CHAPTER 16-7
BIRD NESTS – PASSERIFORMES, PART 2

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Figure 1. ***Grallaricula peruviana*** is a rare bird, shown here with bryophytes in its nest. Photo by Harold Greeney, through Creative Commons

Grallariidae

The Peruvian Antpitta (***Grallaricula peruviana***) is a rare species that uses bryophytes in its nest, as seen in Figure 1.

Regulidae – Kinglets

Wolf (2009) found two species of **Regulidae** that use bryophytes in their nests in North America:

Regulus satrapa (Golden-Crowned Kinglet; Figure 2)
Regulus calendula (Ruby-Crowned Kinglet; Figure 4)

The Golden-crowned Kinglet (***Regulus satrapa***; Figure 2) breeds in the coniferous forests (Figure 3) of the Pacific Northwest and constructs a nest almost entirely of mosses (Ingold & Galati 1997).

Figure 2. ***Regulus satrapa***, Golden-crowned Kinglet. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

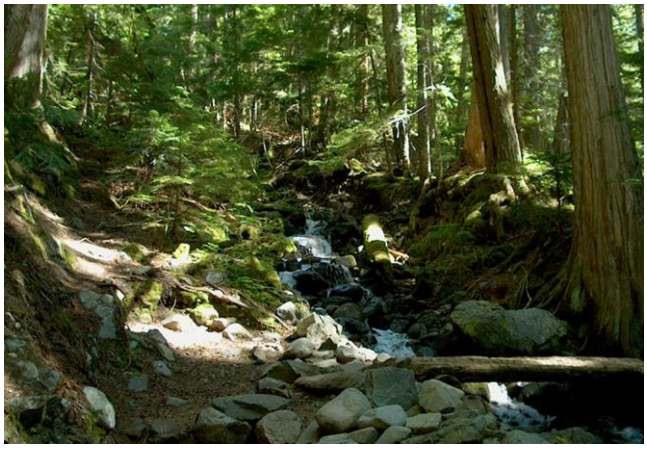

Figure 3. Conifer forest, Garibaldi National Park, BC, home to the Golden-crowned Kinglet, ***Regulus satrapa***. Photo by The Simkin, through public domain.

Figure 4. ***Regulus calendula***, Ruby-crowned Kinglet. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Sylviidae – Old-World Warblers & Gnatcatchers

Wolf (2009) found one species of **Sylviidae** that use bryophytes in their nests in North America: ***Phylloscopus borealis*** (Arctic Warbler; Figure 5).

Figure 5. ***Phylloscopus borealis***, Arctic Warbler. Members of this species use bryophytes in their nests. Photo by Osado, through Creative Commons.

Turdidae – Thrushes

Wolf (2009) found thirteen species of **Turdidae** that use bryophytes in their nests in North America:

Luscinia svecica (Bluethroat; Figure 6)
Oenanthe oenanthe (Northern Wheatear; Figure 7)
Sialia mexicana (Western Bluebird; Figure 8)
Myadestes townsendi (Townsend's Solitaire; Figure 9)
Catharus fuscescens (Veery; Figure 11)
Catharus minimus (Gray-Cheeked Thrush; Figure 12)
Catharus bicknelli (Bicknell's Thrush; Figure 13)
Catharus ustulatus (Swainson's Thrush; Figure 14)
Catharus guttatus (Hermit Thrush; Figure 15-Figure 16)
Turdus pilaris (Fieldfare; Figure 18-Figure 19)
Turdus iliacus (Redwing; Figure 20)
Turdus migratorius (American Robin; Figure 21-Figure 22)
Ixoreus naevius (Varied Thrush; Figure 38)

Figure 6. ***Luscinia svecica***, Bluethroat. Members of this species use bryophytes in their nests. Photo by Andreas Trepte, through Creative Commons.

Figure 7. ***Oenanthe oenanthe***, Northern Wheatear. Members of this species use bryophytes in their nests. Photo by Craig Nash, through Creative Commons.

Figure 8. ***Sialia mexicana***, Western Bluebirds. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 9. ***Myadestes townsendi***, Townsend's Solitaire. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 10. ***Myadestes palmeri***, Puaiohi, nest in a mossy cavity. Photo by Lucas Behnke, with permission.

Figure 11. ***Catharus fuscescens***, Veery. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 12. ***Catharus minimus***, Gray-cheeked Thrush. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 13. ***Catharus bicknelli***, Bicknell's Thrush, on mossy nest. Photo by Kent McFarland, through Creative Commons.

Figure 14. ***Catharus ustulatus***, Swainson's Thrush. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 15. ***Catharus guttatus***, Hermit Thrush. Members of this species use bryophytes in their nests. Photo by Cephas, through Creative Commons.

Figure 16. ***Catharus guttatus***, Hermit Thrush nest and hatchlings. Photo by Per ver Donk, with permission.

Hermit Thrush (*Catharus guttatus*)

Once again, the female is the sole nest-builder in the Hermit Thrush (***Catharus guttatus***; Figure 15-Figure 16) (Cornell Lab of Ornithology). Her bulky handiwork includes mosses in addition to twigs, bark strips, ferns, and grasses. It is not lined with mosses, but rather with conifer needles, rootlets, and plant fibers.

Figure 17. Bird nest in Coast Range of the Pacific Northwest, USA, with mosses still growing. Photo by JeriLynn Peck.

Figure 18. ***Turdus pilaris***, Fieldfare. Members of this species use bryophytes in their nests. Photo by Allan Drewitt, through Creative Commons.

Figure 19. ***Turdus pilaris***, Fieldfare, nest, showing occasional mosses mixed with grasses in the nest. Photo by Andreas Trepte, through Creative Commons.

Figure 20. ***Turdus iliacus***, Redwing. Members of this species use bryophytes in their nests. Photo by Ómar Runólfsson, through Creative Commons.

American Robin (*Turdus migratorius*)

The American Robin (***Turdus migratorius***; Figure 21) uses mosses as a binding material with mud in the inner cup of the nest (Figure 22-Figure 23) (Breil & Moyle 1976). It also uses mosses to line the cup. It seems to have a preference for ***Thuidium delicatulum*** (Figure 24), ***Plagiomnium cuspidatum*** (Figure 25), ***Brachythecium acuminatum*** (Figure 26), ***B. salebrosum*** (Figure 27), and ***Amblystegium varium*** (Figure 28).

Figure 21. ***Turdus migratorius***, American Robin. Members of this species sometimes use mosses as a binder for the mud linings of their nests. Photo by Tom Grey, with permission.

Figure 22. ***Turdus migratorius***, American Robin, on nest. Photo by Jane and Phil, through Creative Commons.

Figure 23. ***Turdus migratorius***, American Robin, nest and young. Photo by Tom Grey, with permission.

Figure 24. ***Thuidium delicatulum***, a moss used as a mud binder to line the Robin's nest. Photo by Janice Glime.

Figure 25. ***Plagiomnium cuspidatum***, a moss used as a mud binder to line the Robin's nest. Photo by Hermann Schachner, through Creative Commons.

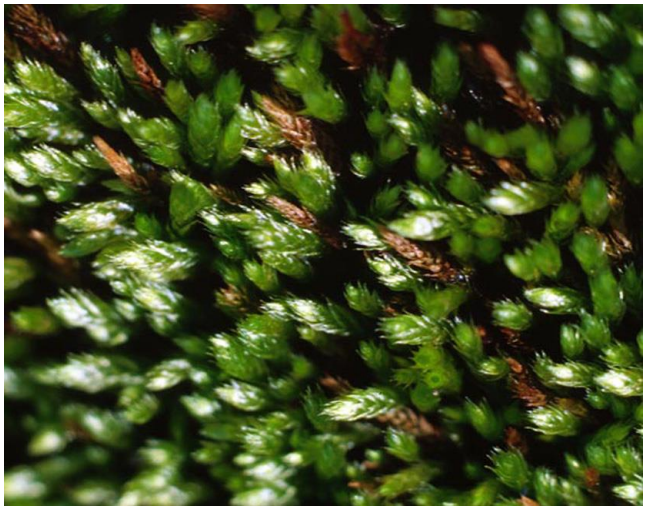

Figure 26. ***Brachythecium acuminatum***, a moss used as a mud binder to line the Robin's nest. Photo by Charles T. Bryson, through Creative Commons.

Figure 27. ***Brachythecium salebrosum*** with capsules, a moss used as a mud binder to line the Robin's nest. Photo by Michael Lüth, with permission.

Figure 28. ***Amblystegium varium***, a moss used as a mud binder to line the Robin's nest. Photo by J. C. Schou, through Creative Commons.

