Table 3. Final size (cm) of yews by study area, repellent treatment, and weight of needles (g) at the Dawson study area. See text for description of protection index.

	Final size (cm)				Needles (g)		Protection index (%)
	Windsor		Dawson		Dawson		
Control	29	a	25	a	14	a	49
Repellex	31	a	23	a	25	a	50
Deer Solution	33	a	23	a	23	a	52
Coyote urine	31	a	25	a	31	a	53
Plantskydd	33	a	23	a	81	ab	60
Deer-Off	35	a	28	ab	74	ab	65
Big Game	31	a	31	ab	140	bc	72
Chew-Not	33	a	29	ab	151	bcd	74
Liquid Fence	34	a	31	ab	164	cd	78
Hinder	36	a	35	bc	169	cde	83
Bobbex	35	a	36	bc	234	de	93
Physical fence	35	a	43	c	251	e	100

where S_{Di} was mean size of yews on i^{th} treatment at Dawson; S_{DF} was mean size of fenced yews at Dawson; W_{Di} was mean weight of yews on i^{th} treatment at Dawson; W_{DF} was mean weight of fenced yews at Dawson; S_{Wi} was mean size of yews on i^{th} treatment at Windsor; and S_{WF} was mean size of fenced yews at Windsor.

Results

Treatment effectiveness

Yew mortality averaged 7% and did not differ among repellents (χ^2_{11} = 10.1, P = 0.52). Size and needle weight did differ among treatments (Tables 2 and 3). Unprotected yews (negative control) were smaller than fenced yews (positive control) at Dawson. At Windsor, where browsing was minimal, plant size did not differ among deer repellent treatments. At Dawson where browsing was more severe, only yews treated with Hinder, Bobbex, and those protected by a fence were larger than unprotected controls (Table 3). Plants protected by a physical fence were 72% larger than unprotected controls.

At Dawson, yews inside a fence had nearly 18× the needle-weights of yews that were unprotected from deer browsing (Table 3). Yews treated with Deer-Away Big Game Repellent, Chew-Not, Liquid Fence, Hinder, and Bobbex also had greater needle weights than unprotected controls. Yews protected by Repellex, Deer Solution, coyote urine, Plantskydd, and Deer-Off were not larger than unprotected controls at both sites and did not have significantly more needles at Dawson. The effectiveness of the various repellents, as indicated by the Protection Index, varied widely among products (Table 3).

Discussion

Comparison of earlier studies

A search of the literature found 10 pen and 12 field studies that evaluated >1 repellent and also had untreated plots (Table 4). There was little consistency in the type of damage reported, which included plant mortality, number of bites, amount consumed, percentage of damage, and damage indices (Table 4). To standardize the damage as objectively as possible, we assumed that the level of damage for the unprotected control to be the maximum damage. Relative effectiveness (%) was defined as $1-(D_t/D_u)$, where D_t was damage for a given treatment and D_u was damage reported for the untreated plots.

No repellent was 100% effective in reducing browse damage (Table 4). In general, egg-based products, including Big Game Repellent, were most effective. Thiram and Hinder were more effective in field than in pen studies. Both repellents reduced browse damage in field studies to levels similar to those reported for