# Force spreading on feathers

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(Dated: October 15, 2019)

PACS numbers:

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TABLE I: Elastic modulus from other works.

| Reference | Young's Modulus (GPa) | Species [Feather] | Method |
|---|---|---|---|
| Hertel 1966 [9] | 9.016 | Unknown [Unknown] | Tensile |
| Purslow & Vincent 1978 [11] | 7.75 (dorsal bending) | Pigeon [Flight] | Bending |
| | 10 (lateral bending) | Pigeon [Flight] | Bending |
| Macleod 1980 [10] | $\sim$ 0.045-0.181 (proximal regions) | Chicken, Turkey, Pheasant, Herring Gull [Pelvic Contour Feathers] | Tensile |
| | $\sim$ 0.210-0.682 (distal regions) | | Tensile |
| | $\sim$ 0.002-0.024 (proximal regions) | | Bending |
| | $\sim$ 0.457-1.850 (distal regions) | | Bending |
| Bonser & Purslow 1995 [4] | 2.5 | Pigeon, Willow Ptarmigan, Sparrowhawk, Gull, Owl, Starling | Tensile |
| | 1.78 | Grey Heron [Flight] | Tensile |
| Bonser 1996 [5] | E $\sim$9.02 | unknown | unknown |
| | E $\sim$2.94 | unknown | unknown |
| | E $\sim$2.52 | Pigeon | Tensile |
| Dawson et al. 2000 [8] | 2.3 $\pm$ 0.2 | Starling (slow-moulting) | Indentation |
| | 2.6 $\pm$ 0.2 | (fast-moulting) | Indentation |
| Bonser 2001 Ibis [6] | 2.42 $\pm$ 0.45 | Ostrich [Contour] | Tensile |
| | 1.71 $\pm$ 0.43 | Ostrich [Wing] | Tensile |
| Bonser 2001 [3] | 4.5 | Swan (Cygnus olor) [Flight] | Compression |
| Cameron et al. 2003 [7] | $\sim$ 4.0 | Swan & Goose [Flight] | Tension |
| | $\sim$ 1.5 | Ostrich [Wing] | Tension |

TABLE II: Elastic modulus from other works.

| Reference | Young's Modulus (GPa) | Species [Feather] | Method |
|---|---|---|---|
| Reddy & Yang 2007 [12] | $\sim$ 4.7 | Chicken [Barbs] | Tensile |
| Weiss & Kirchner 2010 [14] | $\sim$ 3.3 (longitudinal) | Peacock [Tail Longitudinal] | Tensile |
| | $\sim$ 1 (transverse) | Peacock [Tail Transverse] | Tensile |
| Bodde et al 2011 [2] | 2.56 $\pm$ 0.09 | Toucan [Tail] | Tensile |
| Bachmann 2012 [1] | $\sim$5.45 | Barn Owl [Flight] | Bending |
| | $\sim$5.39 | Pigeon [Flight] | Bending |
| | $\sim$6.54 | Barn Owl [Flight] | Nanoindentation |
| | $\sim$5.96 | Pigeon [Flight] | Nanoindentation |
| Schmitz 2015 [13] | $\sim$(5.9-8.4)GPa | Falcon, Pigeon, Kestrel, Sparrowhawk; [Tail] | Nanoindentation |

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