Other members of the genus, such as the Yellow-legged Thrush (***Turdus flavipes***; Figure 29-Figure 30), place bryophytes on the outside of the nest.

Figure 29. ***Turdus flavipes***, Yellow-legged Thrush. Members of this species use mosses on the outsides of their nests. Photo by David R. Santiago, through Creative Commons.

Figure 30. ***Turdus flavipes***, Yellow-legged Thrush, nest with eggs and bryophytes. Photo by David R. Santiago, through Creative Commons.

Chinese Thrush (*Turdus mupinensis*)

In a Chinese study (Zhao *et al*. 2005), nests of the Chinese Thrush (***Turdus mupinensis***; Figure 31) were collected from Xiaolongmen Nature Reserve of Beijing. Nests exhibited seven bryophyte species: ***Anomodon*** sp., ***A. minor*** (Figure 32), ***Entodon*** sp. (Figure 33), ***Lindbergia sinensis*** (see Figure 34), ***Brachythecium*** sp. (see Figure 27), ***Herpetineuron*** sp. (Figure 35), ***Plagiomnium*** sp. (see Figure 25), and ***Myuroclada maximowiczii*** (Figure 36). ***Anomodon minor*** was one of the major nest components.

Figure 31. ***Turdus mupinensis***, Chinese Thrush. Members of this species use mosses in their nests in China. Photo by Charles Lam, through Creative Commons.

Figure 32. ***Anomodon minor***, a species that is used in nests of the Chinese Thrush. Photo by Michael Lüth, with permission.

Figure 33. ***Entodon concinnus***, in a genus that is used in nests of the Chinese Thrush. Photo by Hermann Schachner, through Creative Commons.

Figure 34. ***Lindbergia koelzii*** with capsules, member of a genus used in nests of the Chinese Thrush, ***Turdus mupinensis***. Photo by Michael Lüth, with permission.

Figure 35. ***Herpetineuron toccoae***, member of a genus used in nests of the Chinese Thrush, ***Turdus mupinensis***. Photo by Li Zhang, with permission.

Figure 36. ***Myuroclada maximoviczii***, a species that is used in nests of the Chinese Thrush. Photo by Janice Glime

Blackbird (*Turdus merula*)

The Common Blackbird (***Turdus merula***; Figure 37) makes a bulky cup in its nest, using dry grasses, twigs, stalks, and yes, mosses (Snow 1958). These are plastered with mud or muddy leaves and lined with fine grass, thin dead stems, or rootlets. Mainwaring *et al.* (2014) found that as spring temperatures increased in the lower latitudes, the quantity of mosses used in the nests decreased, suggesting that mosses may be needed for insulation at cooler temperatures (Mainwaring *et al*. 2012).

Figure 37. ***Turdus merula***, Common Blackbird, nesting. Members of this species use bryophytes in their nests. Photo by J. J. Harrison, through Creative Commons.

Nest size of birds is limited on the upper end by becoming more conspicuous and requiring more energy to prepare (Møller 1990). On the small end, it loses insulating ability, stability, and protection to prevent nestlings from falling out of the nest. Møller manipulated nest size of the Blackbird (***Turdus merula***; Figure 37), a species that makes an open-cup woodland nest. When nests were exchanged for smaller or larger nests, there was no effect on nest egg predation by the exchange itself, but larger nests experienced more predation. But real nests that experienced predation were not significantly larger than successful nests. Møller suggested that nest size in nature is dependent on nest site.

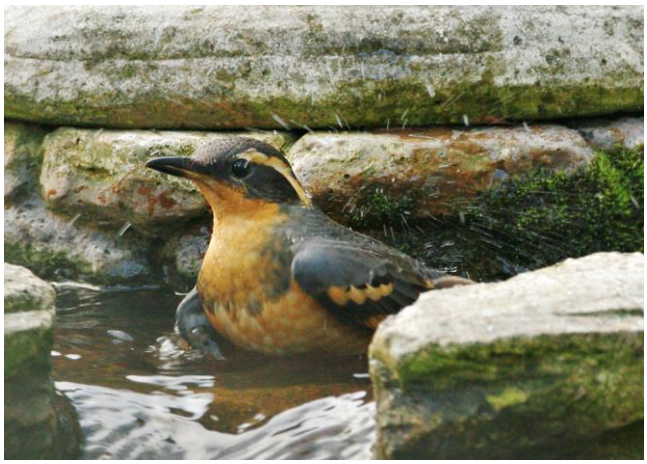

Figure 38. ***Ixoreus naevius***, Varied Thrush. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Muscicapidae – Old World Flycatchers

In the same Chinese study (Zhao *et al*. 2005), nests of three members of this family [Narcissus Flycatcher (***Ficedula narcissina***; Figure 39), Blue-and-white Flycatcher (***Cyanoptila cyanomelana***; Figure 40-Figure 41), Daurian Redstart (***Phoenicurus auroreus***; Figure 42)] were collected from Xiaolongmen Nature Reserve of Beijing. These nests, like those of the Chinese Thrush, exhibited the same seven bryophyte species, with the moss ***Anomodon minor*** (Figure 32) as the main component of nests of all three bird species.

Figure 39. ***Ficedula narcissina***, a Chinese species. Members of this species use bryophytes in their nests. Photo by Alpsdake, through Creative Commons.

Figure 40. ***Cyanoptila cyanomelana***, Blue-and-white Flycatcher male, a species that uses bryophytes to make nests. Photo by Alpsdake, through Creative Commons.

Figure 41. ***Cyanoptila cyanomelana***, Blue-and-white Flycatcher male. Members of this species make their nests with bryophytes. Photo by Alpsdake, through Creative Commons.

Figure 42. ***Phoenicurus auroreus***, Daurian Redstart male. Members of this species use bryophytes in their nests. Photo by Alpsdake, through Creative Commons.

Petroicidae – Australian Robins

Australian Pink Robin (*Petroica rodinogaster*)

The **Australian Pink Robin** (***Petroica rodinogaster***; Figure 43) includes both lichens and mosses in its nest (Figure 44) (Newman & Bratt 1976).

Figure 43. ***Petroica rodinogaster***, Australian Pink Robin. Members of this species build their nests of mosses, especially ***Thuidiopsis sparsa***. Photo by J. J. Harrison, through Creative Commons.

Pharo and Meagher (2011) reported finding a Pink Robin's nest that was made almost entirely from mosses. It was located in a mountain ash forest in Victoria, Australia, in an area that had been lightly burned two years earlier. The nest was "extraordinarily tiny on a branch of *Olearia agrophylla*." The nest was woven exclusively from ***Thuidiopsis sparsa*** (Figure 45) except for a few strands of grass. It is interesting that the moss was not even growing at the site. Therefore, the birds deliberately hunted that moss. The nest has a loose weave, but was strong, with intertwined moss branches. The nest was attached to a branch by numerous strands that were wrapped around the main branch and a smaller branch.

Figure 44. The tiny Australian Pink Robin's nest woven from ***Thuidiopsis sparsa*** (Figure 45), with Emma´s index finger for 'scale.' Photo courtesy of Emma Pharo and David Meagher.

Figure 45. ***Thuidiopsis sparsa***, a moss used to make the nest of the Australian Pink Robin (***Petroica rodinogaster***). Photo through Creative Commons.

Sturnidae – Starlings, *etc.*

Wolf (2009) found one species of **Sturnidae** whose members use bryophytes in their nests in North America: European Starling (***Sturnus vulgaris***; Figure 46-Figure 47).

Figure 46. ***Sturnus vulgaris***, European Starling, the only member of this family that uses mosses in its nest in North America. Photo by Ingrid Taylar, through Creative Commons.

Figure 47. ***Sturnus vulgaris***, European Starling, at nest. Photo by Gynti 46, through Creative Commons.

The European Starling "prefers" to use the wild carrot *Daucus carota* (Figure 48) or the fleabane *Erigeron philadelphicus* (Figure 49) in its nest, both of which have known abilities to suppress parasitic mites in nests (Clark & Mason 1985). We can only wonder if the bryophytes might serve a protective role against mites and other parasites in forested sites.

Figure 48. *Daucus carota* leaves, a species included in nests of the European Starling, presumably to reduce parasite infections. Photo by BioImages, through Creative Commons.

Figure 49. *Erigeron philadelphicus*, a species included in nests of the European Starling, presumably to reduce parasite infections. Photo by Fritzflohr Reynolds, through Creative Commons.

