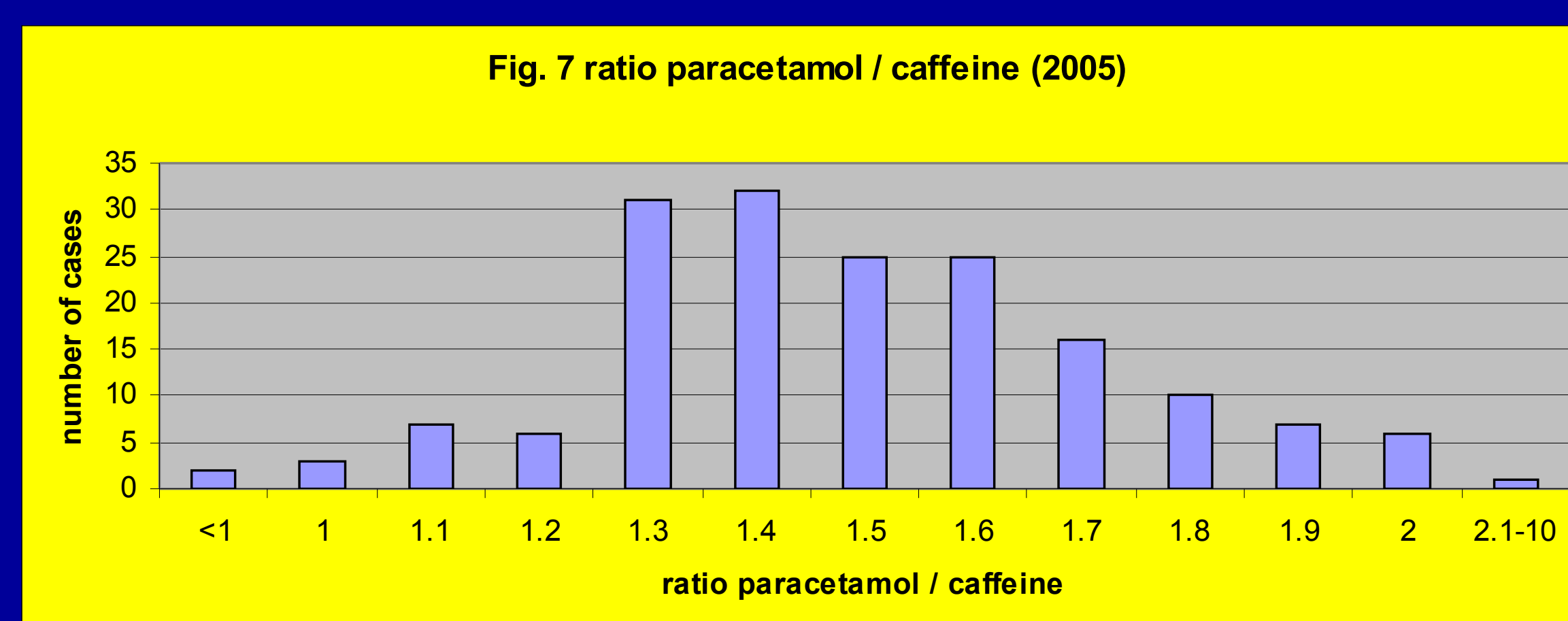