Motacillidae – Wagtails & Pipits

Wolf (2009) found one species of **Motacillidae** whose members use bryophytes in their nests in North America:

Motacilla alba (White Wagtail; Figure 50-Figure 51)
Anthus cervinus (Red-throated Pipit; Figure 54)
Anthus rubescens (American Pipit; Figure 55)

White Wagtail (*Motacilla alba*)

Des Callaghan (Bryonet 23 June 2016) reported that while in the wonderful north of Finland one summer, a fine place for **Splachnaceae**, he noticed an intriguing association between ***Splachnum vasculosum*** (Figure 52-Figure 53) and the insectivorous passerine bird ***Motacilla alba*** (Figure 50). Could the Wagtails be attracted by the odor? Are the mosses a food source? Or do the ***S. vasculosum*** and ***Motacilla alba*** simply like the same habitat? Callaghan recorded this interesting habitat <https://youtu.be/DdlJ7njn3Vg>. Mosses are included in nests (Figure 51) of this wagtail species (Bouglouan 2016).

Figure 50. ***Motacilla alba alba***, White Wagtail. Members of this species use bryophytes in their nests. Photo by Luis Garcia, through Creative Commons.

Figure 51. ***Motacilla alba***, White Wagtail, nest with eggs, a nest that often includes bryophytes. Photo by Walcoford, through Creative Commons.

Figure 52. ***Splachnum vasculosum*** colony, a preferred perch for White Wagtail (***Motacilla alba***). Photo by Des Callaghan, with permission.

Figure 53. ***Splachnum vasculosum*** with capsules and males. Photo by Dick Haaksma, with permission.

Figure 54. ***Anthus cervinus***, Red-throated Pipit. Members of this species use bryophytes in their nests. Photo by Tom Grey with permission.

Figure 55. ***Anthus rubescens***, American Pipit, with insect. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Small Kauai Thrush (*Myadestes palmeri*)

The Small Kauai Thrush or Puaiohi (***Myadestes palmeri***; Figure 56), a small Hawaiian endemic, builds a cavity nest (Figure 57) along a stream bank comprised mostly of bryophytes and tiny ferns, with a weave of fine grass (Kepler & Kepler 1983). The bryophytes trail out of the cavity mouth from the base of the nest, providing an opportunity for these bryophytes to attach and grow on the stream bank. Included bryophytes were the mosses ***Dicranum speirophyllum*** (Figure 58) and ***Campylopus*** sp. (Figure 59) and the liverworts ***Bazzania*** sp. (Figure 60) and ***Lepidozia*** sp. (Figure 61).

Figure 56. ***Myadestes palmeri***, Small Kauai Thrush. Members of this species use bryophytes in their nests. Photo by Eike Wulfmeyer, through Creative Commons.

Figure 57. ***Myadestes palmeri***, Puaiohi, nest with mosses in a cavity. Photo by Lucas Behnke, with permission.

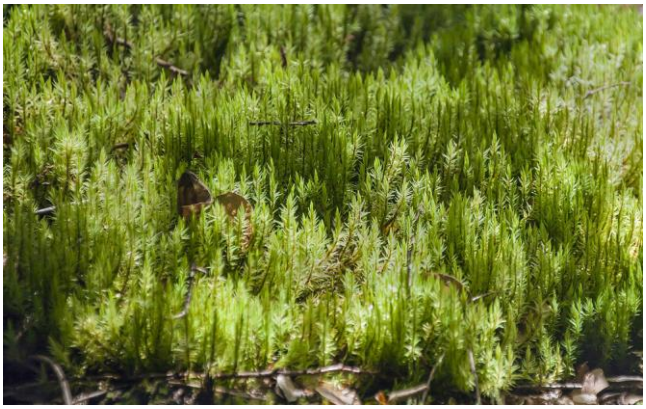

Figure 58. ***Dicranum speirophyllum***, a moss used in the Puaiohi (***Myadestes palmeri***) nest. Photo by John Game, through Creative Commons.

Figure 59. ***Campylopus umbellatus***, a moss representing a genus used in the Puaiohi (***Myadestes palmeri***) nest. Photo by Michael Lüth, with permission.

Figure 60. ***Bazzania*** sp., a leafy liverwort representing a genus used in the Puaiohi (***Myadestes palmeri***) nest. Photo by Ondřej Zicha, through Creative Commons.

Figure 61. ***Lepidozia*** sp., a leafy liverwort representing a genus used in the Puaiohi (***Myadestes palmeri***) nest. Photo by Ken-ichi Uedo, through Creative Commons.

Bombycillidae – Waxwings

Wolf (2009) found two species of **Bombycillidae** that use bryophytes in their nests in North America:

Bombycilla garrulus (Bohemian Waxwing; Figure 62)
Bombycilla cedrorum (Cedar Waxwing; Figure 63-Figure 64)

Figure 62. ***Bombycilla garrulus***, Bohemian Wax Wing. Members of this species use bryophytes in their nests. Photo by Randen Pederson, through Creative Commons.

Cedar Waxwing (*Bombycilla cedrorum*)

The Cedar Waxwing (***Bombycilla cedrorum***; Figure 63) nests in edge habitat, using small evergreens and deciduous trees to hold its nests (Figure 64) (Heinrich 2009). The nest is somewhat similar to that of a Robin in size and rough appearance, but it has no mud lining. The outside typically is decorated with lichens and mosses, probably providing camouflage.

Figure 63. ***Bombycilla cedrorum***, Cedar Waxwing. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 64. ***Bombycilla cedrorum***, Cedar Waxwing, nest with moss & eggs. Photo by Rich Mooney, through Creative Commons.

Peucedramidae – Olive Warbler

Wolf (2009) found one species of **Peucedramidae** that uses bryophytes in their nests in North America: ***Peucedramus taeniatus*** (Olive Warbler; Figure 65).

Figure 65. ***Peucedramus taeniatus***, Olive Warbler. Members of this species use bryophytes in their nests. Photo by Ron Knight, through Creative Commons.

Parulidae – Wood Warblers, *etc.*

Wolf (2009) found 27 species of **Parulidae** that use bryophytes in their nests in North America:

Oreothlypis ruficapilla (Nashville Warbler; Figure 67)
Oreothlypis celata (Orange-crowned Warbler; Figure 66, Figure 68)
Oreothlypis virginiae (Virginia's Warbler; Figure 69)
Dendroica coronata (Yellow-rumped Warbler; Figure 70)
Setophaga pitiayumi (Tropical Parula; Figure 71)
Setophaga magnolia (Magnolia Warbler; Figure 72)
Setophaga tigrina (Cape May Warbler; Figure 73)
Setophaga caerulescens (Black-throated Blue Warbler; Figure 74-Figure 75)
Setophaga nigrescens (Black-throated Gray Warbler; Figure 76)
Setophaga virens (Black-throated Green Warbler; Figure 77)
Setophaga townsendi (Townsend's Warbler; Figure 78)
Setophaga occidentalis (Hermit Warbler; Figure 79)
Setophaga kirtlandii (Kirtland's Warbler; Figure 80)
Setophaga striata (Blackpoll Warbler; Figure 81)
Setophaga cerulea (Cerulean Warbler; Figure 82)
Setophaga ruticilla (American Redstart; Figure 83)
Setophaga citrina (Hooded Warbler; Figure 84-Figure 85)
Protonotaria citrea (Prothonotary Warbler; Figure 86)
Helmitheros vermivorum (Worm-eating Warbler; Figure 88)
Limnothlypis swainsonii (Swainson's Warbler; Figure 90)
Seiurus aurocapilla (Ovenbird; Figure 91-Figure 92)
Parkesia noveboracensis (Northern Waterthrush; Figure 97)
Parkesia motacilla (Louisiana Waterthrush; Figure 98)
Oporornis agilis (Connecticut Warbler; Figure 99)
Geothlypis trichas (Common Yellowthroat; Figure 100)
Cardellina pusilla (Wilson's Warbler; Figure 101)
Cardellina canadensis (Canada Warbler; Figure 102)

Figure 66. ***Oreothlypis celata***, Orange-crowned Warbler. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 67. ***Oreothlypis ruficapilla***, Nashville Warbler. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 68. ***Oreothlypis celata***, Orange-crowned Warbler. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 69. ***Oreothlypis virginiae***, Virginia's Warbler. Members of this species use bryophytes in their nests. Photo by Jerry Oldenettel, through Creative Commons.

Figure 70. ***Dendroica coronata***, Yellow-rumped Warbler. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 71. ***Setophaga pitiayumi***, Tropical Parula. Members of this species use bryophytes in their nests. Photo by Dario Sanchez, through Creative Commons.

Figure 72. ***Setophaga magnolia***, Magnolia Warbler. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 73. ***Setophaga tigrina***, Cape May Warbler. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 74. ***Setophaga caerulescens***, Black-throated Blue Warbler. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 75. ***Setophaga caerulescens***, Black-Throated Blue Warbler, feeding young in nest. Members of this species use bryophytes in their nests. Photo by USFWS, through public domain.

Figure 76. ***Setophaga nigrescens***, Black-throated Gray Warbler. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 77. ***Setophaga virens***, Black-throated Green Warbler. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Townsend's Warbler (*Setophaga townsendi*)

Some birds have very specific uses for the bryophytes. The Townsend's Warbler (***Setophaga townsendi***; Figure 78) lines its nest with the **setae** (stalks of moss capsules) of mosses (and hair) (Baicich & Harrison 2005).

Figure 78. ***Setophaga townsendi***, Townsend's Warbler. Members of this species use bryophytes in their nests. Photo by Jerry Oldenettel, through Creative Commons.

Figure 79. ***Setophaga occidentalis***, Hermit Warbler. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Kirtland's Warbler (*Setophaga kirtlandii*)

In Michigan the Kirtland's Warbler (***Setophaga kirtlandii***; Figure 80) harvests moss sporophytes (Brian Dykstra, pers. comm. 10 December 2011).

Figure 80. ***Setophaga kirtlandii***, Kirtland's Warbler, in Jack pine. Members of this species harvest moss sporophytes, presumably for their nests. Photo by Ron Austing, through Creative Commons.

Figure 81. ***Setophaga striata***, Blackpoll Warbler. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 82. ***Setophaga cerulea***, Cerulean Warbler. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 83. ***Setophaga ruticilla***, American Redstart. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 84. ***Setophaga citrina***, Hooded Warbler. Members of this species use bryophytes in their nests. Photo by Mary Elliott, through Creative Commons.

Figure 85. ***Setophaga citrina***, Hooded Warbler. Members of this species use bryophytes in their nests. Photo by USFSW, through public domain.

Prothonotary Warbler (*Protonotaria citrea*)

The Prothonotary Warbler (***Protonotaria citrea***; Figure 86) nests in abandoned holes made by woodpeckers. Although it sometimes uses few mosses in the actual nest, it does build it on a bed of bryophytes, both mosses and liverworts (Bent 1953; Petit 1989; Blem & Blem 1992, 1994). When building in a nest box, the mosses go in first to form the bed. Then the nest is built on top of them. The bryophytes remain moist, but the cup is not. Blem and Blem found that 75-80% of the dry mass of the nests they studied is composed of mosses and liverworts. They identified five species of mosses and two liverworts (Table 1), with the moss ***Anomodon attenuatus*** (Figure 87) predominating. They suggested that the bryophytes maintain the needed environment within the nest cavity (*e.g.* Mertens 1977a, b). In addition to ameliorating the moisture, bryophytes may serve to reduce pathogens and parasites (Clark & Mason 1985). I have seen several pictures of these nests, but unfortunately I could not find the name of the photographer on those sites.

Figure 86. ***Protonotaria citrea***, Prothonotary Warbler, a species that uses a bed of bryophytes under its nest. Photo by David Inman, through Creative Commons.

Table 1. Occurrence of bryophytes in Prothonotary Warbler (***Protonotaria citrea***) nests in nest boxes along the James River, Virginia, USA. From Blem & Blem 1994.

	Percent occurrence			
Species	**Top**	**Mid-dle**	**Bot-tom**	**Total**
Mosses				
Anomodon attenuatus	97.3	96.4	91.4	95.0
Haplocladium microphyllum	20.6	13.4	21.0	18.3
Amblystegium varium	6.7	7.6	1.3	5.2
Plagiomnium cuspidatum	2.7	1.3	3.1	2.4
Thuidium delicatulum	0.4	1.3	0.0	0.6
Liverworts				
Porella platyphylla	21.9	27.3	32.1	27.1
Frullania eboracensis	0.4	0.8	0.8	0.7

Figure 87. ***Anomodon attenuatus*** with capsules, the primary bryophyte used in the nest of the Prothonotary Warbler. Photo by Bob Klips, with permission.

Worm-eating Warbler (*Helmitheros vermivorum*)

The Worm-eating Warbler (***Helmitheros vermivorum***; Figure 88) uses stems of ***Polytrichum*** in its nest (Figure 89) (Baicich & Harrison 2005).

Figure 88. ***Helmitheros vermivorum***, Worm-eating Warbler. Members of this species use bryophytes in their nests. Photo by Jerry Oldenettel, through Creative Commons.

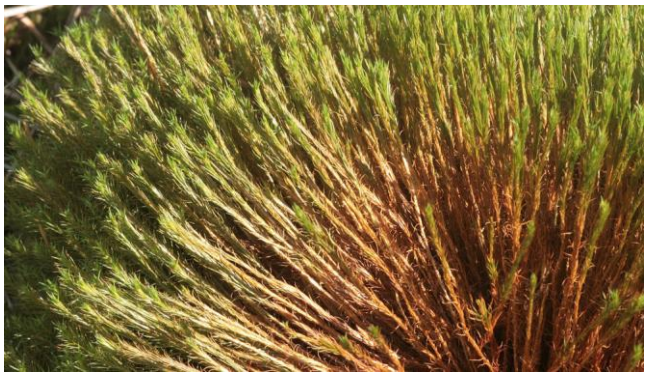

Figure 89. ***Polytrichum commune***, a moss in a genus used in nests of ***Helmitheros vermivorum***, Worm-eating Warblers. Photo by Hermann Schachner, through Creative Commons.

Figure 90. ***Limnothlypis swainsonii***, Swainson's Warbler. Members of this species use bryophytes in their nests. Photo by Carol Foil, through Creative Commons.

Ovenbird (*Seiurus aurocapilla*)

The seclusive Ovenbird (***Seiurus aurocapilla***; Figure 91-Figure 92) may be dependent on mosses in its environment. Apfelbaum and Haney (1981) reported the disappearance of the Ovenbird from a severely burned Jack pine (***Pinus banksiana***; Figure 93-Figure 95) forest in the Great Lakes area. In that fire, ~80% of the feather moss (Figure 96) communities suffered severe loss due to the fire. But other factors related to the fire may have caused them to disappear.

Figure 91. ***Seiurus aurocapilla***, Ovenbird, a ground nester that may be dependent on mosses in its habitat. Photo by Tom Grey, with permission.

Figure 92. ***Seiurus aurocapilla***, Ovenbird, nest and nestlings. Photo by Fredlyfish4, through Creative Commons.

Figure 93. Jack pine (***Pinus banksiana***) healthy forest. Photo by M. Ricon, through Creative Commons.

Figure 94. ***Pinus banksiana*** after fire in Baraga, Michigan, USA. Photo by Janice Glime.

Figure 95. Burned moss in Jack pine forest, Baraga, MI. Photo by Janice Glime.

Figure 96. ***Pleurozium schreberi***, a feather moss that covers vast areas of ground in conifer forests. Photo by Sture Hermansson, with online permission.

Figure 97. ***Parkesia noveboracensis***, Northern Waterthrush. Some members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 98. ***Parkesia motacilla***, Louisiana Waterthrush. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 99. ***Oporornis agilis***, Connecticut Warbler. Members of this species use bryophytes in their nests. Photo from connecticut-warbler-audubon-field-guide, free stock photos.

Figure 100. ***Geothlypis trichas***, Common Yellowthroat. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 101. ***Cardellina pusilla***, Wilson's Warbler. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 102. ***Cardellina canadensis***, Canada Warbler. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Furnariidae – Neotropical Ovenbirds

In the Neotropical ovenbirds (**Furnariidae**) moss use in nesting materials seems to have at least somewhat followed evolutionary lines (Zyskowski & Prum 1999). ***Premnoplex brunnescens*** (Figure 103) builds a domed nest of mosses (Figure 104-Figure 106). This nest may be suspended from structures such as logs.

Figure 103. ***Premnoplex brunnescens***, Spotted Barbtail. Members of this species build domed nests of bryophytes. Photo by Murray Cooper, through Creative Commons.

Figure 104. ***Premnoplex brunnescens***, Spotted Barbtail, nest of bryophytes. Photo by Juan Ignacio Areta, through Creative Commons.

Figure 105. ***Premnoplex brunnescens***, Spotted Barbtail, nest of bryophytes. Photo by Harold Greeney, through Creative Commons.

Figure 106. ***Premnoplex brunnescens***, Spotted Barbtail, nest of bryophytes. Photo by Gustavo Londoño, through Creative Commons.