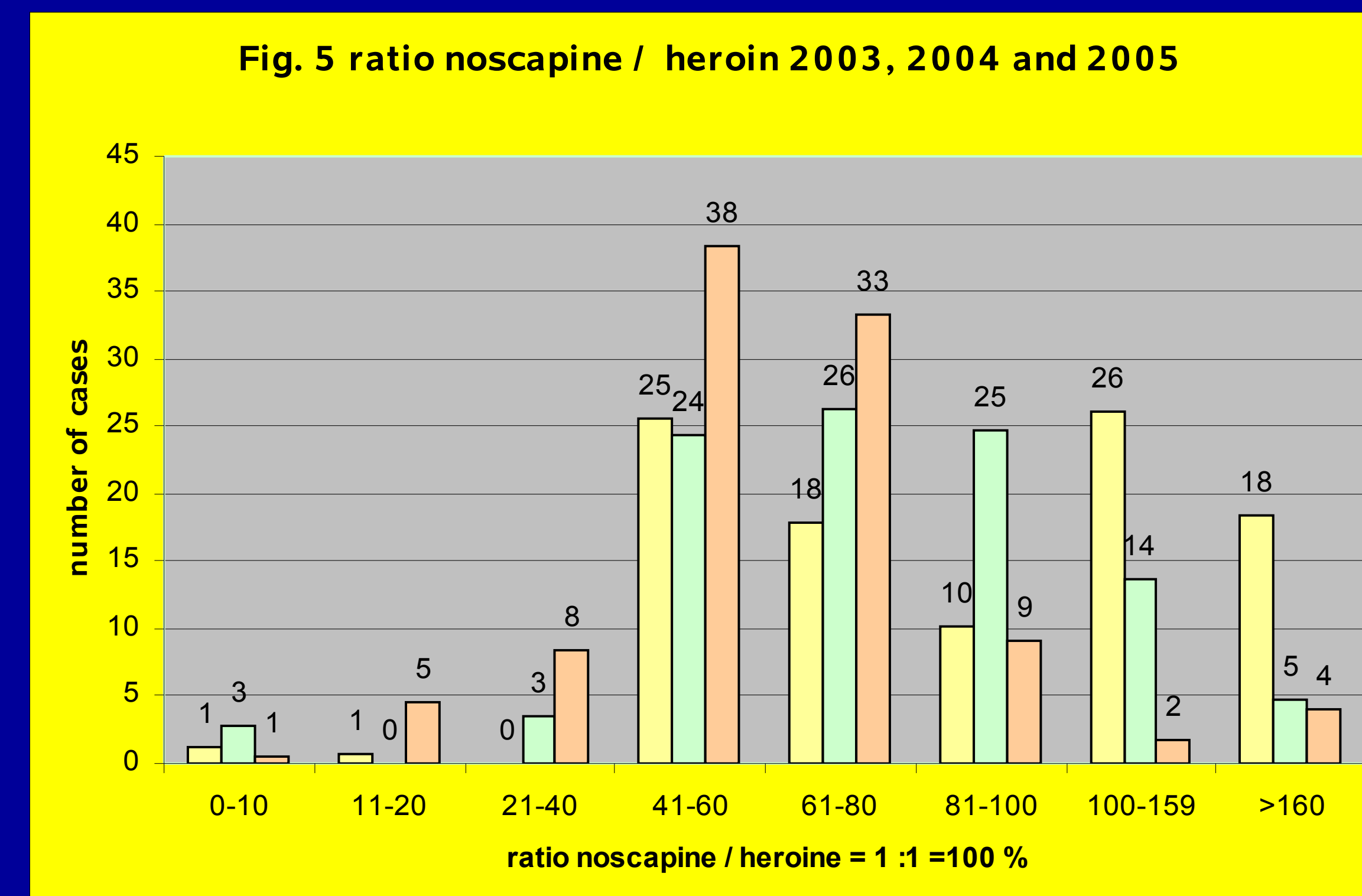