In the Neotropical ***Cranioleuca albiceps*** group (see Figure 107), ***Margarornis*** (Figure 108-Figure 109), ***Premnoplex brunnescens*** (Figure 103-Figure 106), ***Siptornis*** (Figure 110), and Plain Softtail, (***Phacellodomus fusciceps***; see Figure 111), a "pensile" nest (Figure 109) is constructed (Zyskowski & Prum 1999). This is a large nest with a small brood chamber that is entered from below. It is constructed from top down by draping long strands of green mosses or strips of other plant material. The nest hangs down from a log or rocky overhang and in ***Premnoplex brunnescens*** it may also hang from vines. ***Asthenes*** (Figure 112) species construct an ovoid nest (Figure 113) using fresh ***Sphagnum*** (Figure 114). An outer shell of herbaceous stems loosely surrounds it.

Figure 107. *Cranioleuca pallida*, Pallid Spinetail, in Brazil. Members of the ***Cranioleuca albipes*** group build pensile nests that incorporate bryophytes. Photo by Ciro Albano, through Creative Commons.

Figure 108. ***Margarornis rubiginosus***, Ruddy Treerunner. Members of this species make nests among bryophytes. Photo by Carmelo López Abad, through Creative Commons.

Figure 109. ***Margarornis squamiger***, Pearled Treerunner, pensile nest imbedded in bryophytes and rootlets with an entrance at the bottom. Photo by Harold Greeney, through Creative Commons.

Figure 110. ***Siptornis striaticollis***, Spectacled Prickletail, nest. Photo by Harold Greeney, through Creative Commons.

Figure 111. ***Phacellodomus ruber***, Greater Thornbird. Members of this species construct their nests using mosses and other plant material. Photo by Cláudio Dias Timm, through Creative Commons.

Figure 112. ***Asthenes anthoides***, Austral Canastero, Members of ***Asthenes*** incorporate bryophytes in their nests. Photo by Collaerts brothers, through Creative Commons.

Figure 113. ***Asthenes flammulata,*** Many-striped Canastero nest in Ecuador. Photo by Harold Greeney, through Creative Commons.

Figure 114. ***Sphagnum austinii***, member of a genus used in nests of ***Asthenes***. Stan Phillips, through public domain

White-browed Spinetail (*Hellmayrea gularis*)

In the Andean cloud forests, the White-browed Spinetail (***Hellmayrea gularis***; Figure 115) nests (Figure 116) were embedded in hanging masses of epiphytic mosses, but rather than being pendulous, the nests were supported from below or from the sides by stems (Greeney & Zyskowski 2008). These nests were ball-shaped with a side entrance. The exterior consisted of green moss, whereas the internal side consisted of dry bamboo leaves. The nest was lined with soft materials, either *Tillandsia* seed down (Figure 117) or tree-fern scales (Figure 118).

Figure 115. ***Hellmayrea gularis***, White-browed Spinetail, bringing grub to nest. Photo by Murray Cooper, through Creative Commons.

Figure 116. ***Hellmayrea gularis***, White-browed Spinetail, nest embedded in mosses. Photo by Harry Greeney, through Creative Commons.

Figure 117. *Tillandsia schiedeana*; the down (coma) of seeds in this genus are used in the nests of the White-browed Spinetail (***Hellmayrea gularis***). Photo by Roger Culos, through Creative Commons.

Figure 118. Hairy tree fern frond showing scales and hairs used in nests of the White-browed Spinetail, ***Hellmayrea gularis***. Photo by Janna Schreier <janna@jannaschreier.com>, with permission.

Thraupidae – Tanagers & Honeycreepers

Wolf (2009) found one species of **Thraupidae** that use bryophytes in their nests in North America: ***Piranga ludoviciana*** (Western Tanager; Figure 119).

Figure 119. ***Piranga ludoviciana***, Western Tanager. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Yellow-bellied Dacnis (*Dacnis flaviventer*)

The Yellow-bellied Dacnis (***Dacnis flaviventer***; Figure 120) is a bird of the high canopy and nests in this genus are largely unknown. Sheldon and Greeney (2008) were fortunate enough to find one nest and describe it. Although most of the nest is made of ferns, mosses comprise the sparse lining of the cup, woven with rootlets and dried grasses in a circular fashion.

Figure 120. ***Dacnis flaviventer***, Yellow-bellied Dacnis male. Members of this species line their nests with mosses. Photo by Patty McGann, through Creative Commons.

Emberizidae – Emberizines

Wolf (2009) found thirteen species of **Emberizidae** that use bryophytes in their nests in North America:

Spizella arborea (American Tree Sparrow; Figure 121-Figure 122)
Pooecetes gramineus (Vesper Sparrow; Figure 123-Figure 124)
Ammodramus savannarum (Grasshopper Sparrow; Figure 125-Figure 126)
Passerella iliaca (Fox Sparrow; Figure 127)
Melospiza lincolnii (Lincoln's Sparrow; Figure 128)
Zonotrichia albicollis (White-Throated Sparrow; Figure 129)

Zonotrichia querula (Harris's Sparrow; Figure 130)
Zonotrichia leucophrys (White-Crowned Sparrow; Figure 131-Figure 132)
Zonotrichia atricapilla (Golden-Crowned Sparrow; Figure 133)
Junco hyemalis (Dark-Eyed Junco; Figure 134-Figure 137)
Junco phaeonotus (Yellow-Eyed Junco; Figure 138)
Calcarius lapponicus (Lapland Longspur; Figure 139-Figure 140)
Plectrophenax nivalis (Snow Bunting; Figure 141)

Figure 121. ***Spizella arborea***, American Tree Sparrow. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 122. ***Spizella arborea***, American Tree Sparrow, nest and nestlings. Photo from USFWS, through public domain.

Figure 123. ***Pooecetes gramineus***, Vesper Sparrow. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 124. ***Pooecetes gramineus***, Vesper Sparrow, nestlings in nest, begging. Photo by Kati Fleming, through Creative Commons.

Figure 125. ***Ammodramus savannarum***, Grasshopper Sparrow. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 126. ***Ammodramus savannarum***, female Grasshopper Sparrows in nest. Photo by Janet Ruth, USGS, through public domain.

Figure 127. ***Passerella iliaca***, Fox Sparrow. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 128. ***Melospiza lincolnii***, Lincoln's Sparrow. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 129. ***Zonotrichia albicollis***, White-throated Sparrow. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 130. ***Zonotrichia querula***, Harris's Sparrow. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 131. ***Zonotrichia leucophrys***, White-crowned Sparrow. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 132. ***Zonotrichia leucophrys***, White-Crowned Sparrow, nest with eggs. Photo by Jacob W. Franks, NPS, through public domain.

Figure 133. ***Zonotrichia atricapilla***, Golden-crowned Sparrow. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Junco (*Junco hyemalis*)

The common Junco (***Junco hyemalis***; Figure 134) spends its winter in snowy places in the northern USA, then returns to even more northern locations in late April to build its nest of grasses, moss, and rootlets nestled in a mossy bank (Figure 135) or along a woodland trail (Figure 136) (Harrison 2000). Ken-ichi Ueda found a similar construction in a stream bank (Figure 137).

Figure 134. ***Junco hyemalis***, Dark-eyed Junco. Members of this species use bryophytes in their nests. Photo by USFWS, through public domain.

Figure 135. ***Junco hyemalis***, Dark-eyed Junco, nest with eggs in mossy cavity. Photo from USFWS, through public domain.

Figure 136. ***Junco hiemalis***, Dark-eyed Junco, nest with ***Hedwigia ciliata***. Photo courtesy of Susan Studlar.

Figure 137. Junco nest in mossy stream embankment. Photo by Ken-ichi Ueda, through Creative Commons.

Figure 138. ***Junco phaeonotus***, Yellow-eyed Junco. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 139. ***Calcarius lapponicus***, Lapland Longspur. Members of this species use bryophytes in their nests. Photo by Ómar Runólfsson, through Creative Commons.

Figure 140. ***Calcarius lapponicus***, Lapland Longspur, nest. Photo by James K. Lindsey, with permission.

Figure 141. ***Plectrophenax nivalis***, Snow Bunting,. Members of this species use bryophytes in their nests. Photo by Cephas, through Creative Commons.

Eastern Towhee (*Pipilo erythrophthalmus*)

The Eastern Towhee (***Pipilo erythrophthalmus***; Figure 142), formerly the Rufous-sided Towhee, nest (Figure 143) is somewhat unusual in its moss component. The lining can consist of a single material – 70-80 strands of ***Polytrichum ohioense*** setae (Figure 144) interwoven to form the lining (Breil & Moyle 1976). A few had **gametophyte** (leafy plants) fragments or capsules attached.

Figure 142. ***Pipilo erythrophthalmus***, Eastern Towhee male. Members of this species that use setae of ***Polytrichum ohioense*** (Figure 144) to line their nests in the southeastern USA. Photo by Bill Thompson, through Creative Commons.