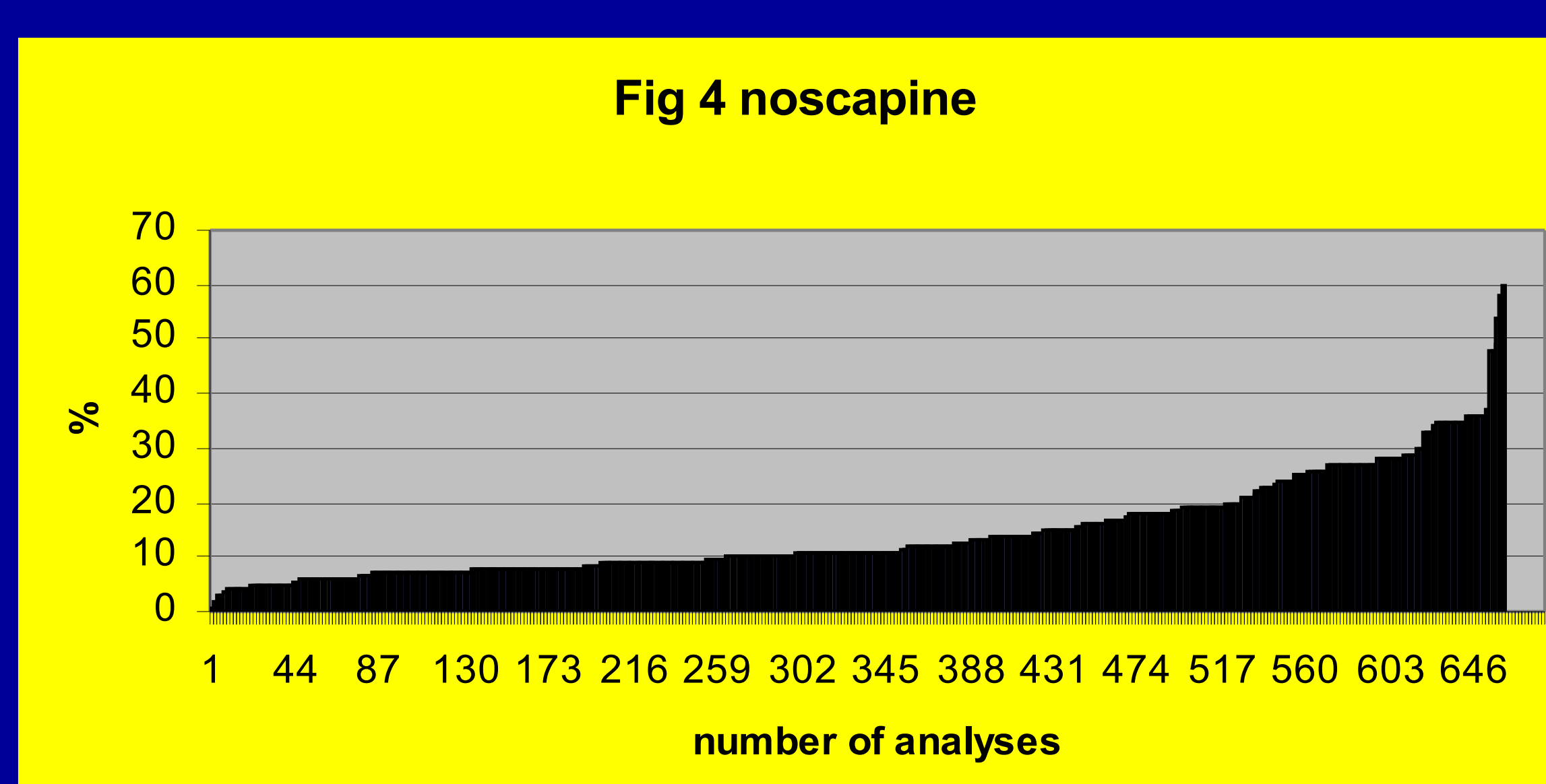
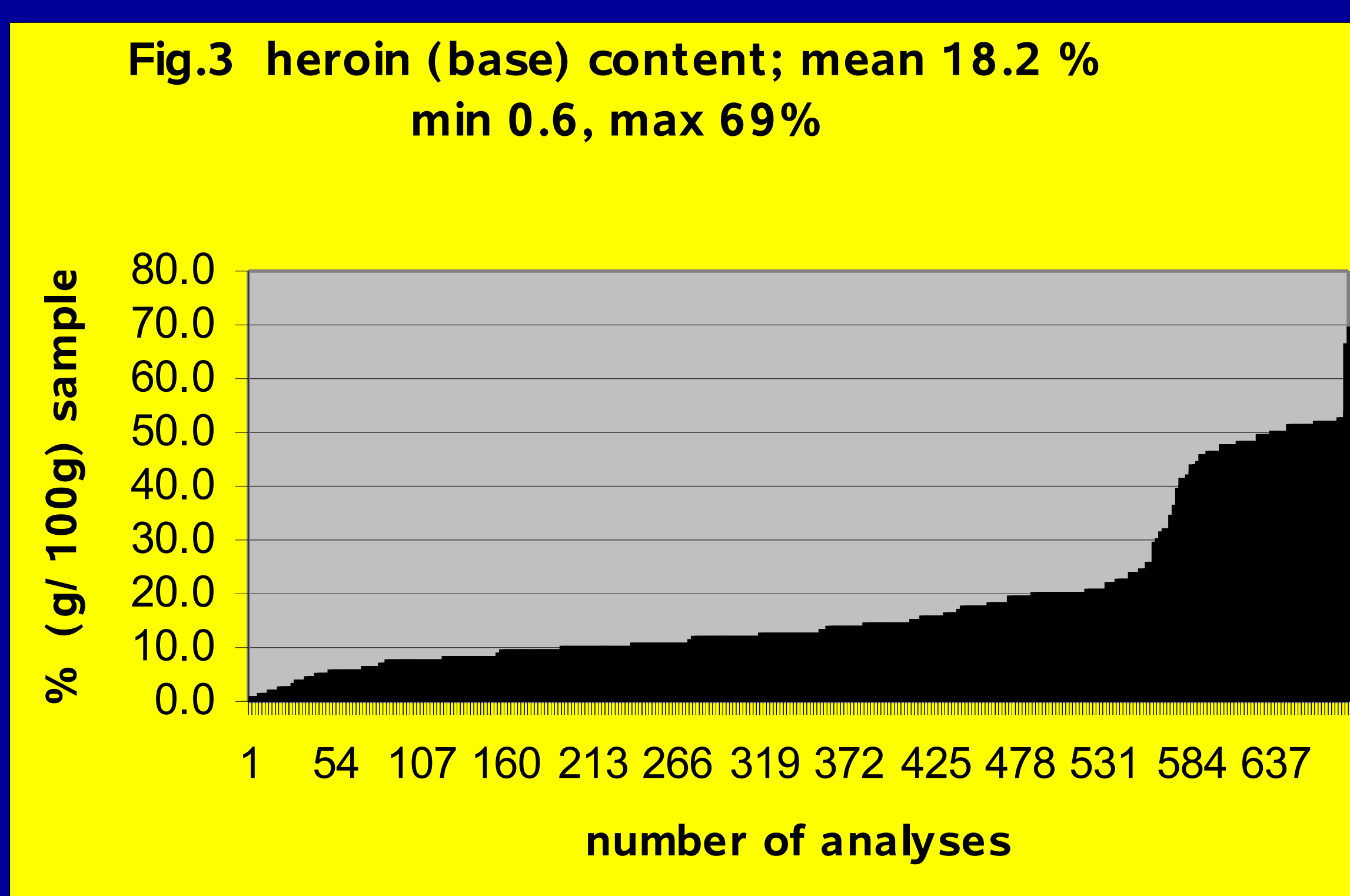
Fig. 1 Global opium production 1990 – 2005 (metric tons) [2]