Figure 143. ***Pipilo erythrophthalmus***, Eastern Towhee, nest. Photo by Bill Thompson, through Creative Commons.

Figure 144. ***Polytrichum ohioense*** showing setae that can be used to line the nests of the Eastern Towhee (***Pipilo erythrophthalmus***). Photo by Bob Klips, with permission.

Savannah Sparrow (*Passerculus sandwichensis*)

Mosses comprised more than 30% of the mass of nesting materials in the southeastern Ontario, Canada, populations of the ground-nesting Savannah Sparrow (***Passerculus sandwichensis***; Figure 145-Figure 146) compared to less than 20% in the northern Manitoba populations (Crossman *et al*. 2011). Although these differences were not statistically significant (p >0.05), they may reflect the somewhat smaller, more compact nests in the northern Manitoba population. But does it vary with climate as an adaptive means to maintain more favorable temperatures? Indeed Crossman and coworkers found that whereas the external dimensions of the nest did not differ, the inner nest cup was significantly shallower in northern Manitoba, indicating a thicker bottom that could provide greater insulation in the northern Manitoba population. But alas, we do not know if the mosses contributed to any insulating properties.

Figure 145. ***Passerculus sandwichensis***, Savannah Sparrow, a species for which moss usage and nest size vary with latitude. Photo by Tom Grey, with permission.

Figure 146. ***Passerculus sandwichensis***, Savannah Sparrow, nest with eggs. Photo by James K. Lindsey, with permission.

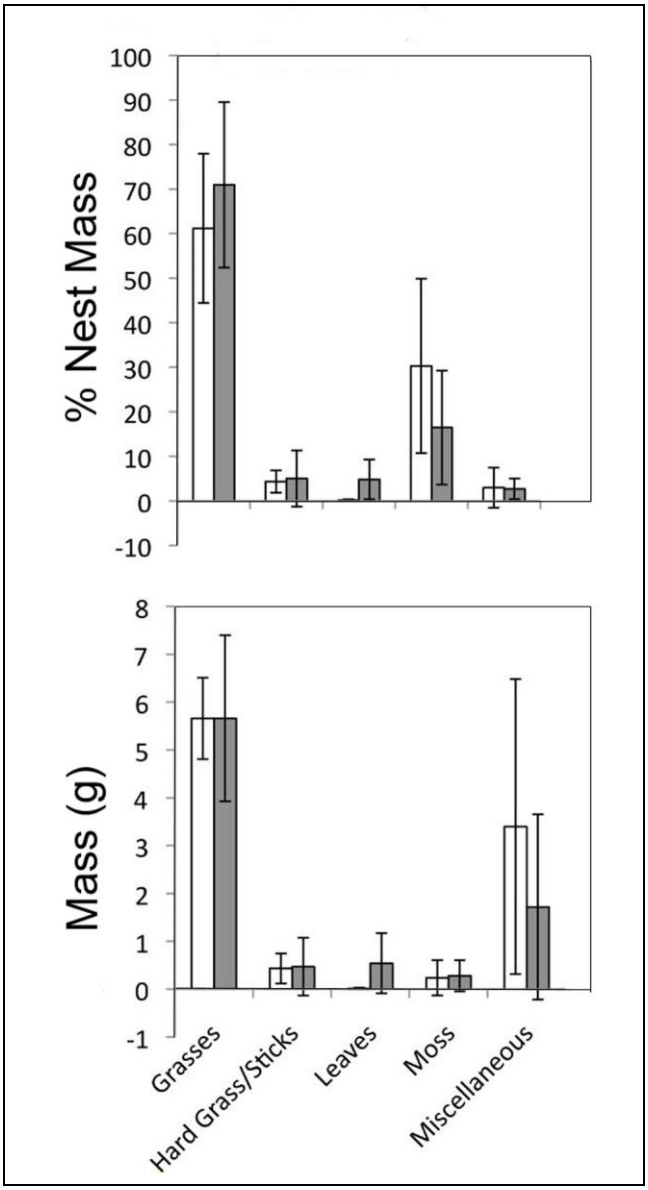

Figure 147. Nest composition for materials comprising ≥1% of nest mass of the Savannah Sparrows (***Passerculus sandwichensis***; Figure 145-Figure 146) that bred in southeastern Ontario (white bars) and northern Manitoba (grey bars). Bars represent dominant nesting materials ≥1% of nest dry mass. Those materials comprising <1% of nest mass are combined into miscellaneous. Plots show means (± SD). Modified from Crossman *et al*. 2011.

Ipswitch Sparrow (*Passerculus sandwichensis princeps*)

The Ipswich Sparrow (***Passerculus sandwichensis princeps***; Figure 148) is endemic on Sable Island, Nova Scotia, Canada. Dwight (1895; Mills & Lucas 2016) notes that mosses are included in their nests. As is typical in many kinds of nests, these are composed of two distinct parts. The outer shell is made of coarse materials including dead weed stalks, grasses, and "little bits" of mosses. The inner cup has finer materials, including hair of ponies and cattle, grasses, and sedges. These nests differ from those of the Savannah Sparrow on the mainland, where the nest is scraped out to form hollows and contain no mosses or lining materials.

Figure 148. ***Passerculus sandwichensis princeps***, Ipswich Sparrow. Members of this subspecies are endemic to Nova Scotia and often include mosses in the linings of their nests. Photo through Creative Commons.

Icteridae – Blackbirds, Orioles, *etc.*

Wolf (2009) found three species of **Icteridae** that use bryophytes in their nests in North America:

Euphagus carolinus (Rusty Blackbird; Figure 149-Figure 150)
Euphagus cyanocephalus (Brewer's Blackbird; Figure 151)
Icterus bullockii (Bullock's Oriole; Figure 152-Figure 154)

Figure 149. ***Euphagus carolinus***, Rusty Blackbird. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 150. ***Euphagus carolinus***, Rusty Blackbird, female on nest. Photo by USFWS, through public domain.

Figure 151. ***Euphagus cyanocephalus***, male Brewer's Blackbird. Members of this species use bryophytes in their nests. Photo by Alan D. Wilson, through Creative Commons.

Figure 152. ***Icterus bullockii***, Bullock's Oriole. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 153. ***Icterus bullockii***, Bullocks Orioles. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 154. Hanging nest of ***Icterus bullockii***, Bullock's Oriole. Members of this species use bryophytes in their nests. Photo by Eugene Zelenko through Creative Commons.

Fringillidae – Fringilline Finches

Wolf (2009) found eleven species of **Fringillidae** that use bryophytes in their nests in North America:

Leucosticte tephrocotis (Gray-crowned Rosy Finch; Figure 155)
Leucosticte atrata (Black Rosy Finch; Figure 156)
Leucosticte australis (Brown-capped Rosy Finch; Figure 157)
Pinicola enucleator (Pine Grosbeak; Figure 158)
Carpodacus purpureus (Purple Finch; Figure 159-Figure 160)
Loxia curvirostra (Red Crossbill; Figure 161)
Loxia leucoptera (White-winged Crossbill; Figure 162)
Carduelis flammea (Common Redpoll; Figure 163-Figure 164)
Carduelis pinus (Pine Siskin; Figure 165)
Carduelis psaltria (Lesser Goldfinch; Figure 166-Figure 167)
Coccothraustes vespertinus (Evening Grosbeak; Figure 168)

Figure 155. ***Leucosticte tephrocotis***, Gray-crowned Rosy Finch, in British Columbia. Members of this species use bryophytes in their nests. Photo by Nigel, through Creative Commons.

Figure 156. ***Leucosticte atrata***, Black Rosy Finch, in British Columbia. Members of this species use bryophytes in their nests. Photo by Peter Wallack, through Creative Commons.

Figure 157. ***Leucosticte australis***, Brown-capped Rosy Finch. Members of this species use bryophytes in their nests. Photo by Dominic Sherony, through Creative Commons.

Figure 158. ***Pinicola enucleator***, Pine Grosbeak. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 159. ***Carpodacus purpureus***, Purple Finch. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 160. ***Carpodacus purpureus***, Purple Finch, feeding young in nest. Photo by Robert Kuhn <www.theonlinezoo>, through Creative Commons.

Figure 161. ***Loxia curvirostra***, Red Crossbill. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Figure 162. ***Loxia leucoptera***, White-winged Crossbill male. Members of this species use bryophytes in their nests. Photo by John Harrison, through Creative Commons.

Figure 163. ***Carduelis flammea***, Cock Redpoll. Members of this species use bryophytes in their nests. Photo by Gail Hampshire, through Creative Commons.

Figure 164. ***Carduelis flammea***, Common Redpoll, feeding young in nest. Note mosses woven into the exterior. Photo by Peter Reese, through nzbirdsonline.org.nz, online permission.

Pine Siskin (*Carduelis pinus*)

The Pine Siskin (***Carduelis pinus***; Figure 165) breeds from SE Alaska to Newfoundland (Van Woerkom 1999). They remain year-round along the Pacific Coast where they prefer coniferous forests and mixed woodlands. Their nests are saucer-shaped, constructed with twigs, grasses, strips of bark, and lichens. These are lined with hair, moss, thistledown, or feathers. The young leave the nest in two weeks. The female remains in the nest with the young and the male brings food for her and she regurgitates food for the nestlings.

Figure 165. ***Carduelis pinus***, Pine Siskin. Members of this species use bryophytes in their nests. Photo by Cephas, through Creative Commons.

Figure 166. ***Carduelis psaltria***, Lesser Goldfinch male. Members of this species use bryophytes in their nests. Photo by Gail Hampshire, through Creative Commons.

Figure 167. ***Carduelis psaltria***, Lesser Goldfinch female. Members of this species use bryophytes in their nests. Photo by Alan D. Wilson, through Creative Commons.

Figure 168. ***Coccothraustes vespertinus***, Evening Grosbeaks, getting drink. Members of this species use bryophytes in their nests. Photo by Tom Grey, with permission.

Brambling (*Fringilla montifringilla*)

The Brambling (***Fringilla montifringilla***; Figure 169) has a name that literally means "mountain fringilla" (Wikipedia 2016a) It lives in birchwoods and coniferous forests of northern Europe and Asia. It is migratory, overwintering in southern Europe, north Africa, north India, northern Pakistan, China, and Japan. This small passerine bird uses mosses, hair, and wool to line its nest (Stevenson 1987).

Figure 169. ***Fringilla montifringilla***, Brambling. Members of this species use bryophytes in their nests. Photo by M. Nishimura, through Creative Commons.

Chaffinch (*Fringilla coelebs*)

Based on the pictures I have seen, the Chaffinch (***Fringilla coelebs***; Figure 170) commonly uses bryophytes extensively in its nests (Figure 171-Figure 173).

Figure 170. ***Fringilla coelebs***, Chaffinch female. Members of this species use bryophytes in their nests. Photo by James K. Lindsey, with permission.

Figure 171. ***Fringilla coelebs***, Chaffinch, nest made largely of bryophytes. Photo by James K. Lindsey, with permission.

Figure 172. ***Fringilla coelebs***, Chaffinch, nest with extensive use of bryophytes. Photo by Trachemys, through Creative Commons.

Figure 173. ***Fringilla coelebs***, Chaffinch, nest of bryophytes. Photo by Nottsexminer, through Creative Commons.

Poo-uli (*Melamprosops phaesoma*)

The Poo-uli (***Melamprosops phaeosoma***; Figure 174) is a Hawaiian honeycreeper, a rare species nearing extinction (Engilis *et al*. 1996;). Its nest is an open cup which it constructs from twigs and bryophytes. Coarse mosses are used to fill the spaces between the twigs, reminiscent of human uses of mosses for chinking. Both nests examined contained ***Homaliodendron flabellatum*** (Figure 175), ***Thuidium plicatum***, ***Trachypodopsis auriculata*** (Figure 176). One nest also contained ***Aerobryopsis wallichi***; the other contained ***Floribundaria floribunda*** (Figure 177). The lining is made from fern rootlets. Leaves and stems of graminoids and dicots constituted less than 5% of the material in the nest.

Figure 174. ***Melamprosops phaeosoma***, Poo-uli, a rare species. Members of this species use bryophytes in their nests. Photo by Paul E. Baker, through public domain.

Figure 175. ***Homaliodendron flabellatum***, a species used in the nest of the Poo-uli, ***Melamprosops phaeosoma***. Photo by Yao, through Creative Commons.

Figure 176. ***Trachypodopsis auriculata***, a species used in the nest of the Poo-uli, ***Melamprosops phaeosoma***. Photo through Creative Commons.

Figure 177. ***Floribundaria floribunda***, a species used in the nest of the Poo-uli, ***Melamprosops phaeosoma***. Photo through Creative Commons.

Kākāwahie or Moloka'i Creeper (*Paroreomyza flammea*)

Kākāwahie or Moloka'i Creeper (***Paroreomyza flammea***; Figure 178) is an extinct member of this family, originally native to Hawaii (Wikipedia 2016b). It fed primarily on larvae of beetles and Lepidoptera. The birds constructed a nest with an exterior of moss.

Figure 178. ***Paroreomyza flammea***, Moloka'i Creeper (bottom 2 birds), an extinct bird that placed mosses on the exterior of the nest. Photo by Frederick William Frohawk, through Creative Commons.

Leiothrichidae – Laughing Thrushes

Nilgiri Laughing Thrush (*Trochalopteron cachinnans*)

The Nilgiri Laughing Thrush (***Trochalopteron cachinnans***; Figure 179) gathers bryophytes and uses them to build nests. These typically include several species.

Figure 179. ***Trochalopteron cachinnans***, Nilgiri Laughing Thrush. Members of this species use bryophytes in their nests. Photo by Antony Grossy, through Creative Commons.

Ptilonorhynchidae – Bower Birds

Bower Birds have some of the most interesting mating behavior in the bird world. The male bower bird builds a mating tunnel or similar structure to attract his mate (Hansell 2000). This tunnel typically involves a column of sticks around a stem of a sapling or small fern that serves

as a central feature of the bower. Depending on the species, this bower is often decorated with blue objects.

Vogelkop Bowerbird (*Amblyornis inornata*)

The Vogelkop Bowerbird (***Amblyornis inornata***; Figure 180) of New Guinea and Australia builds a conical hut (Figure 181) up to 2 m wide by 3.3 m high (Uy 2002). The pathway to this doorway of this hut is paved with a carpet of moss. This mossy path is decorated with rhododendron flowers, red ginger berries, iridescent blue beetle carapaces, and feathers from other birds. One isolated population in the Kumawa Mountains builds a spire around saplings, forming an umbrella-like structure over a circular mossy foundation.

Figure 180. ***Amblyornis inornata***, Vogelkop Bowerbird. Members of this species pave the pathways to their huts with mosses. Photo by Carmelo López Abad, through Creative Commons.

Figure 181. ***Amblyornis inornata***, Vogelkop Bowerbird, bower with hut. Photo by Carmelo López Abad, through Creative Commons.

The females of the Vogelkop Bowerbird (***Amblyornis inornata***; Figure 180) are slightly smaller than the males (Lananhbirds 2010). The dull coloration is offset by one of the largest and most colorful bowers. The bower is a 100-cm-high cone with a 160-cm diameter. Like many human homes, the birds have a front lawn that is cleared and carpeted with mosses. The lawn is the site of flowers, fruit, beetle wings, dead leaves, and other objects in an "artistic" arrangement. Males maintain these objects, replacing ones that are no longer suitable or replacing ones stolen by neighbors.

Because of the dull plumage, this species is of less interest than other Bowerbird species and therefore is of Least Concern on the IUCN Red List (BirdLife International 2004). That is, if humans don't like it, they don't hunt it for its plumage.

Macgregor's Bowerbird (*Amblyornis macgregoriae*)

The Macgregor's Bowerbird (***Amblyornis macgregoriae***; Figure 182) contrasts with the Vogelkop Bowerbird by having the "simplest" bower (Hansell 2000). It builds a maypole tower that is 2-3X the height of the male. This is made of a few hundred fine, interlocked sticks in the center of a moss platform. The platform lacks other adornment.

Figure 182. ***Amblyornis macgregoriae***, Macgregor's Bowerbird. Members of this species use bryophytes in their nests. Photo by Katerina Tvardikova, through Creative Commons.

Golden-fronted Bowerbird (*Amblyornis flavifrons*)

The Golden-fronted Bowerbird (***Amblyornis flavifrons***) builds a bower similar to that of Macgregor's Bowerbird, but the lawn is decorated by little piles of yellow, green, and fruit (Hansell 2000).

Acanthizidae – Scrubwrens, Thornbills, and Gerygones

The Brown Thornbills (***Acanthiza pusilla***; Figure 183) are very active birds, searching for tiny invertebrates (Lloyd 2013). They make an untidy nest (Figure 184)of bark shreds, grass, spider webs, spider egg sacs, amd moss. This nest is hidden close to the ground in tussock grass, saggs or bracken.

Figure 183. ***Acanthiza pusilla*** (Brown Thornbill), a bird that includes mosses in its nest. Photo by Patrick Kavanagh, through Creative Commons.