Results

Table 2 Results	SWA]
Found contents of alkaloids in samples analyzed in Bern, years 2003, 2004, 2005	
heroin free base	0.7 – 69.2 % mean 18.2 %
6-acetyl-morphine	0 – 18.6 % mean 1.7 %
noscapine	0 - 60 % mean 14.1
acetyl-codeine	0 - 6 % mean 1.5 %
papaverine	0 – 19.5 % mean 1.4 %

Results of heroin analyses 2003, 2004 and 2005 free base (Fig. 3). Results of noscapine analyses 2003, 2004, 2005, mean 14 %; min. 0; max. 60 % (Fig. 4) .



heroin	SWA [3]	SWA[4]	SWA [6]	SOA [4]	SOA [5]	SA [6]	Mex [6,7]
heroin	60 %	70–78 %	40-60 %	80-83 %	55-76 %	> 90 %	30-60 %
6-acetyl-morphine	3 %	2-9 %	5-9 %	1-2 %	0.2-0.5 %	< 5 %	0-19 %
noscapine	10 %	0.5-10 %	20-30 %	-	0 - 0.9 %	0.5 %	1-4 %
acetyl-codeine	5 %	3.5-6 %	5-9 %	5-7 %	8-27 %	< 3 %	1-6 %
papaverine	4 %	0.2-2 %	2-6 %	-	-	0.5 %	0.5-3 %

Table 1 Typical contents of alkaloids according the references

Material and Methods

In order to analyze 650 cases the total number of 788 chemical analyses were performed (Fig. 2).

All illicit drug samples were subjected to screening analysis by ion mobility spectrometry (IMS). Confirmation analyses were performed by gas chromatography-mass spectrometry (GC-MS). The quantitative results presented in this work were obtained by high performance liquid chromatography with diode array detection (HPLC-DAD)

Sample weight for analysis: 80mg powder

Solvent: 20 mL methanol

HPLC-DAD: Waters 2695 Separations Module / 2996 PAD

Injection volume: 10 µL and 5 µL; Column: Xterra RP8 5µm

Calibration range heroin: 1 – 25 % (linear, r > 0.995)

Mobile phase A: 1000 mL ultra pure water + 400 µL saturated ammoniumcarbonate solution, B: acetonitril, C: ultra pure water