Figure 184. ***Acanthiza pusilla*** (Brown Thornbill) nest that often includes mosses. Photo by J. J. Harrison, through Creative Commons.

Rhinocryptidae – Tapaculos

Silvery-fronted Tapaculo (*Scytalopus argentifrons*)

In a Costa Rican cloud forest, the nest of the Silvery-fronted Tapaculo (***Scytalopus argentifrons***; Figure 185) was a "substantial" globular structure (Young & Zuchowski 2003). It was made mostly of mosses placed into a subterranean cavity at the end of a short, narrow tunnel.

Figure 185. ***Scytalopus argentifrons***, Silvery-fronted Tapaculo, Members of this species put mosses in their underground nests. Photo by Francesco Veronesi, through Creative Commons.

Callaeatidae – New Zealand Wattlebirds

The Kōkako (***Callaeas wilsoni;*** Figure 186), endemic to the North Island of New Zealand, sometimes includes moss capsules to line its nest (Figure 187). They use lichens, mosses, and liverworts, together with rotten wood and some mud in a central layer of the nest (Jessica Beever, Bryonet 2 May 2003).

Figure 186. ***Callaeas wilsoni***, Kōkako, a New Zealand endemic species. Members of this species use moss capsules to line their nests. Photo through Creative Commons.

Figure 187. ***Callaeas wilsoni***, Kōkako, in a nest with lots of mosses. Photo by Dick Veitch, © Department of Conservation, NZ, with limited online permission.

Zosteropidae – White-eyes

The White-eye (***Zosterops lateralis***; Figure 188-Figure 189) builds a nest (Figure 190) with mosses on the outside (Wikipedia 2017). This tiny nest is suspended from a fork in the branches.

Figure 188. ***Zosterops lateralis***, Wax-eye, a bird that cloaks the outside of its nest in mosses. Photo by Phil Bendle, with permission.

Figure 189. ***Zosterops lateralis***, White-eye. Photo by fir002, through Creative Commons.

Figure 190. ***Zosterops lateralis***, White-eye nest with mosses. Photo by Phil Bendle, with permission.

Effect of Cavity-nesting Birds on Bryophyte Communities

We have already discussed dispersal of bryophytes by birds, but nesting birds can have other effects on bryophyte communities as well. Tatsumi *et al*. (2017) investigated the effects of birds on the tree bole surrounding cavities where birds have nested (Figure 191-Figure 194). They suggested that tree holes (Figure 195-Figure 198) that are inhabited can be enriched with nutrients from those organisms, and those nutrients can escape down the tree trunk. Using the trees *Aria japonica* and *Cercidiphyllum japonicum* in a Japanese temperate forest, they investigated the bryophyte and lichen communities above and below tree holes.

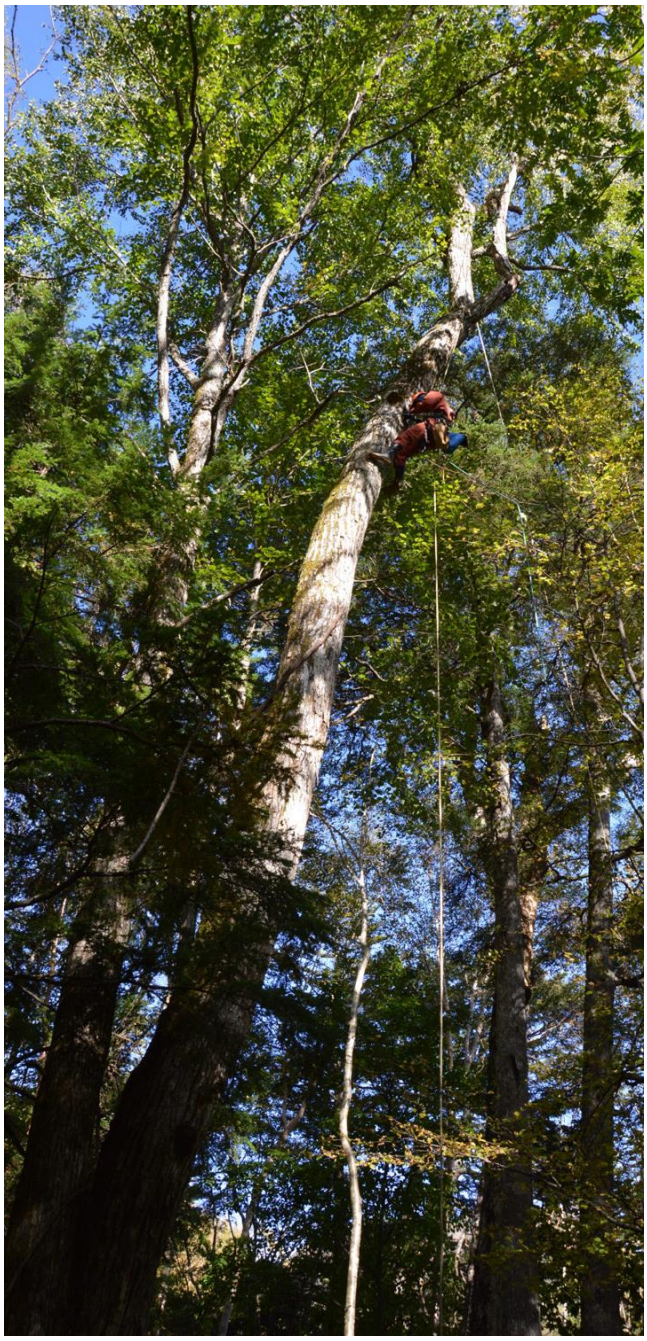

Figure 191. Scaling large trees to investigate the tree hole nesters. Photo courtesy of Shinichi Tatsumi.

Figure 192. Tree hole methods – one of the researchers prepares to place a quadrat frame. Photo courtesy of Shinichi Tatsumi.

Figure 193. Tree hole methods, with a quadrat positioned above the tree hole. Photo courtesy of Åsa Ranlund.

Figure 194. Tree hole methods showing quadrat below the tree hole. Photo of courtesy of Yume Imada.

Figure 195. Tree hole showing diversity above and below the hole. Photo courtesy of Wakana Azuma.

Figure 196. Elongate tree hole and climbing equipment. Photo courtesy of Wakana Azuma.

Figure 197. View of inside of tree hole. Photo courtesy of Wakana Azuma.

Figure 198. Close view of tree hole vegetation. Photo courtesy of Shinichi Tatsumi.

The richness of bryophyte and lichen species did not differ above and below the tree holes (Tatsumi *et al*. 2017). But the species composition of bryophytes differed significantly. The moss ***Anomodon tristis*** (Figure 199) and liverwort ***Porella vernicosa*** (Figure 200) were significantly more common below than above tree holes. On the other hand, the liverwort ***Radula japonica*** (Figure 201) and four lichen species were more frequent above than below the holes. Tatsumi and coworkers suggested nutrient and moisture differences as possible reasons for the species differences. I have to wonder how much the activity of the parents going in and out of the cavity could affect the bryophytes surviving there. These could have two impacts, dispersal and damage. More fragile species might not be able to survive the activity. Others might be transported there on feathers and feet.

Figure 199. ***Anomodon tristis***, a moss that is more common below tree holes than above. Photo by Bob Klips, with permission.

Figure 200. ***Porella vernicosa***, a liverwort that is more common below tree holes than above. Photo by Masanobu Higuchi, with permission.

Figure 201. ***Radula japonica***, a liverwort that is more common above tree holes than below. Photo by Taiwan Mosses, through Creative Commons.

Edible Nests

An interesting twist to the food concept is the use of bird nests as food for humans. I have not documented that any of those used contain mosses, but Salgado *et al*. (1998) found mosses in neotropical bird nests that they examined for **zoopharmacognosy** (behavior in which non-human animals apparently self-medicate by selecting and ingesting or topically using plants, soils, insects, or psychoactive drugs to prevent or reduce harmful effects of pathogens and toxins).

Summary

These passerine birds use mosses for a variety of purposes in their nests. Some put them inside as liners, some make the bottom of the nest thicker, and some weave them on the outside as camouflage. But in most cases we don't know what the function of the mosses really is – insulation, moisture, camouflage, or parasite protection. Or could it be all of these, or simply the mosses are the most available building materials?

The choice of bryophytes usually seems to depend on availability. But in other cases, the species chooses particular bryophytes, even if they are less abundant. Some bowerbirds use mosses to decorate their bowers – making a green path to the nest.

Birds can have an impact on the bryophytes themselves. Aside from being destructive by removing the bryophytes, and dispersing them to new locations, they have an impact on the species found above and below the tree holes where they nest.

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