Gradient: start 50 % A + 50 % C

14.4 min. 70 % A + 30 % B

12.0 min. 50 % A + 50 % B

16.0 min. 50 % A + 50 % C

Retention times: 4.1 min. paracetamol, 4.4 min. caffeine,

7.5 min. acetyl-morphine, 10.4 min. heroin,

11.2 min. acetyl-codeine, 13.1 min. papaverine,

16.4 min. noscapine

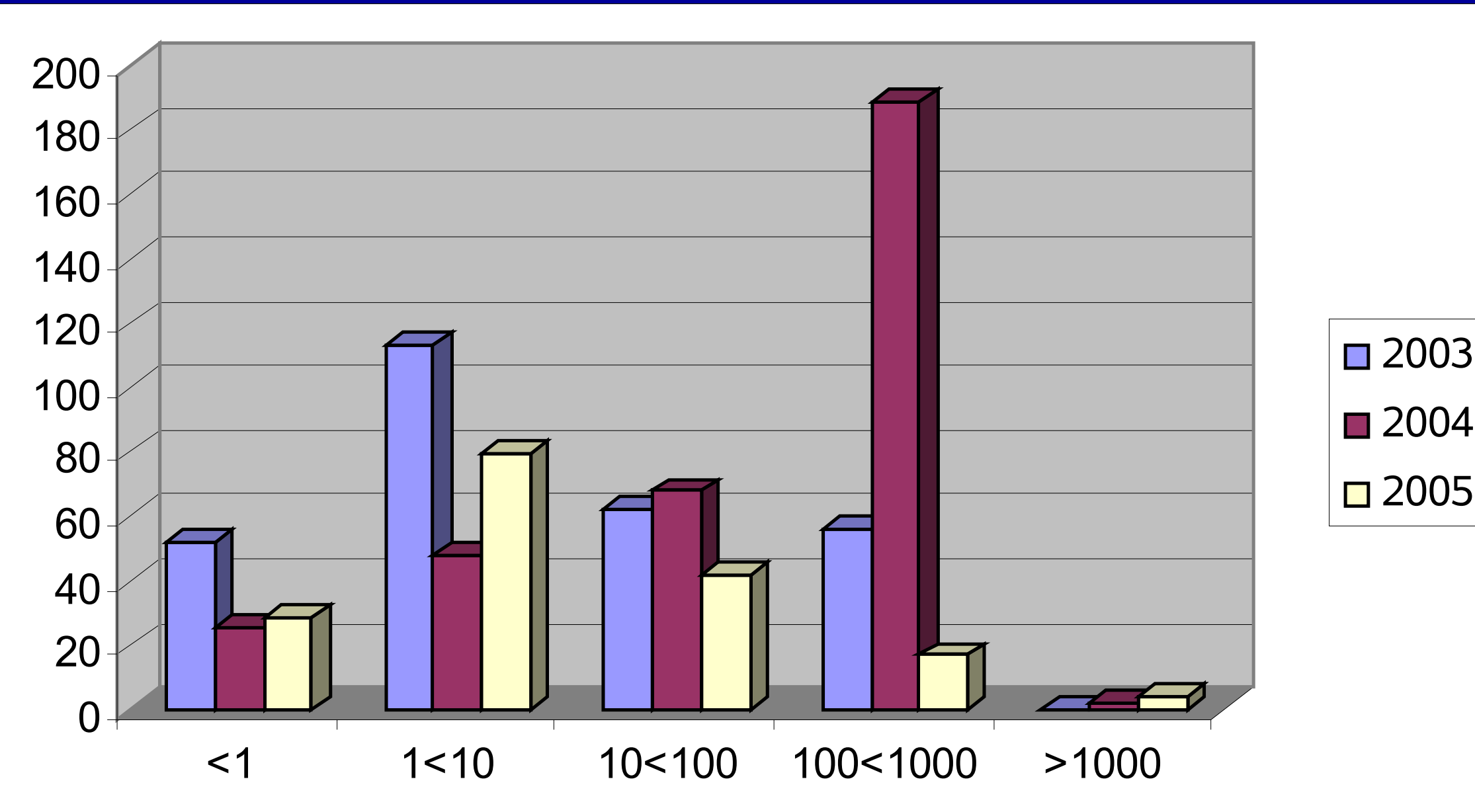


Fig. 2 y-axis: Number of analyses during 2003 (283), 2004 (333), and 2005 (172); x-axis: weight of the packages in gram

Discussion

- ✓ The composition of the heroin remains the same before and after the war. This indicates that the manufacture procedure remains the same as before the war.
- ✓ The analyzed heroin samples contain paracetamol and caffeine most often in a ratio between 1.3 and 1.7. Most of the samples contain noscapine as adulterant.
- ✓ The results of Klemenc [8] are confirmed by our work.

Conclusion

The noscapine is added to the heroin at the source of production.
For interpretation of profiling analyses noscapine must be considered as an adulterant.

References

- [1] Opium hits record in Afghanistan, CNN.com, August 16, 2006 <http://www.cnn.com/2006/WORLD/asiapcf/08/16/afghanistan.opium/index.html> [2]
- [2] Afghanistan Opium Survey 2005, UNODC (Vienna) http://www.unodc.org/unodc/en/crop_monitoring.html
- [3] Recommended methods for testing heroin, United Nations, NY 1986
- [4] Abschlussbericht der Projektgruppe "Erkennungsdienst Heroin", Wiesbaden, 30. Oktober 1981
- [5] M. Collins, E. Casale, D. Brynn Hibbert, S. Panicker, J. Robertson and S. Vujic, J. Forensic Sci, 51(3), 597-602 (2006)
- [6] Recommended methods for testing opium, morphine and heroin, United Nations, NY 1998
- [7] Microgram Bulletin, Vol. XXXVIII, No. 5, May 2005, p. 76, DEA, Washington DC
- [8] S. Klemenc, Noscapine as an adulterant in illicit heroin samples, Forensic Science International, 108(1), 45-49 (2000)

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